Chapter 11 Ratio and Its Application

1. Content Standard

6.4.1. Students will be able to define ratio and use it in various situations and appreciate its usefulness in daily life.

2. Unit Objectives

- To understand the meaning of ratio and apply it.
- To understand the meaning of equal ratio.

3. Teaching Overview

Students learned rate which is the amount compared to the base amount when taking the base as 1. Students learn another way of expressing relationship between 2 quantities in this topic. Ratio does not require to make the base amount 1, however, we can use a pair of simple quantities.

Ratio :

The relations students already learned such as relative amounts, how many times and percentages can be represented as a value. Ratio can be represented as a pair of numbers. It is also represented as a pair of simple whole numbers or quantities.

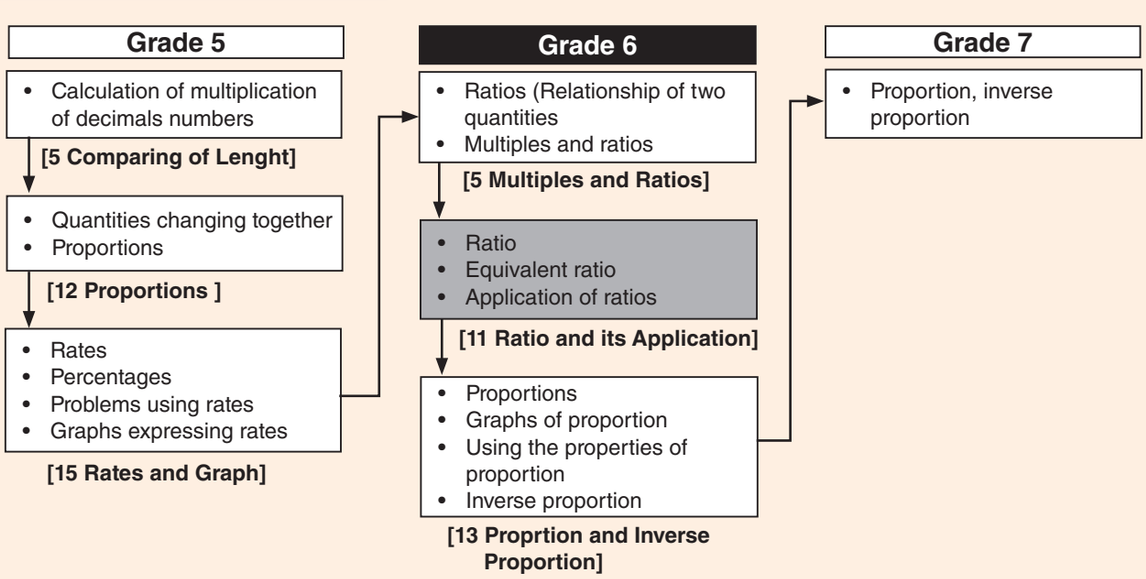
Equivalent Ratio :

They learn the features of equivalent ratios. We can multiply the pair of numbers as a ratio by the same number, or divide by the same number and the ratio given by the calculation is still equivalent to the original ratio. Students should investigate it using many numbers.

Application of Ratio :

Since ratios can represent relationship between 2 quantities, we can find another quantity when we know one quantity and ratio. Students also learn distribution ratio for distributing something in a ratio of A : B.

4. Related Learning Contents



Unit 11

Unit: Ratio and Its Application
Sub-unit: 1. Ratio
Lesson 1 of 1

Textbook Page :
092 to 094
Actual Lesson 073

Sub-unit Objectives

- To understand the meaning and how to express ratio.

Lesson Objectives

- To understand the meaning of ratio and how to express it.

Prior Knowledge

- Proportions (Grade 5)
- Multiples and Ratios (Grade 6)

Preparation

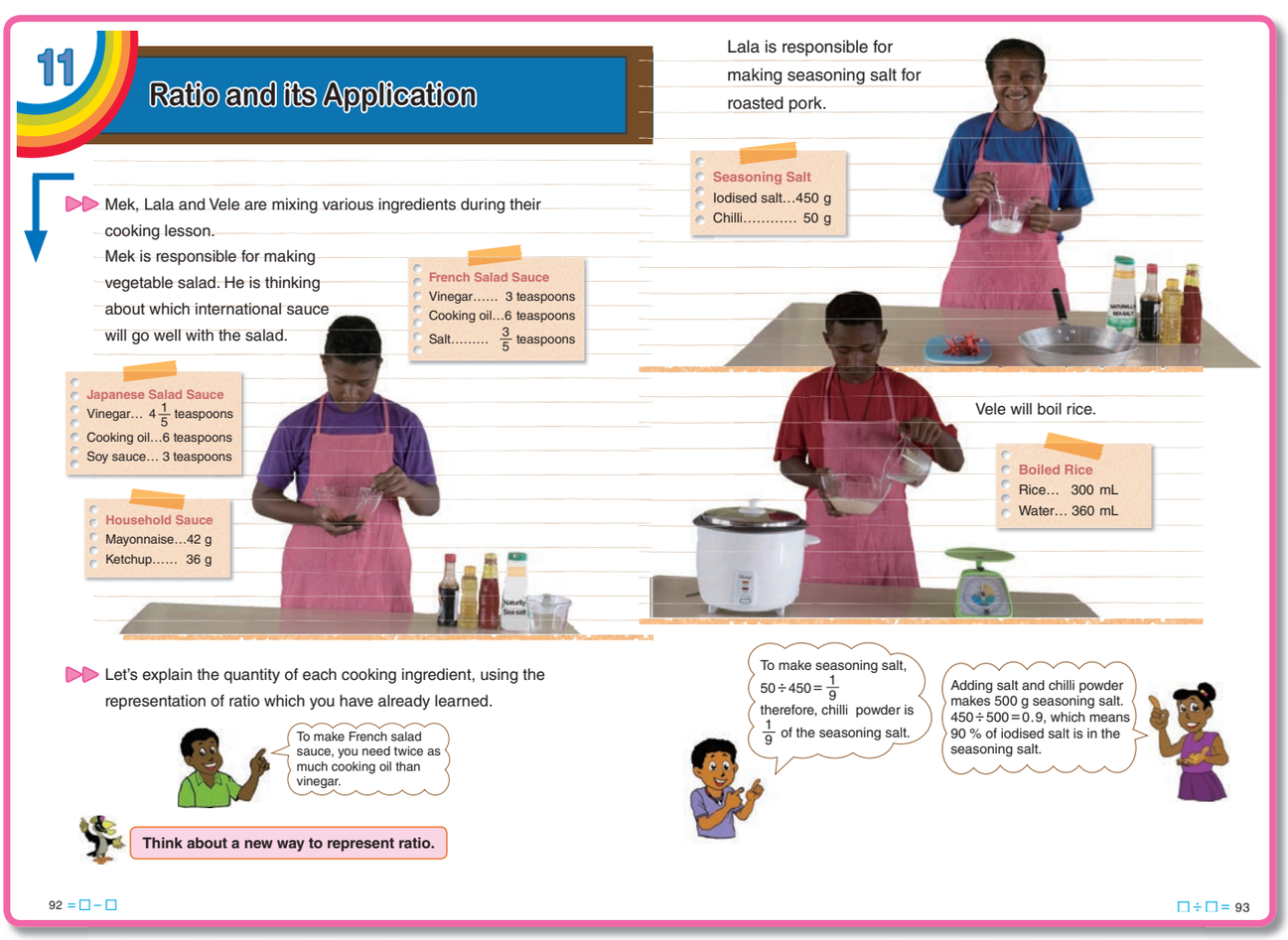
- Copy of each sauce receip for Blackboard

Assessment

- Define ratio and explain its meaning based on real life situations. F
- Solve the exercises correctly. S

Teacher's Notes

- The colon symbol ':' is used to represent ratio and read as "is to".



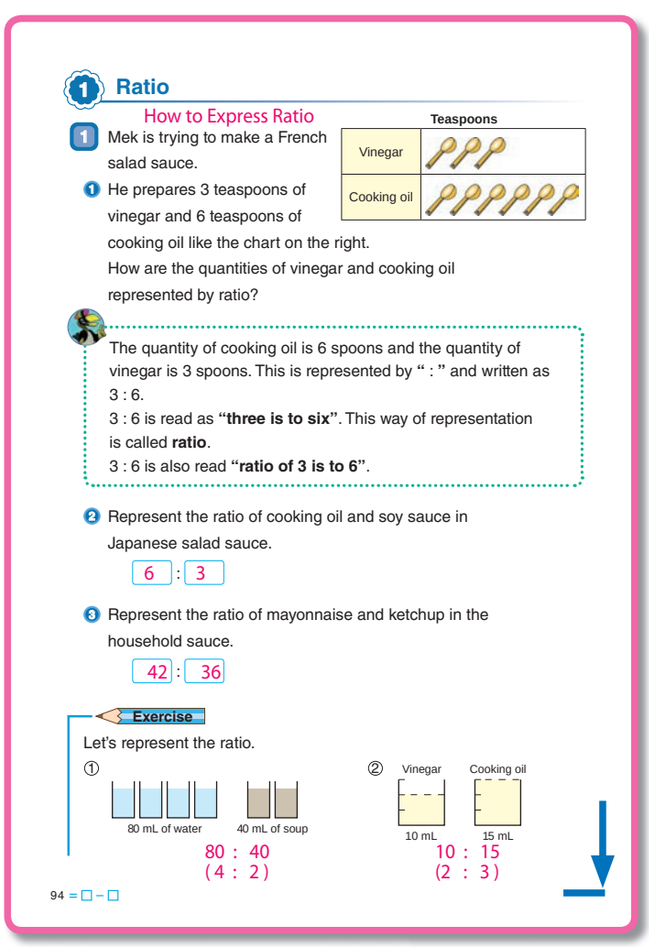
Lesson Flow

1 Understand the meaning of ratio.

T/S ▶▶ Read and understand the situation by discussing the mixtures of various ingredients.
S Consider the amount of each ingredient used and explain the quantity of cooking ingredients using the representation of ratio of making the sauce.
T Confirm the students' explanations.

2 Relating ratio to fractions and percentages.

T Let students look at Lala's recipe on seasoning salt.
S Represent the ratio of iodised salt to chilli powder as a fraction.
TN $50 \div 450 = \frac{50}{450} = \frac{1}{9}$ therefore, chilli powder is $\frac{1}{9}$ of seasoning salt.
S Represent the ratio of iodised salt in seasoning salt.
TN Adding iodised salt and chilli powder makes 500 g in total for the recipe.
So, $450 \div 500 = 0.9$, $0.9 \times 100 = 90\%$ of iodised salt in the seasoning salt.
S Think about new ways to represent ratio.
T Introduce the Main Task. (Refer to the BP)


1 Ratio

How to Express Ratio

1 Mek is trying to make a French salad sauce.

1 He prepares 3 teaspoons of vinegar and 6 teaspoons of cooking oil like the chart on the right.
How are the quantities of vinegar and cooking oil represented by ratio?

	Teaspoons
Vinegar	
Cooking oil	

The quantity of cooking oil is 6 spoons and the quantity of vinegar is 3 spoons. This is represented by " : " and written as 3 : 6.
3 : 6 is read as **"three is to six"**. This way of representation is called **ratio**.
3 : 6 is also read **"ratio of 3 is to 6"**.

2 Represent the ratio of cooking oil and soy sauce in Japanese salad sauce.
6 : 3

3 Represent the ratio of mayonnaise and ketchup in the household sauce.
42 : 36

Exercise
Let's represent the ratio.
① 80 mL of water, 40 mL of soup
80 : 40
(4 : 2)
② Vinegar, Cooking oil; 10 mL, 15 mL
10 : 15
(2 : 3)

94 = □ − □

3 Definition and representation of ratio.

T/S 1 Read and understand the given situation.
T 1 How are the quantities of vinegar and cooking oil represented using ratio?
S The quantity of vinegar is 3 teaspoons and cooking oil is 6 teaspoons.

4 Important Point

T/S Explain the important point in the box .
TN Students can either use the word (**is to**) or use colon (**:**) to represent ratio.

5 Representation of ratio.

S 2 Represent the ratio of cooking oil and soy sauce in the Japanese salad sauce.
6 : 3
S 3 Represent the ratio of mayonnaise and ketchup in Mek's sauce.
42 : 36

6 Complete the Exercise.

S Solve the exercises.
T Confirm students' answers.

7 Summary

T What have you learned in this lesson?
S Present ideas on what they have learned.
T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan

Lesson 73 Sample Blackboard Plan is on page 151.

Unit 11

Unit: Ratio and Its Application
Sub-unit: 2. Equivalent Ratio
Lesson 1 of 4

Textbook Page : 095 and 096
Actual Lesson 074

Sub-unit Objectives

- To understand the meaning of equal ratios and value of ratios.
- To understand how to simplify ratios.

Lesson Objectives

- To understand and represent the value of ratio .
- To understand, compare and represent the value of equal ratio.

Prior Knowledge

- Proportions (Grade 5)
- Ratio

Assessment

- Think about how to find the value of ratio. F
- Explain the definition of equal ratio. S

Teacher's Notes

The term concentration in this context means, how sweet the cordial is in task 2.

2 Equivalent Ratio

How to find the value of ratio

1 The volume of rice and water needed to boil rice for 3 people is shown on the right.

Rice… 300 mL
Water… 360 mL

1 Let's represent the ratio of rice to water in ratio form.

300 : 360

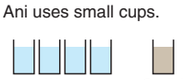
2 How many times is the volume of rice compared to the volume of water? Let's represent it as a fraction. $300 \div 360 = \frac{300 \div 60}{360 \div 60} = \frac{5}{6}$

When a ratio is represented as A : B, based on B, the number that shows A is how many times of B and is called value of ratio A : B.
Value of ratio A : B is the quotient of A ÷ B.

2 You make cordial by mixing with water.

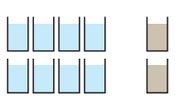
How to mix with water
Water … 4
Cordial … 1

1 Ani uses small cups.



Value of ratio 4 : 1 is 4

2 Buru uses the same cup as Ani and makes the drink for 2 children.



Value of ratio 8 : 2 is 4

3 Was the concentration level of the cordial that Ani and Buru made the same? Yes. They both have the same value.

When the values of 2 ratios are equal, we say the two ratios are equal and it is written as
4 : 1 = 8 : 2

3 There are 3 different combinations of rice and water.
Based on the quantity of water, let's think about the value of ratios of rice to water in the three different combinations.

Ⓐ Rice… 60 mL, Water…72 mL
Ⓑ Rice… 100 mL, Water…120 mL
Ⓒ Rice… 300 mL, Water…360 mL

1 Values of ratios in Ⓐ and Ⓒ are both ☐,
Therefore, 60 : 72 = 300 : 360.
60 : 72 = (60 × ☐) : (72 × ☐)
= 300 : 360

60 : 72 = 300 : 360 (× ☐ / × ☐)

2 Values of ratios in Ⓒ and Ⓑ are both ☐
Therefore, 300 : 360 = 100 : 120.
300 : 360 = (300 ÷ ☐) : (360 ÷ ☐)
= 100 : 120

300 : 360 = 100 : 120 (÷ ☐ / ÷ ☐)

The ratio A : B is equal to the ratio which is made by multiplying or dividng A and B by the same number.

Exercise

1 Which ratio is equal to 3 : 1?
① 6 : 3 ② 6 : 2 ③ 1 : 3 ④ 13 : 10 ⑤ 9 : 3

2 Write 3 ratios that are equal to 6 : 9.

☐ ÷ ☐ = 95

96 = ☐ – ☐

Lesson Flow

1 Review the previous lesson.

T Introduce the Main Task. (Refer to the BP)

2 Represent ratio in ratio form and as a fraction.

T/S 1 Read and understand the given situation.

T Allow students to discuss the amount of water and rice to boil rice for 3 people.

S 1 Represent the ratio of rice to water in ratio form. 300 : 360

T 2 How many times is the volume of rice compared to volume of water? Represent it as a fraction.

S Represent ratio as a fraction.
$300 \div 360 = \frac{5}{6}$

3 Important Point

T/S Explain the important point in the box .

4 Finding the value of ratio.

T/S 2 Read and understand the given situation.

S 1 Look at Ani's mixing of cordial and find the value of ratio. Value of ratio 4 : 1 is 4

S 2 Study the mixing of cordial by Buru and Ani and find the value of ratio.
Value of ratio 8 : 2 is 4

S 3 Compare the concentration level that Ani and Buru made.

T Are they the same?

S Ani and Buru made the same concentration of cordial mixture because they both have the same value of ratio.

5 Important Point

T/S Explain the important point in the box .

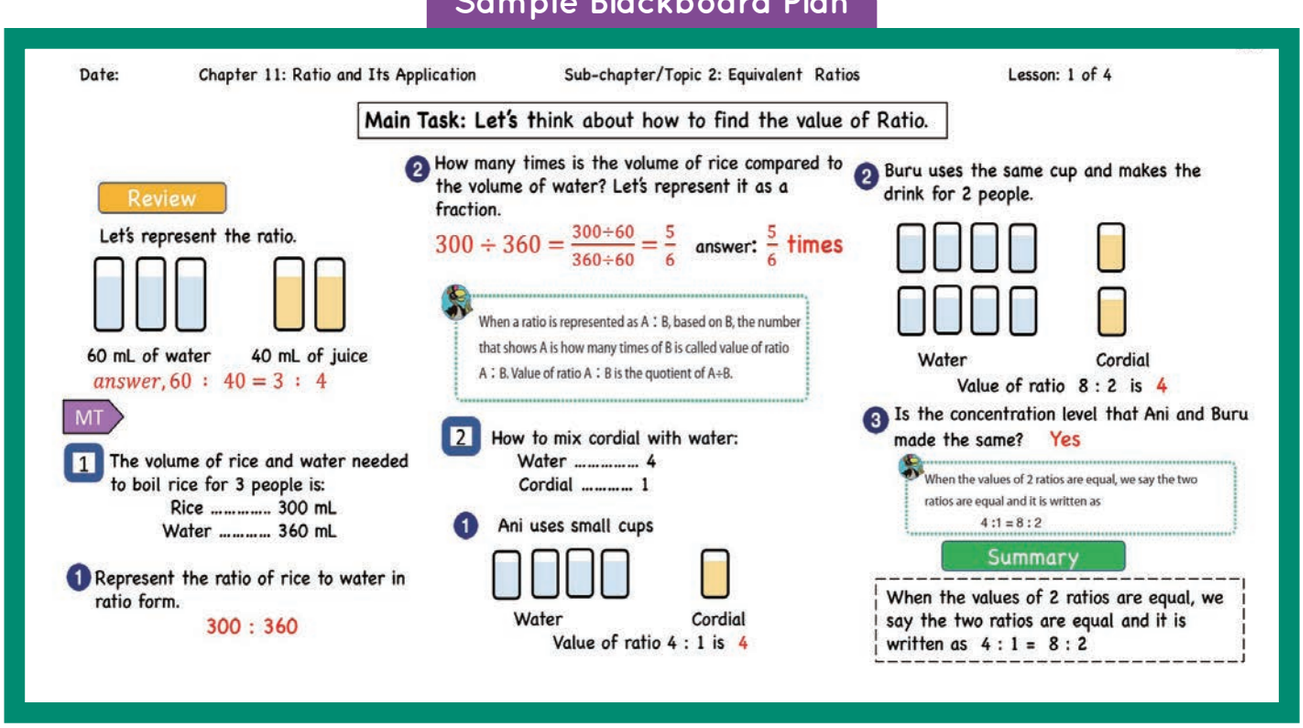
6 Summary

T What have you learned in this lesson?

S Present ideas on what they have learned.

T Use students' ideas to confirm important concepts of this lesson.

Sample Blackboard Plan



Unit 11

Unit: Ratio and Its Application
Sub-unit: 2. Equivalent Ratio
Lesson 2 of 4

Textbook Page : 096
Actual Lesson 075

Lesson Objectives

- To think about multiplication and division of ratios.

Prior Knowledge

- Multiples and Rates
- Value of ratio

Preparation

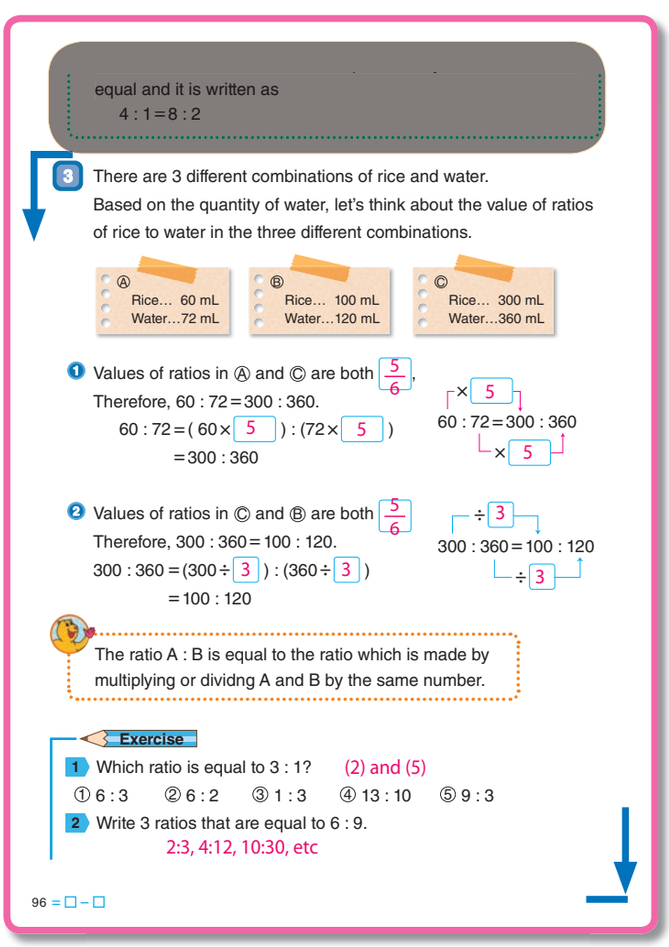
- Refer to the Blackboard Plan.

Assessment

- Think about multiplication and division of ratios by the same number. F
- Solve the exercises correctly. S

Teacher's Notes

The ratio of A : B is equivalent to the ratio which is either multiplied (increased) or divided (reduced) by the same number.



equal and it is written as
4 : 1 = 8 : 2

3 There are 3 different combinations of rice and water.
Based on the quantity of water, let's think about the value of ratios of rice to water in the three different combinations.

Ⓐ	Ⓑ	Ⓒ
Rice… 60 mL Water…72 mL	Rice… 100 mL Water…120 mL	Rice… 300 mL Water…360 mL

1 Values of ratios in Ⓐ and Ⓒ are both $\frac{5}{6}$,
Therefore, 60 : 72 = 300 : 360.
60 : 72 = (60 × 5) : (72 × 5)
= 300 : 360

60 : 72 = 300 : 360 (× 5 on both sides)

2 Values of ratios in Ⓒ and Ⓑ are both $\frac{5}{6}$
Therefore, 300 : 360 = 100 : 120.
300 : 360 = (300 ÷ 3) : (360 ÷ 3)
= 100 : 120

300 : 360 = 100 : 120 (÷ 3 on both sides)

The ratio A : B is equal to the ratio which is made by multiplying or dividng A and B by the same number.

Exercise

1 Which ratio is equal to 3 : 1? (2) and (5)
① 6 : 3 ② 6 : 2 ③ 1 : 3 ④ 13 : 10 ⑤ 9 : 3

2 Write 3 ratios that are equal to 6 : 9.
2:3, 4:12, 10:30, etc

96 = □ – □

Lesson Flow

1 Review the previous lesson.

2 Find the value of ratio in three different combinations.

T/S ③ Read and understand the given situation.
S Share their ideas in finding the value of ratios.
T Introduce the Main Task. (Refer to the BP)

3 Multiplying to find equivalent ratios.

S ① Think about the values of ratios for Ⓐ and Ⓒ.
T What does it mean, 60 : 72 = 300 : 360 ?
S The value of ratio is the same, $\frac{5}{6}$
S Fill in the blank boxes to confirm.
TN Students should understand that if multiplying A : C by the same number, it becomes the same ratio.

4 Dividing to find equivalent ratios.

S ② Think about the value of ratio for Ⓒ and Ⓑ
T What does it mean, 300:360 = 100 : 120 ?
S The value of ratio is the same, $\frac{5}{6}$
S Fill in the blank boxes to confirm.
TN Students should understand that if dividing C : B by the same number, it becomes the same ratio.

5 Important Point

T/S Explain the important point in the box .

6 Complete the Exercise.

S Solve the exercises.
T Confirm students' answers.

7 Summary

T What have you learned in this lesson?
S Present ideas on what they have learned.
T Use students' ideas to confirm important concepts of this lesson.

Sample Blackboard Plan (Lesson 73)

Date: Chapter 11: Ratio and Its Application Sub-chapter/Topic 1: Ratio Lesson: 1 of 1

Main Task: Let's think about and understand the meaning of Ratio.

MT

Think about how to represent Mek's recipe as a ratio for the Japanese dressing.

1. vinegar to cooking oil to soy sauce
2. vinegar : cooking oil : soy sauce
3. $4\frac{1}{5} : 6 : 3$

Represent the ratio of iodised salt to chilli powder as a fraction in Lala's recipe.

$50 \div 450 = \frac{50}{450} = \frac{1}{9}$ therefore, salt is $\frac{1}{9}$ of the seasoning salt.

Represent the ratio of iodised salt in seasoning salt.

Adding salt and chilli powder makes 500 g in total.

So, $450 \div 500 = 0.9$

$0.9 \times 100 = 90\%$ of salt in the seasoning.

① Mek is trying to make a French dressing using the recipe shown.

Vinegar	
Cooking oil	

① How are the quantities of vinegar and cooking oil represented?

The quantity of cooking oil is 6 spoons and the quantity of vinegar is 3 spoons. This is represented by ":"

3 : 6

3 : 6 is read as "three is to six". This way of representation is called ratio.

② Represent the ratio of cooking oil and soy sauce in Japanese dressing.

6 : 3

③ Represent the ratio of mayonnaise and ketchup in Mek's sauce.

42 : 36

Exercise

(Refer to TM for Questions and Answers)

Summary

- The quantity of cooking oil is 6 and the quantity of vinegar is 3 spoons. This is represented by ":" (3 : 6)
- 3 : 6 is read as "three is to six". This way of representation is called ratio.

Sample Blackboard Plan (Lesson 75)

Date: Chapter 11: Ratio and Its Application Sub-chapter/Topic 2: Equivalent Ratio Lesson: 2 of 4

Main Task: Let's think about how to divide and multiply ratios.

Review

MT

③ There are 3 different combinations of rice and water.

Ⓐ	Ⓑ	Ⓒ
Rice 60 mL	Rice 100 mL	Rice 300 mL
Water 72 mL	Water 120 mL	Water 360 mL

① Value of ratio in A and C are both $\frac{5}{6}$

Therefore, 60 : 72 = 300 : 360.

60 : 72 = (60 × 5) : (72 × 5)

= 300 : 360

② Values of C and B are both $\frac{5}{6}$

Therefore, 300 : 360 = 100 : 120.

300 : 360 = (300 ÷ 3) : (360 ÷ 3)

= 100 : 120

300 : 360 = 100 : 120 (÷3)

The ratio A : B is equal to the ratio which is made by multiplying the same number to A and B and dividing A and B by the same number.

Summary

The ratio A : B is equal to the ratio which is made by multiplying the same number to A and B and dividing A and B by the same number.

Exercise

(Refer to TM for Questions and Answers)

Unit 11

Unit: Ratio and Its Application
Sub-unit: 2. Equivalent Ratio
Lesson 3 of 4

Textbook Page : 097
Actual Lesson 076

Lesson Objectives

- To understand how to find equal ratios through representations.

Prior Knowledge

- Multiplication and Division of Ratio.

Preparation

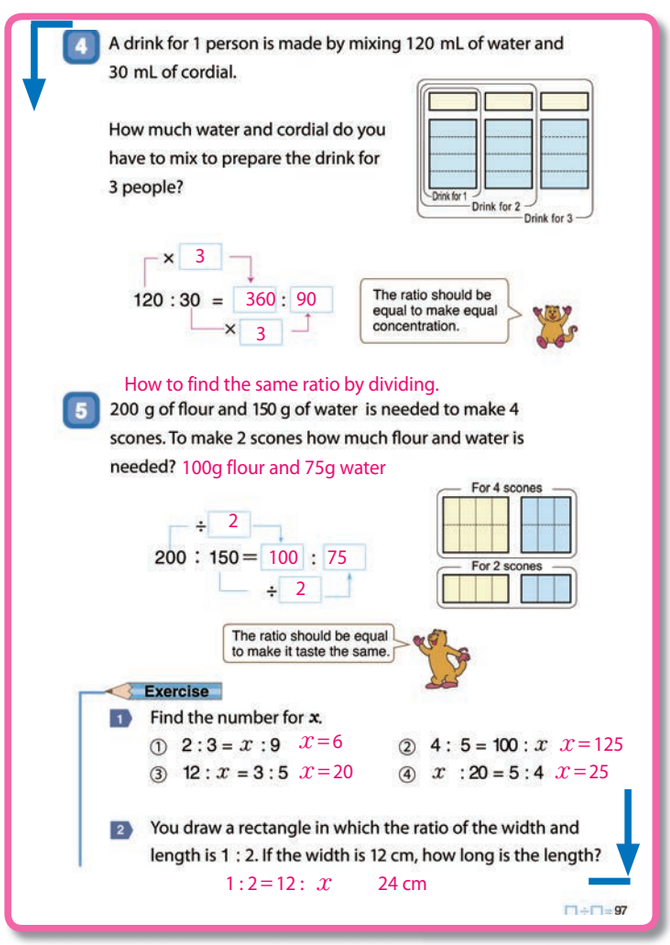
- Diagram for Task 4 and 5.

Assessment

- Use the diagram representation to find the equal ratio by multiplying and dividing. F
- Solve the exercises correctly. S

Teacher's Notes

This lesson continues from the previous lesson. Refer to the the important points in that lesson in order to apply the same concepts.



4 A drink for 1 person is made by mixing 120 mL of water and 30 mL of cordial.

How much water and cordial do you have to mix to prepare the drink for 3 people?

Drink for 1 Drink for 2 Drink for 3

120 : 30 = 360 : 90 (×3, ×3)

The ratio should be equal to make equal concentration.

How to find the same ratio by dividing.

5 200 g of flour and 150 g of water is needed to make 4 scones. To make 2 scones how much flour and water is needed? 100g flour and 75g water

For 4 scones
For 2 scones

200 : 150 = 100 : 75 (÷2, ÷2)

The ratio should be equal to make it taste the same.

Exercise

1 Find the number for x.

① $2 : 3 = x : 9$ $x = 6$
② $4 : 5 = 100 : x$ $x = 125$
③ $12 : x = 3 : 5$ $x = 20$
④ $x : 20 = 5 : 4$ $x = 25$

2 You draw a rectangle in which the ratio of the width and length is 1 : 2. If the width is 12 cm, how long is the length?

$1 : 2 = 12 : x$ 24 cm

97

Lesson Flow

1 Review the previous lesson.

T Introduce the Main Task. (Refer to the BP)

2 Find the equal ratio by multiplication.

T/S 4 Read and understand the given situation.
T Allow students to discuss the amount of water to cordial to make a drink for one person.
S A drink for one person 120 : 30, = 360 : 90
T How much water and cordial do you have to prepare in order to make a drink with same concentration for 3 people?
S We have to prepare for 3 people, so multiply the ratio by 3 and fill in the boxes.
TN Find the same ratio by multiplying.
S We need 360 mL of water and 90 mL of cordial for 3 people with the same concentration.

3 Find the equal ratio by division.

T/S 5 Read and understand the given situation.
T Allow students to discuss amount of flour to water to make 4 scones
S 200 g of flour and 150 g of water is needed to make 4 scones.
To make 2 scones, how much flour and water is needed?
S We have to make 2, so divide the ratio by 2 and fill in the boxes.
We need 100 g of flour and 75 mL of water for 2 scones with the same taste.
TN Find the same ratio by dividing.

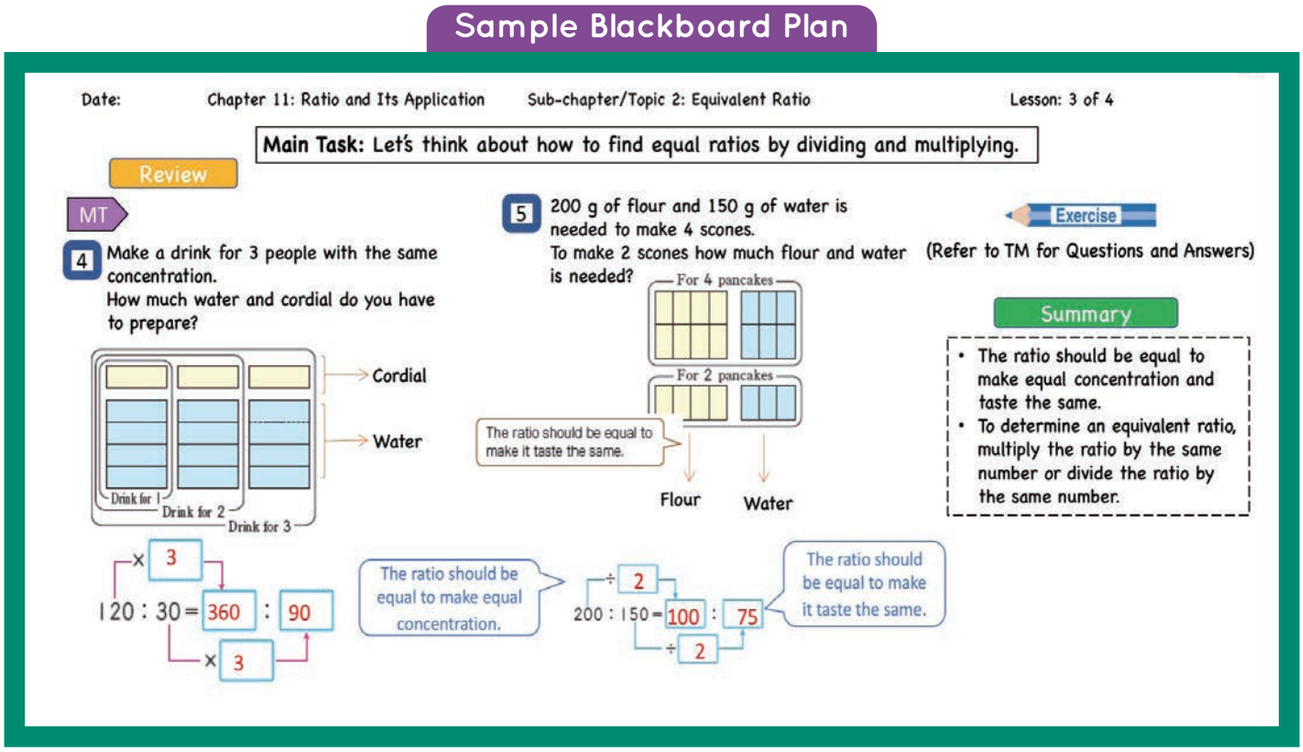
4 Complete the Exercise.

S Solve the exercises.
T Confirm students' answers.

5 Summary

T What have you learned in this lesson?
S Present ideas on what they have learned.
T Use students' ideas to confirm important concepts of this lesson.

Sample Blackboard Plan



Unit 11

Unit: Ratio and Its Application
Sub-unit: 2. Equivalent Ratio
Lesson 4 of 4

Textbook Page : 098
Actual Lesson 077

Lesson Objectives

- To simplify ratio using the properties of ratio.

Prior Knowledge

- Equal ratio

Preparation

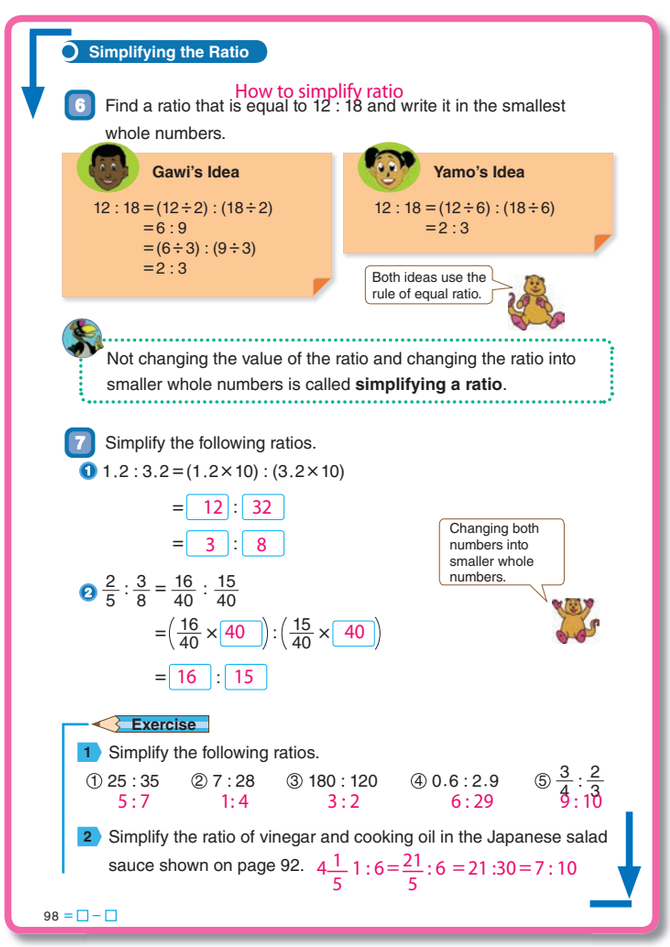
- Gawi's and Yamo's Ideas

Assessment

- Identify the method of simplifying ratio. F
- Use the method of simplifying ratio. F
- Solve the exercises correctly. S

Teacher's Notes

When simplifying ratios, do not change the value of ratio but reduce it its simpest form similar to the idea of simplifyng fractions.



Simplifying the Ratio

How to simplify ratio

6 Find a ratio that is equal to 12 : 18 and write it in the smallest whole numbers.

Gawi's Idea

12 : 18 = (12 ÷ 2) : (18 ÷ 2)
= 6 : 9
= (6 ÷ 3) : (9 ÷ 3)
= 2 : 3

Yamo's Idea

12 : 18 = (12 ÷ 6) : (18 ÷ 6)
= 2 : 3

Both ideas use the rule of equal ratio.

Not changing the value of the ratio and changing the ratio into smaller whole numbers is called **simplifying a ratio**.

7 Simplify the following ratios.

1 1.2 : 3.2 = (1.2 × 10) : (3.2 × 10)
= 12 : 32
= 3 : 8

2 $\frac{2}{5} : \frac{3}{8} = \frac{16}{40} : \frac{15}{40}$
$= \left(\frac{16}{40} \times 40\right) : \left(\frac{15}{40} \times 40\right)$
= 16 : 15

Changing both numbers into smaller whole numbers.

Exercise

1 Simplify the following ratios.

① 25 : 35 → 5 : 7
② 7 : 28 → 1 : 4
③ 180 : 120 → 3 : 2
④ 0.6 : 2.9 → 6 : 29
⑤ $\frac{3}{4} : \frac{2}{3}$ → 9 : 10

2 Simplify the ratio of vinegar and cooking oil in the Japanese salad sauce shown on page 92. $4\frac{1}{5} : 1 : 6 = \frac{21}{5} : 6 = 21 : 30 = 7 : 10$

98 = □ − □

Lesson Flow

1 Review the previous lesson.

T Introduce the Main Task. (Refer to the BP)

2 How to simplify ratios.

T/S 6 Read and understand the given situation.
T Ask the students to find a ratio that is equal to 12 :18 in its simplest form.
S Use their prior knowledge to simplify and share their ideas.
T Direct students to the ideas in the textbook.
S Compare and discuss Gawi's and Yamo's ideas.
T Confirm that both Gawis's and Yamo's ideas use the rule of equal ratio.
T What does it mean by simplifying a ratio?
S Share their answers.
TN Confirm answers using the important point.

3 Important Point

T/S Explain the important point in the box .....

4 7 Simplify ratios into smaller numbers.

S 1 In the case of decimal number, change them to whole numbers first and simplify.
TN For decimals, we change them into whole numbers then we simplify using the rule of equal ratio.
T 2 In the case of fractions, simplify them to whole numbers.
TN For fractions, we change the numerator into smaller whole numbers then we simplify using equal ratio.

5 Complete the Exercise.

S Solve the exercises.
T Confirm students' answers.

6 Summary

T What have you learned in this lesson?
S Present ideas on what they have learned.
T Use students' ideas to confirm important concepts of this lesson.

Sample Blackboard Plan

Date: Chapter 11: Ratio and Its Application Sub-chapter/Topic 2: Equivalent Ratio Lesson: 4 of 4

Main Task: Let's think about how to simplify ratios.

Review

MT

6 Find a ratio that is equal to 12 : 18 and write it in its smallest whole number.

Gawi's Idea

$12 : 18 = (12 \div 2) : (18 \div 2)$
$= 6 : 9$
$= (6 \div 3) : (9 \div 3)$
$= 2 : 3$

Yamo's Idea

$12 : 18 = (12 \div 6) : (18 \div 6)$
$= 2 : 3$

Not changing the value of the ratio and changing the ratio into smaller whole numbers is called **simplifying a ratio.**

7 Simplify the following ratios.

1 $1.2 : 3.2 = (1.2 \times 10) : (3.2 \times 10)$
$= 12 : 32$
$= 3 : 8$

2 $\frac{2}{5} : \frac{3}{8} = \frac{16}{40} : \frac{15}{40}$
$= \left(\frac{16}{40} \times 40\right) : \left(\frac{15}{40} \times 40\right)$
$= 16 : 15$

Exercise

(Refer to TM for Questions and Answers)

Summary

- To simplify decimal ratios, change the ratios into smaller whole numbers.
- Simplifying a ratio dose not change the value of the ratio.

Unit 11

Unit: Ratio and Its Application
Sub-unit: 3. Application of Ratio
Lesson 1 of 2

Textbook Page : 099
Actual Lesson 078

Sub-unit Objectives
- To apply ratio in daily life situations.

Lesson Objectives
- Solving problems by applying ratio properties.

Prior Knowledge
- Ratio and Simplifying ratio

Preparation
- Diagram of the Triangles
- Right triangle ruler

Assessment
- Apply ratio in daily life to solve ratio problems. F
- Solve the exercises correctly. S

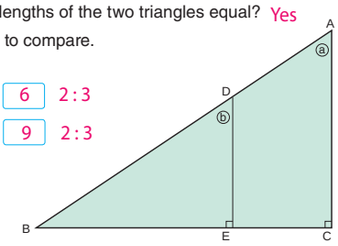
Teacher's Notes
Students will use rulers to measure the exact lengths of the triangles in the textbook to fill in the boxes in 1 and compare the ratios.
For activity 2, we find the value of x by multiplying by the same number to make the equality of the ratio 2 : 3.
Therefore x is $2 \times 4 = 8$.
Ratio is used in various situations in daily life. It is also important for the students to find the use of ratio in daily life and to solve problems in various daily life problems using ratio.

3 Application of Ratio

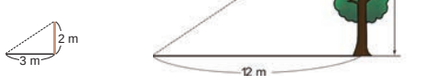
1 From the length of the shadow, find the height of the tree.

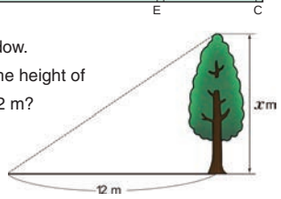
1 There is a right triangle ⓐ.
Put point E on side BC and make a right triangle ⓑ.
Are the ratios of the lengths of the two triangles equal? Yes
Measure the lengths to compare.

DE : EB = 4 : 6 2 : 3
AC : CB = 6 : 9 2 : 3



2 A 2 m pole makes a 3 m shadow.
In this situation, how long is the height of the tree when its shadow is 12 m?





Represent the height of the tree as x and make a mathematical sentence by using the equality of two ratios and fill the blank.

$2 : 3 = x : 12$ (×4 on the left, ×4 on the right)

Answer: 8 metres

Exercise

How long is the height of the tree if its shadow is 15 m in the same situation as problem 2? $2 : 3 = x : 15$ $x = 10$

Answer: 10 metres

□ ÷ □ = 99

Lesson Flow

1 Review the previous lesson.

T Introduce the Main Task. (Refer to the Blackboard Plan)

2 Application of equivalent ratio.

S 1 1 Read and understand the given situation.
S Using the right triangle ⓐ ABC, put point E on side BC and make a right triangle ⓑ.
T Are the ratio of the lengths of the two triangles equal?
S Measure the lengths as a ratio (1) DE : EB and (2) AC : CB and compare.
TN Students' will realise that the lengths are not equal but the ratio is the same.

3 Application of ratio to find the value of x.

T 2 Let the students read and understand the situation.
S Work out the height of the tree in this case considering its shadow as 12 m.
S Represent the height of the tree as x and make a mathematical sentence by using the equality of two ratios and fill in the box.

4 Complete the Exercise.

S Solve the exercise.
T Confirm students' answers.

6 Summary

T What have you learned in this lesson?
S Present ideas on what they have learned.
T Use students' ideas to confirm important concepts of this lesson.

Sample Blackboard Plan

Date: Chapter 11: Ratio and Its Application Sub-chapter/Topic 3: Application of Ratio Lesson: 1 of 2

Main Task: Let's think about solving problems by simplifying ratios.

Review

Simplify the ratio.

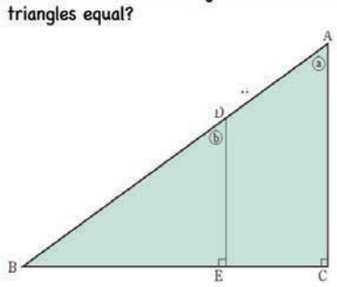
$4:12 = (4 \div 2):(12 \div 2)$
$= 2:6$
$= (2 \div 2):(6 \div 2)$
$= 1:3$

or $4:12 = (4 \div 4):(12 \div 4)$
$= 1:3$

MT

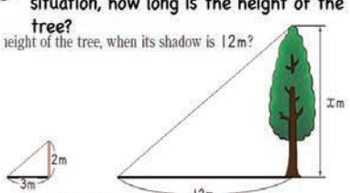
1 From the length of shadow, find the height of the tree.

1 Are the ratios of the lengths of the two triangles equal?



DE : EB= 4 : 6 = 2 : 3
AC : CB= 6 : 9 = 2 : 3

2 A 2m pole makes a 3m shadow. In this situation, how long is the height of the tree?
Height of the tree, when its shadow is 12m?



×4
2 : 3 = x : 12 2x4=8
×4 Height is 8 metres

Exercise

(Refer to TM for Questions and Answers)

Summary

We can find the value of x by multiplying by the same number to make the equality of the ratio.

Unit 11

Unit: Ratio and Its Application
Sub-unit: 3. Application of ratio
Lesson 2 of 2

Textbook Page : 100
Actual Lesson 079

Lesson Objectives

- To understand how to calculate dividing by ratio.

Prior Knowledge

- Ratio, value of ratio and simplification of ratio

Preparation

- Tape diagram

Assessment

- Calculate the quantity of a ratio by dividing. F
- Solve the exercises correctly. S

Teacher's Notes

In this lesson, students are expected to divide quantities into a given ratio.
Ambai's idea:
Making a ratio of older sister to the whole string (simplifying ratio by division).

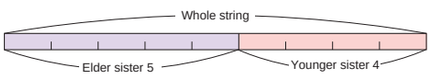
5 : 9 = x: 72

Sare's Idea:
Considering the whole length as 1, calculate each part using fraction(representing ratio by fractions).

Dividing by Ratio

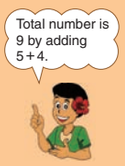
How to calculate ratio

2 We divide 72 cm of string between the elder sister and the younger sister in the ratio of 5 : 4.
How long is each string going to be?



Ambai's Idea

We use the ratio of the elder sister's string to the whole string to find the length of the elder sister's string.
If the length of the elder sister's string is x cm,
5 : 9 = x : 72
We use the same method to find the length of the younger sister's string.



Sare's Idea

We assume that the whole string is 1 and consider how long is the elder sister's string out of 1.
Elder sister's string……
$\frac{5}{9}$ out of the whole string $72 \times \frac{5}{9} =$ 40
We use the same method to find the length of the younger sister's string.

Exercise

We divide 500 mL of milk for Jaydan and his father in the ratio of 2 : 3.
How much milk does Jaydan get?

$500 \times \frac{2}{5} = 200$
Answer: 200 mL

100 = □ – □

Lesson Flow

1 Review the previous lesson.

T Introduce the Main Task. (Refer to the Blackboard Plan)

2 How to divide using ratio.

T/S 2 Read and understand the situation and discuss the length of string divided in the ratio between the two sisters.
T Ask students to think about how long each string will be.
S Give ideas on how to solve the problem
T/S Discuss Ambai 's and Sare's ideas.
TN Refer to the Teacher's Notes for the calculation.
T/S Make comparisons with Ambai's and Sare's ideas with own ideas.

3 Complete the Exercise.

S Solve the exercise.
T Confirm students' answers.

4 Summary

T What have you learned in this lesson?
S Present ideas on what they have learned.
T Use students' ideas to confirm important concepts of this lesson.

Sample Blackboard Plan

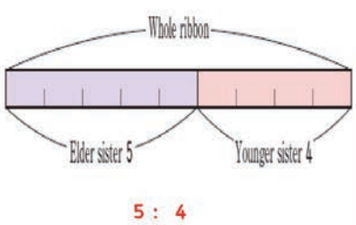
Date: Chapter 11: Ratio and Its Application Sub-chapter/Topic 3: Application of Ratio Lesson: 2 of 2

Main Task: Let's think about dividing quantities by a given ratio.

Review

MT

2 We divide 72cm of tape measure between the elder sister and younger sister in the ratio 5 : 4. How long is each tape measure going to be?



5 : 4

Discuss:

Ambai's Idea

We use the ratio of the elder sister's string to the whole string for finding the length of elder sister's string. (Total number is 9 by 5+4.)
If the length of the elder sister's string is X cm,
5 : 9 = X : 72
We use the same method to find the length of the younger sister's ribbon.

Sare's Idea

We assume that the whole string is 1 and consider how long is the elder sister's string out of 1.
Elder sister's string..... $\frac{5}{9}$ out of the whole string $72 \times \frac{5}{9} = 40$
We use the same method to find the length of the younger sister's string.

Exercise

(Refer to TM for Questions and Answers)

Summary

We can find the value of x by dividing by the same number to make the equality of the ratio.

Unit 11 Unit: Ratio and its Application

Exercise, Problems, Evaluation and Mathematics Extra
Lesson 1 and 2 of 2

Textbook Page : p.99~100
Actual Lesson 080 and 81

Lesson Objectives

- TTo confirm their understanding on the concepts they learned in this unit by completing the Exercise, Problem and Evaluation Test confidently.

Prior Knowledge

- All the contents learned in this unit of Ratio.

Preparation

- Evaluation Test.

Assessment

- Solve the exercises correctly to confirm what they learned in the unit. F S

Teacher's Notes

This is the last lesson of Chapter 11.
Students should be encouraged to use the necessary skills learnt in this unit to complete all the exercises and solve the problems in preparation for the evaluation test.
The test can be conducted as assesment for your class after finishing all the exercises.
Use the attached evaluation test to conduct assesment for your class after finishing all the exercises, problems and review as a seperate lesson.

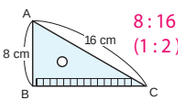
EXERCISE

1 Let's represent the ratios for the following: Page 94

① The quantity of cooking oil and vinegar.

100 : 50
(2 : 1)

② The length of side AB and AC in a set-square.



8 : 16
(1 : 2)

2 Find the number for x. Pages 96 and 97

① 3 : 5 = x : 10 $x = 6$
② 7 : 4 = 35 : x $x = 20$
③ 80 : x = 5 : 8 $x = 128$
④ x : 125 = 3 : 5 $x = 75$

3 Simplify the following ratios. Page 98

① 36 : 48 3 : 4
② 800 : 1400 4 : 7
③ 1.2 : 0.8 3 : 2

4 You draw a rectangle, where the ratio of length to width is 2 : 3. If the width is 18 cm, how long is the length? Page 99

2 : 3 = x : 18 $x = 12$ Answer: 12 cm

Grade 5 Do you remember?

Let's calculate.

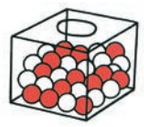
① 3.6×1.2 4.32
② 1.5÷2.5 0.6
③ 6.4×0.8 5.12
④ 4.32÷3.6 1.2
⑤ 9.43×4.1 38.663
⑥ 4.08÷5.1 0.8
⑦ $\frac{1}{6}+\frac{1}{2}$ $\frac{2}{3}$
⑧ $\frac{8}{15}-\frac{1}{3}$ $\frac{1}{5}$
⑨ $\frac{7}{12}+\frac{7}{8}$ $1\frac{11}{24}$
⑩ $1\frac{1}{2}-\frac{2}{3}$ $\frac{5}{6}$
⑪ $2\frac{1}{6}+\frac{5}{12}$ $2\frac{7}{12}$
⑫ $2\frac{3}{4}-1\frac{3}{8}$ $1\frac{3}{8}$

PROBLEMS

1 You need, 400 g of steamed rice and 40 g of curry to make curry rice for 4 people.
● Utilising equal ratio.

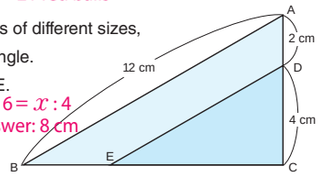
① How many g of steamed rice and curry do you need, to make curry rice for 2 people? 200 g rice, 20 g curry
② How many g of steamed rice and curry do you need, to make curry rice for 8 people? 800 g rice, 80 g curry
③ There is 600 g of steamed rice.
If you try to make curry rice in the same ratio as the one you made for 4 people, how many g of curry do you need? 60 g

2 Ben is drawing a box which has red balls and white balls in the ratio of 3 : 4.
There are 28 white balls.
How many red balls should he draw?
● Representing ratio of two quantities.



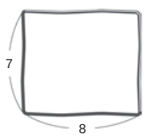
21 red balls

3 There are two set-squares of different sizes, overlapping at the right angle.
Find the length of side DE.
● You can use equal ratio in the diagram.



12 : 6 = x : 4
Answer: 8 cm

4 Nason tried to make a rectangle with its length and width in the ratio of 7 : 8 using a 60 cm string.
How long should the width and length of this rectangle be?
● You can use dividing by ratio.



60÷2=30
30 x $\frac{1}{7}$=14 30 x $\frac{8}{15}$=16
Answer: Width: 14cm Length: 16cm

□ ÷ □ = 101 102 = □ − □

Lesson Flow

1 Complete Exercise from ① to ④.

TN ① Represent the ration for each case in ① and ②.
② Calculate the equivalent ratios for ① to ④ by finding the value of x.
③ Complete the exercise by smplifying the ratios.
④ Complete the exercise by solving the problem.

2 Complete the Do You Remember exercise.

TN Calculate the problems.

3 Complete Problems ① to ④.

TN All problems to be done for homework.

TN ① Read the problem and solve questions ① to ③.
② Use the given ratio to find the number of red balls to be drawn.
③ Study the diagram and solve the problem.
④ Solve the problem by identifying length and width using a given ratio.

4 Complete the Evaluation Test.

TN Use the attached evaluation test to conduct assesment for your class after finishing all the exercises and problems as a seperate lesson.
S Complete the evaluation test.

Mathematics Practices in Papua New Guinea

Traditional Patterns and Symmetry

Papua New Guinea consists of diverse cultures, customs and languages and is also home to many distinctive traditional patterns, shapes and symbols that indicate the practices of mathematics in culture and tradition.
Many of these can be seen mostly as symmetrical structures or figures, demonstrated in tattoos, artefacts, bilum and basket weaving, initiations, traditional buildings, costume designs and many more.
Tattoos play significant roles in respective tribes. They can be found on different parts of the body depending on their significance.
Whole-body tattooing is common in some parts of Papua New Guinea. Some are done as an indication of maturity while others represent tribal identity. Different patterns of lines and figures are used in symmetry with bush materials to draw lines and congruent shapes.

Central Tattoos

Bilums come in different patterns with each pattern resembling certain tribes or clans.
More complex and specific patterns are made for carrying during public appearances or special ceremonial events including yam festivals, tumbuan dances, bride price payment, compensation and barter system.
These patterns are inherited from elders and carefully woven using cane or bamboos to create uniform and symmetrical patterns and shapes.
Here are more examples of symmetrical patterns and figures in PNG.

Highlands Bilum

Momase Bilum

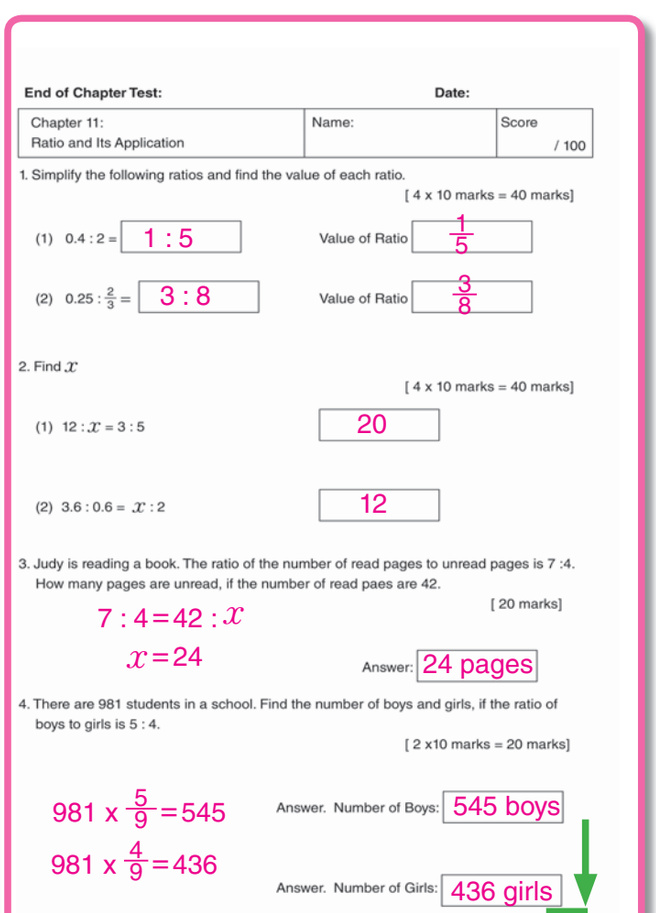
Sepik Carving

Oro Tapa

Buka Tray and Basket

Milne Bay Yam House

□ ÷ □ = 103



End of Chapter Test: **Date:**

Chapter 11: Ratio and Its Application	Name:	Score / 100

1. Simplify the following ratios and find the value of each ratio.
[4 x 10 marks = 40 marks]

(1) 0.4 : 2 = 1 : 5 Value of Ratio $\frac{1}{5}$

(2) 0.25 : $\frac{2}{3}$ = 3 : 8 Value of Ratio $\frac{3}{8}$

2. Find x
[4 x 10 marks = 40 marks]

(1) 12 : x = 3 : 5 → 20

(2) 3.6 : 0.6 = x : 2 → 12

3. Judy is reading a book. The ratio of the number of read pages to unread pages is 7 :4. How many pages are unread, if the number of read paes are 42.
[20 marks]

$7 : 4 = 42 : x$
$x = 24$
Answer: 24 pages

4. There are 981 students in a school. Find the number of boys and girls, if the ratio of boys to girls is 5 : 4.
[2 x10 marks = 20 marks]

$981 \times \frac{5}{9} = 545$ Answer. Number of Boys: 545 boys
$981 \times \frac{4}{9} = 436$ Answer. Number of Girls: 436 girls

End of Chapter Test **Date:**

Chapter 11: Ratio and Its Application	Name:	Score / 100

1. Simplify the following ratios and find the value of each ratio. [4 × 10 marks = 40 marks]

(1) 0.4 : 2 = ☐ Value of Ratio ☐

(2) 0.25 : $\frac{2}{3}$ = ☐ Value of Ratio ☐

2. Find x [4 × 10 marks = 40 marks]

(1) 12 : x = 3 : 5 ☐

(2) 3.6 : 0.6 = x : 2 ☐

3. Judy is reading a book. The ratio of the number of read pages to unread pages is 7: 4. How many pages are unread, if the number of read pages are 42. [20 marks]

Answer: ☐

4. There are 981 students in a school. Find the number of boys and girls, if the ratio of boys to girls is 5 : 4. [2 × 10 marks = 20 marks]

Answer. Number of Boys: ☐

Answer. Number of Girls: ☐

Chapter 12 Enlargement and Reduction of Figures

1. Content Standard

6.3.2. Students will be able to expand the plane figures by enlargement and reduction and explore the properties for expansion.

2. Unit Objectives

- To deepen the understanding about plane figures through observation and drawing practice.
- To understand the enlarging and reducing properties of geometrical figure.

3. Teaching Overview

Students have some ideas of enlarged and reduced drawings in a sense. For instance, they learned that small square and large square are still squares in Grade 2. In Grade 5, they learned congruency of figures and its definition by focusing on the sizes of corresponding angles and lengths of corresponding sides. In this topic, students broaden the perspective on observing figures with basic concepts of similarity.

Enlarging and Reducing Figures:

Students compare 2 figures looking alike and investigate by measuring sizes of angles, length of corresponding sides to find enlarged and reduced figures. Then they discuss the features of enlargement and reductions in figures. Finally, they define enlarged and reduced figures. Further theories will be taken care of in Grade 9, however, they should know that figures with different angles are not enlarged or reduced figures.

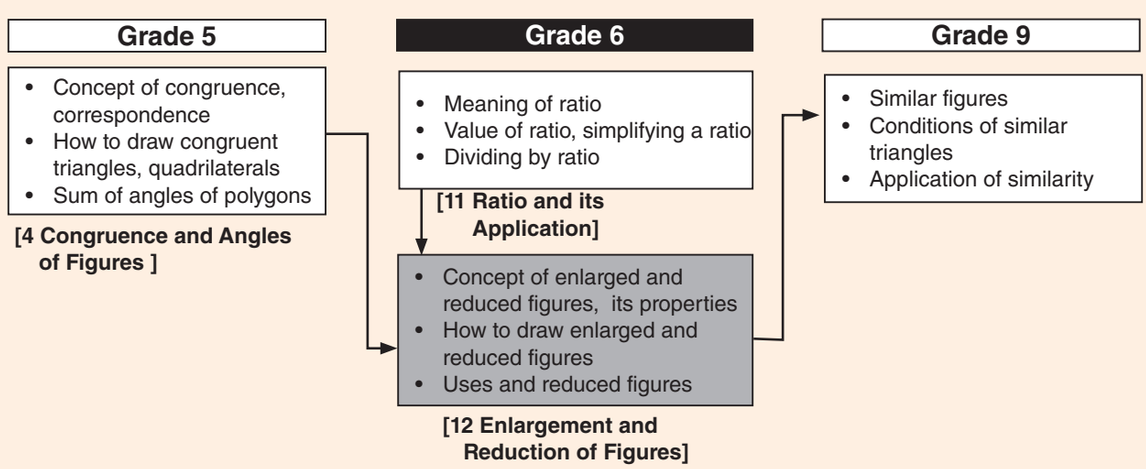
How to Draw Enlarged and Reduced Drawings:

They learn 2 methods ; using graph papers and drawing lines from an origin.

Uses of Reduced Drawings:

They utilise the concept of reduced drawings for interpreting maps. They will get used to finding the actual distance of a segment on a map and also finding a length on a map when they know the actual distance.

4. Related Learning Contents



Unit 12

Unit: Enlargement and Reduction of Figures
Sub-unit: 1. Enlarging and Reducing Figures
Lesson 1 of 3

Textbook Page : 104 and 105
Actual Lesson 082

Sub-unit Objectives

- To understand the meaning and properties of enlarging and reducing geometrical figures.
- To understand the properties of angles and sides of enlarging and reducing figures.

Lesson Objectives

- To find the meaning of similar shape by focusing on the length of the corresponding sides and the size of corresponding angles among the given figures.

Prior Knowledge

- Understand how to measure and draw lengths and angles of plane figures.

Preparation

- Diagram of the four figures in the textbook
- 30 centimetre ruler, protractor, tracing papers and a result table

Assessment

- Identify figures of similar shapes. F
- Understand and explain the meaning of similar shapes. S

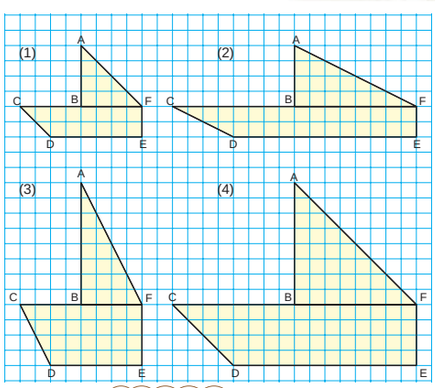
Teacher's Notes

It is important for students to understand the meaning of **"similar shapes"** by measuring and comparing the length of corresponding sides and size of corresponding angles of figures correctly using a ruler and protractor.

Students are expected to discover the common ratio or relationship that exist between the lengths of all the corresponding sides of the similar shape figures. They will also find out that the size of corresponding angles of the similar shapes are always congruent or equal.

12 Enlargement and Reduction of Figures

From the shapes drawn, which one has the same shape as (1) in figure (2), (3) and (4) below?



How can we tell if the shapes are similar?

104 = □ × □ × □

1 Enlarging and Reducing Figures

Are they the same boat? Let's look at the sizes.

1 Let's compare shapes (1) to (4) on page104.

1 Measure the lengths and angles of the 4 shapes and organise them on the table below.

	Length of side (cm)			Angle (Degree)			
	Side AB	Side CD	Side AF	Angle A	Angle C	Angle D	Angle E
(1)	2	1.4	2.8	45	45	135	90
(2)	2	2.3	4.5	63	27	153	90
(3)	4	2.3	4.5	27	63	117	90
(4)	4	2.8	5.6	45	45	135	90

2 Compare the lengths of the 3 sides. Which shape has the length 2 times the length as in (1)? Shape (4)

3 Compare the size of the 4 angles. Which shape has the same size angles as in (1)? Shape (4)

Let's investigate the properties of figures with the same shape but different sizes and how to draw them.

□ × □ × □ = 105

Lesson Flow

1 Compare shapes by observation.

T ▶▶ Which of these figures (2), (3) or (4) are exactly the same as figure (1)?

S Compare the figures and explain how they are the same or different by considering the hint from the speech bubble.

S (2) looks longer horizontally compared to (1).
(3) looks longer vertically compared to (1).
(4) looks like an enlarged figure of (1).

T Introduce the Main Task. (Refer to the Blackboard Plan)

2 1 Compare shapes (1) to (4) and record the results on the table.

T Give out the blank copies of the table or ask the students to draw it.

S 1 Measure the length and angles of the 4 shapes and record the results on the table.

3 Understand the relationship about the lengths of corresponding sides and the size of corresponding angles of figure (1) to (4).

T Ask the students to do activity 2 and 3.

S Compare the results on the table to identify any relationship among the figures to answer the questions.
Answers: 2 Shape (4)
3 Shape (4)

TN Students should explain their answers and the reasons why they chose them.

4 Summary

T What have you learned in this lesson?

S Present ideas on what they have learned.

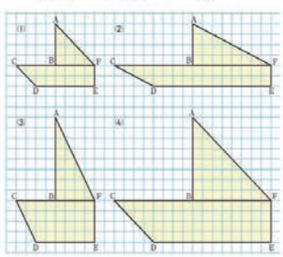
T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan

Date: Chapter 12: Enlargement and Reduction of Figures Sub-chapter/Topic 1: Enlarging and Reducing Figures Lesson: 1 of 3

Main Task: Let's think about and understand similar shapes.

▶▶ Which of the three figures (2,3 or 4) is the "**similar shape**" of figure 1



How to find out?
(i) measure the length of sides.
(ii) measure size of angles.

MT

1 Let's compare shapes 1 - 4.

1 Measure the lengths and angles of the 4 shapes and organise them on the table below.

	Length of side (cm)			Angle (Degree)			
	Side AB	Side CD	Side AF	Angle A	Angle C	Angle D	Angle E
(1)	2	1.4	2.8	45	45	135	90
(2)	2	2.3	4.5	63	27	153	90
(3)	4	2.3	4.5	27	63	117	90
(4)	4	2.8	5.6	45	45	135	90

2 Which shape has the length 2 times the length as in (1)? Explain.
Shape (4)

3 Which shape has the same size angles as in (1)? Explain.
Shape (4)

Exercise

(Refer to TM for Questions and Answers)

Summary

- The size of the corresponding angles of similar shapes are always equal.
- The length of corresponding sides increase or decrease in size according to the size of enlargement.

Unit 12

Unit: Enlargement and Reduction of Figures
Sub-unit: 1. Enlarging and Reducing Figures
Lesson 2 of 3

Textbook Page : 106 and 107
Actual Lesson 083

Lesson Objectives

- To investigate the characteristics of sides and angles of figures enlarged.
- To understand how to find the ratio and value of ratio between enlarged and reduced figures.

Prior Knowledge

- Understand how to measure and draw lengths and angles of plane figures.

Preparation

- Enlarged copy of figures in the textbook
- Ruler, protractor, compass and A4 papers

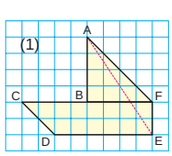
Assessment

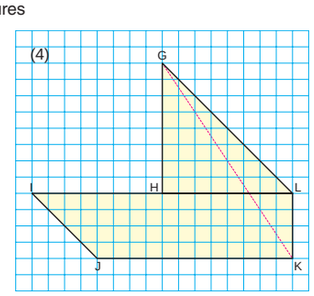
- Understand and explain the corresponding sides and angles of enlarged and reduced figures. F
- Identify the ratio between enlarged and reduced figures. F S
- Solve the exercises correctly. S

Teacher's Notes

- It is important for students to represent and interpret lengths of corresponding sides in simplified ratio correctly. Students must understand that the lengths of all corresponding sides of enlarged and reduced figures share the same ratio and all their corresponding angles remain equal or congruent.
- Also, if students understand the relationship among congruent, reduced and enlarged figures, then they should be able to draw or differentiate the figures accordingly. It is important to note that a congruent or an enlarged figure is changed into a reduced figure by dividing the lengths of the corresponding sides by the same measure or proportion. Whereas, all lengths of corresponding sides of a congruent or reduced figure is multiplied by the same measure to make an enlarged figure. However, if all lengths of the corresponding sides are in the ratio 1 : 1, then the two figures are congruent.
- Corresponding angles of reduced, congruent and enlarged figures remain the same or equal.

2 The figures below are figures (1) and (4) on page 104. We rename the points of each figure A to F and G to L.





1 Find the simplified ratio of the length of side DE to the length of side JK.

How many times longer are the lengths of the corresponding sides of figure (4) than figure (1)?

Side DE : Side JK = 3 : 6 = 1 : 2

Side DE ÷ Side JK = $\frac{3}{6} = \frac{1}{2}$ (times more)

Let's investigate the other corresponding sides lengths.

2 Line AE corresponds to line GK. Measure these 2 lines and represent them in a simplified ratio.

How many times is the length of line AE longer than line GK? 2 times

3 Let's compare the corresponding angles.

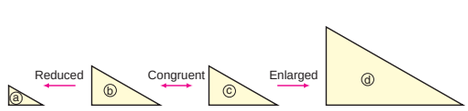
Corresponding angles are equal.

If each corresponding angle is equal and all lengths of corresponding sides are extended in the same ratio, this is called **enlarged figure**.
If decreased in the same ratio, this is called **reduced figure**.

In an enlarged figure and a reduced figure, all lengths of the corresponding sides are in the same ratio and all corresponding angles are equal.

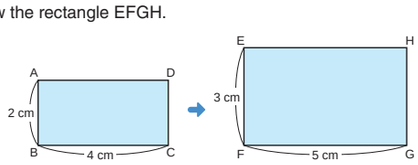
Figure (4) is two times an enlarged drawing of figure (1) and figure (1) is a $\frac{1}{2}$ reduced drawing of figure (4).

If the lengths of the corresponding sides are in the ratio of 1 : 1, the 2 figures are congruent.



Exercise

Enlarge the length and width of rectangle ABCD by 1 cm and draw the rectangle EFGH.



① Is rectangle EFGH an enlarged figure of rectangle ABCD? Yes

② If you want to enlarge rectangle EFGH 1.5 times of rectangle ABCD, how long is the length?

4 × 1.5 = 6 Answer: 6 cm

106 = □ × □ × □

□ × □ × □ = 107

Lesson Flow

1 Review the previous lesson.

2 2 Investigate the ratio of the corresponding sides and length.

T Introduce the Main Task. (Refer to the BP)
T/S Read and understand the given situation.
T What is the ratio of all the lengths of corresponding side in figure (1) and figure (4)?
S Do activity 1 and 2 and share their answers with the class.

3 Compare the size of corresponding angles.

T What do you notice about the size of corresponding angles of the figure (1) and (4)?
S 3 Measure and compare corresponding angles and then share their findings with the class.

4 Meaning and properties of enlarged and reduced figures.

T What do you notice about the lengths of the corresponding sides and corresponding angles of figure (1) and (4)?
S Figure out based on findings in activity 1 to 3 that:
(i) ratio of sides and whether the ratio value has increased or decreased.
(ii) angles do not change.

5 Important Point

T/S Explain the important points in the boxes [ ] and [ ].

6 Relationship among congruent, enlarged and reduced figures.

TN Show a diagram of different sizes of reduced and enlarged figures.
T Ask students how they can be compared.
S Explain using the features of the:

- original and enlarged figures.

Answer: The value of ratio increases but size of angles do not change.

- congruent and original figures.

Answer: The value of ratio and size of angles do not change.

- original and reduced figures.

Answer: The value of ratio decreases (reduced) but size of angles do not change.

7 Complete the Exercise.

S Solve the exercises.
T Confirm students' answers.

8 Summary

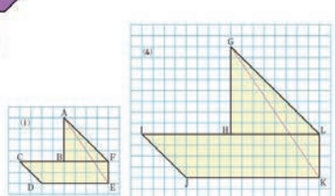
T What have you learned in this lesson?
S Present ideas on what they have learned.
T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan

Date: Chapter 12: Enlargement and Reduction of Figures Sub-chapter/Topic 1 Enlarging and Reducing Figures Lesson: 2 of 3

Main Task: Let's investigate and understand the meaning of reduced and enlarged figures.

MT 2



1 Find the simplified ratio of the length of side DE to the length of side JK. Also, how many times longer are the lengths of the corresponding sides of figure (4) than figure (1)?

Side DE : Side JK = 3 : 6 = 1 : 2

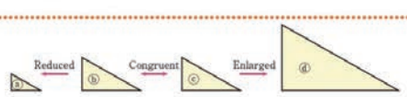
Side DE÷Side JK = 3/6 = 1/2 (times more)

2 How many times is the length of line AE longer than the length of line GK?
2 times

3 Compare the corresponding angles.(Discuss)
The corresponding angles are equal.

If each corresponding angle is equal, and all lengths of corresponding sides are extended in the same ratio, this is called **enlarged drawing**. If decreased in the same ratio, this is called **reduced drawing**.

In an enlarged drawing and a reduced drawing, all lengths of corresponding sides are in the same ratio and all corresponding angles are equal.



(i) *figure (a) and original figure (b).*
- value of ratio decreased,
- angles remain the same.

(ii) *figure(b) and figure (c).*
- value of ratio remain as 1 so, no change occurs.
- angles remain the same.

iii) *figure (c) and figure(d).*
- value of ratio increased,
- angles remain the same.

Exercise

(Refer to TM for Questions and Answers)

Summary

Summarise the lesson using the important points in the boxes [ ].

Unit 12

Unit: Enlargement and Reduction of Figures
Sub-unit: 1. Enlarging and Reducing Figures
Lesson 3 of 3

Textbook Page : 108
Actual Lesson 084

Lesson Objectives

- To identify the enlarged figure or reduced figure of an original figure around them.
- To find the ratio and value of ratio by which the original figure is extended or reduced.

Prior Knowledge

- Meaning and properties of enlarged and reduced figures
- Ratio and the value of ratio between enlarged and reduced figures

Preparation

- Drawing of figures ⓐ to ⓓ , ruler, protractor, compass and tracing papers.

Assessment

- Explain the ratio by which the original figure is enlarged or reduced. F
- Identify the ratio and value of ratio of enlarged and reduced figures. S

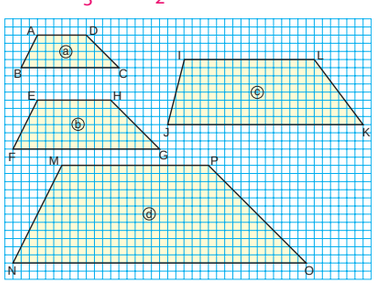
Teacher's Notes

Students need to know how to identify enlarged and reduced figures, confirming it with these two important features.
(i) congruency of all corresponding angles
(ii) similarity of the value of ratio applied to all corresponding sides of the two figures.

Moreover, students need to understand that to enlarge a figure, the ratio value is greater than 1, whereas to reduce a figure, the ratio value is less than 1. Also, students need to be aware of enlarged and reduced figures in their surroundings and also recognise its uses in their surroundings.

3 Let's investigate the figures below.

1. Which is an enlarged drawing of figure ⓐ and by how many times is it enlarged? (b) 1.5 times (d) 3 times
2. Which is a reduced drawing of figure ⓓ and by how many times is it reduced? (a) $\frac{1}{3}$ (b) $\frac{1}{2}$



4 Look around you and find enlarged and reduced figures.

Reduced image captured on camera.

Enlarged image in a microscope.

108 = □ × □ × □

Lesson Flow

1 Review the previous lesson.

2 3 Investigate and identify enlarged figures.

T Introduce the Main Task. (Refer to the BP)

T 1 Which figures (ⓑ, ⓒ or ⓓ) is an enlarged drawing of figure ⓐ and by how many times figure ⓐ is enlarged? (Give a hint such as measuring by counting units and comparing the lengths of corresponding sides.)

S Explain their answers and how to find them.

Example: Figure (b)

- FG (ⓑ's side) ÷ BC (ⓐ's side)

  $18 \div 12 = 1.5$

Example: Figure (c)

- NO (ⓓ's side) ÷ BC (ⓐ's side)

  $36 \div 12 = 3$

3 Investigate and identify reduced figures.

T 2 Which figures (ⓐ, ⓑ or ⓒ) is a reduced drawing of figure ⓓ and by how much it is reduced?

T Advice students to apply the similar way used in activity1 but this time, the length of the bigger figure will be used as a divisor.

S Explain their answers and how to find them.

Example: Figure ⓐ

- BC (ⓐ's side) ÷ NO (ⓓ's side)

  $12 \div 36 = \frac{1}{3}$

Example: Figure (b)

- FC (ⓑ's side) ÷ NO (ⓓ's side)

  $18 \div 36 = \frac{1}{2}$

4 4 Look for enlarged and reduced figures around them.

T Refer students to the examples in the textbook.

S Name some enlarged or reduced figures around them or in their daily lives and explain why they think so with the class.

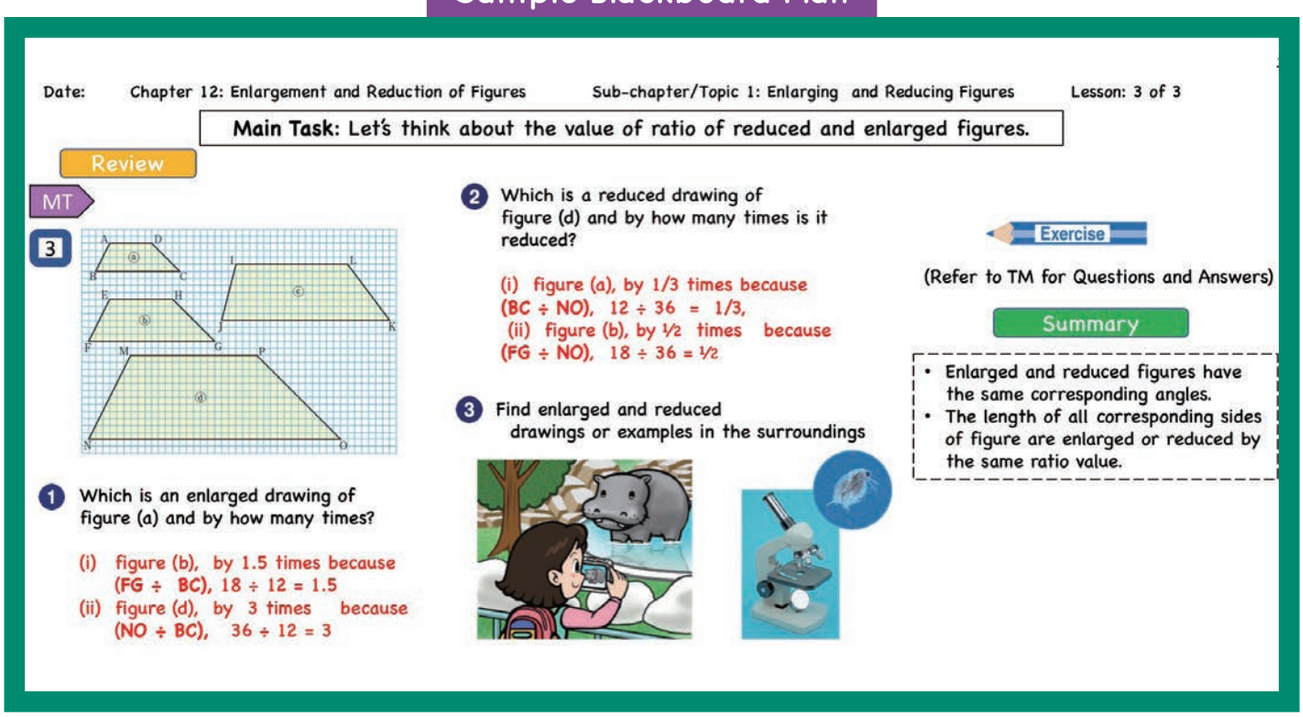
5 Summary

T What have you learned in this lesson?

S Present ideas on what they have learned.

T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan



Unit 12

Unit: Enlargement and Reduction of Figures

Sub-unit: 2. How to Draw Enlarged and Reduced Figures

Lesson 1 out of 5

Textbook Page : 109 and 110
Actual Lesson 085

Sub-unit Objectives

- To draw enlarged and reduced figures using grid papers.
- To draw enlarged and reduced figures using measurement of sides, angles and ratio.
- To draw enlarged and reduced figures using the center point for construction.

Lesson Objectives

- To draw a reduced figure by counting the grids of the original figure and reducing it by $\frac{1}{2}$ to get the length of the reduced figure.
- To draw an enlarged figure by counting the grids of the original figure and doubling it to get length of enlarged figure.

Prior Knowledge

- Enlarged and reduced drawings
- How to draw figures like triangles using protractors and compass.

Preparation

- Grid paper, metre ruler, quadrilateral ABCD, Triangle ABC, protractor and compass

Assessment

- Draw an enlarged quadrilateral that is two times the original using grid paper. F
- Draw a reduced triangle that is $\frac{1}{2}$ times the original using grid paper. S

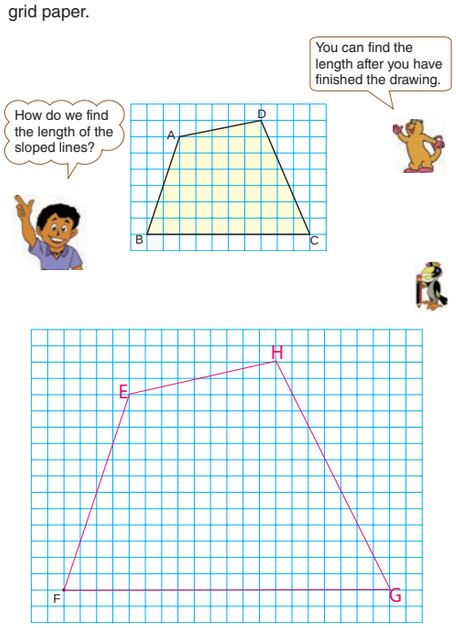
Teacher's Notes

Students should be aware of how to draw figures using ratio (enlarged/reduced scale). The term "ratio" should not be used but help them to understand the meaning of enlarging and reducing by the same ratio. It's recommended for the teacher and students to use "grid number" to explain the relationship between the original figure and enlarged or reduced figures. Common misconception is when students only increase the height by 2. It is also important to inform the students that all the sides will increase together by the same ratio. For the triangle it is required to emphasise to the students that small grids are half of the original grid where 2 are counted as 1 square.

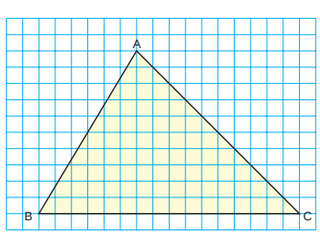
2 How to Draw Enlarged and Reduced Figures

How to Draw Using Grid Paper

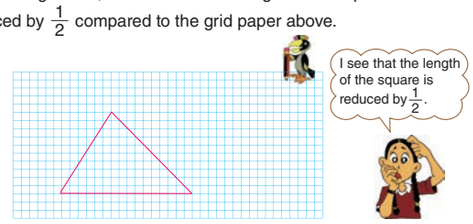
1 Let's think about how to draw an enlarged figure EFGH which is 2 times of the quadrilateral ABCD.
Point F is corresponding to point B and it is already drawn on the grid paper.



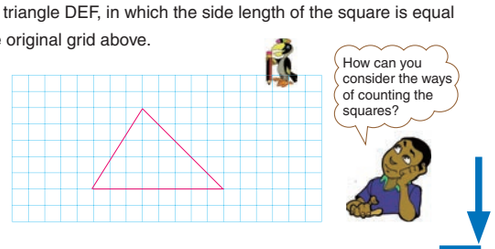
2 Draw triangle DEF which is triangle ABC reduced by $\frac{1}{2}$ on the two grid papers below.



1 Draw triangle DEF, in which the side length of the square is reduced by $\frac{1}{2}$ compared to the grid paper above.



2 Draw triangle DEF, in which the side length of the square is equal to the original grid above.



□×□×□= 109

110 =□×□×□

Lesson Flow

1 Review the previous lesson.

2 Draw an enlarged drawing from the quadrilateral ABCD.

T Introduce the Main Task. (Refer to the BP)
T/S 1 Read and understand the given situation.
T What similar and different features do enlarged figures have in common?
S Enlarged figures have all lengths of corresponding sides in the same ratio (enlarged scale) and all corresponding angles are equal.
T Ask students to draw the enlarged quadrilateral EFGH on the grid given.
S Construct the enlarged quadrilateral;
- starting from point F
- find out all the corresponding vertices (counting grid number and finding out the positions)
- connect all the vertices to get the final drawing EFGH.

3 Explain how you drew an enlarged quadrilateral of ABCD.

T Allow students to discuss how they found the length of corresponding sides.
S Lengths of corresponding sides: 2 times, 2) Grid number used in 1 should be double in 2, 3) First draw the line FG.
T Confirm the length of sides and the size of angles for the enlarged figure.

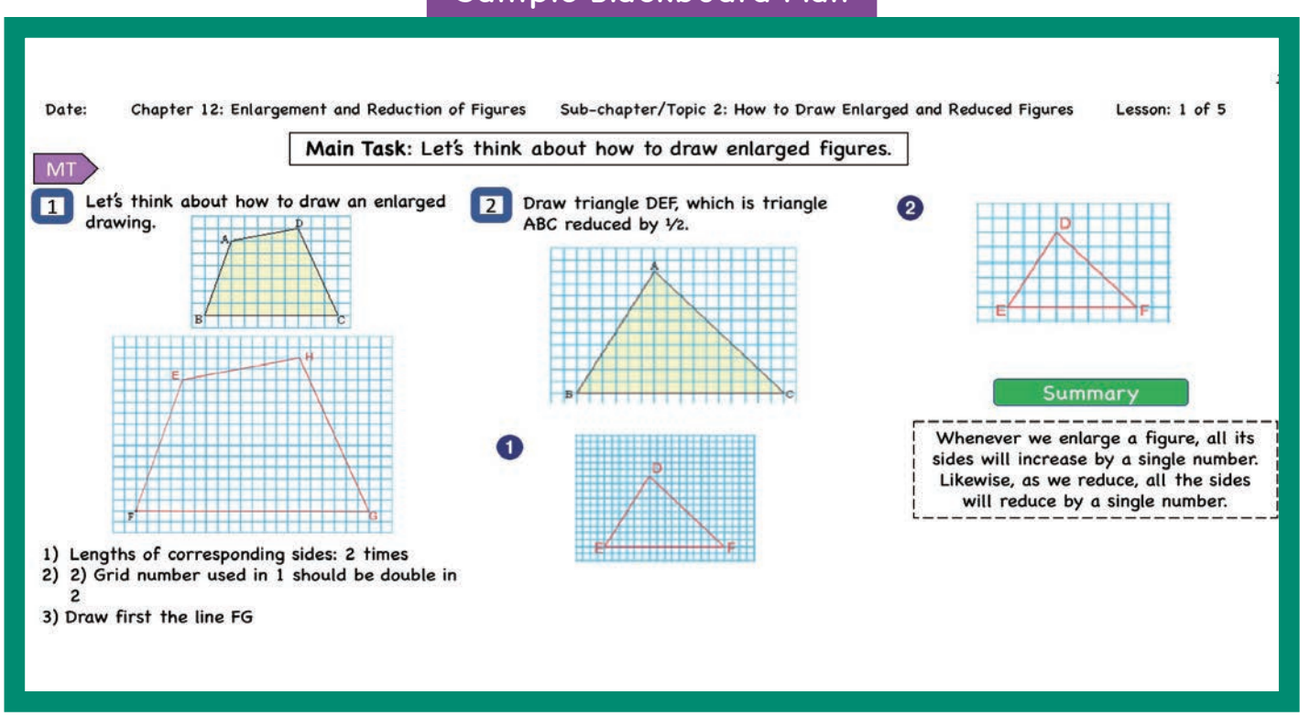
4 Draw a reduced figure of triangle ABC by $(\frac{1}{2})$ on two grid papers.

T/S 2 Read and understand the given situation.
T What similar and different features do reduced figures have in common?
S Reduced figures have all lengths of corresponding sides in the same ratio (reduced scale) and all corresponding angles are equal.
S Draw triangles 1 and 2 with the scale of $\frac{1}{2}$ on two different grid papers and explain.

5 Summary

T What have you learned in this lesson?
S Present ideas on what they have learned.
T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan



Unit 12

Unit: Enlargement and Reduction of Figures
Sub-unit: 2. How to Draw Enlarged and Reduced Figures
Lesson 2 of 5

Textbook Page : 111 and 112
Actual Lesson 086

Lesson Objectives

- Draw an enlarged triangle by using a compass or a protractor to measure sides and angles.

Prior Knowledge

- How to draw triangles using a protractor and a compass.
- Properties of congruent triangles

Preparation

- Triangle ABC, compass, protractor, ruler, paper with line EF

Assessment

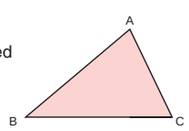
- Think about how to draw enlarged figures without using a grid paper correctly. F S
- Demonstrate how to draw an enlarged figure using a compass or a protractor. S

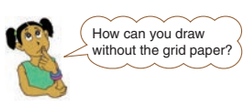
Teacher's Notes

This lesson is focused on drawing triangles using protractors and compasses. It is important to closely monitor the students in using mathematical tools as they easily forget how to measure sides, angles and lengths.
If students have difficulties drawing the enlarged triangle, refer them to the 3 ideas in the textbook.
Flow 4 in the lesson is an additional exercise to consolidate what they have learned.

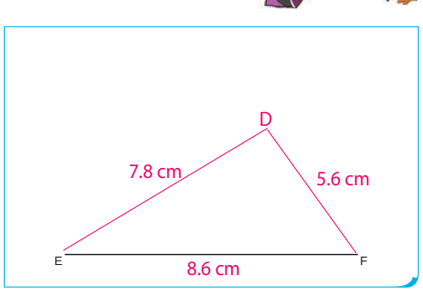
How to Draw Using Sides and Angles

3 Let's think about the method to draw triangle DEF, which is 2 times the enlarged drawing of triangle ABC.



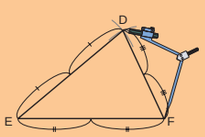


1. Which sides and angles should you measure?
2. Line EF, which is twice the enlarged line of line BC is already drawn.
   Point D is the corresponding point of point A.
   Let's think about where point D should be placed and finish the drawing.



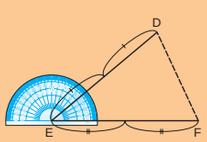
Vavi's Method to Draw

Enlarge all 3 sides to twice the lengths.



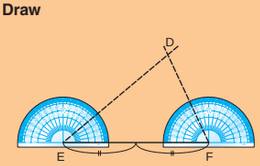
Mero's Method to Draw

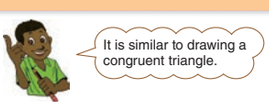
Enlarge 2 sides twice the lengths and use the angle between 2 lines.



Naiko's Method to Draw

Enlarge 1 side twice the length and use 2 angles on the other line.





□×□×□= 111　　112 =□×□×□

Lesson Flow

1 Review the previous lesson.

T Introduce the Main Task. (Refer to the BP)

2 3 Draw triangle DEF using triangle ABC and determine the position of a vertex.

T/S Read and understand the given situation.

T Refer to triangle ABC and ask students what they need to do to draw an enlarged figure (× 2) of the triangle, using a ruler, a compass and a protractor.

S 1) We need to identify the position of the vertex D, 2) measure all the sides and angles of the original triangle to apply them for the enlarged figure.

T 1 Which sides or angles of the triangle ABC we need to measure before we enlarge it?

S 1) Sides AB & AC
2) Sides AB & BC and the angle B
3) Angles B & C

T 2 Give students work paper with line EF already drawn and ask them to draw the enlarged figure, directing their attention to vertex D which corresponds to vertex A and length of line EF which is twice the length of BC

S Use previous knowledge to construct enlarged triangle DEF and check in a pairs whether the figures are correctly drawn in terms of length of sides and size of angles.

3 Categorise and confirm students' ideas on drawing the enlarged triangle.

T Identify similar and different methods amongst students' ideas on how they are constructing triangle DEF and group them, using the 3 sample ideas on the textbook

S Display their ideas on the blackboard, based on the 3 sample ideas and explain.

T Confirm their ideas using Vavi's, Mero's and Naiko's ideas.

4 Draw enlarged triangles using different ideas

T Ask students to try to draw the same enlarged figure using ideas they have not tried yet.

S Check in pairs whether the drawn figures are congruent to the original enlarged figure or not.

S Practice to draw the enlarged figures and check in pairs for congruency.

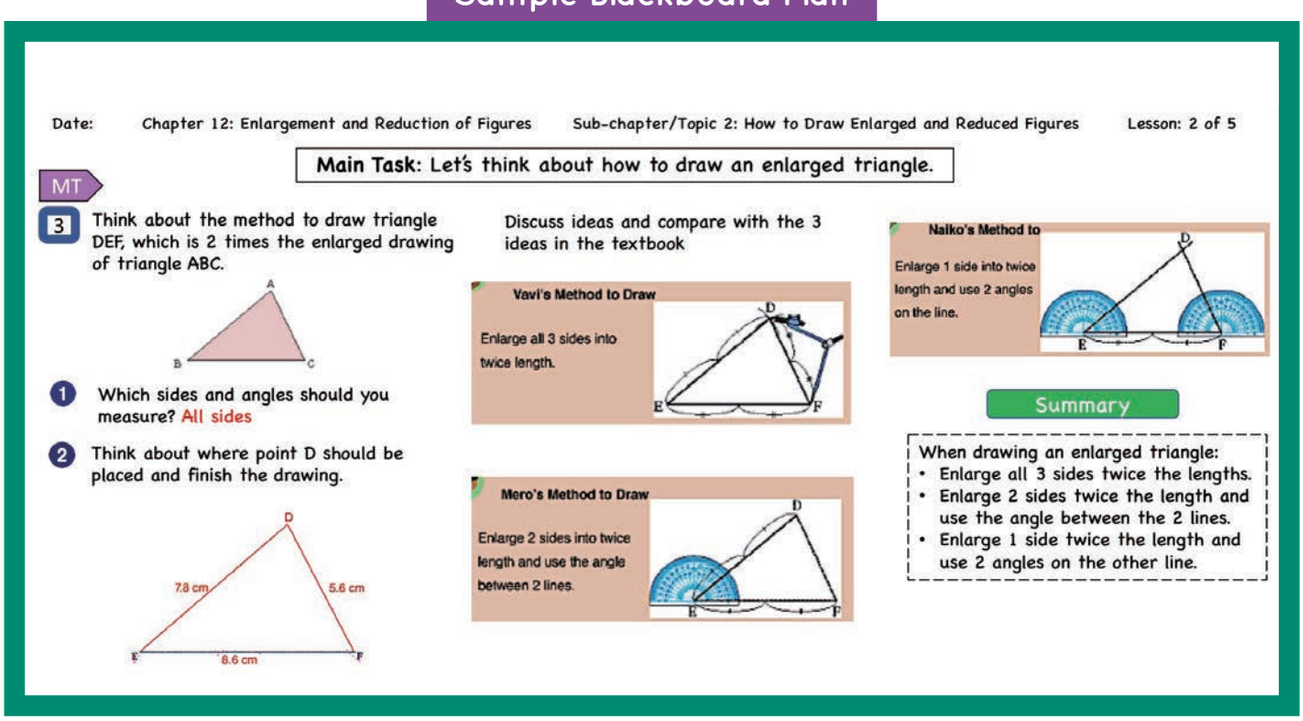
5 Summary

T What have you learned in this lesson?

S Present ideas on what they have learned.

T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan



Unit 12

Unit: Enlargement and Reduction of Figures
Sub-unit: 2. How to Draw Enlarged and Reduced Figures
Lesson 3 of 5

Textbook Page : 113
Actual Lesson 087

Lesson Objectives

- To draw a reduced figure of a given figure by using previously learned methods.

Prior Knowledge

- Drawing triangles using a protractor and a compass.
- Properties of reduced figures and ratio (reduced scale)

Preparation

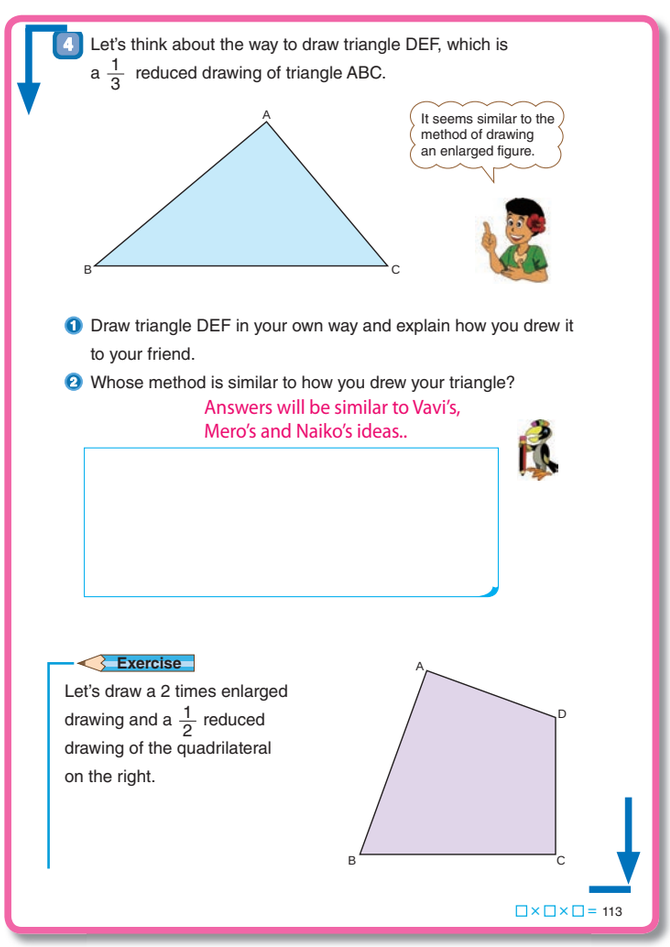
- Triangle ABC and Quadrilateral ABCD model
- meter ruler, compass, protractor

Assessment

- Draw reduced figures using various methods. F
- Demonstrate how to reduce triangle ABC by a ratio of a fraction and draw a new reduced figure. S
- Solve the exercise correctly. S

Teacher's Notes

This lesson is about drawing reduced figures using previously learned knowledge on how to construct figures.
The difficulty in this lesson is applying their knowledge of drawing triangles and quadrilaterals.
Assist students to draw or demonstrate some parts of the drawing process.
Reduced figure uses the same method of drawing enlarged figures.
The only differences are the ratio and size of the figures (length of sides and not the size of angles).



Lesson Flow

1 Review the previous lesson.

2 4 Draw a $\frac{1}{3}$ reduced drawing of Triangle ABC.

T Introduce the Main Task. (Refer to the Blackboard Plan)

T/S Read and understand the given situation.

T 1 Ask students to think of ways on how to draw triangle DEF which is a $\frac{1}{3}$ reduced figure of triangle ABC.

S Use their own ideas based on what they learned from previous lessons to draw the figure and explain how they drew it to their friends.

TN For the reduced figure, the size and lengths should be drawn according to the given ratio or fraction.

S Reduced figure should be smaller than the original figure according to the ratio of $\frac{1}{3}$.

T 2 Ask students to compare their ideas with Vavi's, Mero's and Naiko's methods.

S Idenitfy similar methods applied to reduce the triangle by $\frac{1}{3}$.

3 Complete the Exercise.

S Solve the exercise.

T Confirm students' answers.

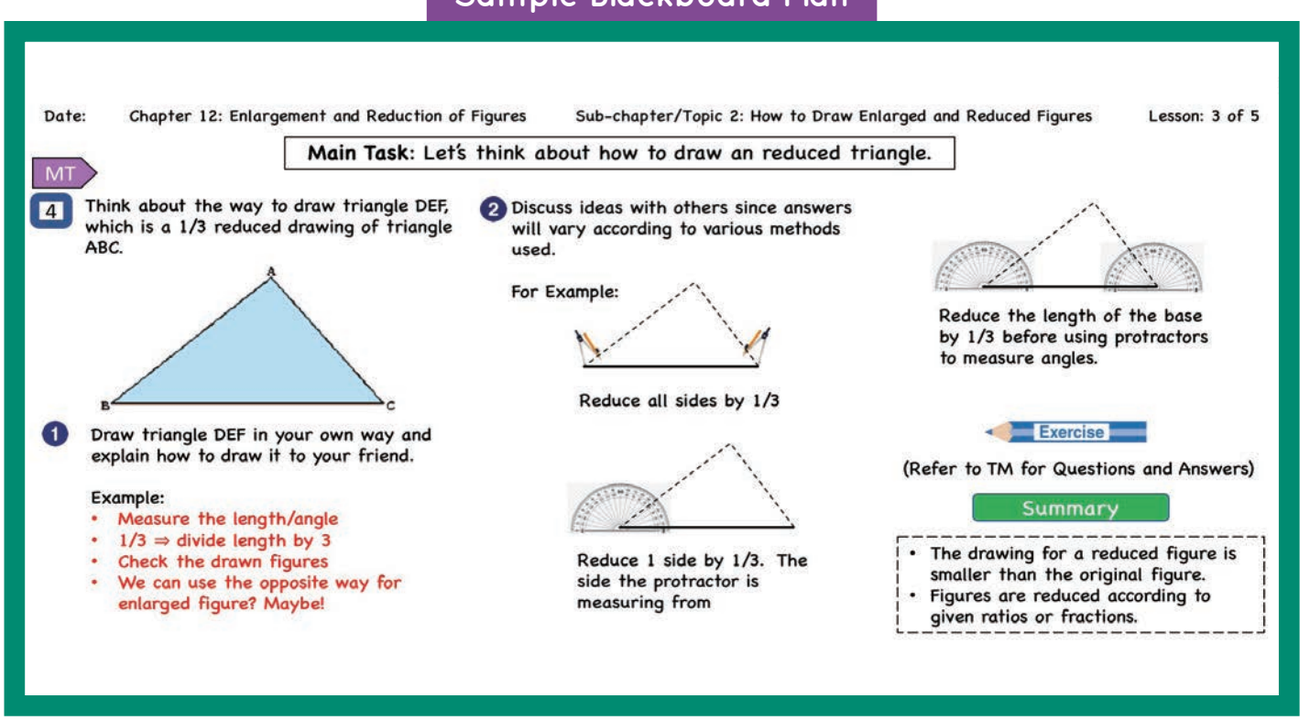
4 Summary

T What have you learned in this lesson?

S Present ideas on what they have learned.

T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan



Unit 12

Unit: Enlargement and Reduction of Figures
Sub-unit: 2. How to Draw Enlarged and Reduced Figures
Lesson 4 of 5

Textbook Page : 114
Actual Lesson 088

Lesson Objectives

- Draw an enlarged figure by using a vertex of the original figure as a centre point.

Prior Knowledge

- Properties of enlarged figures and the meaning of ratio (enlarged scale)

Preparation

- Triangle ABC on page 114, metre ruler, compass, protractor

Assessment

- Draw an enlarged figure from 1 vertex of the original figure. F
- Demonstrate how to draw a reduced figure of triangle ABC by using the vertex C as the centre point. S

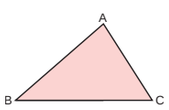
Teacher's Notes

Carefully check the students work if they understand enlarging or reducing a figure using a vertex and provide assistance. If students have enough time, they can try to draw the enlarged or reduced figures from different vertices.

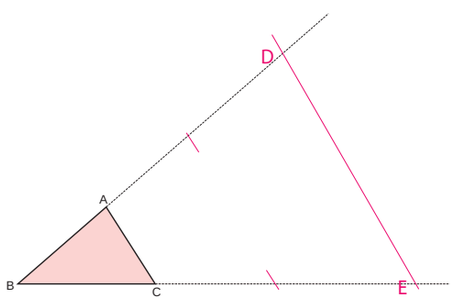
Flow 4, 5 and 6 are additional activities to consolidate the method of enlarging and reducing from a point of reference.

How to Draw Using Centre Point

5 By focusing on point B, use line BA and BC to draw triangle ABC that is enlarged 3 times.



1 Extend line BA and place point D, corresponding point of point A. Then extend line BC and place point E, corresponding point of point C.



2 Check and see if triangle DBE is 3 times triangle ABC.

Like the example above, we can draw enlarged drawings and reduced drawings using 1 point and its connected lines.
The point you use is called the **centre point**.

114 = □ × □ × □

Lesson Flow

1 Review the previous lesson.

T Introduce the Main Task. (Refer to the BP)

2 Enlarge drawing by focusing on one point.

T 5 Refer students to triangle ABC and get them to discuss how this figure can be enlarged 3 times, when line BC and BA are extended 3 times from point B?

S Discuss and share their ideas.

T/S 1 Extend line BA and place point D, as the corresponding vertex A. Then extend line BC and place point E, as corresponding vertex C.

T 2 Measure and confirm all the sides as 3 times larger than the original ones and all the angles as congruent.

S Connect all the vertices or points to see if triangle DBE is 3 times triangle ABC.

TN In this case, Vertex B is used as the point of reference when drawing an enlarged or reduced figure.

3 Important Point

T/S Explain the important point in the box .

4 Comparing methods of drawing.

T What is common and different, compared with other methods?

S Similarities: The sides a of the original triangles are extended according to the ratio

S Difference: Angles are not used in this method.

5 Think about how to draw a reduced figure using the same method.

T Allow students to think about how to apply the same method to draw a reduced figure.

S Measure the sides and reduce the length of the sides BA and BC by the same ratio.

6 Draw a reduced figure by half when C is the point of reference.

S: Draw a reduced figure of ABC by $\frac{1}{2}$ using C as the point of reference.

T Confirm that the 2 new vertices for the figure are middle points of the original

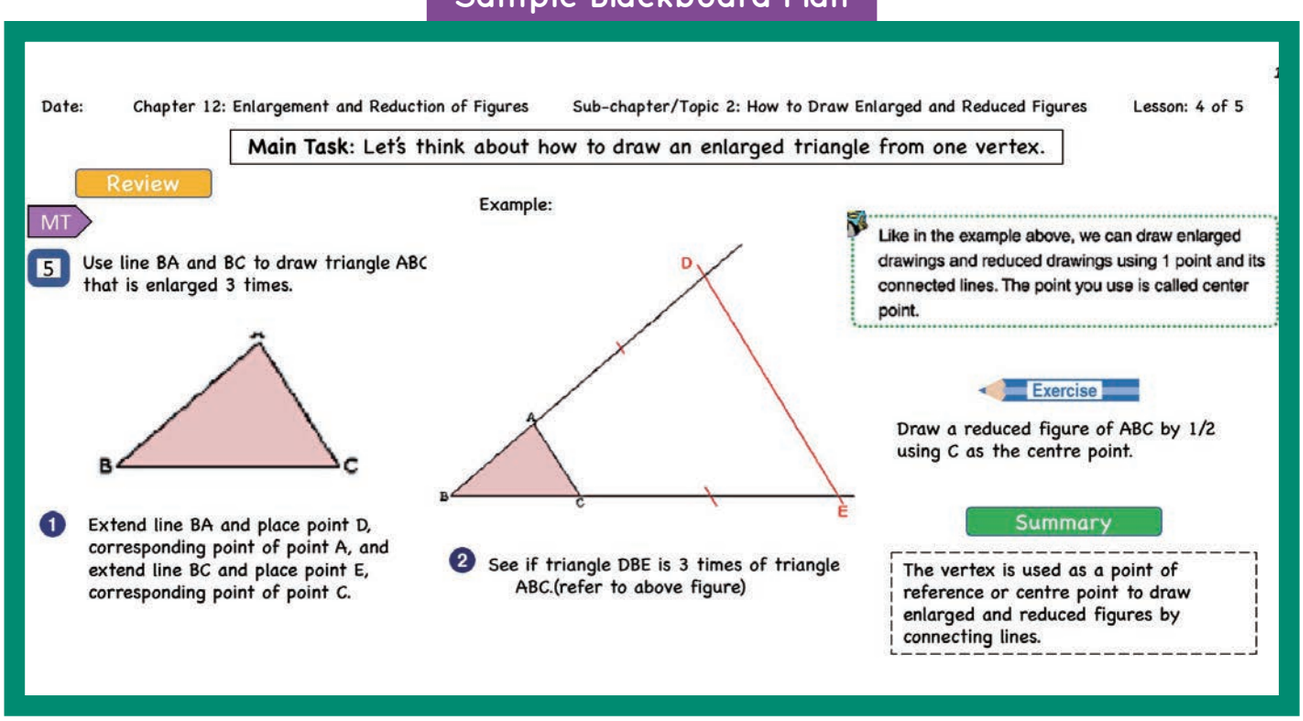
7 Summary

T What have you learned in this lesson?

S Present ideas on what they have learned.

T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan



Unit 12

Unit: Enlargement and Reduction of Figures
Sub-unit: 2. How to Draw Enlarged and Reduced Figures
Lesson 5 of 5

Textbook Page : 115
Actual Lesson 089

Lesson Objectives

- To draw an enlarged figure by using the centre point on any part of the figure.

Prior Knowledge

- How to draw enlarged and reduced figures by using given ratios and fractions and by using the vertex.

Preparation

- Quadrilateral ABCD, metre ruler, protractor and compass

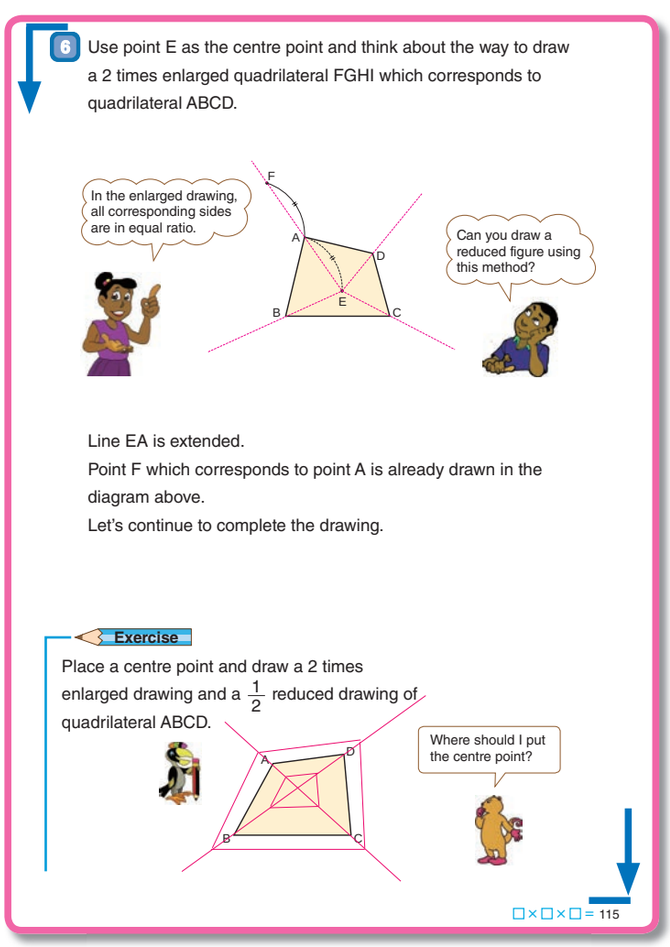
Assessment

- Draw a reduced and enlarged figure, using a centre point, which is not the vertex of the original figure. F S
- Solve the exercise correctly. S

Teacher's Notes

The lesson is focused on using centre point to enlarge and reduce figures, but not using the vertices.
Emphasise to the students on how the length is measured. Lines should be drawn from the centre point to corresponding points (new vertices), connecting the vertices of original figure.
The length of lines should correspond with the given ratio (enlarged or reduced scale).

The 2 times enlarged drawing has double the length of each side of the original figure. However, because the area becomes 4 times, some students misunderstand it as a 4 times enlarged drawing. The difference between the ratio of side and a ratio of area should be understood through folding a square paper.



Lesson Flow

1 Review the previous lesson.

2 Draw an enlarged figure using one point from inside of a triangle

T Using the same triangle ABC, add point D in the middle of the shape and ask students whether we can draw an enlarged triangle (× 2) from this point.

TN The centre point can be placed anywhere within the figure.

S Discuss and explain such as extending the line from the centre through the vertex to the corresponding point 2 times.

S Draw a line from point D through vertex A, B and C to find the vertex of the enlarged figure.

T Let the students enlarge it 2 times.

S Extend lines and measure the length which will be 2 times longer on each side, connect all the sides and get the enlarged figure.

T Introduce the Main Task. (Refer to the BP)

3 6 Enlarge quadrilaterals using a center point

T/S Read and understand the given situation.

T Ask the students to look at quadrilateral ABCD. Guide them to use point E as the center point to think about how to draw an enlarged quadrilateral FGHI (× 2).

S Study quadrilateral ABCD and extend the lines from point E through points A B C and D and then measure the new points on the lines to get the enlarged figure.

T Confirm students drawings.

4 Complete the Exercise.

S Solve the exercise.

T Confirm students' answers.

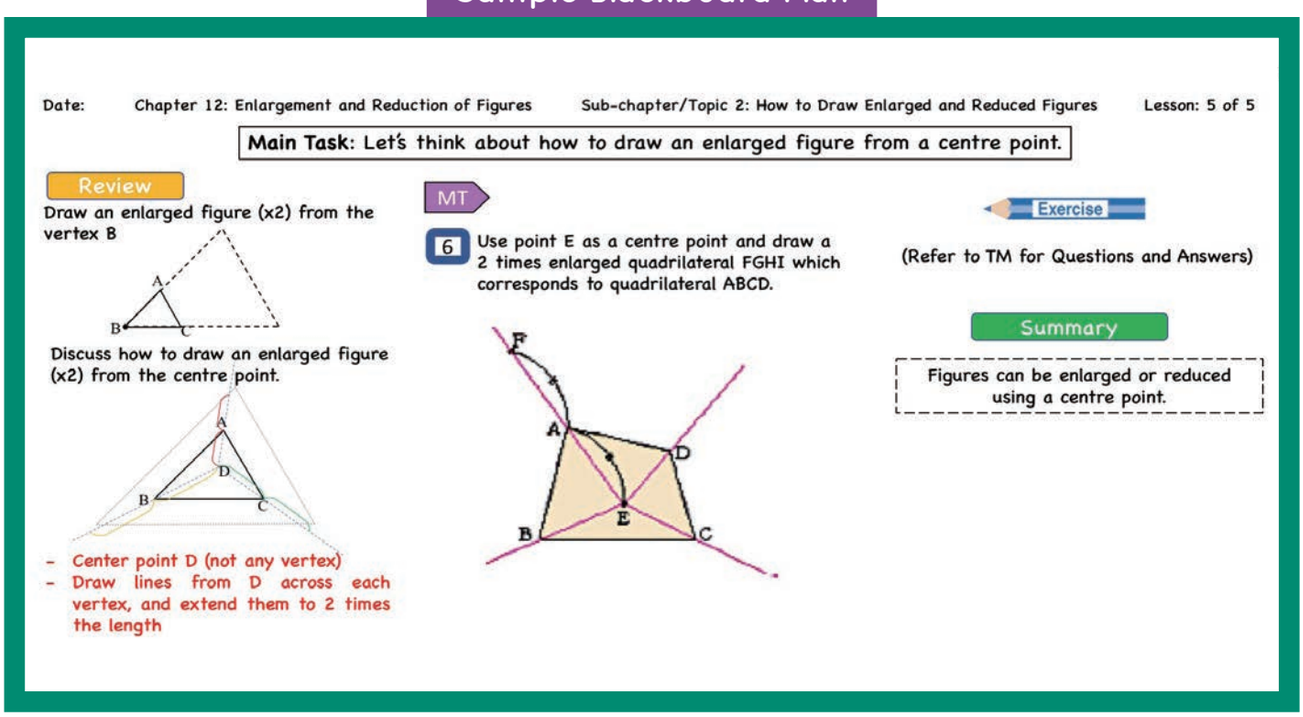
5 Summary

T What have you learned in this lesson?

S Present ideas on what they have learned.

T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan



Unit 12

Unit: Enlargement and Reduction of Figures
Sub-unit: 3. Uses of Reduced Figures
Lesson 1of 1

Textbook Page : 116 and 117
Actual Lesson 090

Sub-unit Objectives

- To apply the reduced scale to reduced drawing and understand its meaning.

Lesson Objectives

- To understand the meaning of reduced scale and how to express it.
- To find the real length from reduced drawings.

Prior Knowledge

- Reduced scale and how to use the reduced scale.
- Difference between metre and centimetre and be able to convert centimetres to metres.
- Using centimetre ruler to find the length and width of reduced figures.

Preparation

- Diagram of Task 1, 2 and 3 on the chart or blackboard

Assessment

- Applying the reduced scale to real life situations. F
- Find the real length from the reduced scale and reduced length from the real length. S

Teacher's Notes

The difficulty in this lesson is:

- To use the reduced scale to draw a reduced figure.
- To apply the reduced scale to calculate the real distance,length and height of an object.

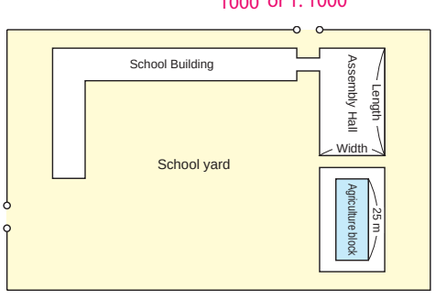
Connect figures drawn with the reduced scale, emphasise the meaning of reduced scale and showing all the process of operation and change of measurement unit (mm, cm, m,etc). Students have experienced finding the actual distance using reduced scale from social studies (Scale of Maps)

3 Uses of Reduced Figures

1 The picture below is a reduced drawing of Lea's school.

① The actual width of the agriculture block is 25 m.
How long is it in cm and mm on the reduced drawing and by how much is it reduced? 2 cm 5 mm

② How long in m is the actual length of 1 cm on the reduced drawing? 10 m $\frac{1}{1000}$ or 1: 1000



The ratio that represents how much it is reduced from the real length is called **reduced scale**. The picture above is a reduced drawing in $\frac{1}{1000}$ reduced scale.
There are 3 ways to show a **reduced scale**.

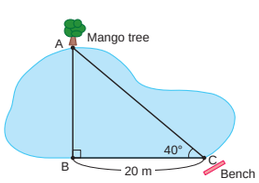
Ⓐ $\frac{1}{1000}$ Ⓑ 1 : 1000 Ⓒ 0 10 20 30m

Figure Ⓒ represents 1 cm which is equal to 10 m on the scale.

③ What is the actual length and width of the school hall in m?
Width : 2×1000 = 2000 cm (20 m) Length: 3.3×1000 = 3300 (cm) (33 m)

2 Kelon went to the pond in the park.
She walked from point C to point B.

What should you do to find the distance from point B to point A where the mango tree grows?

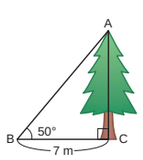


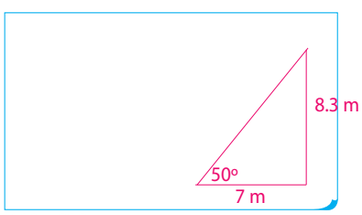
① Follow the steps below and draw a reduced drawing of the right triangle ABC in $\frac{1}{500}$ reduced scale.

① Find the length of line BC and draw it.
② From point B, draw a line perpendicular to line BC.
③ Measure a 40° angle from point C and place point A.
④ Draw the right angle ABC.

② Measure line AB of the reduced figure and find the actual distance to the mango tree. 3.4×500 = 1700
1700cm = 17m Answer: 17 meters

3 How tall in m is the tree shown below?
Explain the way to solve using mathematical sentences, figures and words.





8.3×100 = 830
830 cm = 8.3 m Answer: 8.3 meters

116 = □×□×□ □×□×□= 117

Lesson Flow

1 Review the previous lesson.

T Introduce the Main Task. (Refer to the BP)

2 Find the reduced and actual lengths on a map.

T/S 1 Read and understand the given situation.

S 1 Measure the length corresponding to 25 m of width and divide it by 25 m (aligning unit of length).

T Ask the students to calculate the actual length corresponding to 1 cm on the map using the previous ideas of actual width of the Agriculture Block of 25 m being reduced, which is ($\frac{1}{1000}$) as a reduced scale.

S 2 Calculate the actual length if the reduced length is 1 cm using the reduced scale $\frac{1}{1000}$
$\frac{1000}{1} \times 1 = 1000$, $1000 \div 100 = 10$ (10 m)

3 Important Point

T/S Explain the important point in the box .

4 Calculate the actual length and width.

T 3 Ask students to calculate the actual length and width of the Assembly Hall.

S Calculate the actual length and width of the Assembly Hall.

5 Draw a reduced figure ($\frac{1}{500}$) corresponding to the right triangle a, b, c.

T 2 Ask students to draw the reduced figure corresponding to the figure provided in the textbook.

S 1 Draw the reduced figure according to the steps(1 to 4) in the textbook and explain how they find the actual length of AB if the actual length of BC is 20 m.

TN The reduced scale $\frac{1}{500}$ for AB (AB can be measured from the reduced figure drawn by the students).How to find out the actual length of AB
(3.4 × 500 = 1700,1700 ÷ 100 = 17, 17 m)

T Confirm students' answers.

T 2 Ask students to meaure line AB of the reduced figure, then find the actual distance to the mango tree.

S Measure line AB and calculate to find the actual distance.

T Confirm students answers.

6 Find the actual height of the tree.

T 3 Ask the students to calculate the actual length (height) of the tree.

S Find the height of the tree, multiplying the reduced length corresponding to the height of the tree by $\frac{100}{1}$ (which is the reciprocal of the reduced scale).
Then, 100 × 8.3 = 830,
830 cm=8.3 m.

T Confirm students' answers.

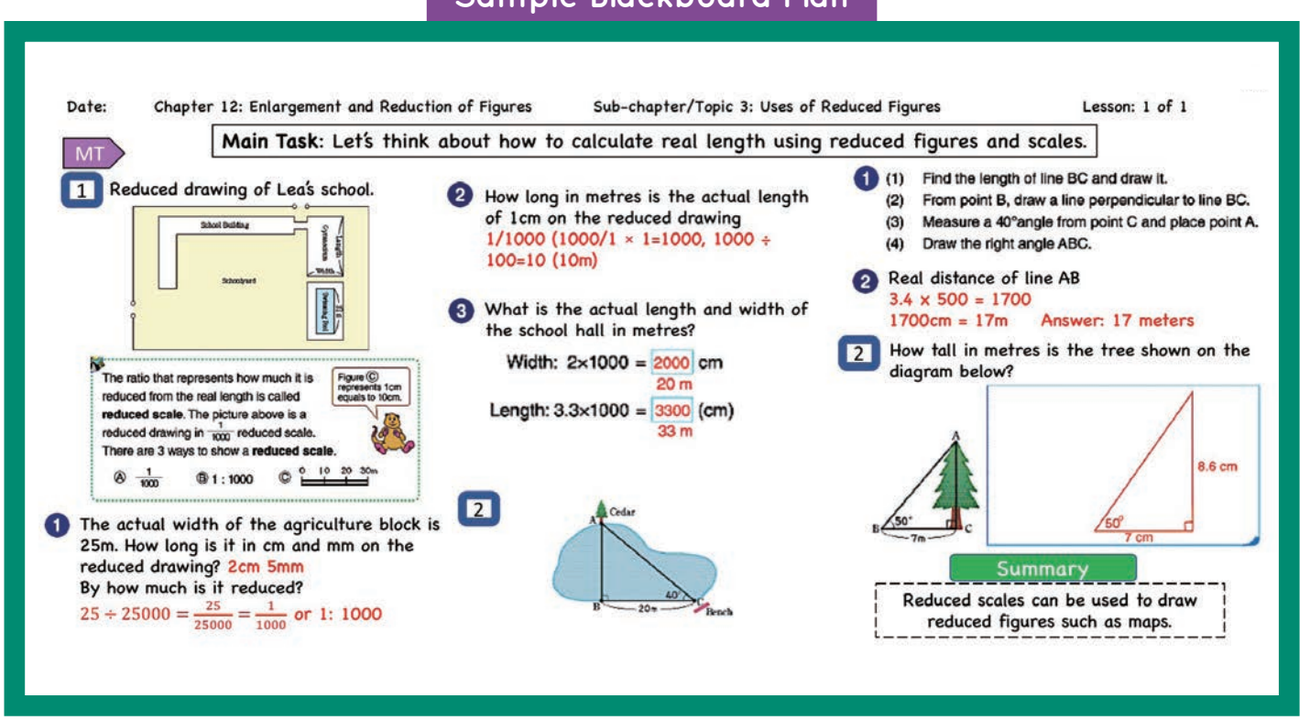
7 Summary

T What have you learned in this lesson?

S Present ideas on what they have learned.

T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan



Unit 12

Unit: Enlargement and Reduction of Figures
Exercises, Review and Evaluation
Lesson 1 and 2 of 2

Textbook Page : 118 and 119
Actual Lesson 091 & 092

Lesson Objectives

- To confirm their understanding on the concepts they learned in this unit by completing the Exercise, Review and Evaluation Test confidently.

Prior Knowledge

- All the contents learned in this unit on Geometrical Figures.

Preparation

- Evaluation Test

Assessment

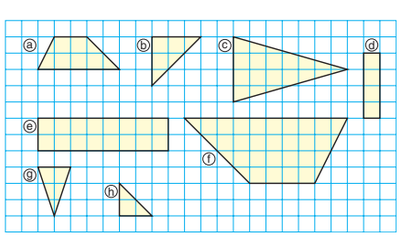
- Solve the exercises and review exercises correctly. F S

Teacher's Notes

This is the last lesson of Chapter 12.
Students should be encouraged to use the necessary skills learnt in this unit to complete all the exercises and solve the problems in preparation for the evaluation test.
The test can be conducted as assesment for your class after finishing all the exercises.
Use the attached evaluation test to conduct assesment for your class after finishing all the exercises, problems and review as a seperate lesson.

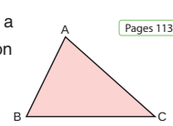
EXERCISE

1 Which shape is an enlarged or a reduced figure of the other? Give reason. Pages 104 to 110



A and F
B and H
C and G
D and E

2 Draw a 2 times enlarged figure and a $\frac{1}{2}$ reduced figure of triangle ABC on the right. Pages 113 to 115



3 There is a map of a school that is drawn in $\frac{1}{500}$ reduction scale. Pages 116 and 117
In the reduced drawing, the school hall is in the shape of a rectangle 6 cm length and 3.2 cm width. What are the actual widths and lengths of the school hall in m? $6 \times 500 = 3000$ cm Answer: 30 m
$3.2 \times 500 = 1600$cm Answer: 16 m

Grade 6 Do you remember?

Let's calculate.

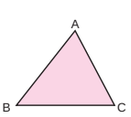
① $\frac{1}{2} \times \frac{1}{3}$ $\frac{1}{6}$ ② $\frac{3}{8} \times \frac{4}{5}$ $\frac{3}{10}$ ③ $\frac{5}{12} \times \frac{3}{5}$ $\frac{1}{4}$

④ $\frac{3}{7} \div \frac{1}{3}$ $1\frac{1}{7}$ ⑤ $\frac{5}{6} \div \frac{2}{3}$ $1\frac{1}{4}$ ⑥ $\frac{9}{16} \div \frac{3}{4}$ $\frac{3}{4}$

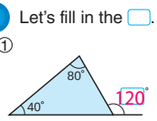
118 = □ × □ × □

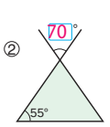
REVIEW

1 Let's draw a congruent triangle as the one on the right.
Which length and angle do you need to know in order to draw one? Side AB, BC CA, etc
Angle A or B or C, etc

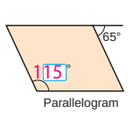


2 Let's fill in the □.

① 

② 

Isosceles triangle

③ 

Parallelogram

3 Let's divide in vertical form.

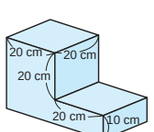
① 6 ÷ 1.5 4 ② 9 ÷ 0.6 15 ③ 1.4 ÷ 3.5 0.4
④ 6.9 ÷ 4.6 1.5 ⑤ 3.6 ÷ 2.4 1.5 ⑥ 6.1 ÷ 0.4 15.25
⑦ 0.8 ÷ 0.5 1.6 ⑧ 9.24 ÷ 4.2 2.2 ⑨ 2.28 ÷ 0.4 5.7

4 Let's find the quotient by (whole) number, without decimals and remainder.

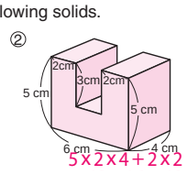
① 6.1 ÷ 1.7 3 rem 1 ② 9.7 ÷ 0.6 16 remainder 0.1

5 There are 13.5 kg of rice. If you eat 0.9 kg of the rice every day, how many days will it take to finish the rice?
$13.5 \div 0.9 = 15$ Answer: 15 days

6 Let's find the volume of the following solids.

① 

$20 \times 30 \times 20 + 20 \times 10 \times 20$
$= 12000 + 4000$
$= 16000$ 16000cm²

② 

$5 \times 2 \times 4 + 2 \times 2 \times 4 + 5 \times 2 \times 4$
$= 40 + 16 + 40$
$= 96$ 96 cm²

□ × □ × □ = 119

Lesson Flow

1 Complete Exercise ① to ③.

S ① Identify sets of reduced and enlarged figures and explain why.
② Draw an enlarged and reduced figure of triangle ABC.
③ Read the situation and work out the actual widths and lengths from the information given.

2 Complete the Do You Remember exercise.

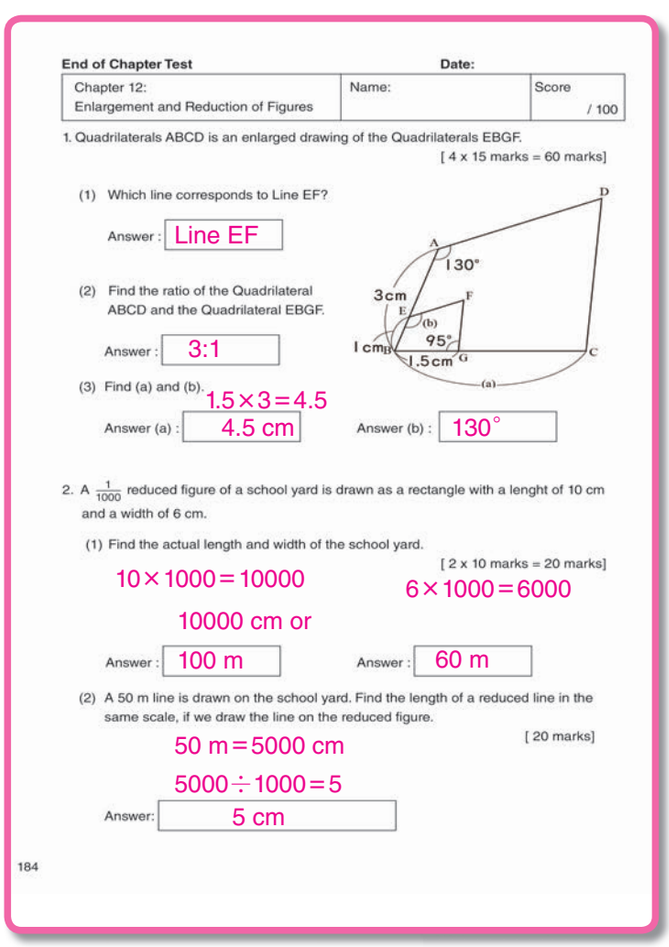
S Calculate multiplication of fractions and division of fractions.

3 Solve the Review from 1 to 3.

S 1 Draw a congruent triangle to the one given.
2 Find the unknown angles for the figures given in ① to ③.
3 Solve problems ① to ⑨ by calculating in vertical form.
4 Divide the decimal numbers to get the quotients as whole numbers.
5 Solve the word problem by answering the question.
6 Find the volume of the two solids.

4 Complete the Evaluation Test.

TN Use the attached evaluation test to conduct assesment for your class after finishing all the exercises and review as a seperate lesson.
S Complete the evaluation test.



End of Chapter Test **Date:**

Chapter 12: Enlargement and Reduction of Figures	Name:	Score / 100

1. Quadrilaterals ABCD is an enlarged drawing of the Quadrilaterals EBGF.
[4 x 15 marks = 60 marks]

(1) Which line corresponds to Line EF?
Answer : Line EF

(2) Find the ratio of the Quadrilateral ABCD and the Quadrilateral EBGF.
Answer : 3:1

(3) Find (a) and (b).
1.5×3=4.5
Answer (a) : 4.5 cm
Answer (b) : 130°

2. A $\frac{1}{1000}$ reduced figure of a school yard is drawn as a rectangle with a lenght of 10 cm and a width of 6 cm.

(1) Find the actual length and width of the school yard.
[2 x 10 marks = 20 marks]
10×1000=10000
10000 cm or
Answer : 100 m
6×1000=6000
Answer : 60 m

(2) A 50 m line is drawn on the school yard. Find the length of a reduced line in the same scale, if we draw the line on the reduced figure.
[20 marks]
50 m=5000 cm
5000÷1000=5
Answer: 5 cm

184

End of Chapter Test **Date:**

Chapter 12: Enlargement and Reduction of Figures	Name:	Score / 100

1. Quadrilaterals ABCD is an enlarged drawing of the Quadrilaterals EBGF.

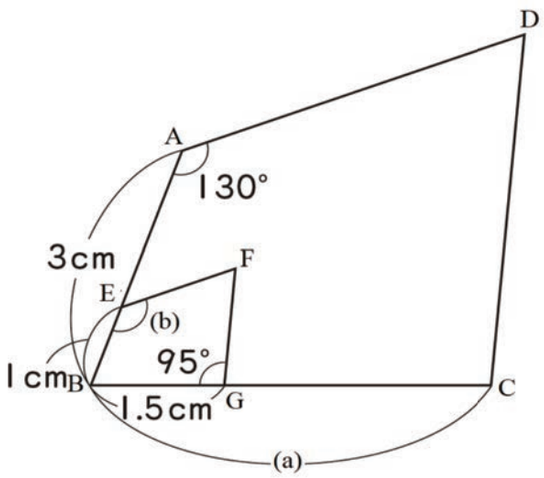
[4×15 marks=60 marks]

(1) Which line corresponds to Line EF?

Answer :

(2) Find the ratio of the Quadrilateral ABCD and the Quadrilateral EBGF.

Answer :



(3) Find (a) and (b).

Answer (a) : Answer (b) :

2. A $\frac{1}{1000}$ reduced figure of a school yard is drawn as a rectangle with a length of 10 cm and a width of 6 cm.

(1) Find the actual length and width of the school yard. [2×10 marks=20 marks]

Answer : Answer :

(2) A 50 m line is drawn on the school yard. Find the length of a reduced line in the same scale, if we draw the line on the reduced figure. [20 marks]

Answer:

Chapter 13 Proportion and Inverse Proportion

1. Content Standard

6.4.2. Students will be able to appraise the proportional relationship between two numbers or quantities in various simultaneous expression approaches and appreciate their usefulness in daily life.

2. Unit Objectives

- To investigate the relationship of two quantities that change in a related function.
- To understand the concept of proportion. In addition, to learn its characteristics by using equations, tables and graphs.
- To solve problems by applying the relationship of proportion.
- To understand the relationship of inverse proportion.

3. Teaching Overview

Students learned simple proportional relationships in Grade 5. This unit will be the preparation of learning linear functions in the further grades.

Proportion :

Students are to understand proportional relationship such as "One of 2 quantities changing together changes twice, thrice, 4 times, etc., another quantity changes in the same manner". They are also required to express the relationship in a mathematical sentence using $\times$ and y.

Graphs of Proportion :

Students learn how to express the relationship between 2 quantities as a graph. They also learn how to interpret proportional graphs.

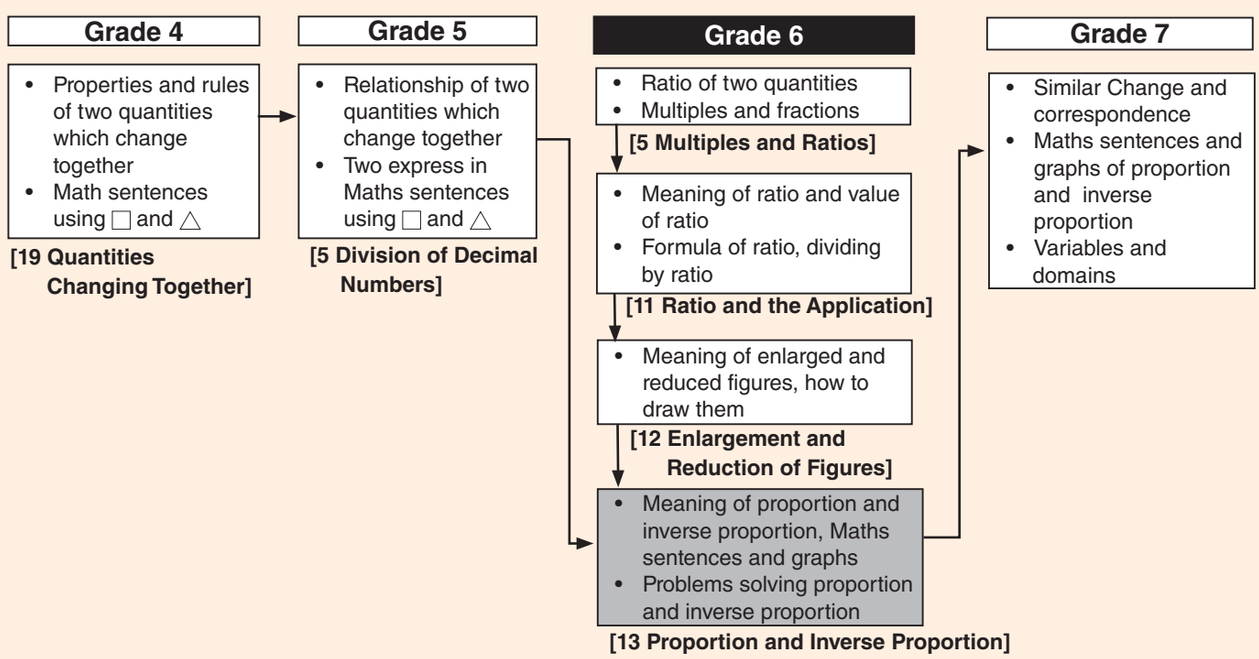
Using Properties of Proportion :

They express proportional relationships given as tables or situations as a mathematical sentence. They should find that there is a constant condition.

Inverse Proportion :

They learn the meaning of inverse proportions, their mathematical expressions and graphs while paying attention to the differences from proportion.

4. Related Learning Contents



Unit 13

Unit: Proportion and Inverse Proportion
Sub-unit: 1. Proportion
Lesson 1 of 7

Textbook Page : 120 and 121
Actual Lesson 093

Sub-unit Objectives

- To understand the relationship of how two quantities change together at the same time.
- To estimate and explain the relationship of how two quantities change together.

Lesson Objectives

- To understand how two quantities change in a related manner through actual activities that shows the relationship between the number of paper and its weight and thickness.
- To estimate and explain how two quantities change in a related manner.

Prior Knowledge

- Proportion. (Grade 5)

Preparation

- Stack of paper, scale and ruler

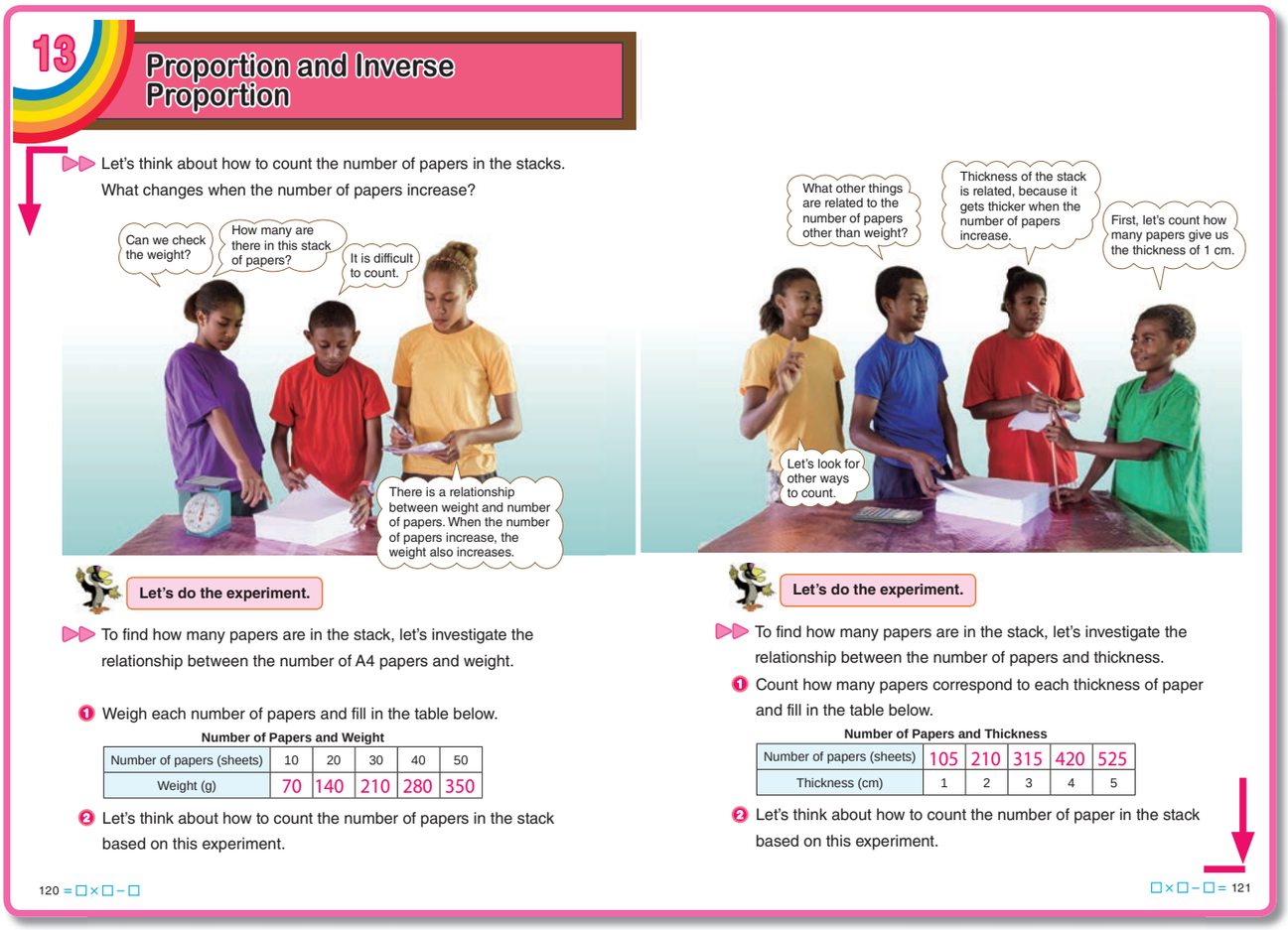
Assessment

- Investigate and explain how two quantities change relatively. F
- Explain the concept of proportion in the experiments. S

Teacher's Notes

Experiment Tips

- Before performing the experiment you should do a trial before the lesson.
- Use regular photocopy paper available in school. Weigh and measure a sheet of paper.
- Be careful that there is no dirt or air between papers before the experiment as few errors may occur.
- Advice students to measure several times until value becomes stable before filling in the table.
- Scales are required in this lesson.



13 Proportion and Inverse Proportion

Let's think about how to count the number of papers in the stacks. What changes when the number of papers increase?

Can we check the weight?
How many are there in this stack of papers?
It is difficult to count.
There is a relationship between weight and number of papers. When the number of papers increase, the weight also increases.

What other things are related to the number of papers other than weight?
Thickness of the stack is related, because it gets thicker when the number of papers increase.
First, let's count how many papers give us the thickness of 1 cm.
Let's look for other ways to count.

Let's do the experiment.

To find how many papers are in the stack, let's investigate the relationship between the number of A4 papers and weight.

1. Weigh each number of papers and fill in the table below.

Number of Papers and Weight

Number of papers (sheets)	10	20	30	40	50
Weight (g)	70	140	210	280	350

2. Let's think about how to count the number of papers in the stack based on this experiment.

120 = □ × □ − □

Let's do the experiment.

To find how many papers are in the stack, let's investigate the relationship between the number of papers and thickness.

1. Count how many papers correspond to each thickness of paper and fill in the table below.

Number of Papers and Thickness

Number of papers (sheets)	105	210	315	420	525
Thickness (cm)	1	2	3	4	5

2. Let's think about how to count the number of paper in the stack based on this experiment.

□ × □ − □ = 121

Lesson Flow

1 To know about the number of papers in stacks without counting.

T ▶▶ Ask students to discuss about the picture on the left and the speech bubbles.
S Realise that it is difficult to count the papers one by one and think of other methods of finding the number without counting.
T Introduce the main task and present a stack of A4 papers and ask students to think of ways on how to count them.

2 Discuss the method to use.

T What changes when the number of paper increases?
S Possible student responses:
• As the number of papers increase the pile becomes thicker.
• As the number of papers increase, the pile becomes heavier.
T Confirm students responses and emphasise the relationship between weight and the number of papers and thickness and the number of papers.

3 ▶▶ Do Experiment No.1 in groups.

T/S ❶ Weigh each number of papers and fill in the table.
S Experiment 1: In small groups weigh the number of papers and fill in the table.

4 ❷ Think about how to determine the relationship between the number of papers and the weight.

T What is the weight of 10 sheets of paper?
S 70 g.
TN Out of curiosity students may want to find the weight of 1 sheet of paper.
T What is the weight of 20 sheets of paper?
S 140 g.
T What changes when the number of papers increase?
S When the number of sheets of paper increases, its weight increases as well.
T Ask one or two groups to share their findings to the class.
TN Let students find out the relationships of what they have learned and lead them to think of more ideas on changing quantities.

5 Examine the relationship between the number of sheets of paper and its thickness.

T ▶▶ Ask students to discuss about the picture on the right and speech bubbles.
S ❶ Experiment 2: Count how many papers correspond to each thickness of paper and fill in the table.
T/S In small groups measure the thickness of the number of papers and fill in the table.

6 ❷ Think about how to determine the number of sheets of paper in their groups.

T How many sheets of paper make 1 cm?
S 105 sheets of paper.
TN For different types of papers when the thickness is 1 cm, the measured value becomes 90 – 110 sheets of papers depending on the paper type.
T How many sheets of paper make 2 cm?
S 210 sheets of paper.
T What changes when the thickness increases?
S The number of sheets of paper increases, as the thickness increases.

7 Summary

T What have you learned in this lesson?
S Present ideas on what they have learned.
T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan

Date: Chapter 13: Proportion and Inverse Proportion Sub-chapter/Topic 1: Proportion Lesson: 1 of 7

Main Task: Let's think about how to find out the number of sheets of papers.

MT

▶▶ **Experiment 1**

❶ Let's think about how to find out the number of sheets of papers and its weight.

Sheets	10	20	30	40	50
g	70	140	210	280	350

❷ Findings:
•We can calculate paper by weighing the pile of paper.
• We need the weight of a sheet of paper.
• We can apply the concept of Proportion.

▶▶ **Experiment 2**

❶ Let's think about how to find out the number of sheets of papers and its thickness.

Sheets	105	210	315	420	525
cm	1	2	3	4	5

❷ Findings:
•We can calculate the pile of paper by its thickness.
• We need to know how many papers make 1 cm.
• We can apply the concept of Proportion.

Summary

From the experiments:
•We can find the weight by the number of papers
• We can find the number of papers by its thickness.
• It was not easy to measure the thickness of papers.
• We can weigh the number of papers if we have a scale.

Unit 13

Unit: Proportion and Inverse Proportion
Sub-unit: 1. Proportion
Lesson 2 of 7

Textbook Pages : 122 and 123
Actual Lesson 094

Lesson Objectives

- To determine the relationship between how the number of sheets of paper and its weight change together.

Prior Knowledge

- Experiments on number of sheets of paper and weight from previous lesson

Preparation

- Copy of the report on a chart, four ideas on the chart

Assessment

- Explain the relationship of how paper and weight change together. F
- Understand the meaning of proportion. S

Teacher's Notes

It is easier to find the rule between two numbers of objects by making a table that shows the set of two numbers of objects that change together.
Have the students to use the term "therefore" when they explain the reason from the result.

1 Proportion

Lucial's group wrote a report about the relationship between number of papers and weight.

(Mathematics Report) Date: Monday, 11th November
Theme : Check out the relationship between number of papers and weight.
Materials : Stack of papers, scale and calculator.
How : Weigh each number of papers and record the weight in the table.
Prediction : Number of papers and weight will be in proportion.
Result :

Number of Papers and Weight

Number of paper (sheets)	10	20	30	40	50
Weight (g)	70	140	210	280	350

Observation : When the number of papers increases two times from 10 to 20, the weight also increases twice from 70 g to 140 g. The relationship between other number of papers and weight is shown below.

Number of paper (sheets)	10	20	30	40	50
Weight (g)	70	140	210	280	350

(2 times, 3 times, 4 times, 5 times)

Therefore, the relationship between the number of papers and weight is directly proportional.

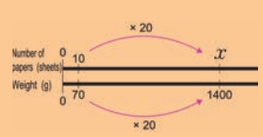
Phrase
"Therefore, it is ~"
Phrase that you use to explain reasoning from the result.

122 = □ × □ − □

1 There are 1400 g of papers that Lucial's group weighed.
How many sheets are there in this stack?
Fill in the ☐ below and explain each idea to your friend.

Ambai's Idea

The weight is 20 times more than 70 L, therefore the number of papers is also 20 times more.
10 × 20 = 200



Gawi's Idea

Find how many papers are there in 1 g.
10 ÷ 70 = 1/7
It is 1400 times more than 1 g of paper.
1/7 × 1400 = 200

Number of papers (sheets)	1/7	?
Weight (g)	1	1400

(× 1400 above and below)

Kekeni's Idea

Represent the number of papers in 1400g with x and think about the ratio of number of papers and the ratio of the weights.

10 : x = 70 : 1400
(÷ 7 above and below)

Mero's Idea

Represent the number of papers in 1400 g with x and think about the ratio of the number of papers to weight.

10 : 70 = x : 1400
(× 20 above and below)

□ × □ − □ = 123

Lesson Flow

1 Review the previous lesson.

2 Think about and discuss how the number of sheets of paper and weight are related.

T Ask students to look at the table of Experiment 1 and think about how the weight of paper changes when the number of sheets of paper increases twice, three times, four times,...etc.

T As one quantity increases, how does the other quantity change?

S The weight of the paper increases with the number of sheets of paper.

T What kind of relationship is found in the way the two quantities change?

S As the sheets of paper increased by 2 times, the weight also increased by 2 times.

T Introduce the phrase *Therefore, it is...*

3 Understand the meaning of Proportion.

T Introduce the Main Task. (Refer to the BP)

T/S 1 Read and understand the given situation.

T Allow students to read through the textbook individually and study the ideas.

TN From what the students had learned, they may give the following ideas:

T How many sheets of paper are there?

S Since 10 sheets of paper weigh 70 g, 1 sheet of paper weigh 7 g. For 1400 g, 1400 ÷ 7 = 200 (sheets)

S Since weight 1400 g is twenty times more than 70 g, the number of sheets of paper has become 20 times more as well. $10 \times 20 = 200$ (sheets)

S Find out the number of sheets per 1 g. $\frac{10}{70} = \frac{1}{7}$ and so $\frac{1}{7} \times 1400 = 200$ (sheets)

S Apply concept of ratio when 1400 g is given in x set of papers.
Then $10 : x = 70 : 1400$ so $x = 20$.

S Apply one of the ideas in the textbook to their experiment.

4 Compare and share their ideas in their small groups.

S Therefore, the relationship between the numbers of papers and weight is directly proportional.

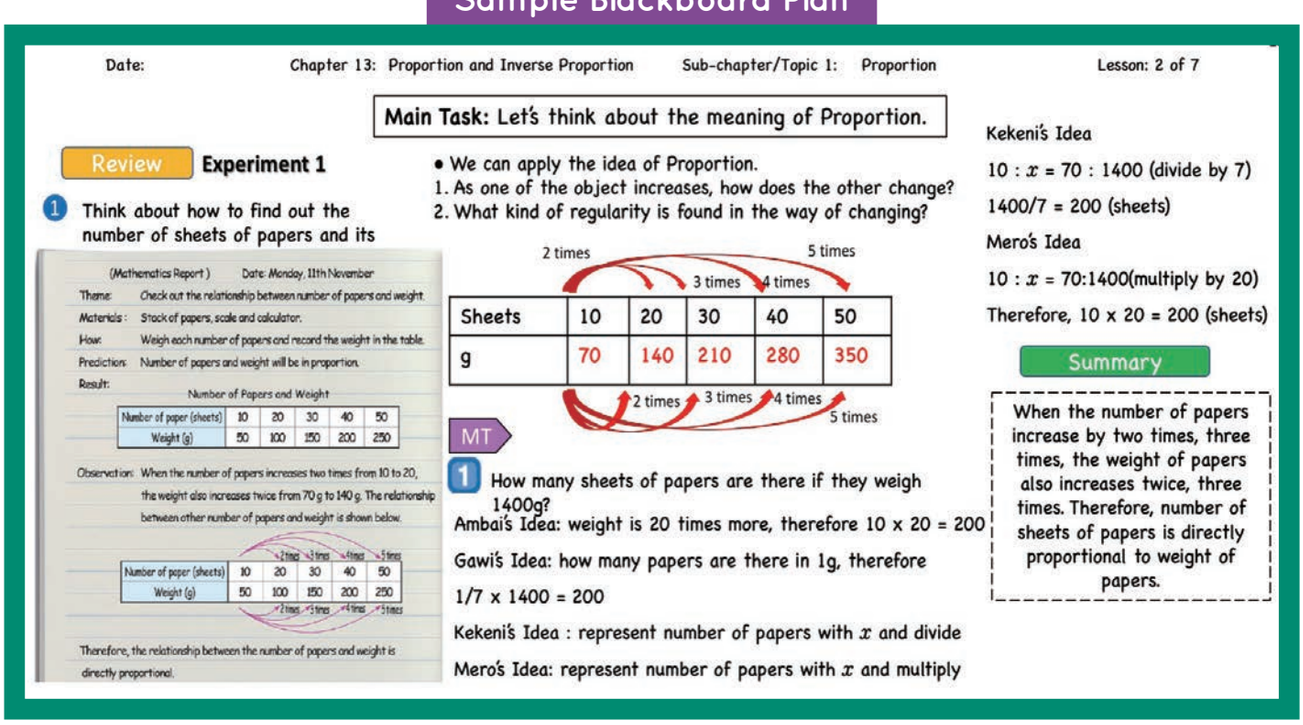
5 Summary

T What have you learned in this lesson?

S Present ideas on what they have learned.

T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan



Unit 13

Unit: Proportion and Inverse Proportion
Sub-unit: 1. Proportion
Lesson 3 of 7

Textbook Page : 124
Actual Lesson 095

Lesson Objectives

- o determine the relationship between the number of sheets of paper and its thickness on how they change together.

Prior Knowledge

- Experiment on number of sheets of papers and its thickness

Preparation

- Table for task 2

Assessment

- Explain the relationship of paper and its thickness. F S
- Develop the meaning of proportion using the number of papers and its thickness. S

Teacher's Notes

It is easier to find the rule between two quantities by making a table that shows the set of two numbers of objects that change in a related manner.
Have the students to use the term "therefore" when they explain the reason from the result.
It is easy to find the relationship between two quantities by arranging two quantities which change together on a table.
-How does the amount of one change when the other amount increases?
-Are there any rules in the way of change?

2 Ratu's group checked out the relationship between the number of papers and thickness.
They made a table below to show the results.

Number of Papers and Thickness

Number of papers (sheets)	105	210	315	420	525
Thickness (cm)	1	2	3	4	5

1 Let's make a mathematics report based on this table.
2 When the thickness of the stack is 9 cm, how many sheets of paper are there? 900 sheets

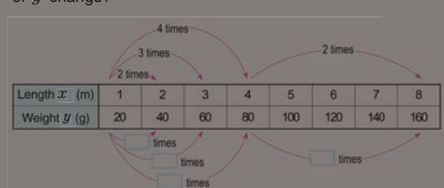
3 Investigate the relationship between the length of a wire and the weight.

Length of a Wire and Weight

Length (m)	1	2	3	4	5	6	7	8
Weight (g)	20	40	60	80	100	120	140	160

1 If you represent the length of a wire with x metres, and weight with y grams, y increases as x increases.
When the value of x changes 2 times, 3 times and 4 times or more, how does the corresponding value of y change?

y



124 = □ × □ − □

Lesson Flow

1 Review the previous lesson.

T Introduce the Main Task. (Refer to the BP)

2 Make a mathematics report based on Ratu's group's table.

T/S 2 Read and understand the given situation.

T Ask students to work in groups to think about how the thickness of paper changes when the number of sheets of paper increases.

S 1 Write their report as in the previous lesson stating the theme, materials, how, prediction, result and observation.

T As one quantity increases, how does the other quantity change?

S The thickness of the paper increases with the number of sheets of papers.

T What kind of relationship is found in the way the two quantities change?

S As the sheets of paper are increased by 2 times, the thickness also increases by 2 times.

3 Relationship between the number of papers and thickness.

T 2 Allow students to work individually.
When the thickness of paper is 9 cm, how many sheets of paper are there?

S When the thickness is 1cm, there are 105 sheets of paper. So when it is 9 cm, the number of sheets of paper becomes 9 times more.
Therefore, 105 × 9 = 945 (sheets).

S Add the number of sheets of paper when the thickness is 4 cm and 5 cm.
420 + 525 = 945 (sheets).

S When the thickness is 3 cm, there are 315 sheets of paper. So when it is 9 cm, the number of sheets of paper becomes three times more
315 × 3 = 945 (sheets).

4 Compare and share their ideas in their groups.

S Therefore, the relationship between the thickness and the numbers of sheets of paper are in proportion.

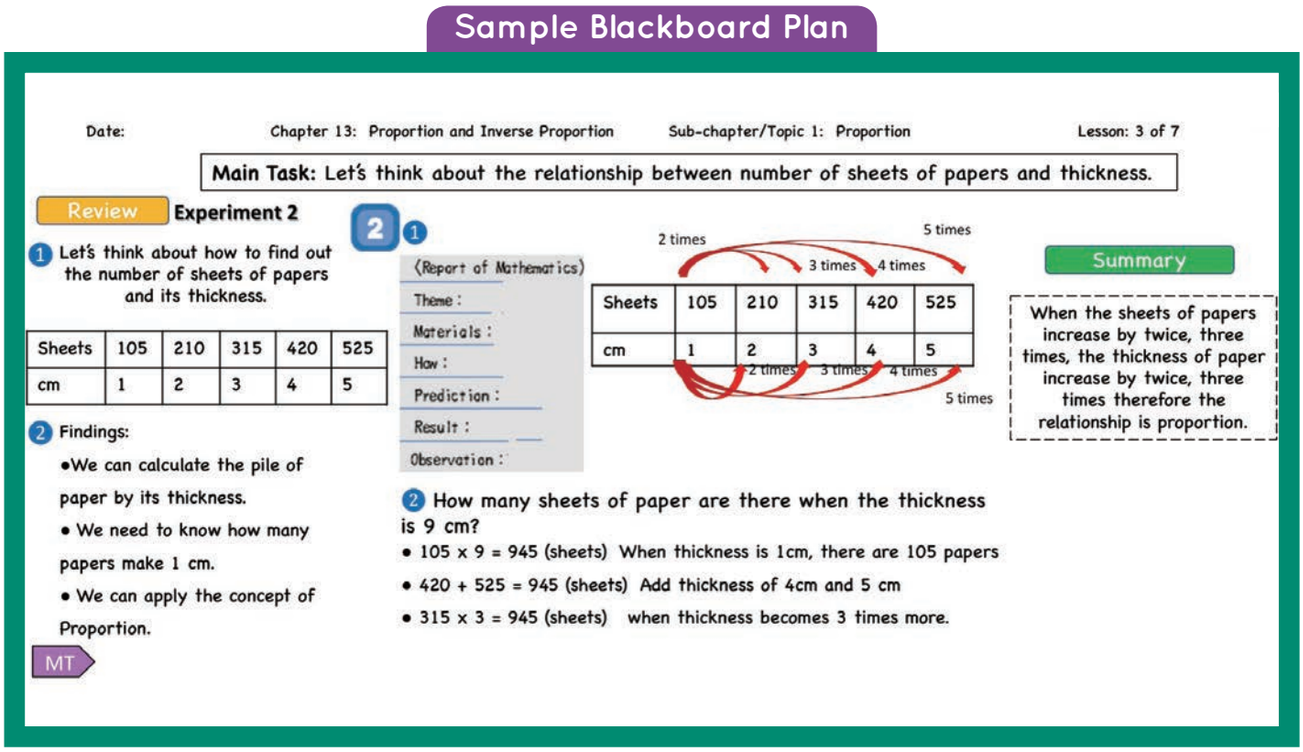
5 Summary

T What have you learned in this lesson?

S Present ideas on what they have learned.

T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan



Unit 13: Unit: Proportion and Inverse Proportion

Sub-unit: 1. Proportion

Lesson 4 of 7

Textbook Page : 124 and 125
Actual Lesson 096

Lesson Objectives

- To determine how lengths and weight of wire change.
- To put together the meaning of proportion.

Prior Knowledge

- Proportional relationships

Preparation

- Task tables on the chart

Assessment

- Explain the relationships of lengths and weight of wire. F
- Explain the 2 changing quantities in a proportional relationship. S
- Complete the exercises correctly. S

Teacher's Notes

Making meaning of x and y variable in the relationship of Proportion.
In general any two quantities (x and y) when one (x) changes 2 times, 3 times, 4 times….. and the other (y) changes in the same manner then we say they are in proportion.
In the same way, when (x) changes $\frac{1}{2}$ times and $\frac{1}{3}$ times, (y) also changes $\frac{1}{2}$ times and $\frac{1}{3}$ times.

2 Ratu's group checked out the relationship between the number of papers and thickness.
They made a table below to show the results.

Number of Papers and Thickness

Number of papers (sheets)	105	210	315	420	525
Thickness (cm)	1	2	3	4	5

1 Let's make a mathematics report based on this table.
2 When the thickness of the stack is 9 cm, how many sheets of paper are there?

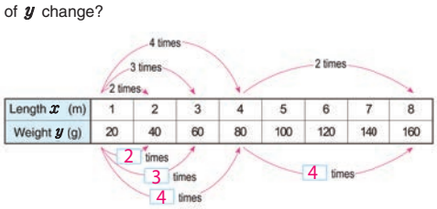
3 Investigate the relationship between the length of a wire and the weight.

Length of a Wire and Weight

Length (m)	1	2	3	4	5	6	7	8
Weight (g)	20	40	60	80	100	120	140	160

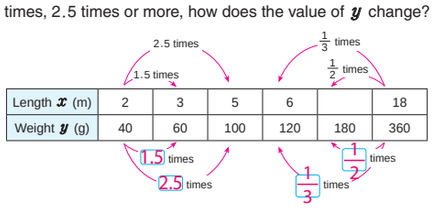
1 If you represent the length of a wire with x metres, and weight with y grams, y increases as x increases.
When the value of x changes 2 times, 3 times and 4 times or more, how does the corresponding value of y change?

y



When there are two changing quantities, x and y, and if the value of x changes 2 times, 3 times and so on, and the value of y also changes 2 times, 3 times and so on respectively, we say that y is **proportional** to x.

2 When y is proportional to x, and the value of x changes 1.5 times, 2.5 times or more, how does the value of y change?



3 When y is proportional to x and the value of x changes $\frac{1}{2}$ times, $\frac{1}{3}$ times and soon, how does the value of y change?

It changes $\frac{1}{2}$ times, $\frac{1}{3}$ times more

Exercise

Let's investigate the relationship between x and y.
① Fill in the blanks on the table with numbers.

Ⓐ Time and Distance, Running at Speed of 40 km per Hour

Time x (hours)	1	2	3	4	5	6	7
Distance y (km)	40	80	120	160	200	240	280

Ⓑ Side and Area of a Square

Side x (cm)	1	2	3	4	5	6
Area y (cm²)	1	4	9	16	25	36

② In which table Ⓐ or Ⓑ is y proportional to x? A

124 = □×□−□

□×□−□= 125

Lesson Flow

1 Review the previous lesson.

T Introduce the Main Task. (Refer to the BP)

2 ❸ Investigate the relationship of length and weight based on the table.

T ❶ Ask students to write in their exercise book what they find out from the table.

S Expected Responses.

- When length increases 2 times, 3 times, the weight also increased by 2 times, 3 times.
- When length increases by 1 m, the weight increase by 20g.
- Weight ÷ Length = 20 (the answer is constant)
- Weight is 20 times as much as length.

3 Important point

T/S Explain the important point in the box .

4 ❷ Determine if the relationship of proportion exists.

T When y is proportional to x and the value of x changes 1.5 times, 2.5 times and so on, how does the value of y change?

S Fill in the blank squares (□) in the table.

S When the value of x changes 1.5 times and 2.5 times, y also changes 1.5 times and 2.5 times. Therefore, y is proportional to x.

5 ❶ Determine if the relationship of proportion exists.

T When y is proportional t x and the value of x changes $\frac{1}{2}$ times, $\frac{1}{3}$ times and so on, how does the value of y change?

S Fill in the blank squares (□) in the table.

S When the value of x changes $\frac{1}{2}$ times and $\frac{1}{3}$ times, y also changes $\frac{1}{2}$ times and $\frac{1}{3}$ times. Therefore, y is proportional to x.

6 Complete the Exercise.

S Solve the exercises.

T Confirm students' answers.

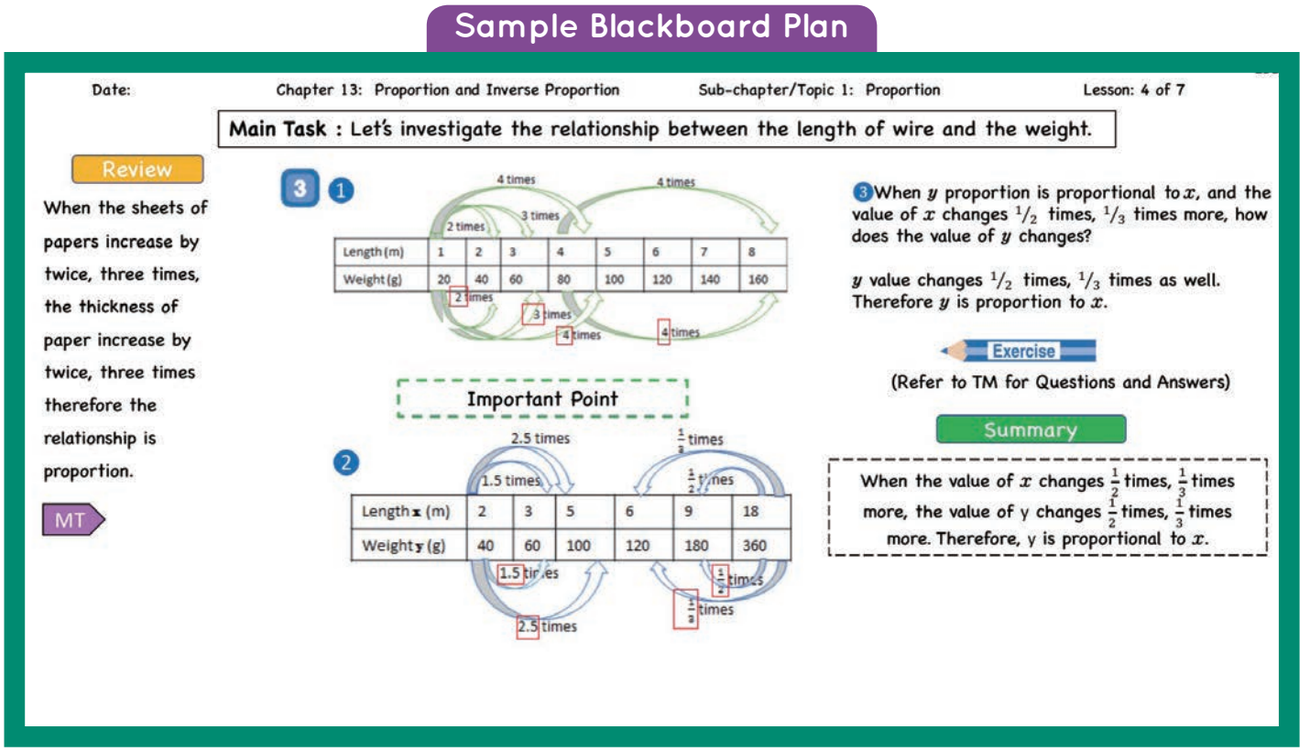
7 Summary

T What have you learned in this lesson?

S Present ideas on what they have learned.

T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan



Unit 13: Unit: Proportion and Inverse Proportion

Sub-unit: 1. Proportion

Lesson 5 of 7

Textbook Page : 126 and 127
Actual Lesson 097

Lesson Objectives

- To investigate the rules of proportion with the relationship of volume and depths of water.
- To explain the relationship of proportion in the form of an equation.

Prior Knowledge

- Meaning of Proportion

Preparation

- Tables, container, water

Assessment

- Explain the rules of proportion with the relationship of volume and depths of water. F
- Identify that the relationship of proportion can be described in an equation. S

Teacher's Notes

The formula $y = a \times x$, represents the proportional relationship, it describes the size of y (changing ratio) when $\times$ increases by 1. In addition to that it shows y value when $x = 1$.
Remember that when y or $x = 0$ there are no quantities such as an empty container, etc.

Mathematics Sentence of Proportion

4 You pour water into an empty tank. The relationship between the volume of water that you poured, represented by x Litres and the depth of water in the tank, represented by y cm, is organised in the table below.

Volume of Water and Depth of Water in the Tank

Volume of water x (L)	0	1	2	3	5	8	11	15	17
Depth y (cm)	0	2	4	6	10	16	22	30	34

1 Is the depth of water y cm proportional to the volume of water in the tank x L? Yes

2 Let's investigate how the value of y increases.
By how much does the value of y increase when the value of x increases by 1? 2 times

Increase by 1, Increase by 2, Increase by 3, Increase by 4

x	0	1	2	5	8	11	15	17
y	0	2	4	10	16	22	30	34

Increase by 2, Increase by 2, Increase by 6, Increase by 8

The rule of how the water increases.
When you pour 1 L of water, the depth increases by 2 cm.

3 Study the expressions on the right and use the corresponding values of x and y to calculate $y \div x$.

$2 \div 1 = 2$
$4 \div 2 = 2$
$6 \div 3 = 2$
⋮

Ⓐ What does the quotient of $y \div x$ mean?
Ⓑ Compare the quotient and the rule of how the water increases.

For every 1 L poured, the length increases by 2 cm

4 Use the information that 1 L of water makes 2 cm of depth, let's investigate the relationship between the volume of water and the depth and represent the relationship of x and y in a mathematical sentence.

Depth of water y (cm)	Depth of water per 1 L (cm)	Volume of water x (L)
0	2×0	0
2	2×1	1
4	2×2	2
6	2×3	3
8	2×4	4
10	2×5	5
12	2×6	6
y	$2 \times x$	x

$y = 2 \times x$

Depth of water per 1 L does not change.

5 Let's use the mathematical sentence above to find the depths when you pour 10 L and 20 L of water into the tank.

When you pour 10L
$y = 2 \times 10$
$= 20$ cm depth

When you pour 20 L
$y = 2 \times 20$
$= 40$ cm depth

126 = □ × □ − □

□ × □ − □ = 127

Lesson Flow

1 Review the previous lesson.

T Introduce the Main Task. (Refer to the BP)

2 Examine if y cm is in a relationship of proportion with x L.

T/S 4 Read and understand the given situation.
T 1 Is the depth of water y cm proportional to the volume of water in the container x L?
S When the value of x increases, the value of y also increases. Therefore, x and y are proportional.

3 Investigate how the value of y increases when x increases by 1.

T 2 By how much does the value of y increase when the value of x increases by 1?
S Fill in the blank squares □ and explain that when x increases by 1, y increases by 2.
T Confirm the rule that when x increases by 1, y increases by 2 (the depth increases by 2 cm when the volume increases by 1 L)

4 To think about the meaning of y divided by x.

T Help the students to study and understand the vertical relationship of x and y in the table 2.
T 3 Ask the students to study the expressions and use the corresponding values to calculate $y \div x$.
S Find the answers to the expressions y divided by x as 2.
T What does the quotient of $y \div x$ mean?
S The quotient is the same (2) and does not change.
TN The answer of y divided by x and the consistent number of increasing water by 2 cm in the table are the same.

5 Express the relationship of x and y in a mathematical sentence.

T 4 Ask the students to study the given information and explain how to complete the activity.
TN Assist the students to understand that they can get depth of water as 2 × (volume of water) and lead them to find the mathematical sentence of $y = 2 \times x$.
S Fill in the boxes to complete the mathematical sentences.
T Confirm the mathematical sentence $y = □ \times x$.

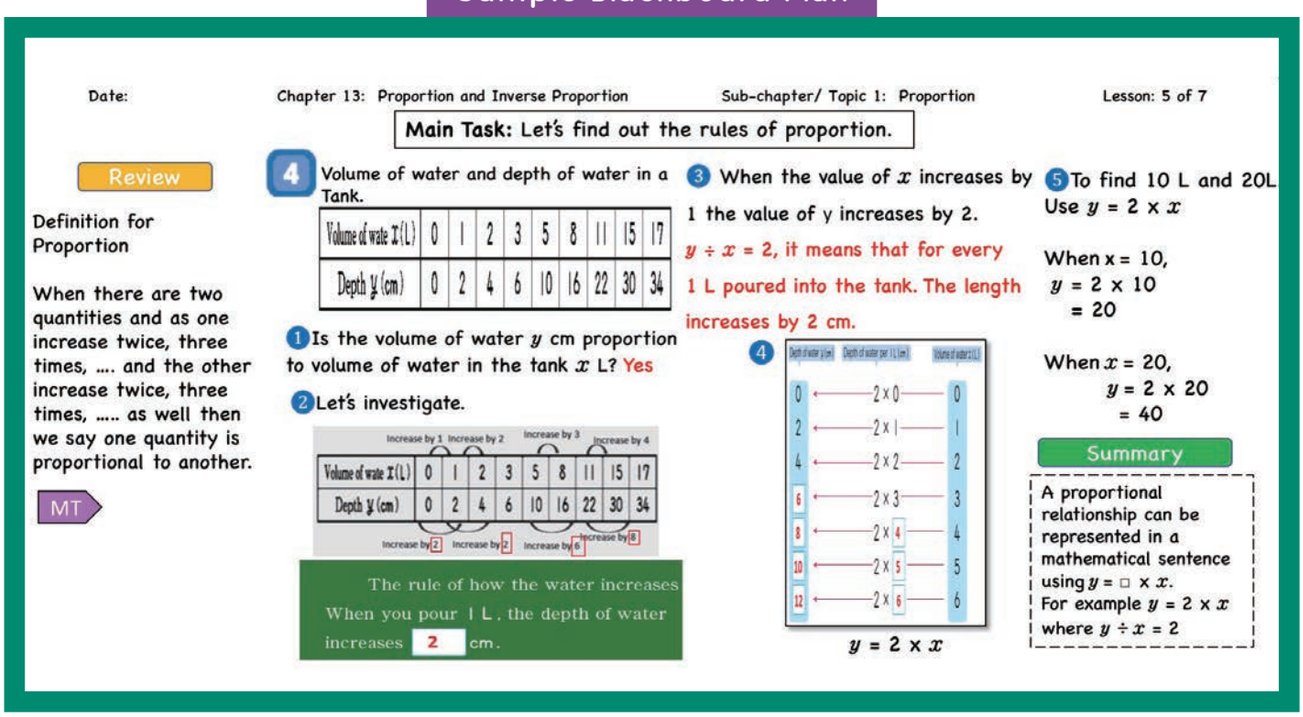
6 Determine depths of water when 10 L and 20 L of water are added.

S 5 Use the mathematical sentence to do activity
T Assist students to realise that by using $y = 2 \times x$, they can find 10 L and 20 L.
When $x = 10$, $y = 2 \times 10$ thus $y = 20$
and when $x = 20$, $y = 2 \times 20$ and so $y = 40$

7 Summary

T What have you learned in this lesson?
S Present ideas on what they have learned.
T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan



Unit 13

Unit: Proportion and Inverse Proportion
Sub-unit: 1. Proportion
Lesson 6 of 7

Textbook Page : 128
Actual Lesson 098

Lesson Objectives

- To understand the meaning of the formula of proportional relationship.

Prior Knowledge

- Relationship and Meaning of Proportion
- Representing proportion in a mathematical sentence

Preparation

- Table in task 5

Assessment

- Explain the meaning of the formula of proportional relationship. F
- Solve the exercises correctly. S

Teacher's Notes

Review the formula $y = a \times x$, where a is the constant and x and y are the changing quantities.

5 Let's represent the relationship of length of a wire x cm and weight y g in a mathematical sentence.

Length of a Wire and Weight

Length x (cm)	1	2	3	4	5	6
Weight y (g)	20	40	60	80	100	120

1. Find the quotient of $y \div x$. 20
2. Represent the relationship of x and y in a mathematical sentence.

$y =$ [20] $\times$ [x]

3. Find the weight of 12 cm of wire. $y = 20 \times 12$ $= 240$ Ans: 240 g

When there are 2 changing quantities x and y, and y is proportional to x, their relationship can be represented in the mathematical sentence below.

$y =$ constant number $\times x$

The constant number in a proportion relationship represents
① How much value of y increases when x value increases by 1.
② Quotient of $y \div x$.
③ Value of y when value of x is 1.

Exercise

Let's represent the relationship between the time that a car travels, x hour and the distance y km in a mathematical sentence.

Time and Distance, Running at Speed of 40 km per Hour

Time x (hours)	1	2	3	4	5	6
Distance y (km)	40	80	120	160	200	240

Quotient of $y \div x = 40$ Ans: $y = 40 \times x$

128 = □ × □ − □

Lesson Flow

1 Review the previous lesson.

T Introduce the Main Task. (Refer to the BP)

2 Represent the relationship of length of a wire x cm and weigth y g.

T/S 5 Read and understand the given situation.

TN Assist students to understand that the weight of wire y grams has a proportional relationship with length x cm.

T Ask the sudents to find the quotient of $y \div x$

S ❶ Study the table and find the quotient 20.

3 ❷ Represent the relationship of x and y in a mathematical sentence.

T "What does the quotient represent?"

S The quotient is 20 and does not change.

TN Allow student to explain individually what activity ❸ indicates. Guide the students to understand that $y = 20 \times x$.

S From the answer found in activity ❶, students can apply 20 × length in order to find out the weight of length.

S ❸ Use the formula to find the weight of 12 m of wire.

4 Important Point

T/S Explain the important point in the box .

5 Understand proportional relationship as y = Constant × x.

T Have students to realise that when they find out the constant, they can complete the equation of proportion.

T/S Discuss with the class on the three points in the green board.

6 Complete the Exercise.

S Solve the exercise.

T Confirm students' answers.

7 Summary

T What have you learned in this lesson?

S Present ideas on what they have learned.

T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan

Date: Chapter 13: Proportion and Inverse Proportion Sub-chapter/Topic 1: Proportion Lesson: 6 of 7

Main Task: Let's show the relationship of proportion into an algebraic equation.

Review

What does the quotient of $y \div x$ mean in relation to volume and depth of water? The relationship of volume and depth of water is represented by x and y; as the volume of water increases by 1 the depth of water increases by 2 cm when we divide.

$y = 2 \times x$

MT

5

Length of a Wire and Weight

Length x (m)	1	2	3	4	5	6
Weight y (g)	20	40	60	80	100	120

1. Find the quotient of $y \div x$?

When $y \div x$ the answer is 20. $y = 20 \times x$

2. Represent the relationship of x and y in a mathematical sentence. $y = 20 \times x$

3. Find the weight of 12m of wire. $y = 20 \times x$

$y = 20 \times 12$

Answer: 240g

Important Point

Exercise

(Refer to TM for Questions and Answers)

Summary

The constant number in a proportion relationship represents;
1. How much value of y increases when x value increases by 1.
2. Quotient of $y \div x$.
3. Value of y when value of x is 1.

Unit 13

Unit: Proportion and Inverse Proportion
Sub-unit: 1. Proportion
Lesson 7 of 7

Textbook Page : 129
Actual Lesson 099

Lesson Objectives

- To examine the relationship of length of one side of a regular polygon and its perimeter and to represent it in the formula..

Prior Knowledge

- Meaning of the formula of proportional relationship.

Preparation

- Table for Task 6

Assessment

- Apply the formula of proportional relationship to side length and perimeter of regular shapes. F S
- Solve the exercises correctly. S

Teacher's Notes

Review the formula $y = a \times x$, where a is the constant and x and y are the changing quantities.
The idea of proportion can be applied to Side and Perimeter of any regular polygon.

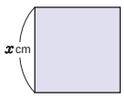
6 Represent the side of the equilateral triangle with x cm and its perimeter with y cm.

Side and Perimeter of an Equilateral Triangle

Side x (cm)	1	2	3	4	5	6
Perimeter y (cm)	3	6	9	12	15	18

1. Let's fill in the table.
2. Is y directly proportional to x? yes
3. Let's represent the relationship of x and y in a mathematical sentence. What does the constant number represent?
   The constant number represents the increased value of y as x increases by 1
   When y is proportional to x, it is also represented by a mathematical sentence below.
   $y =$ x × constant number

7 When the side of the square is x cm and the perimeter is y cm, let's represent the relationship between x and y in a mathematical sentence.
$y = 4 \times x$



Exercise

Draw the table to show the relationship between x and y and write a mathematical sentence. What does the constant number mean?

① Diameter x cm and perimeter y cm in a circle. $y = 3.14 \times x$
② 50 kina ball, x ball and total cost y kina. $y = 50 \times x$
③ A side x cm and perimeter y cm in a hexagon. $y = 6 \times x$

□ × □ − □ = 129

Lesson Flow

1 Review the previous lesson.

T Introduce the Main Task. (Refer to the BP)

2 6 Investigate the proportional relationship in an equilateral triangle.

T/S Read and understand the given situation.
T Ask students to complete activity ❶ and ❷ individually.
S ❶ Study and fill in the table.
T ❷ Is y directly proportional to x?
S Yes. When the side length increases by 1 the perimeter increases by 3.

3 ❸ Represent the relationship of x and y in a mathematical sentence and determine what the constant is.

T What does the constant number represent?
S The constant number represents the quotient of the increasing value of $y \div x$, which is 3.
TN Perimeter = one side of length × 3.
Assist students to apply the actual number in place of the constant number and generalise the relationship.
$y = x \times 3$.

4 Understand the equation of a proportional relationship.

T Assist students to understand that when y is proportional to x, it can be represented as $y = x \times$ constant number.

5 Investigate the proportional relationship in a square.

T/S 7 Read and understand the given situation.
T When the side of a square is x cm and perimeter is y cm, represent their relationship in a mathematical sentence.
S $y = 4 \times x$ is similar to the relationship of an equilateral triangle.

6 Complete the Exercise.

S Solve the exercises.
T Confirm students' answers.

7 Su mmary

T What have you learned in this lesson?
S Present ideas on what they have learned.
T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan

Date: Chapter 13: Proportion and Inverse Proportion Sub-chapter/Topic 1: Proportion Lesson: 7 of 7

Main Task: Let's examine the equation of proportion.

Review

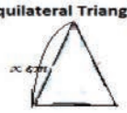
Write the mathematical sentences for proportion using algebraic equation.

y = constant number × x

MT

6 Represent the side of the equilateral triangle with x cm, and its perimeter with cm.

Equilateral Triangle



1 Side and Perimeter of a Equilateral Triangle

Side x (cm)	1	2	3	4	5	6
Perimeter y (cm)	3	6	9	12	15	18

2 Is y directly proportional to x?
Yes, y is directly proportional to x.
3 What does constant number represent? The constant number represents the quotient of the increasing value of $y \div x$, which is 3. Perimeter = one side of length x 3.

7 Length of one side of square is x cm and perimeter y cm. Perimeter = Length of one side x x
Answer: $y = 4 \times x$

Exercise

(Refer to TM for Questions and Answers)

Summary

Regular Polygons with side length (x) is directly proportional perimeter (y). The constant number represents the increased value of y as x increases by 1.

Unit 13

Unit: Proportion and Inverse Proportion
Sub-unit: 2. Graphs of Proportion
Lesson 1 of 2

Textbook Page : 130 and 131
Actual Lesson 100

Sub-unit Objectives

- To be able to draw the graph of proportion and understand its characteristics.
- To be able to analyse the relationship of numbers of objectives from the graph

Lesson Objectives

- To understand that when the relationship of two quantities in proportion is shown on the graph, the line which goes through the crossing point of vertical and horizontal axis (origin) is constant.

Prior Knowledge

- Meaning and Equation of Proportion

Preparation

- Table of Volume of water and depth

Assessment

- Plot the points on the graph from a table. F S
- Draw a proportional relationship on a graph. F S

Teacher's Notes

Students experienced drawing bar and line graphs with a pair of numbers from the table. They may have difficulty formulating an equation from the table and may not see that they only need to connect the origin to the dot. Do not let the students do the equation and then graph but show them a table that has several corresponding values and based on the table, they can make a graph.
Students should identify the different intervals of the scales when they draw their graph.

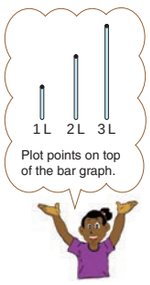
2 Graphs of Proportion

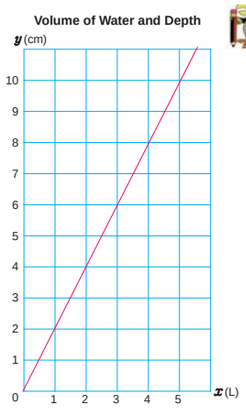
1 Let's make a graph that represents the relationship between the volume of water x L and the depth of water y cm when poured into a tank.

Volume of Water and Depth

Volume of water x (L)	0	1	2	3	4	5
Depth y (cm)	0	2	4	6	8	10

1 Plot points that represents a pair of values, the value of x and its corresponding value of y, on the graph.



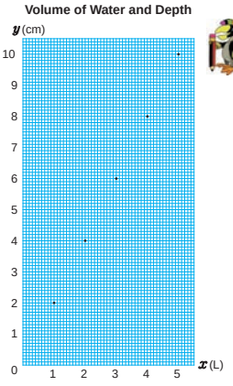


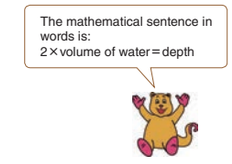
2 How are the points lining up?
In a straight line

3 Complete the table below and plot points that represents a pair of values, the value of x and its corresponding value of y, on the graph below.

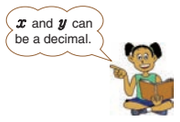
Volume of Water and Depth

Volume of water x (L)	0	0.1	0.2	0.5	1	2.4	3.9
Depth y (cm)	0	0.2	0.4	1	2	4.8	7.8





4 Can we connect any two points with one straight line? yes



When you draw a proportional relationship in the graph, it becomes a straight line that goes through the origin.

130 = □ × □ − □

□ × □ − □ = 131

Lesson Flow

1 Review the previous lesson.

T Introduce the Main Task. (Refer to the BP)

2 Plot points using x and y values from the table.

T/S ❶ Read and understand the given situation.
T Allow students to complete activity ❶ and ❷.
S Plot points on the graph and describe how the points are lined up.
T ❸ Ask students to see the relationship of x and y in the equation $y=2\times x$.
S Based on the equation $y=2\times x$ students find the corresponding value of y when the value of x is 0.1, 0.2, 0.5, 2.4, 3.9 and so on, and write down on the table.

3 Connect points to represent a proprtional relationship.

T ❹ Guide students to understand that the dot placed according to table in activity ❸ are also in straight line.
S Plot dots according to the table and connect all points with a straight line.
S Extend the line from 0 because when the volume of water is 0 L, the depths of water is 0 cm.
T When the line does not form a straight line, ask students to check their dots again.

4 Describe the relationship of proportion in a graph.

S There are two characteristics of this graph that describes the relationship of proportion.
• It is a straight line.
• It goes through 0.
T When two numbers of objects are not related in the manner mentioned above, we cannot say these two numbers are proportional.

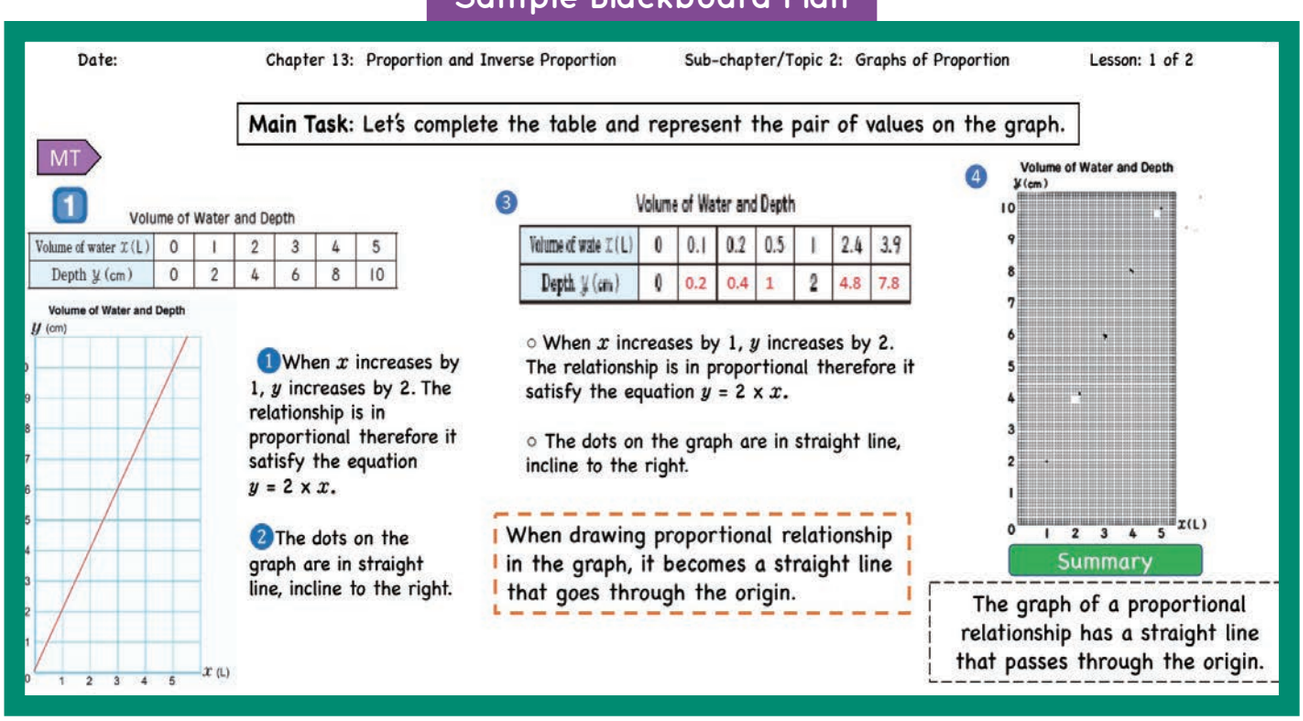
5 Important Point

T/S Explain the important point in the box .

6 Summary

T What have you learned in this lesson?
S Present ideas on what they have learned.
T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan



Unit 13

Unit: Proportion and Inverse Proportion
Sub-unit: 2. Graphs of Proportion
Lesson 2 of 2

Textbook Page : 132
Actual Lesson 101

Lesson Objectives

- To read and understand the relationship two quantities from graphs.

Prior Knowledge

- Meaning and Equation of Proportion

Preparation

- Enlarged graph

Assessment

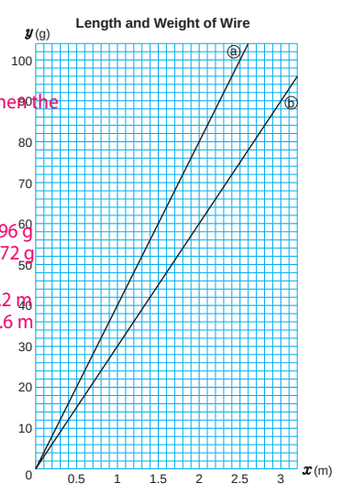
- Read and understand the relationship of two quantities on a graph. F S

Teacher's Notes

Reading of graph is an important skill for students to master.
They may have their own way of reading the graph; the important point is they should read horizontally then vertically or vice versa forming a right angle.
(Observe the reading line on the board)

Students are accustomed to representing the relationship between two quantities in a table by drawing bar graph and line graph. However, it is difficult for many students to express a mathematical sentence of x and y on a graph. They have to just determine the origin and another point and connect them with a line, but they feel very difficult. Therefore, it is important to guide step by step, not directly drawing a graph from a math sentence but first presenting in a table and drawing the graph.

2 The graph below represents the relationships between the length of a wire x m and its weight y g of two different wires ⓐ and ⓑ.



1 Which wire weighs more? (a)
How did you find it from the graph?
Compare the weight when the lentgh is the same

2 Read the lengths or weights of each wire.
① Weights of 2.4 m of wire ⓐ and ⓑ. (a)96 g (b)72 g
② Lengths of 48 g of wire ⓐ and ⓑ. (a) 1.2 m (b) 1.6 m

3 How much is the weight of each wire per m? (a) 40 g (b) 30 g

4 What do the following wires represent, ⓐ or ⓑ?
Ⓐ 3.8 m and 114 g of wire. 114 ÷ 3.8 = 30 g Ans: (line b)
Ⓑ 4.2 m and 168 g of wire. 168 ÷ 6.8 = 40 g Ans: (line a)

132 = □ × □ − □

Lesson Flow

1 Review the previous lesson.
T Introduce the Main Task. (Refer to the Blackboard Plan)

2 ❷ Investigate which wire is heavier from the graph.
T/S Read and understand the given situation.
T ❶ How can you compare the weights of wire?
S Compare using the same quantity by measuring the weight of the same length.
S Read from the graph to get the weights of the same length.
TN In the graph that indicates two proportions, students understand that one above from the other is heavier.
T Allow students to work individually, then ask them to share their ideas with their friends.
T Guide students to realise that both wire ⓐ and ⓑ are in a relationship of proportion by looking at the graphs.
S ❷ Read and understand the weight and length of wire from the graph. Share ideas in small groups.
TN Refer to Teachers' Notes.
S ❸ Find the weight of each wire individually.
S Use prior knowledge of per unit to find the weight of each wire per metre on the graph.

3 Determine the weights of length that are not shown in the graph.
S ❹ Based on activity ❸, students make algebraic equations for ⓐ and ⓑ.
ⓐ $y = 40 \times x$.
ⓑ $y = 30 \times x$.

4 Summary
T What have you learned in this lesson?
S Present ideas on what they have learned.
T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan

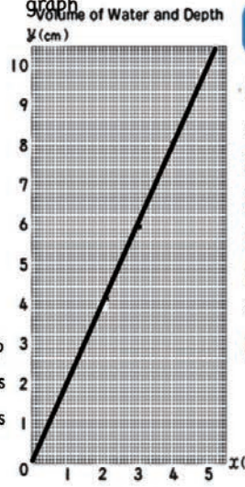
Date:
Chapter 13: Proportion and Inverse Proportion
Sub-chapter/Topic 2: Graphs of Proportion
Lesson: 2 of 2

Main Task: Let's read and understand the graph

Review

- Graph can be drawn from a table or equation
- We connect any two points with a straight line
- When drawing a proportional relationship in the graph, it becomes a straight line that goes through the origin.

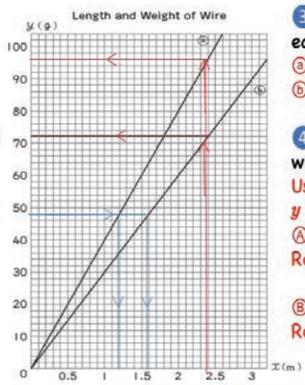
MT



2

❶ How can you compare the weights of wire?
By looking at the graph, line ⓐ is more heavier than line ⓑ.

❷ Read the Lengths or weights of each wire.
(1) 2.4 m
ⓐ 96g
ⓑ 72g
(2) 48g
ⓐ 1.1 m
ⓑ 1.6 m



❸ How much is the length of each wire per meter?
ⓐ 40 g per m
ⓑ 30 g per m

❹ What do the following wires represent, ⓐ or ⓑ?
Using $y = 40 \times x$ and $y = 30 \times x$
Ⓐ 3.8m and 114g of wire.
Represents ⓑ $y = 30 \times 3.8 = 114$
Ⓑ 4.2 m and 168 g of wire
Represents ⓐ $y = 40 \times 4.2 = 168$

Summary

- When reading a graph, read horizontally then vertically to identify the specific point on a graph.
- A graph passing through the origin in a straight line has a relationship that is proportional.

Unit 13

Unit: Proportion and Inverse Proportion
Sub-unit: 3. Using the Properties of Proportion
Lesson 1 of 3

Textbook Page : 033
Actual Lesson 102

Sub-unit Objectives

- To state that some phenomena can be solved efficiently by using the relationships of proportion.
- To solve problems by using equations and graphs of proportion.

Lesson Objectives

- To apply the properties of proportion to solve problems.

Prior Knowledge

- Meaning and Equation of Proportion
- Graphs of Proportion

Preparation

- Table and band graph

Assessment

- Find missing amount in the table by thinking about the relationship between two amounts. F
- Solve the problems by using a table and equations. S

Teacher's Notes

When $x \div y$, the answer is always constant in the equation of proportion, therefore we can apply the relationship to work out the increase in any two quantities that change together at the same rate.

3 Using the Properties of Proportion

1 The table below represents the relationship between the volume of cola drink and the weight of sugar in it.

Volume of Cola and Sugar

Volume of cola x (ml)	0	1	50	100	150	180	250
Weight of sugar y (g)	0	0.12	6	12	18	21.6	30

1. Is the weight of sugar y g, proportional to the volume of cola x millilitres (ml)? Yes
2. How many grams of sugar is in 250 ml of cola? 30 g

Sare's Idea

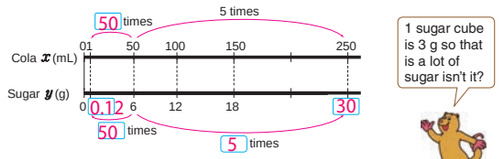
250 ml of cola is 5 times more than 50 ml, therefore the weight of sugar is 5 times more.

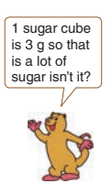
		×5	
x	50	250	
y	6	?	
	×5		

Vavi's Idea

The weight of sugar per millilitre of cola is constant, therefore I can make a mathematical sentence.

		×250	
x	1	250	
y	□	?	
	×250		





Ⓐ Let's find the answer using Sare's idea.

Ⓑ Let's represent the relationship between x and y in a mathematical sentence using Vavi's idea.

$y = 0.12 \times x$

3. How many g of sugar are in 180 ml cola?

$y = 0.12 \times 180$ Ans: 21.6 g

□×□−□= 133

Lesson Flow

1 Review previous lesson.

T Introduce the Main Task. (Refer to the BP)

2 ❶ Investigate the relationship of sugar with the amount of cola.

T/S Read and understand the given situation.

T ❶ Is the weight of sugar y g, proportional to the volume of cola x mL?

S When 50 mL cola becomes 100 mL which is twice as much, 6 g sugar becomes twice as much 12 g, when coke is 150 mL, three times, and sugar becomes 18 g, which is 3 times as before. Therefore, it can be said that the amount of sugar has a relationship of proportion with the amount of cola.

T Use students' ideas to confirm important concepts. In addition, let students see that $y \div x$ has a quotient of 0.12.

3 Find out how many grams of sugar are contained in 250 mL.

T ❷ How many grams of sugar are in 250 mL of cola?

T/S Discuss the thinking processes of Sare and Vavi.

T Allow students to complete the band diagram.

S Ⓐ Try to solve the problem with Sare's way of thinking.

S Ⓑ Try to solve the problem with Vavi's way of thinking using $y = 0.12 \times x$.

T Use students' ideas to confirm important concepts.
Confirm students answer as 30 g.

4 Using the equation $y = 0.12 \times x$, find the amount of sugar in 180 mL of cola.

T Use students' ideas to confirm important concepts.
❸ How many grams of sugar are in 180 mL cola?

S Apply $x = 180$ into the equation $y = 0.12 \times x$ to find the amount of sugar.

T/S Some students may think $12 \times 1.8 = 21.6$ (g).
If so, have a class discussion for them to understand
180 mL is 1.8 times as much as 100 mL.

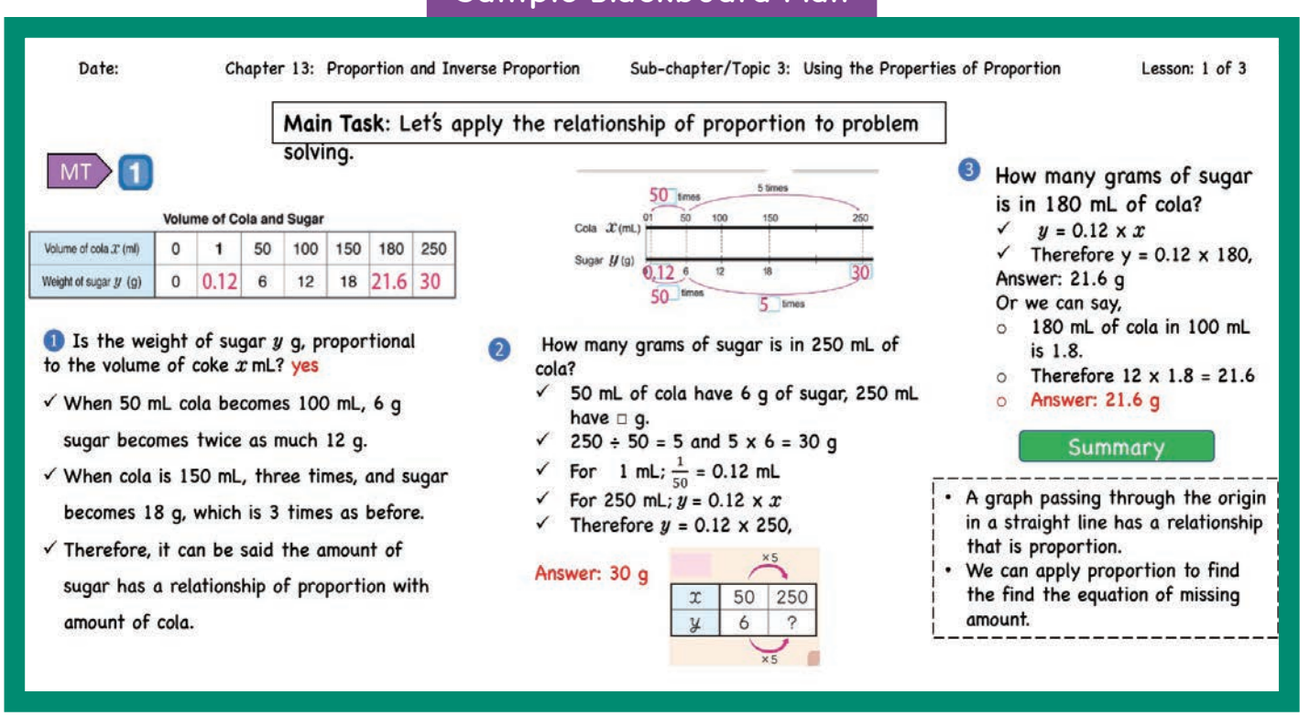
5 Summary

T What have you learned in this lesson?

S Present ideas on what they have learned.

T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan



Unit 13

Unit: Proportion and Inverse Proportion
Sub-unit: 3. Using Properties of Proportion
Lesson 2 of 3

Textbook Page : 134
Actual Lesson 103

Lesson Objectives

- To solve the problem using the graph.

Prior Knowledge

- Meaning and Equation of Proportion
- Graph of proportion

Preparation

- Graph for Task 2

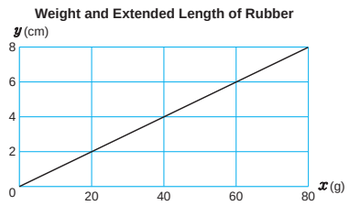
Assessment

- Apply the relationship of the graph to solve problem. F
- Solve the exercises correctly. S

Teacher's Notes

The graph of Proportion increases at a constant rate so we say that y is proportional to x.
When x increases by 2 times, 3 times…, y increases by 2 times, 3 times as well.

2 The graph below represents the relationship between the weight x grams and the extended length of rubber y cm.



1. If the weight increases by 20 g, how long does the rubber extend in cm? 2 cm
2. Represent the relationship between x and y in a mathematical sentence. $y = \frac{1}{10} \times x$
3. If you attach a stone onto the rubber and it extends to13 cm. What is the weight of this stone? $13 = \frac{1}{10} \times x$ $x = 130$

Exercise

The table below represents the relationship between the number of nails x and its weight y g.

Number of Nails and Weight

Number of nails x (nails)	0	1	50	100	150	200	250
Weight of nails y (g)	0	ⓐ 6	300	600	900	ⓑ 1200	ⓒ 1500

① Is y proportional to x? yes
② Find the number that goes into ⓐ, ⓑ and ⓒ.
③ Represent the relationship between x and y in a mathematical sentence. How many nails are there if the weight is 240 g?

$y = 6 \times x$
$240 = 6 \times x$
$x = 240 \div 6$
$= 40$
Ans: 40 nails

134 = □ × □ − □

Lesson Flow

1 Review the previous lesson.

T Introduce the Main Task. (Refer to the Blackboard Plan)

2 Understand the characteristics of graphs.

T/S 2 Read and understand the given situation.
T What does the graph represent?
TN Lead the students to understand that the graph indicates the relationship of the weight of weights and the length of stretched rubber.
S Realise that the graph is proportional, thus it forms a straight line that goes through the origin.

3 To find the length of stretched rubber.

T 1 When weight increases by 20 g, how many cm does the rubber stretch?
S Read and understand the length of rubber stretched when weight of weights is 20 g.
S The length of rubber will increase 2 cm, when the weight increases by 20 g.
T 2 Let's write an equation which represents the relationship of x and y.
TN Assist students to determine the relationship of the two quantities based on the graph of proportion.
S Indicate the relationship of x and y into an equation; $y = 0.1 \times x$
T 3 If a stone is attached to the rubber, it stretched 13 cm. How many grams is the weight of stone?
S Solve the problem by using the relationship of proportion $y = 0.1 \times x$.
$x = 13 \div 0.1$, therefore the weight of stone is 130 g.

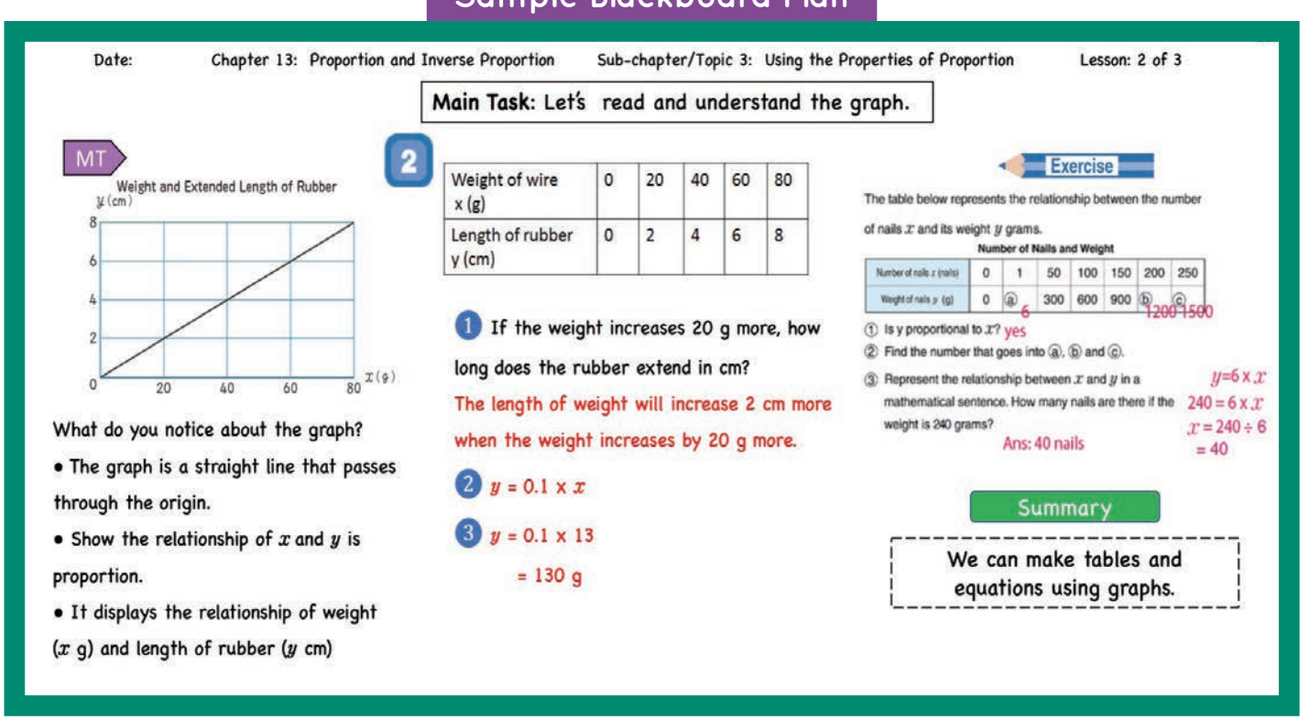
4 Complete the Exercise.

S Solve the exercises.
T Confirm students' answers.

5 Summary

T What have you learned in this lesson?
S Present ideas on what they have learned.
T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan



Unit 13

Unit: Proportion and Inverse Proportion
Sub-unit: 3. Using Properties of Proportion
Lesson 3 of 3

Textbook Page : 135 and 136
Actual Lesson 104

Lesson Objectives

- To understand that it is useful to apply the properties of proportion in order to predict a phenomenon.

Prior Knowledge

- Graphs of Proportion

Preparation

- Article on global warming
- Prepare graph on the board

Assessment

- Apply the properties of proportion to predict the phenomenon. F S
- Solve the exercises correctly. S

Teacher's Notes

Proportion can be applied in any situation as long as the students can understand the properties of proportion that is as one quantity x increases by 2 times, 3 times… the other quantity y changes the same

Predict the Global Environment

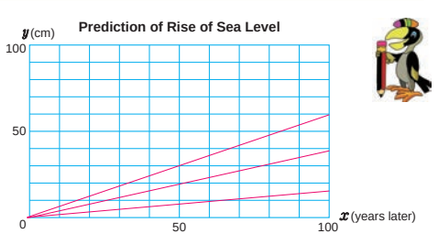

Manus Island

3 It is predicted that there will be a lot of influence on our lives due to global warming. One of the influences is the rise of sea level due to the melting of ice in the North Pole and the part of land could be covered by the ocean because of it.
Predict the rise of sea level by using the idea of proportion.

1 There are a lot of predictions about how fast the sea level will rise.

Make a graph for each of the three predictions below and calculate how much the sea level will rise in cm.

ⓐ Rise 12 cm in past 100 years. It will continue to rise.
ⓑ Rise 4 cm in next 10 years.
ⓒ Rise 6 cm in next 10 years.



2 After how many years, will the land that is 50 cm above the sea level be covered by the sea completely? (a) 417 yrs
(b) 125 yrs
(c) 83 yrs (Refer to BP for calculations) □×□−□= 135


(Funafuti, Tuvalu)

EXERCISE

1 Complete the tables below. Pages 120 to 125

①
Number of Pencils and Price

Number of pencils x (pencils)	1	2	3	4	5
Price y (toea)	50	100	150	200	250

②
Walking Time and Distance

Time x (hours)	1	2	3	4	5
Distance y (km)	4	8	12	16	20

2 Represent the following relationship of x and y in a mathematical sentence. $y = 3 \times x$ Pages 123 to 129

Length and Weight of Wire

Length x (cm)	0	1	2	3	4	5	6
Weight y (g)	0	3	6	9	12	15	18

3 A ribbon costs 80 toea per 1 m. Pages 130 to 134

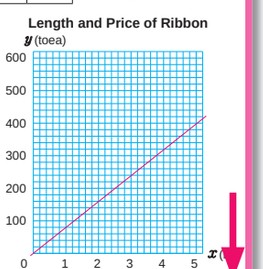
① Show the relationship between the length of ribbon x cm and its cost y toea in the table below.

Length and Price of Ribbon

Length x (cm)	0	1	2	3	4	5
Cost y (toea)	0	80	160	240	320	400

② Represent the relationship of x and y in a mathematical sentence.

③ Show the relationship of values x and y, on the graph.



136 = □×□−□

Lesson Flow

1 Review the previous lesson.

2 ③ Read about global warming and understand the fact.

T Read or show to students the prepared applicable documents. Assist them to understand the effect of global warming.

T Introduce the Main Task. (Refer to the Blackboard Plan)

3 ① Draw three graphs based on Ⓐ - Ⓒ.

T Guide students to think that in Ⓑ it is 40 cm in 100 years, Ⓒ 60 cm in 100 years.

S In pairs they share ideas and draw a straight line going through 0 to Ⓐ for 12 cm, Ⓑ for 40 cm and Ⓒ for 60 cm for 100 years later.

T Check work and ask students to share ideas in small groups.

T Have 3 students to draw their graph for Ⓐ - Ⓒ on the board.

4 Complete Exercise ① to ③.

TN ① Complete the table in ① and ②.
② Present relationship of x and y in a mathematics sentence.
③ Show the relationship between the lenght of ribbon and cost.

5 Summary

T What have you learned in this lesson?

S Present ideas on what they have learned.

T Use students' ideas to confirm the important concepts of this lesson.

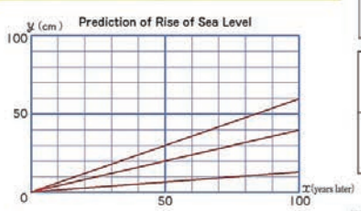
Sample Blackboard Plan

Date: Chapter 13: Proportion and Inverse Proportion Sub-chapter/Topic 3: Using the Properties of Proportion Lesson: 3 of 3

Main Task: Let's Predict the Global Environment

MT 3

Ⓐ Rise 12cm in past 100 years. It will continue to rise.
Ⓑ Rise 4cm in next 10 years.
Ⓒ Rise 6cm in next 10 years.



① How much sea level will rise?
Ⓐ Past 100 years 12 cm
Ⓑ 100 years later 40 cm
Ⓒ 100 years later 60 cm

② After how many years will the land that is 50 cm above the sea level be covered by sea completely?

Number of Years x (years)	100	?
Rise of sea level y (cm)	12	50

Number of Years x (years)	10	?
Rise of sea level y (cm)	4	50

Number of Years x (years)	10	?
Rise of sea level y (cm)	6	50

① $50 \div 12 = \frac{25}{6}$ ② $12 \div 100 = 0.12$
$100 \times \frac{25}{6} = 4166...$ $y = 0.12 \times x$
Answer: 417 years later $50 \div 0.12 = 4166...$

① $50 \div 4 = \frac{25}{2}$ ② $4 \div 10 = 0.4$
$10 \times \frac{25}{2} = 125$ $y = 0.4 \times x$
Answer: 125 years later $50 \div 0.4 = 125$

① $50 \div 6 = \frac{25}{3}$ ② $6 \div 10 = 0.6$
$10 \times \frac{25}{3} = 83.3...$ $y = 0.6 \times x$
Answer: 83 years later $50 \div 0.6 = 83.3..$

Summary

Proportion is useful in predicting results.

Unit 13

Unit: Proportion and Inverse Proportion
Sub-unit: 4. Inverse Proportion
Lesson 1 of 3

Textbook Page : 137 and 138
Actual Lesson 105

Sub-unit Objectives

- To understand the meaning of inverse proportion
- To investigate two quantities of inverse proportion and understand the characteristics of it.

Lesson Objectives

- To understand the meaning of inverse proportion.
- To investigate the relationship of two quantities where one increases and the other decreases.

Prior Knowledge

- Previous sub unit on direct proportion.

Preparation

- 24 pieces of 1 cm² squares for each group
- 3 charts of the 3 tables

Assessment

- Think about the relationship of two quantities. F
- Explain the relationship where one quantity increases causes the other to decrease. S

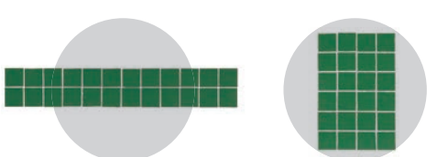
Teacher's Notes

Let the students identify the difference as they go through the activities.
Do not define the term for them before the task.

4 Inverse Proportion

1 How does the length and width of a rectangle with a fixed area of 24 cm² change?

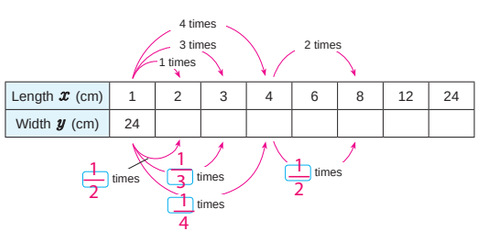
① Make many kinds of different rectangles using 24 of 1 cm² squares and complete the table below.



Length and Width of a Rectangle with an Area of 24 cm²

Length x (cm)	1	2	3	4	6	8	12	24
Width y (cm)	24	12	8	6	4	3	2	1

② If the value of x changes 2 times, 3 times and so on, how does the value of y change?

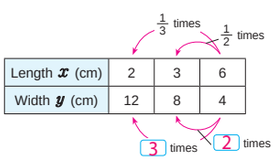


When there are two changing quantities x and y, and if the value of y changes by $\frac{1}{2}$ and $\frac{1}{3}$ times as the value of x changes 2 and 3 times respectively, we say that y is **inversely proportional** to x.

Proportion can be called direct proportion or inverse proportion.

Compare direct and inverse proportion.

③ If the value of x changes $\frac{1}{2}$ and $\frac{1}{3}$ times, how does the value of y change?



Exercise

Are two quantities inversely proportional?

Ⓐ The x cm length and y cm width of a rectangle, when the fixed sum of all its lengths is 24 cm. yes

Length x (cm)	1	2	3	4	5	6
Width y (cm)	11	10	9	8	7	6

Ⓑ Speed and time when you ride 100 km by bicycle. yes

Speed x (km/h)	5	10	20	25
Time y (hour)	20	10	5	4

□×□−□= 137 138 =□×□−□

Lesson Flow

1 Review the previous lesson.

2 ❶ The relationship between the length and width of a rectangle.

T/S Read and understand the given situation.
T Assist students to identify that the two quantities are the length and width of the rectangle.
S ❶ Make many kinds of different rectangles using 24 of 1 cm² squares and complete the table.
T Assist students in constructing different kinds of rectangles.
S Display their completed tables to the class as part of correction.
T Introduce the Main Task. (Refer to the BP)

3 Understanding how the quantity of length affects the length of a rectangle.

T ❷ If the value of x changes 2 times, 3 times, how does the value of y change?
S Fill in the ☐ in the table to see the relationship.
S Notice that when x is multiplied by 2, y is multiplied by $\frac{1}{2}$, x multiplied 3, y is multiplied by $\frac{1}{3}$ and so on.

4 Important Point

T/S Explain the important point in the box ☐.

5 Using the definition of inverse proportion to explain the table.

T ❸ If the value of x changes $\frac{1}{2}$ and $\frac{1}{3}$ times, how does the value of y change?
S Identify that when x decreases by $\frac{1}{2}$, y increases by 2 and when x decreases by $\frac{1}{3}$, y increases by 3.

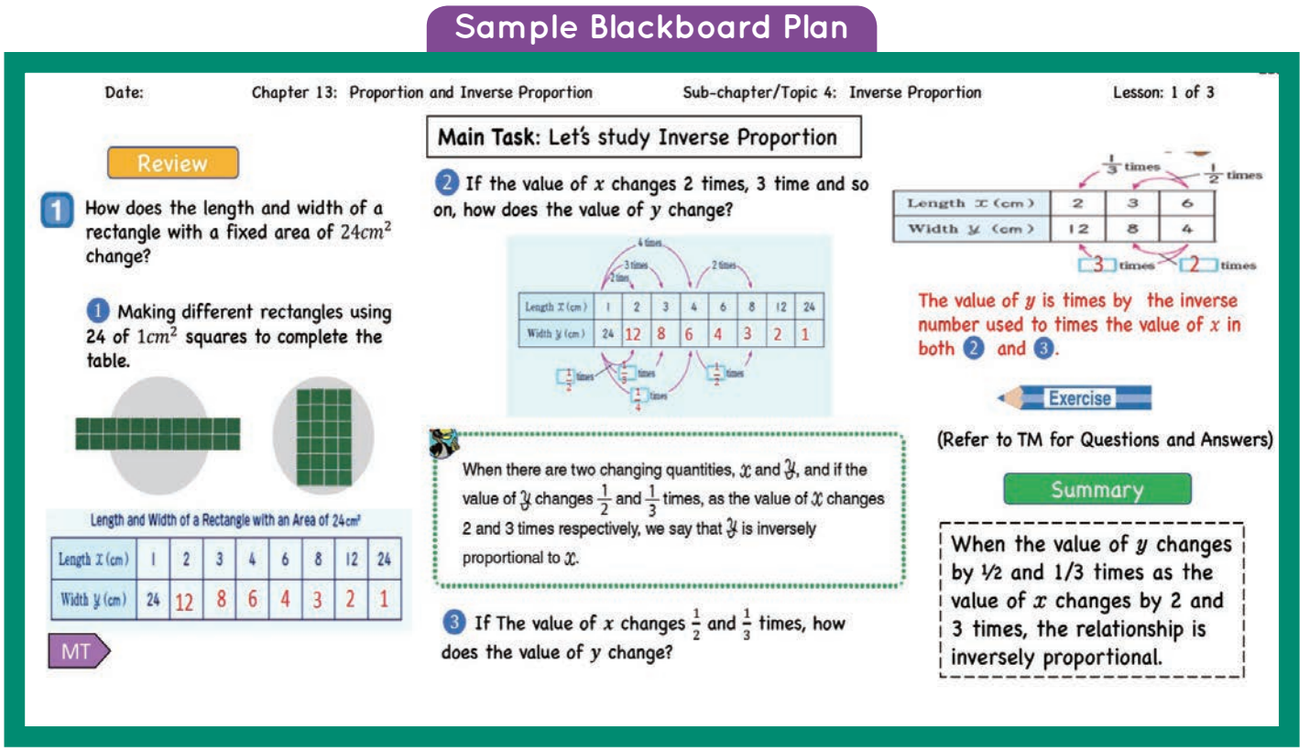
6 Complete Exercise.

S Solve the exercises.
T Confirm students' answers.

7 Summary

T What have you learned in this lesson?
S Present ideas on what they have learned.
T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan



Unit 13

Unit: Proportion and Inverse Proportion
Sub-unit: 4. Inverse Proportion
Lesson 2 of 3

Textbook Page : 139
Actual Lesson 106

Lesson Objectives

- To understand the meaning of mathematical sentences which shows inverse proportion.

Prior Knowledge

- Meaning of Inverse Proportion

Preparation

- Table showing length and width of a rectangle
- Chart of mathematical sentence of length and width

Assessment

- Identify the meaning of the mathematical sentence which shows inverse proportion. F
- Represent the relationship of inverse proportion as a mathematical sentence. S

Teacher's Notes

To identify the relationship of two changing quantities as one increases, the other decreases and when $x \times y$ the product is the same or is constant.

If two amounts are proportional, one amount increases as the other amount increases. On the other hand, the inverse proportion means that when one amount increases, the other decreases. When one amount becomes x times, the other amount becomes $\frac{1}{x}$ times. It is important to let students think through comparing proportion and inverse proportion.

2 Represent the relationship of length x cm and width y cm of a rectangle, when its fixed area is 24 cm² in a mathematical sentence and on the graph.

Length and Width of a Rectangle with a Fixed Area of 24 cm²

Length x (cm)	1	2	3	4	6	8	12	24
Width y (cm)	24	12	8	6	4	3	2	1

1 What kind of pattern is there between x and y?
When x increases y decreases

2 Find the product of the corresponding values of x and y.
What does the product mean?
x and y are inversely proportional

Length (cm)		Width (cm)		Area (cm²)
1	×	24	=	24
2	×	12	=	24
3	×	8	=	24
4	×	6	=	24
x	×	y	=	24

When there are 2 quantities x and y, and y is inversely proportional to x, their relationship can be represented in the mathematical sentence below.

$x \times y =$ Constant number

3 Find the value of y when value of x is 5.

$5 \times y = 24$
$y = 24 \div 5$
$y = 4.8$

When y is inversely proportional to x, it is also represented in the mathematical sentence below.

$y =$ constant number $\div x$

□×□−□= 139

Lesson Flow

1 Review the previous lesson.

2 ② Representing length as × cm and width as y cm.

T/S Read and understand the given situation.
T/S Discuss the representation of length and width as × and y in the table.
T ① What kind of pattern is there between × and y?
S Study the table and report that when × increases, y decreases.
T Check and confirm students' findings.
T Introduce the Main task. (Refer to the BP)

3 The meaning of the product of x and y.

T ② Find the product of the corresponding values of × and y.
What does the product mean?
S Complete the mathematical sentence by filing in the ☐ on the chart and realize that x and y are inversely proportional and their product is constant.
TN By filling in the ☐, the students will notice that the product is the same (constant number) which is the area of the rectangle.
i.e. 24 cm².
T Confirm the mathematical sentence; $x \times y = 24$

4 Important Point

T/S Explain the important point in the box ☐.

5 Find the unknown quantity using the definition of inverse proportion.

S ③ Find the value of y when the value of × is 5.
T Confirm students answers using the definition that $5 \times y = 24$ so $y = 24 \div 5 = 4.8$
T/S When y is inversely proportional to x, it is also represented as y=constant number × x.

6 Summary

T What have you learned in this lesson?
S Present ideas on what they have learned.
T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan

Date: Chapter 13: Proportion and Inverse Proportion Sub-chapter/Topic 4: Inverse Proportion Lesson: 2 of 3

Main Task: Let's make Mathematical Sentence for Inverse Proportion

Review

2 Length and Width of a 24 cm^2 rectangle

Length x (cm)	1	2	3	4	6	8	12	24
Width y (cm)	24	12	8	6	4	3	2	1

① What kind of pattern is there between x and y?

Student Ideas

As x increases, y decreases

MT

② Find the product of the corresponding values of x and y and what does the product mean?
The product of x and y means length × width which gives the area of the rectangle.

Length(cm)	Width(cm)	Area(cm^2)
1 ×	24 =	24
2 ×	12 =	24
3 ×	8 =	24
4 ×	6 =	24
x ×	y =	24

Important point

③ Find the value of y when value of x is 5.

$x \times y$ = constant number
$5 \times y = 25$
$y = 24 \div 5$
$y = 4.8$

Summary

When y is inversely proportional to x, it is also represented in the mathematical sentence as:
y = constant number ÷ x

Unit 13

Unit: Proportion and Inverse Proportion
Sub-unit: 4. Inverse Proportion
Lesson 3 of 3

Textbook Page : 140
Actual Lesson 107

Lesson Objectives

- To deepen the understanding and the meaning of inverse proportion.
- To understand a graph that shows inverse proportion.

Prior Knowledge

- Meaning of Inverse Proportion
- Line graphs (Grade 4)

Preparation

- Grid papers and if possible enlarged graph paper

Assessment

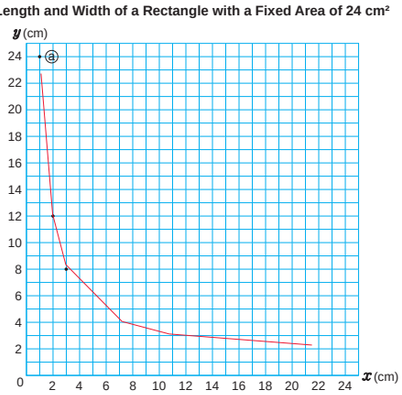
- Draw a graph that shows inverse proportion. F
- Construct and comprehend graphs of inverse proportion. S

Teacher's Notes

To identify the difference between the two graphs, the main difference is their physical appearance.
The graph of Proportion is an increasing straight line where as the graph of the Inverse proportion is a curve.

4 Plot points on the value of x and its corresponding y value on the graph and connect them with straight lines.

Length and Width of a Rectangle with a Fixed Area of 24 cm²



6 Compare it with a graph that shows proportion on page 132.

Point ⓐ is $x = 1$ and $y = 24$.

3 There is the job which takes 60 days to complete when 1 person does the same amount of work per day.

1 Represent the relationship of x and y in a mathematical sentence. $x \times y = 60$

2 Using the mathematical sentence from problem 1, find how many days it takes to complete the job with 5 people. $y = 60 \div 5 = 12$ days

3 Using the mathematical sentence from problem 1, find how many people are needed to complete the job in 10 days.

$x = 60 \div 10 = 6$ people

140 = □ × □ − □

Lesson Flow

1 Review the previous lesson.

T Introduce the Main Task. (Refer to the BP)

2 Draw a graph of inverse proportion.

T Ensure all students have a grid paper each and ask them to do the activity 4.

S Plot the points on the pair of x and its corresponding value of y and connect them with a straight line

TN Students should reflect back to grade 4 on the 5 steps in constructing a line graph to help them draw the graph.

T Confirm students graph with an enlarged graph on the blackboard.

3 Compare graph of inverse proportion and graph of proportion.

T Let the students locate a graph of proportion from the previous sub unit on proportion.

S Locate a graph of proportion.

T 5 Ask students to make comparisons and comment on any differences or similarities.

S Compare the graphs and give feedback based on what they discover.

TN Main difference is that a graph of proportion is a straight line and a graph of inverse proportion is a curve or slope.

4 Solve problem involving inverse proportion.

T/S 3 Read and understand the given situation.

T Ask students to complete activity 1, 2 and 3.

S 1 Represent the relationship of $\times$ and y in a mathematical sentence.
Relationship: $x \times y = 60$ or $y = \frac{60}{x}$

S 2 Using the mathematical sentence in 1, find how many days it takes to complete the job with 5 people.
$y = 60 \div 5 = 12$ days

S 3 Using the mathematical sentence in 1, find how many people are needed to complete the job in 10 days.
$x = 60 \div 10 = 6$ people

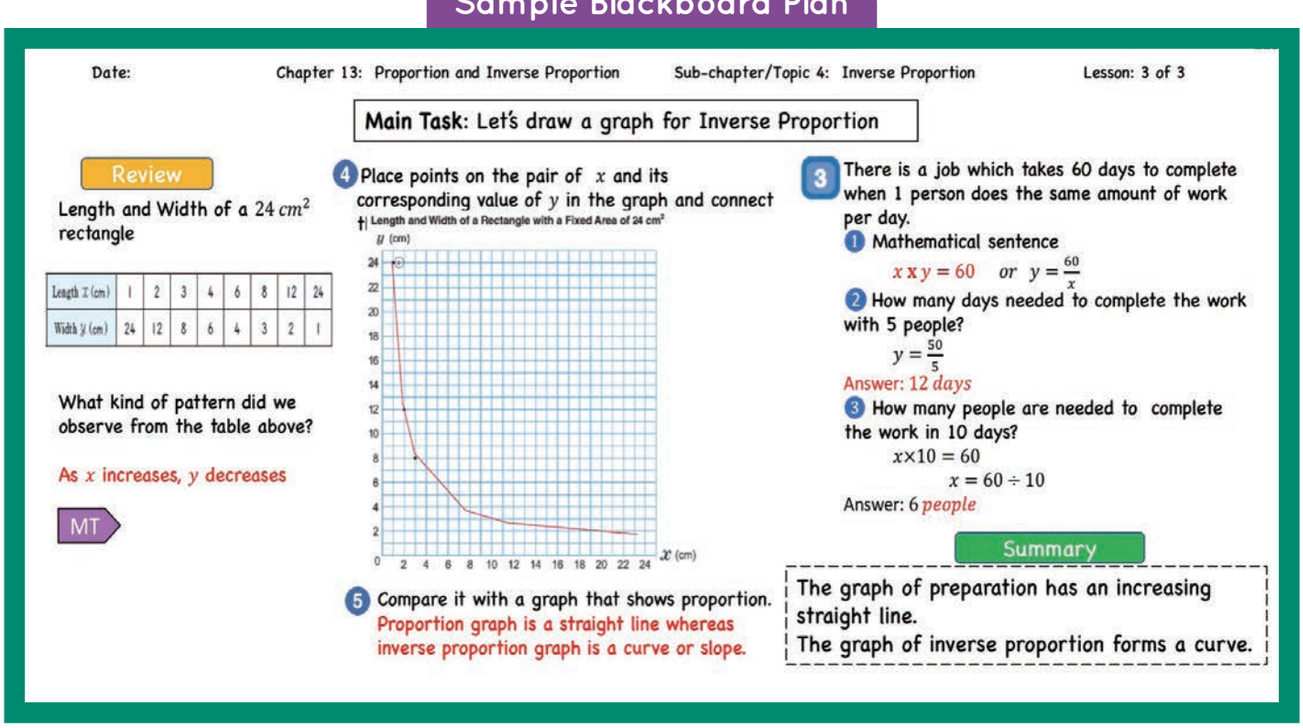
5 Summary

T What have you learned in this lesson?

S Present ideas on what they have learned.

T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan



Unit 13

Unit: Proportion and Inverse Proportion
Sub-unit: Exercise, Review and Evaluation
Lesson 1 of 2

Textbook Page : 141 and 142
Actual Lesson 108 & 109

Lesson Objectives

- To confirm their understanding on the concepts they learned in this unit by completing the Exercise, Review and Evaluation Test confidently.

Prior Knowledge

- All the contents learned in this unit of Proportion and Inverse Proportion.

Preparation

- Evaluation Test

Assessment

- Solve the exercise and review exercises correctly. F S

Teacher's Notes

This is the last lesson of Chapter 13. Students should be encouraged to use the necessary skills learned in this unit to complete all the exercises and solve the problems in preparation for the evaluation test. Use the attached evaluation test to conduct assesment for your class after finishing all the exercises and review as a seperate lesson.

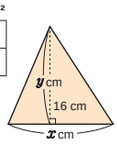
EXERCISE

1 The table below shows the relationship of the base x cm and height of a triangle y cm which has a fixed area of 16 cm².

Pages 137 to 140

Base and Height of a Triangle, Which Has a Fixed Area of 16 cm²

Base x (cm)	1	32	4	5	8	16	32
Height y (cm)	32	16	8	6.4	4	2	1



① Complete the table above.
② Is y inversely proportional to x? Yes
③ Represent the relationship of x and y with a mathematical sentence. $x \times y = 32$ ($y = 32 \div x$)
④ When the base is 10 cm, what will be the height? 3.2 cm

2 Zoe rides a bike at a speed of 1 km/h for a 100 km distance.
① Show the relationship of speed (x) and time (y) in the table.

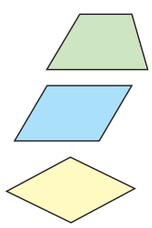
Relationship of Speed and Time for a 100 km Distance

Speed x (km/h)	1	2	4	5	10	20	25
Time y (hours)	100	50		20			

② Represent the relationship of x and y in a mathematical sentence.
③ What will be the time taken to travel 100 km at a speed of 100 km/h?

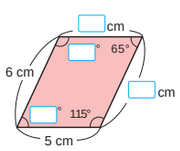
REVIEW

1 Write the correct words in the ☐ by looking at the figures on the right.

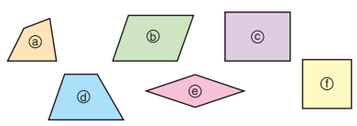


① A quadrilateral that has one pair of parallel opposite sides is called trapezoid
② A quadrilateral in which the opposite sides are both parallel is called parallelogram
③ A quadrilateral in which all 4 sides are equal in length is called rhombus

2 The figure on the right is a parallelogram. Fill in the ☐ with appropriate numbers. Construct a parallelogram that has the same sides and angles.



3 Which of these quadrilaterals have the following characteristics?



① Two pairs of parallel sides. b,c,e,f
② Four angles of equal size. c,f
③ Diagonals of equal length. c,f
④ Opposite sides with equal length. b,c,e,f
⑤ Opposite angles with equal size. b,c,e,f
⑥ No parallel sides. a,d

☐ × ☐ − ☐ = 141

142 = ☐ × ☐ − ☐

Lesson Flow

1 Complete Exercise ① and ②.

S ① and ②. Complete table of the relationship of the base and height of the triangle .

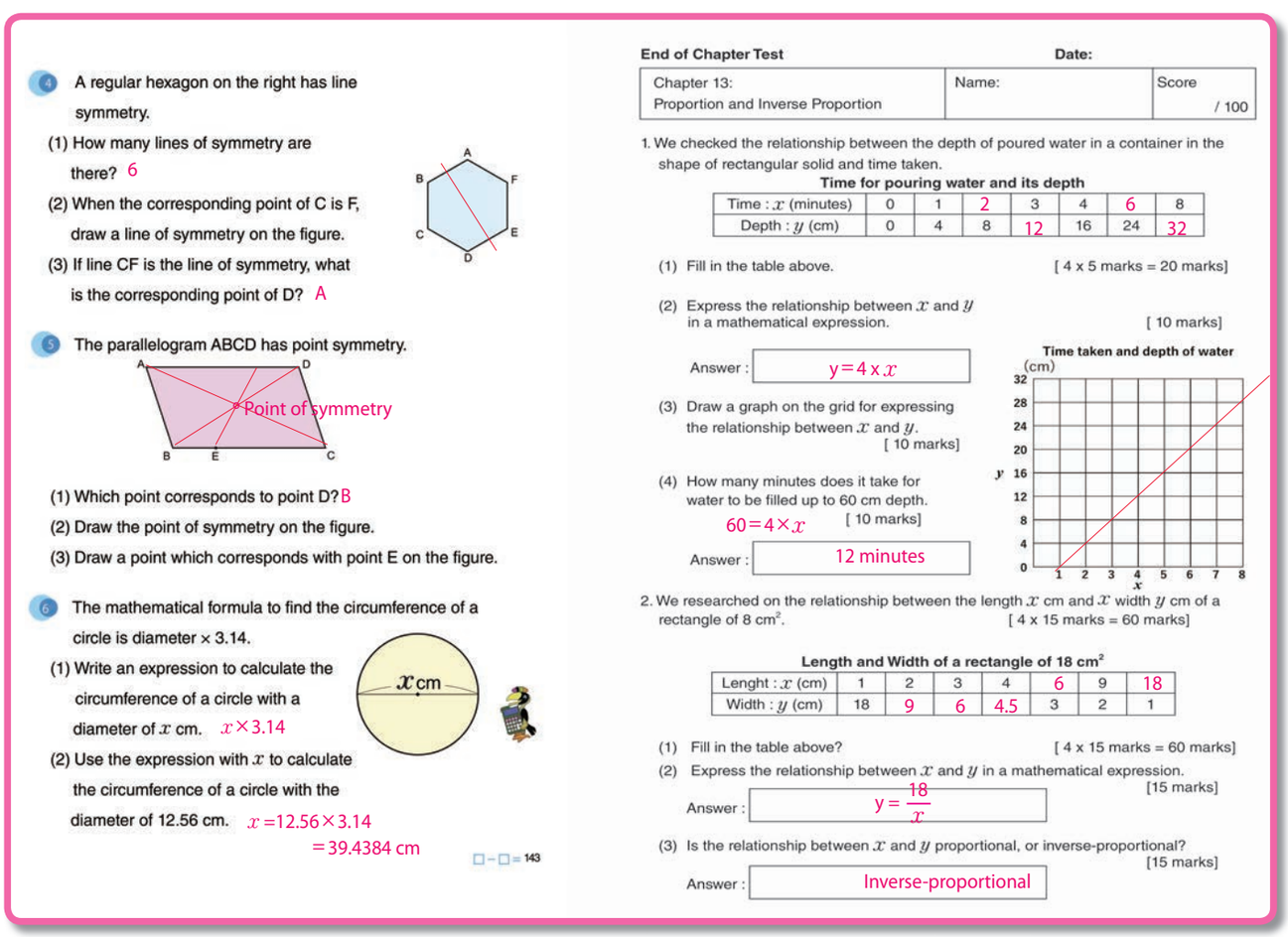
2 Complete Review 1 to 6.

S
1. Read the problem and solve questions ① to ③.
2. Use the given ratio to find the number of red balls to be drawn.
3. Study the diagram and solve the problem.
4. Solve the problem by identifying length and width using a given ratio.
5. sStudy the diagram and solve the problem.
6. Solve the problem by identifying length and width using a given ratio.

3 Complete the Evaluation Test.

TN Use the attached evaluation test to conduct assesment for your class after finishing all the exercises and review as a seperate lesson.

S Complete the evaluation test.



4 A regular hexagon on the right has line symmetry.

(1) How many lines of symmetry are there? 6

(2) When the corresponding point of C is F, draw a line of symmetry on the figure.

(3) If line CF is the line of symmetry, what is the corresponding point of D? A

5 The parallelogram ABCD has point symmetry.

Point of symmetry

(1) Which point corresponds to point D? B

(2) Draw the point of symmetry on the figure.

(3) Draw a point which corresponds with point E on the figure.

6 The mathematical formula to find the circumference of a circle is diameter × 3.14.

(1) Write an expression to calculate the circumference of a circle with a diameter of x cm. $x \times 3.14$

(2) Use the expression with x to calculate the circumference of a circle with the diameter of 12.56 cm. $x = 12.56 \times 3.14 = 39.4384$ cm

x cm

□ - □ = 143

End of Chapter Test **Date:**

Chapter 13: Proportion and Inverse Proportion	Name:	Score / 100

1. We checked the relationship between the depth of poured water in a container in the shape of rectangular solid and time taken.

Time for pouring water and its depth

Time : x (minutes)	0	1	2	3	4	6	8
Depth : y (cm)	0	4	8	12	16	24	32

(1) Fill in the table above. [4 x 5 marks = 20 marks]

(2) Express the relationship between x and y in a mathematical expression. [10 marks]

Answer : $y = 4 \times x$

(3) Draw a graph on the grid for expressing the relationship between x and y. [10 marks]

Time taken and depth of water

(cm) 32 28 24 20 16 12 8 4 0 — y — 1 2 3 4 5 6 7 8 — x

(4) How many minutes does it take for water to be filled up to 60 cm depth. [10 marks]

$60 = 4 \times x$

Answer : 12 minutes

2. We researched on the relationship between the length x cm and x width y cm of a rectangle of 8 cm^2. [4 x 15 marks = 60 marks]

Length and Width of a rectangle of 18 cm^2

Lenght : x (cm)	1	2	3	4	6	9	18
Width : y (cm)	18	9	6	4.5	3	2	1

(1) Fill in the table above? [4 x 15 marks = 60 marks]

(2) Express the relationship between x and y in a mathematical expression. [15 marks]

Answer : $y = \frac{18}{x}$

(3) Is the relationship between x and y proportional, or inverse-proportional? [15 marks]

Answer : Inverse-proportional

End of Chapter Test **Date:**

Chapter 13: Proportion and Inverse Proportion	Name:	Score / 100

1. We checked the relationship between the depth of poured water in a container in the shape of rectangular solid and time taken.

Time for pouring water and its depth

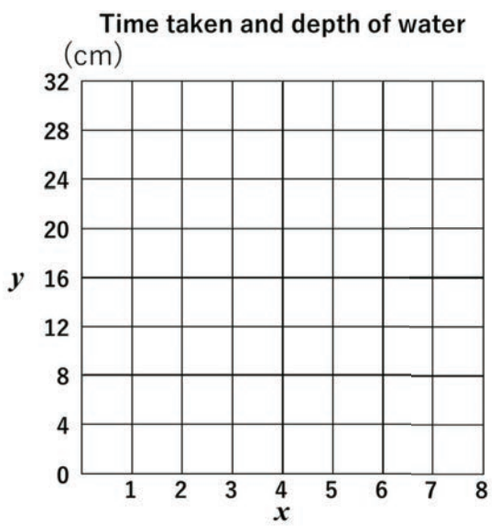
Time : $\times$ (minutes)	0	1		3	4		8
Depth : y (cm)	0	4	8		16	24	

(1) Fill in the table above. [4 × 5 marks = 20 marks]

(2) Express the relationship between $\times$ and y in a mathematical expression. [10 marks]

Answer :

(3) Draw a graph on the grid for expressing the relationship between $\times$ and y. [10 marks]



(4) How many minutes does it take for water to be filled up to 60 cm depth. [10 marks]

Answer :

2. We researched on the relationship between the length $\times$ cm and $\times$ width y cm of a rectangle of 8 cm^2. [4 × 15 marks = 60 marks]

Length and Width of a rectangle of 18 cm^2

Lenght : $\times$ (cm)	1	2	3	4		9	
Width : y (cm)	18				3	2	1

(1) Fill in the table above? [4 × 15 marks = 60 marks]

(2) Express the relationship between $\times$ and y in a mathematical expression. [15 marks]

Answer :

(3) Is the relationship between $\times$ and y proportional, or inverse-proportional? [15 marks]

Answer :

Chapter 14 How to Explore Data

1. Content Standard

6.4.4. Students will be able to examine data and analyse and represent it statistically and appreciate its usefulness in daily life.

2. Unit Objectives

- To determine the average of data and the distribution of data and represent it statistically.
- To get to know the average of data as the mean.
- To get to know the tables and graphs that represents frequency distribution.

3. Teaching Overview

Students learn how to marshal data in Grade 5. In Grade 6, students will acquire knowledge and skills of expressing and analysing data statistically. They also acquire the skill of utilizing the interpretation for decision making. Therefore evaluating the tendency of data and discussing on the meaning of the interpretation should be encouraged.

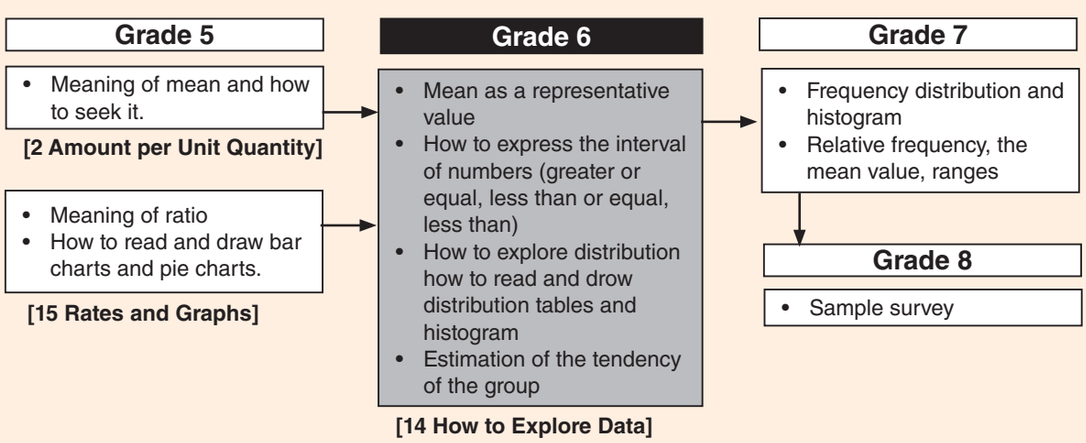
Mean :

Students learn mean as the result of leveling off. In this grade, they learn means for representing the characteristics of data set.

How to Explore Distribution :

How to marshal data follows the following 4 steps; Overviewing the data, Deciding the classes/ intervals, Recording frequencies and Drawing a histogram. Students are required to master correct usage of terminologies such as “greater than or equal to”, “less than or equal to” and “less than”.

4. Related Learning Contents



Unit 14

Unit: How to Explore Data
Sub-unit: 1. Mean
Lesson 1 of 2

Textbook Page : 144 and 145
Actual Lesson 110

Sub-unit Objectives

- To understand the meaning of mean using data.
- To understand how to find the mean of data

Lesson Objectives

- To use the mean for comparing real data.
- To interpret data on a table.

Prior Knowledge

- Measurement as an approximate value
- The mean (average) of measured values

Preparation

- Table showing local temperature

Assessment

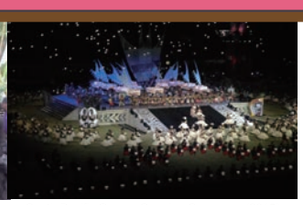
- Explain how mean can be calculated from a data table. F
- Compare and analyse data. F S

Teacher's Notes

Students learned about the mean of measured values in Gr.5.
Based on this, students should be expected to understand mean as a representative value (average) of data to deepen their understanding of mean.

14 How to Explore Data

Earthquake (2018)



South Pacific Games Opening Ceremony (2015)

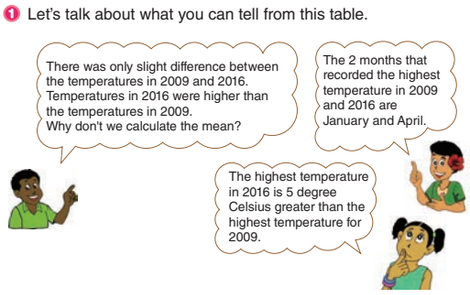
1 Mean

1 The table below shows the data of the highest monthly temperatures in NCD in 2009 and 2016.

Highest Monthly Temperature in NCD (°C)

Year \ Month	1	2	3	4	5	6	7	8	9	10	11	12
2009	31.0	30.1	28.9	31.3	30.3	30.0	29.9	29.1	30.0	30.8	30.9	30.8
2016	35.5	35.0	35.9	36.0	35.7	35.0	34.8	33.0	34.0	34.7	34.9	35.0

1 Let's talk about what you can tell from this table.



2 Ratu looked at the table and decided to compare the average highest monthly temperature of the year.
How is he calculating the mean?
Fill in the ☐ with a number and explain.

How to calculate the mean of highest monthly temperature of the year in 2009.

(Sum of highest monthly temperature from January to December) ÷ 12

3 Ratu calculated the mean of highest monthly temperatures of the year for each year and said 2016 was hotter than 2009.
Like what Ratu did, calculate the mean and round them off to tenths place and compare them.

2009	2016
361.8÷12=30.15	419.5÷12=34.95
Answer: 30.2°	Answer: 35°

2016 was hotter compared to 2009

Exercise

The number of classes in 16 primary schools in Angoram District, East Sepik Province is shown below.
Calculate the mean and round off to the tenths place.

6, 12, 6, 6, 6, 12, 16, 6, 16, 10, 11, 12, 7, 12, 12, 6

Answer: 9.8 classes.

144 = ☐×☐÷☐

☐×☐+☐= 145

Lesson Flow

1 Discuss the data of Average Temperature on the table.

T/S Study the the two pictures and discuss the kind of information or data that can be obtained from these situations.

T Introduce the Main Task. (Refer to the BP)

T/S 1 Read and understand the given situation.

T Allow students to study the data table showing the highest monthly temperatures for NCD in 2009 and 2016.

S 1 Discuss and interpret the information from the table.

S Identify and explain information by comparing the data of the two years, 2009 and 2016.
Example: Temperatures for 2016 are all in the 30's.

2 Explain how to compare data of different years.

T Guide students to compare the temperatures of both years by their average.

S 2 Compare the 2 years by finding the average for each year which is;
(Sum of monthly highest temperature from January to December) ÷ 12

S Generalise how mean can be calculated based on prior knowledge.

3 3 Find the monthly highest temperature average for year 2009 and 2016.

S Use the data from the table to calculate the mean for each year.

S Give a general comparison of the highest average temperature for the 2 years.

T From the calculations of each year's average, students will give a general comparison that 2016 was a hotter year compared to 2009 for NCD.

4 Complete the Exercise.

S Solve the exercises.

T Confirm students' answers.

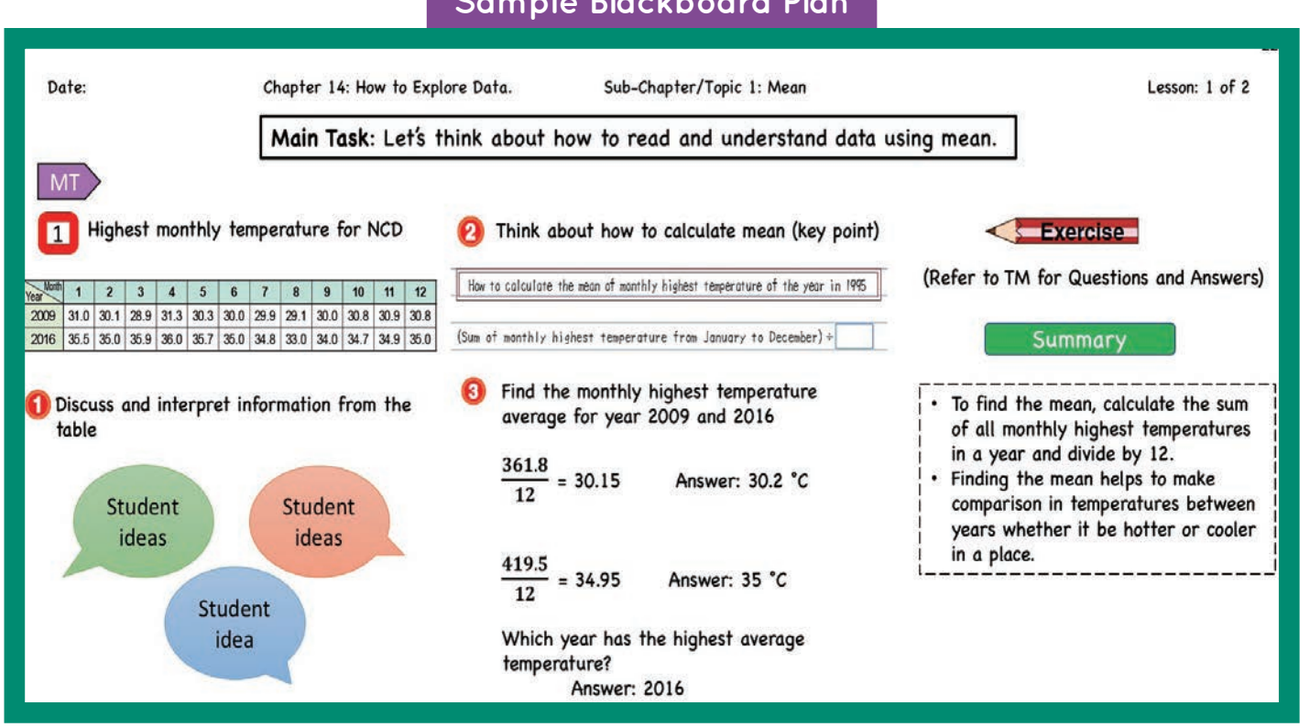
5 Summary

T What have you learned in this lesson?

S Present ideas on what they have learned.

T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan



Unit 14

Unit: How to Explore Data
Sub-unit: 1. Mean
Lesson 2 of 2

Textbook Page : 146
Actual Lesson 111

Lesson Objectives

- To understand how to calculate the average of scores(heights) as the mean.

Prior Knowledge

- The mean (average) of measured values

Preparation

- Data of heights

Assessment

- Calculate mean in different ways to compare and find the easier way. F S

Teacher's Notes

Students may find Vavi's Idea to be interesting. However, guide them to understand that Sare's Calculation is working with two operations and so there are minimum chances of making mistake than Vavi.

Finding the mean

2 The numbers below show the heights of 13 members of a PNG basketball team.
What is the average height of this team in cm?
Round off to the tenths place.
2503 ÷ 13 = 192.53
Answer rounded: 192.5 cm

Team PNG - South Pacific Games

188, 198, 179, 183, 191, 205, 195, 196, 185, 203, 187, 194, 199 (cm)

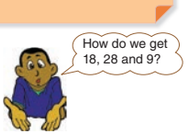
1 Fill in the ☐ with numbers and explain how to find the mean.

Sare's Idea

(188 + 198 + 179 + 183 + 191 + 205 + 195 + 196 + 185 + 203 + 187 + 194 + 199) ÷ 13 = 192.5
Therefore, the mean is 193 cm.

Vavi's Idea

(18 + 28 + 9 + 13 + 21 + 35 + 25 + 26 + 15 + 33 + 17 + 24 + 29) ÷ 13 = 22.5
170 + 22.5 = 192.5
Therefore, the mean is 193 cm.



2 Compare Sare's and Vavi's ideas.

146 = ☐ × ☐ ÷ ☐

Lesson Flow

1 Review the previous lesson.

T Introduce the Main Task. (Refer to the Blackboard Plan)

2 ❷ Find the average height of basketball players in a team.

T/S Read and understand the given situation.
S Round off the heights to the nearest tenths place
S Calculate the average height.

3 ❶ Think about and explain how to get the average height.

S Fill in the spaces for the 2 ideas to calculate the mean.
T
- Sare's Idea Adding all the heights and dividing the total heights by the number of players.
- Vavi's Idea Based on 170 cm (least common height of all players) and the difference of individual heights to 170 cm.

Total of (heights-170) ÷ 13 = Average difference
170 + Average difference = Mean Height

4 ❷ Compare and discuss the 2 ideas

T Let students compare the 2 ideas from activity ❶ to determine which is easier.
S Compare and conclude that Sare's idea is much easier considering the less calculations involved.
S Demonstrate how the 2 ideas are used to get the mean for the height of the players in the team.

5 Summary

T What have you learned in this lesson?
S Present ideas on what they have learned.
T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan

Date: Chapter 14: How to Explore Data. Sub-Chapter/Topic 1: Mean. Lesson: 2 of 2

Main Task: Let's think about how to calculate the average as the mean.

Review

MT

2 The numbers below shows the heights of 13 members of a basketball team. What is the average height of this team in centimetres? Round off to tenths place.

188, 198, 179, 183, 191, 205, 195, 196, 185, 203, 187, 194, 199 (cm)

$\frac{2503}{13} = 192.53$

Answer rounded to tenths: 192.5 cm

❶ Explain how to get the average height.

Yuri's Idea

(188+198+179+183+191+205+195+196+185+203+187+194+199) ÷ 13 = 192.5

Therefore, the mean is 192 cm.

Adding all the heights and dividing the total heights by the number of players.

Yuto's Idea

(18+28+9+13+21+35+25+26+15+33+17+24+29) ÷ 13 = 22.5

170+22.5=192.5

Therefore, the mean is 193 cm.

Total of (heights-170) ÷ 13 = Average difference
170 + Average difference = Mean Height

❷ Compare and discuss the 2 ideas as the summary of the lesson.

- Compare and conclude that Raka's idea is much easier considering less calculations involved.
- Demonstrate how the 2 ideas are used to get the mean for the height of the players in the team.

Summary

To calculate the mean;
- Find the least common height(170)
- Then find the average difference
- Add the average difference to the least common height(170) to get the mean height.

Unit 14

Unit: How to Explore Data
Sub-unit: 2. How to Explore Distribution
Lesson 1 of 4

Textbook Page : 147 to 149
Actual Lesson 112

Sub-unit Objectives

- To organise data and analyse the distribution on a frequency distribution table or graph.
- To understand the meaning and how to draw a histogram.
- To understand how to read a histogram and analyse the information.

Lesson Objectives

- To think about how to analyse the distribution of 2 sets of data.
- To organise data on a number line to easily understand distribution.

Prior Knowledge

- Collecting, sorting and organising data
- Representing data using pie and bar graphs

Preparation

- Number lines for group A & B

Assessment

- Analyse the distribution of two sets of data. F
- Organise data on a number line. S

Teacher's Notes

Data collection and arrangement is important in order to read the distribution and know the best and worst or average without calculation. Data distribution on number line is one way of making accurate reading.

2 How to Explore Distribution

The following are records of throwing a softball for two groups.

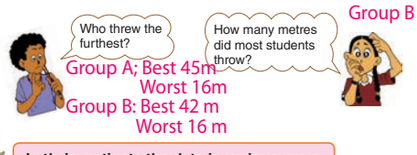
Records of Throwing a Softball

Group A				Group B			
Number	Distance (m)	Number	Distance (m)	Number	Distance (m)	Number	Distance (m)
①	22	⑪	26	①	40	⑪	37
②	31	⑫	16	②	34	⑫	30
③	42	⑬	42	③	26	⑬	28
④	23	⑭	18	④	30	⑭	32
⑤	24	⑮	22	⑤	19	⑮	42
⑥	35	⑯	38	⑥	21	⑯	37
⑦	45	⑰	29	⑦	33	⑰	30
⑧	23	⑱	28	⑧	16	⑱	32
⑨	31	⑲	31	⑨	38	⑲	21
⑩	41	⑳	33	⑩	24		

1 Comparing 2 sets of data by longest, shortest and mean

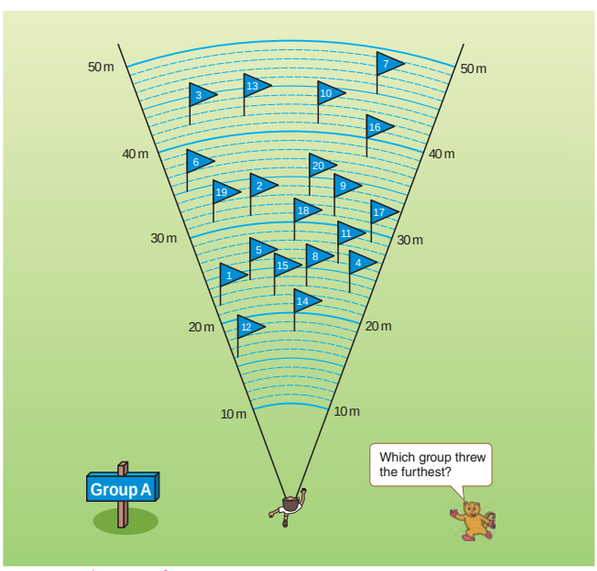
Which group has better records? Let's investigate the following statistics and talk about it.

① Best and worst record ② Average



Group A 30m
Group B 30 m

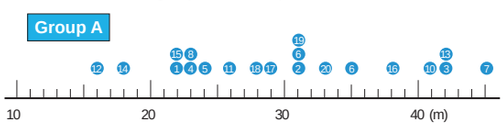
Let's investigate the data in various ways.



2 Distribution of Data

To make the records easy to read, represent each data on the number line. Data for group A is done.

Do the same for group B and compare the distribution.



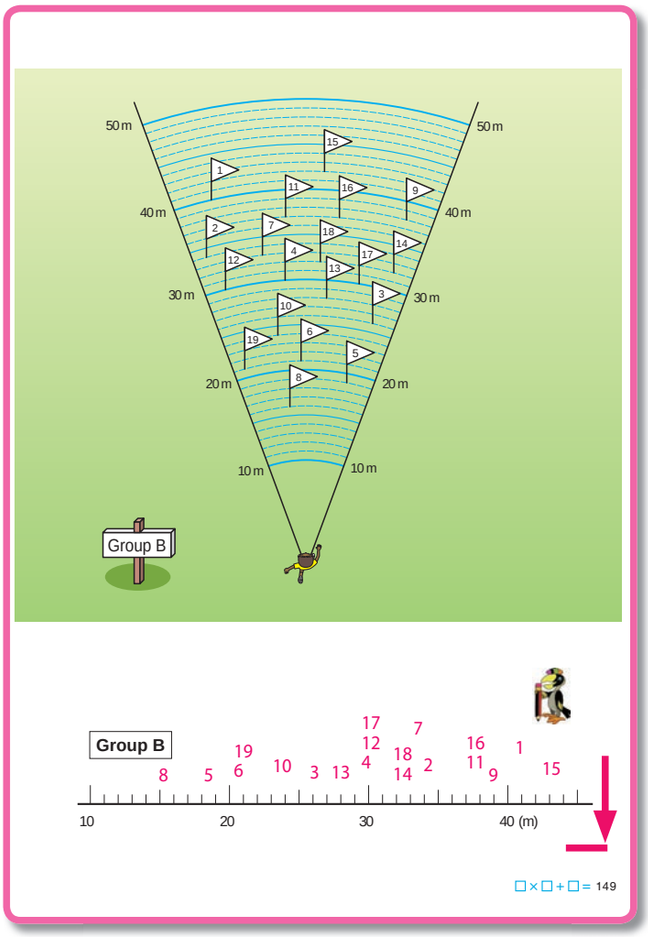
□×□+□= 147 48 =□×□÷□

Lesson Flow

1 Review the previous lesson.

2 Investigate and discuss the table of records.

T/S ▶▶ Read and understand the given information.
S Study the information on the table showing the distance of a softball been thrown.
T/S 1 Read and understand the given situation.
T Ask the students to identify the best and worst records and the average.
S 1 Identify the best and worst records from the 2 groups.
Group A: Best: 45 m Worst: 16 m
Group B: Best: 42 m Worst: 16 m
S 2 Investigate the average distance thrown by each group based on the results.
Group A: 30 metres
Group B: 30 metres
T Give an opportunity to the students to explain how they determine their average without doing any calculations.



3 Represent data on number lines.

T/S 2 Read and understand the given situation.
T Let students represent the data for Group B in the diagram onto a number line.
TN Allow students to observe how the data for Group A was represented on the number line and do the same for Group B.
S Plot the data for group B on the number line to display the distribution
S Identify the best and worst record and also the average from the distribution.

4 Compare and discuss the 2 sets of data

T How can we identify the best record?
S By identifying the last record.
T How can we identify the worst record?
S By identifying the first record.
T How can we identify the mean record?
S By identifying the position where most of the records are clustered.

5 Summary

T What have you learned in this lesson?
S Present ideas on what they have learned.
T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan

Lesson 101 sample Blackboard Plan is on page 231..

Unit 14

Unit: How to Explore Data
Sub-unit: How to Explore Distribution
Lesson 2 of 4

Textbook Page : 150 and 151
Actual Lesson 113

Lesson Objectives

- To understand how to make and read the distribution on a frequency table.
- To understand the meaning of Greater than or Equal to and Less than.

Prior Knowledge

- Collecting, sorting and organising data
  - Representing data using pie and bar graphs
  - Representing distribution on a number line

Preparation

- Frequency tables

Assessment

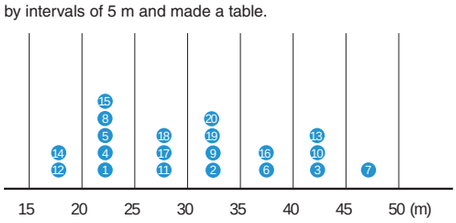
- Organise data on frequency tables. F S
- Compare 2 sets of data from frequency tables. F S

Teacher's Notes

Explain to student the terms Greater or Equal and less than before students fill in the frequency table.

Organising data on a frequency distribution table

3 To organise the distribution in more detail, they separated the data by intervals of 5 m and made a table.



1 Organise the distribution above in the table.

Record of Throwing a Softball (Group A)

Distance (m)	Number of students
Greater or Equal 15 ~ Less Than 20	2
20 ~ 25	5
25 ~ 30	3
30 ~ 35	4
35 ~ 40	2
40 ~ 45	3
45 ~ 50	1

This table includes the shortest to longest records. They divided the recorded distance by 5 m into 7 classes to find out how many students belong to each class.

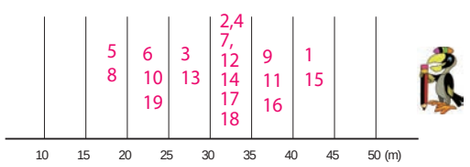
2 How many students belong to the recorded distance that is greater or equal to 25 m and less than 30 m? 3 students

3 In which class greater or equal to and less than do 4 students belong to? Greater than or equal to 30 m and less than 35 m

Comparing Data

4 Explore the data for group B and compare it with group A.

1 Separate the records by intervals of 5 m and complete the table.



2 Record the distribution above in the table.

Record of Throwing a Softball (Group B)

Distance (m)	Number of students
Greater or Equal 15 ~ Less Than 20	2
20 ~ 25	3
25 ~ 30	2
30 ~ 35	7
35 ~ 40	3
40 ~ 45	2
45 ~ 50	0

3 Compare the records of group A and B.

Ⓐ Which group has more records that are greater or equal to 40 m? Group A

Ⓑ Which group has more records that are less than 25 m? Same

Ⓒ Which group has more records that are greater or equal to 25 m and less than 35 m? Group B

150 = □ × □ ÷ □

□ × □ + □ = 151

Lesson Flow

1 Review the previous lesson.

T Introduce the Main Task. (Refer to the BP)

2 ❸ Organise the distribution of data in detail.

T/S Read and understand the given situation.

T Assist students to re-organise the data for Group A in more detail on a number line.

S Separate the data by intervals of 5 m and place the records in each category or class.

S ❶ Organise and record the data from the number line into a frequency table.

TN The table should be prepared in advance to be utilised on the board. Spend a few minutes to explain how the table has been organised.

T What does 15 - 20 mean?

S Records that are Greater than or Equal to15 and Less Than 20

3 Read the information and answer questions based on the frequency table.

T Give time to students to read the information on the table and answer questions ❷ and ❸.

S ❷ Answer: 3 Children

S ❸ Answer: Greater than or Equal to 30 m and Less than 35 m.

4 ❹ Re-organise the data for Group B and compare with Group A.

T/S Read and understand the given situation.

T Get the students to re-organise the data for Group B in more detail on a number line and frequency table.

S ❶ Separate the records by intervals of 5 m and place the records in each category.

S ❷ Explore the distribution by organizing the records from the number line into a frequency table.

T ❸ Get the students to compare the records of Group A and Group B to answer these questions.

S Ⓐ Answer: Group A

S Ⓑ Answer: Same

S Ⓒ Answer: Group B

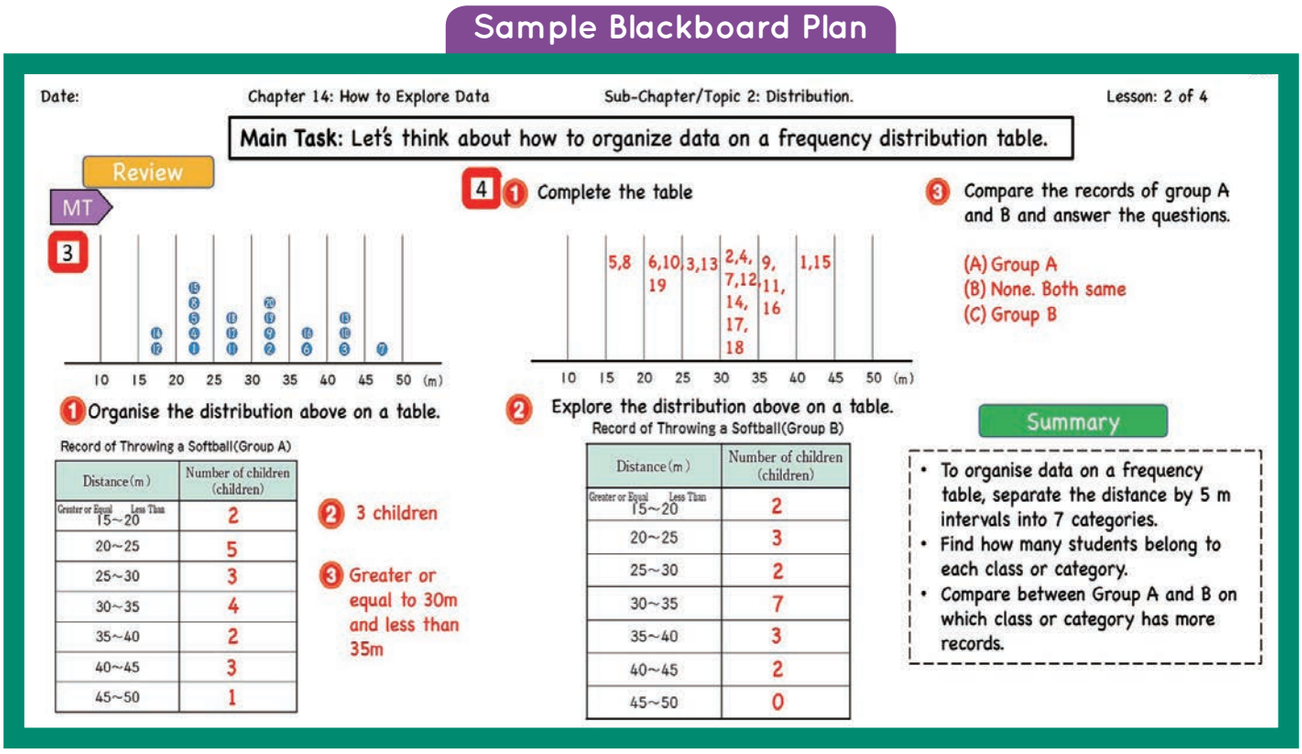
5 Summary

T What have you learned in this lesson?

S Present ideas on what they have learned.

T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan



Unit 14

Unit: How to Explore Data
Sub-unit: How to Explore Distribution
Lesson 3 of 4

Textbook Page : 152 and 153
Actual Lesson 114

Lesson Objectives

- To understand the meaning of histogram.
- To understand how to make and read a histogram.

Prior Knowledge

- Collecting, sorting and organising data
- Representing data using pie and bar graphs
- Representing distribution on a number line

Preparation

- Square grid paper, table for Task 6.

Assessment

- Organise data on histograms. F
- Compare 2 sets of data from histograms and tables. F S

Teacher's Notes

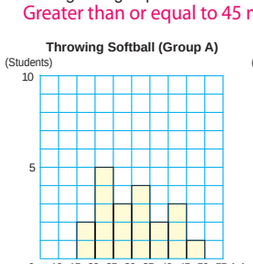
Differentiate the Histogram from Bar graph.
Bar graph represents a single data and Histogram represents range of data.

Histogram

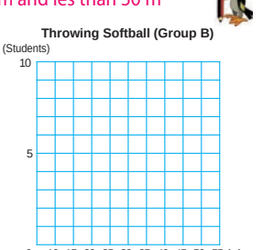
5 Based on the table of group A on page 150, they drew a graph to compare the distribution records of throwing a softball in group A and B.

1 How many students threw a softball greater than or equal to 35 m and less than 40 m in group A? 2 children

2 In which class, greater or equal and less than, does 1 student belong to in group A?
Greater than or equal to 45 m and les than 50 m



Even distribution



Concentrated in one area

The graph, which looks like the above, is called a **histogram**.
It is easy to read the distribution by looking at the bars.
In the **histogram**, the horizontal axis represents the range and vertical axis represents how many students are in each range.

3 Draw a histogram for group B.

4 Compare the shapes of the 2 histograms and discuss about how they are distributed. Group A is more distributed

6 In which class, greater or equal and less than, do most students belong to in each group?
What is the percentage ratio of this class out of all for each group?
Group A: Greater or equal to 20 m and less than 25 m, 25%
Group A: Greater or equal to 30 m and less than 35 m, 36.8%

6 In which class, greater or equal and less than, does the fifth student belong to for each group?
The fifth child in both groups is in the class of Greater or equal to 35 m and less than 40 m

6 Fill in the table to compare the distribution records of group A and B.
What can you tell from this table?
Comparing data by organising table

	Group A	Group B
Longest Record (m)	45 m	42 m
Shortest Record (m)	16 m	16 m
Mean (m)	$\frac{600}{20}$ =30 m	$\frac{540}{90}$ =28 m
Class that most students belong to (m)	Greater or Equal ~ 20 Less Than 25	Greater or Equal ~ 30 Less Than 35
Percentage (%) of students whose record is less than 20 m.	$\frac{2}{20}$ ×100=10%	$\frac{2}{19}$ x100=11%
Percentage (%) of students whose record is greater or equal to 20 m and less than 35 m.	$\frac{12}{100}$ x100=60%	$\frac{12}{19}$ x100=63%
Percentage (%) of students whose record is greater or equal to 40 m.	$\frac{3}{20}$ x100=15%	$\frac{2}{19}$ x100=11%

7 Let's investigate the records of throwing a softball in your school.

152 = □ × □ ÷ □

□ × □ + □ = 153

Lesson Flow

1 Review the previous lesson.

2 ❺ Interpret the information on the histogram of Group A records.

T Introduce the Main Task.(Refer to the BP)
T Allow students to study the histogram for Group A and answer ❶ and ❶.
S ❶ Answer: 2 Children
S ❷ Answer: Greater than or Equal to 45 and Less than 50

3 Understand the meaning of Histogram.

T Lead the students to realise that the vertical axis represents the number of children while the horizontal axis represents the range of records.
T "What information can be seen on the horizontal axis?"
S Range of records in metres.
T "What information can be seen on the vertical axis?"
S Number of children.

4 Important Point

T/S Explain the important point in the box ( ).

5 Draw a histogram for Group B.

T Get the students to draw a histogram for Group B using the distribution table from the previous lesson.
S ❸ Draw histograms for Group B using Group A histogram as an example.
S ❹ Compare and discuss the distribution of both histograms.
Group A: Even Distribution (Spread).
Group B: Concentrated on one area (Clustered).
S ❺ Answer: Group A: Greater than or Equal to 20 and Less than 25
Percentage ratio: $\frac{5}{20} \times 100 = 25\%$
Group B: Greater than or Equal to 30 and Less than 35.
Percentage ratio: $\frac{7}{19} \times 100 = 37\%$
S ❻ Answer: Group A: Greater than or Equal to 20 and Less than 25 Group B: Greater than or Equal to 15 and Less than 20.

6 ❻ Compare Data on the table.

T Let students fill in the given table and compare the distribution records.
S Complete filling in the table of results and give a summary of what they have found from the results.
T Allow students to present their findings from the table of results.

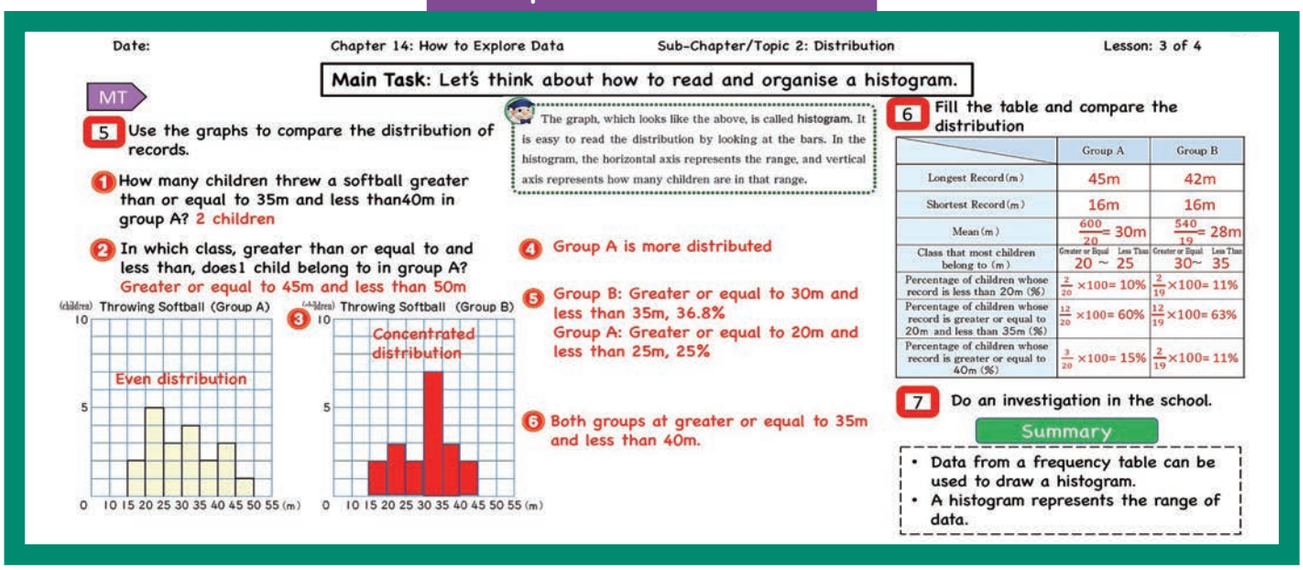
7 ❼ Investigate records in your own school.

T/S Do your own investigation at your school on softball throwing records.

8 Summary

T What have you learned in this lesson?
S Present ideas on what they have learned.
T Use students' ideas to confirm important concepts of this lesson.

Sample Blackboard Plan



Unit 14

Unit: How to Explore Data
Sub-unit: How to Explore Distribution
Lesson 4 of 4

Textbook Page : 154
Actual Lesson 115

Lesson Objectives

- To organise data on a frequency table and histogram.
- To read the characteristics of data on a frequency table and histogram.

Prior Knowledge

- Collecting, sorting and organising data
- Representing data using graphs
- Representing distribution on a histogram

Preparation

- Table for Task 8

Assessment

- Organise data on histograms. F
- Compare 2 sets of data from histograms and tables. F S

Teacher's Notes

Task 8 is a consolidating Task.
Let the students apply their prior knowledge and skills to draw histogram before answering activity
1 to 4.

- Interpret raw data from the table.
- Distribute data on a number line
- Then do a frequency distribution table displaying classes or categories (finding the intervals)
- Draw a Histogram

8 The data below shows the record of throwing a softball for grade 6 boys in West Primary School.

Record of throwing a softball

No	Distance	No	Distance	No	Distance
(1)	35 (m)	(12)	22 (m)	(23)	42 (m)
(2)	13	(13)	42	(24)	34
(3)	42	(14)	17	(25)	44
(4)	26	(15)	15	(26)	19
(5)	24	(16)	29	(27)	36
(6)	22	(17)	38	(28)	14
(7)	45	(18)	18	(29)	21
(8)	23	(19)	28	(30)	24
(9)	31	(20)	34	(31)	43
(10)	41	(21)	48	(32)	22
(11)	17	(22)	30	(33)	37

1 How is the record distributed?
The record is distributed between 13 m and 48 m.

2 What is the average of the record? 29.7 metres

3 How many students belong to the recorded distance that is greater or equal to 25 m and less than 40 m? 11 children

4 When ordering the record, whose throw is in the middle of the class? Student 16

154 = □ × □ ÷ □

Lesson Flow

1 Review the previous lesson.

T Introduce the Main Task. (Refer to the BP)

2 8 Investigate and discuss the data from the table of records.

T ❶ Allow students to study the data from the table and answer activity.
"How are the records distributed?"

TN Remind students to do a frequency table and draw a histogram as they answer the activities. (refer to Teachers Note)

S Use the information on the table to fill in the boxes.
Answer: Between 13 m and 48 m.

T ❷ What is the average for the records?

S Calculate the average record to get the answer 29.7 meters.

S ❸ Identify the number of children that have a recorded distance of greater or equal to 25 and less than 40 metres. Answer: 11 children.

T Let students find the record that is in the middle of the class.

S ❹ Identify the record that is in the middle of the class.
Answer: 29 is the middle number. Therefore, student 16 throw is in the middle of the class.

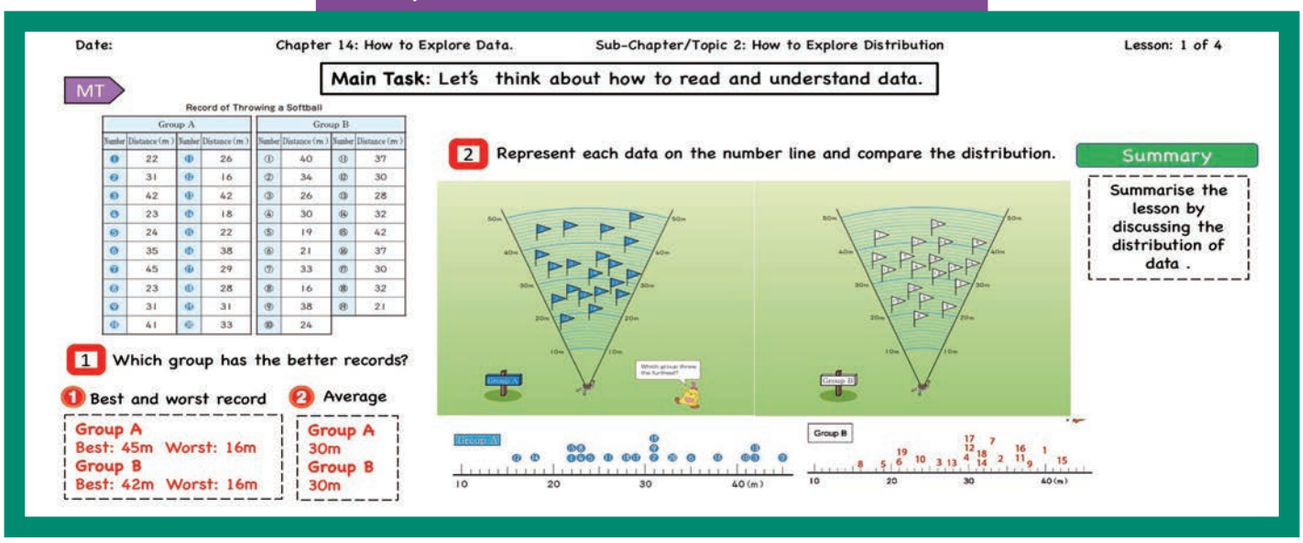
3 Summary

T What have you learned in this lesson?

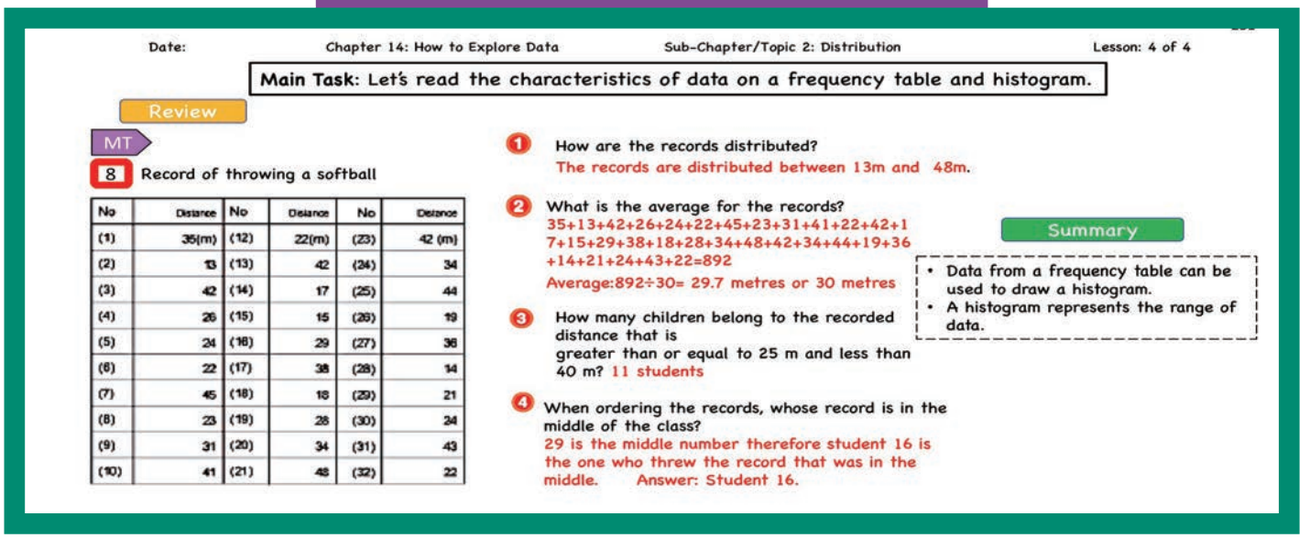
S Present ideas on what they have learned.

T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan (Lesson # 101)



Sample Blackboard Plan (Lesson # 104)



Unit 14

Unit: How to Explore Data
Sub-unit: Problems, Review and Evaluation
Lesson 1 and 2 of 2

Textbook Page : 155 to 157
Actual Lesson 116 & 117

Lesson Objectives

- To confirm their understanding on the concepts they learned in this unit by completing the Problems, Review and Evaluation Test confidently.

Prior Knowledge

- All the contents learned in this unit of How to Explore Data.

Preparation

- Evaluation Test

Assessment

- Solve the problems and review exercises correctly. F S

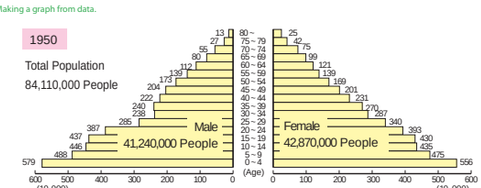
Teacher's Notes

This is the last lesson of Chapter 14.
Students should be encouraged to use the necessary skills learned in this unit to complete all the Review Exercises and solve the Problems in preparation for the evaluation test.
Use the attached evaluation test to conduct assesment for your class after finishing all the problems and review as a seperate lesson.

PROBLEMS

1 The type of graph below is a population pyramid. It shows the male and female population by ages in 1950 in Japan.

● Making a graph from data.

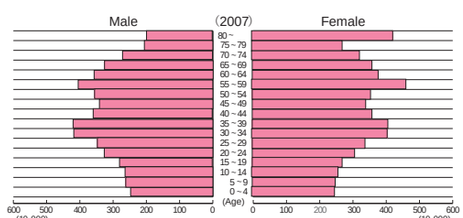


The data below is a table of population of male and female by ages in 2007. Make a population pyramid based on this data.

(10 000)

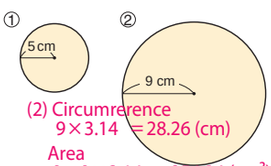
Age	Male	Female	Total of male and female	Age	Male	Female	Total of male and female
0 ~ 4	278	265	543	45 ~ 49	388	385	773
5 ~ 9	301	286	588	50 ~ 54	402	403	805
10 ~ 14	307	292	598	55 ~ 59	516	527	1043
15 ~ 19	322	306	628	60 ~ 64	413	434	847
20 ~ 24	372	352	724	65 ~ 69	375	409	784
25 ~ 29	397	383	780	70 ~ 74	319	373	692
30 ~ 34	475	462	936	75 ~ 79	241	316	557
35 ~ 39	476	466	943	80 ~	235	478	714
40 ~ 44	414	408	822	Sum Total	6231	6546	12777

(The numbers are rounded off, therefore, some calculations do not match.)



REVIEW

1 Calculate the circumference and the area of these circles.



(1) Circumrerence
$5 \times 3.14 = 15.7$ (cm)
Area
$5 \times 5 \times 3.14 = 78.5$ (cm^2)

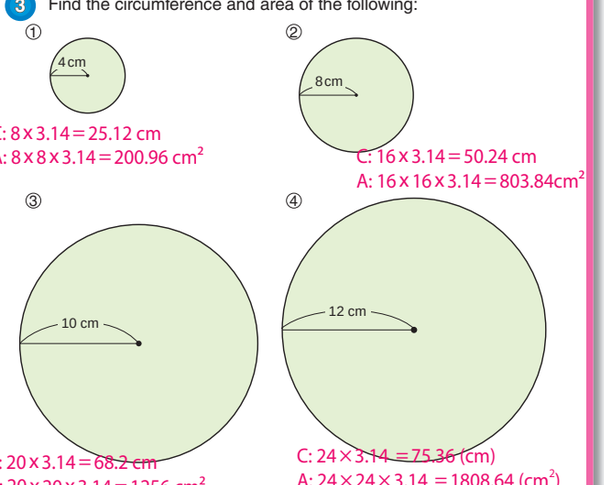
(2) Circumrerence
$9 \times 3.14 = 28.26$ (cm)
Area
$9 \times 9 \times 3.14 = 254.34$ (cm^2)

2 Calculate the diameter and the area of these circles.

① A circle with 9.42 cm circumference.
Diameter: $9.42 \div 3.14 = 3$ cm
Area: $3 \times 2 \times 3.14 = 18.84$cm^2

② A circle with 18.84 cm circumference.
Diameter: $18.84 \div 3.14 = 6$ cm
Area: $6 \times 2 \times 3.14 = 37.68$ cm^2

3 Find the circumference and area of the following:



① C: $8 \times 3.14 = 25.12$ cm
A: $8 \times 8 \times 3.14 = 200.96$ cm^2

② C: $16 \times 3.14 = 50.24$ cm
A: $16 \times 16 \times 3.14 = 803.84$cm^2

③ C: $20 \times 3.14 = 68.2$ cm
A: $20 \times 20 \times 3.14 = 1256$ cm^2

④ C: $24 \times 3.14 = 75.36$ (cm)
A: $24 \times 24 \times 3.14 = 1808.64$ (cm^2)

Lesson Flow

1 Solve Problem 1.

S 1 Draw a population pyramid using the data of population in the table.

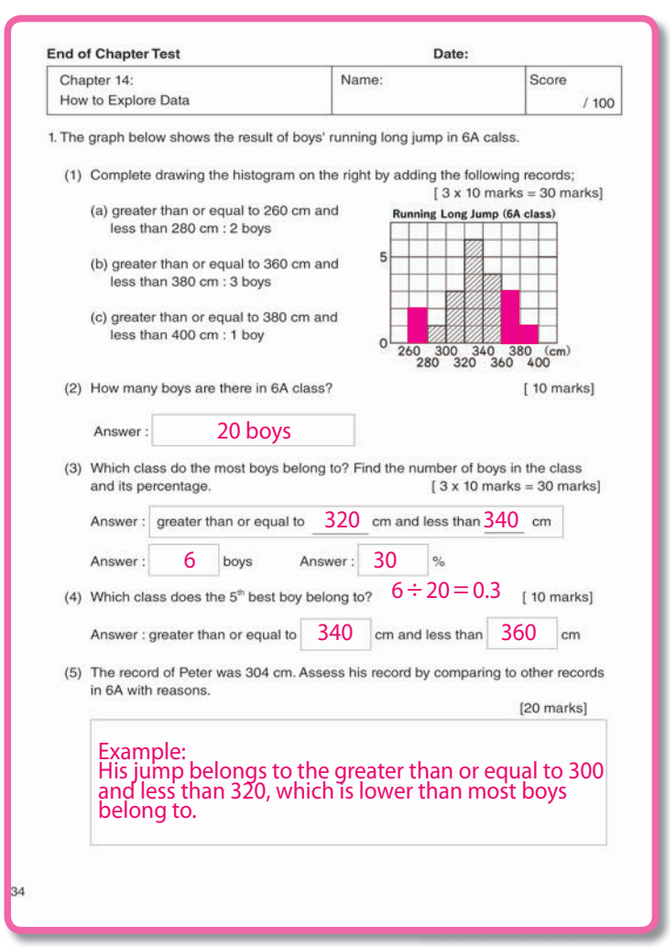
2 Solve the Review from 1 to 3.

S 1 Calculate to find the area and circumference.
2 Calculate to find the area and diameter.
3 Calculate to find the area and circumference..

3 Complete the Evaluation Test.

TN Use the attached evaluation test to conduct assesment for your class after finishing all the problems and review as a seperate lesson.

S Complete the evaluation test.



End of Chapter Test **Date:**

Chapter 14: How to Explore Data	Name:	Score / 100

1. The graph below shows the result of boys' running long jump in 6A calss.

(1) Complete drawing the histogram on the right by adding the following records; [3 x 10 marks = 30 marks]

(a) greater than or equal to 260 cm and less than 280 cm : 2 boys

(b) greater than or equal to 360 cm and less than 380 cm : 3 boys

(c) greater than or equal to 380 cm and less than 400 cm : 1 boy

(2) How many boys are there in 6A class? [10 marks]

Answer : 20 boys

(3) Which class do the most boys belong to? Find the number of boys in the class and its percentage. [3 x 10 marks = 30 marks]

Answer : greater than or equal to 320 cm and less than 340 cm

Answer : 6 boys Answer : 30 %

(4) Which class does the 5th best boy belong to? $6 \div 20 = 0.3$ [10 marks]

Answer : greater than or equal to 340 cm and less than 360 cm

(5) The record of Peter was 304 cm. Assess his record by comparing to other records in 6A with reasons. [20 marks]

Example:
His jump belongs to the greater than or equal to 300 and less than 320, which is lower than most boys belong to.

34

End of Chapter Test **Date:**

Chapter 14: How to Explore Data	Name:	Score / 100

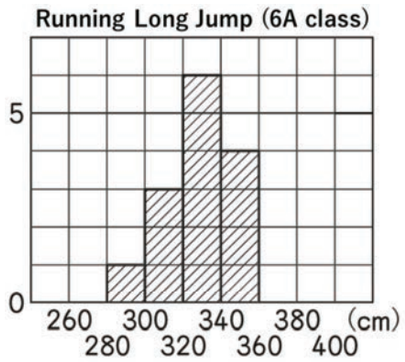
1. The graph below shows the result of boys' running long jump in 6A calss.

(1) Complete drawing the histogram on the right by adding the following records; [3×10 marks=30 marks]

(a) greater than or equal to 260 cm and less than 280 cm : 2 boys

(b) greater than or equal to 360 cm and less than 380 cm : 3 boys

(c) greater than or equal to 380 cm and less than 400 cm : 1 boy



(2) How many boys are there in 6A class? [10 marks]

Answer : ____

(3) Which class do the most boys belong to? Find the number of boys in the class and its percentage. [3×10 marks=30 marks]

Answer : greater than or equal to _____ cm and less than _____ cm

Answer : ____ boys Answer : ____ %

(4) Which class does the 5th best boy belong to? [10 marks]

Answer : greater than or equal to ____ cm and less than ____ cm

(5) The record of Peter was 304 cm. Assess his record by comparing to other records in 6A with reasons. [20 marks]

Chapter 15 Quantity and Unit

1. Content Standard

6. 2. 3. Students will be able to explain the metric unit system and measure various quantities of measurements using it and appreciate its usefulness in real life.

2. Unit Objective

- To understand quantity and the units of the metric system.

3. Teaching Overview

In this unit, students synthesise the units learned and the relationships among them. It will make students appreciate the system and understand how to convert to another unit.

How to Represent Quantities:

Students learn that there are several quantities. There are 2 types of quantities; discrete quantities such as oranges or persons and continuous quantities. They also should notice that we differentiate to use unit according to objects.

Units of Length: km, m, cm & mm:

Length is the base of metric system. Students should not miss it with conversions.

Units of Area: m^2, ha, a, m^2, cm :

Area is defined by a square. If a side of a square is made 10 times an original side, the area becomes $10 \times 10 = 100$ times.

Units of Volume: m^3, cm^3, kL, dL & mL :

Volume is a 3 - dimensional quantity. Therefore, if an edge of a cube gets 10 times an original edge, the volume becomes $10 \times 10 \times 10 = 1000$ times.

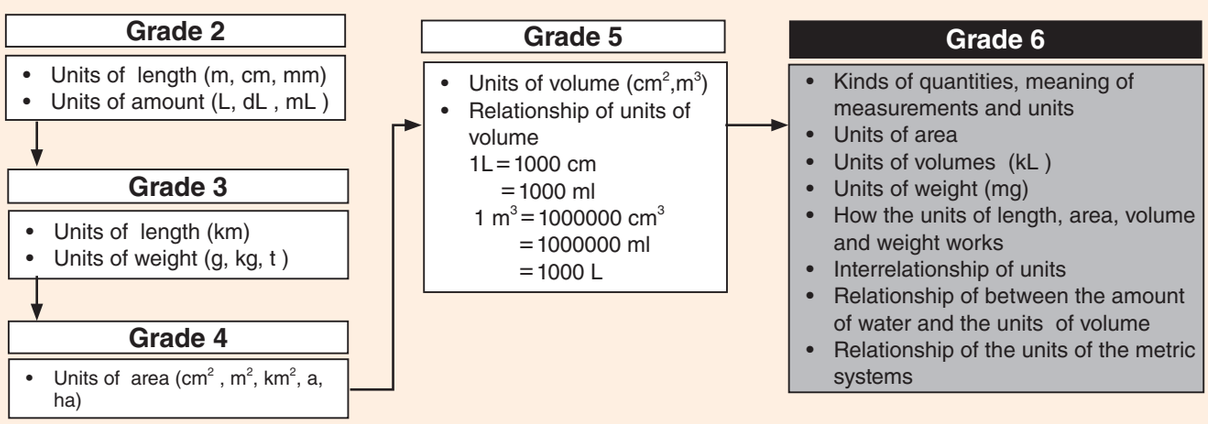
Units of Weight: t, kg, g & mg :

They should understand the relationship between volume of water and its weight.

Metric System:

Teachers should motivate students' interest in the historical origin of metric system. In this topic, students should be given lots of exercise of conversions.

4. Related Learning Contents



Unit 15

Unit: Quantity and Unit
Sub-unit: How to Represent Quantity
Lesson 1 of 1

Textbook Page : 157 and 158
Actual Lesson 118

Sub-unit Objectives

- To distinguish the meaning and characteristics of quantity.

Lesson Objectives

- To understand that there are two types of quantities (discrete quantities and continuous quantities) and find various quantities in their daily life.
- To summarise the units of quantities.

Prior Knowledge

- Unit of quantities in terms of distance, weight, time and amount

Preparation

- Table of Quantity and Unit

Assessment

- Explain the difference between discrete quantities and continuous quantities. F
- Find various quantities in our daily life. F
- Summarise the units of quantities. S

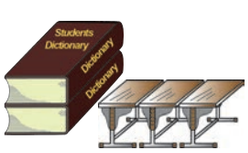
Teacher's Notes

Quantity is the expression of value that is comparable. For example, length, width, bulk, weight, thickness, speed and time.
Discrete quantities are those such as pencils and people while Continuous quantities are those such as weight and time.

15 Quantity and Unit

1 How to Represent Quantity

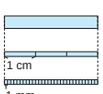
There are many kinds of quantities for things.
For example, there are number of pages, length and width, area of cover, weight and volume for books.



There are number of pieces, weight, area and volume of desks.
"2 volumes" or "3 books" are used to describe number of books.
"5 m" is used to describe the length of a string and "2.3 kg" is used to describe the weight of clay.
There are two types of quantities. One quantity describes something countable that is discrete, like the number of books or desks and the other quantity describes things that are not separated but continuous like the length of string or weight of clay.

	How to count	Unit of number
Discrete quantities	• Count by piece. • Represented by whole numbers.	piece, person, sheet, etc.
Continuous quantities	• Select unit and measure. • Can be in decimal or fraction.	m, L, kg, m², cm², minute, etc.

Units like 3 m, 3 cm, 3 L, 3 kg and 3 m² are used for quantities like length, volume or weight and are also standard scales.
For example, 3 cm represents length in cm and tells us it is 3 of 1 cm. If we measure 3 cm in units of millimetre it is 30 of 1 mm, therefore it is 30 mm.



□ × □ − □ = 157

1 What units of measurement are used to represent the following quantities?
Organise the information on the table.

	Units used
① Distance from home to school	Km, m
② Volume of juice	L,dL mL
③ Weight of a bag	Kg,g
④ Weight of an elephant	Tonne, kg
⑤ Area of classroom	m^2
⑥ Area of an island	km^2
⑦ Time taken to go to school	minutes

Let's think about other units that are used around you.

158 = □ ÷ □ − □

Lesson Flow

1 Discuss what kind of quantities you find in your daily life.

T Introduce the Main Task. (Refer to the Blackboard Plan)
T/S Read and understand the information on How to Represent Quantity.
T What kind of quantities can you find around you?
S Pencil, water, distance etc.
T Ask students to list down different types of quantities on the blackboard.
S List down as many types of quantities as they can on the blackboard.
T Assist the students to catergorise them into 2 groups and categorise discrete quantities and continuous quantities.
T/S Discuss the information in the textbook and confirm their listings according to the two types of quantities.
S Summarise discrete quantity and continuous quantity.

2 1 Think about the appropriate unit to show various quantities.

T Allow students to think about the appropriate units for each given quantity to fill in the table.
S Complete filling in the table and discuss the reasons why they chose those units.
T Ask students to think about other quantities and their units in their daily life.
S Identify and describe other quantities that are in the textbook.

3 Summary

T What have you learned in this lesson?
S Present ideas on what they have learned.
T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan

Date: Chapter 15: Quantity and Unit Sub-Chapter/Topic 1: How to Represent Quantity Lesson: 1 of 1

Main Task: Let's think about different types of quantities.

MT

1.Think about and discuss the different types of quantities in the surroundings and list them down.
Examples: pencil, water, distance, weight, etc.

2.Categorize the different quantities into 2 groups.

There are 2 types of quantities. One quantity describes something countable that is discrete, like number of books or desks, and the other quantity describes somethings that are not separated but continuous like the length of string or weight of clay.

	How to count	Unit of number
Discrete quantities	• Count by piece. • Represented by whole numbers.	piece, person, sheet, etc.
Continuous quantities	• Select unit and measure. • Can be in decimal or fraction.	m, L, kg, m^2, cm^2, minute, etc.

1 What kind of units are used to represent the following quantities?

	Used units
① Distance from home to school	Km, m
② Volume of juice	L,dL mL
③ Weight of a bag	Kg,g
④ Weight of an elephant	Tonne
⑤ Area of classroom	m^2
⑥ Area of an island	km^2
⑦ Time taken to go to school	minutes

Let's think about other units that are used around you.

Summary

- Discrete quantities are countable quantities.
- Continuous quantities are measurable quantities.

Unit 15

Unit: Quantity and Unit
Sub-unit: Units of Length: km, m, cm, mm
Lesson 1of 1

Textbook Page : 159
Actual Lesson 119

Sub-unit Objectives
- To comprehend the meaning and characteristic of length.

Lesson Objectives
- To summarise the units of length.
- To represent quantities using units of length.

Prior Knowledge
- Unit of distance(mm, cm, m and km)

Preparation
- Relationship of units

Assessment
- Use the appropriate units of length considering the distance. F
- Represent the relationship among units. F
- Summarise the relationship of units of length. S

Teacher's Notes
A Unit table can be used to express the conversion of units. Guide students to understand the table since the table will appear through the lessons.

Km			M
0	6		
	6	0	0

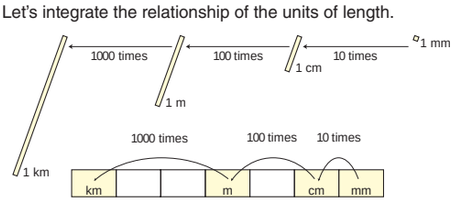
For the conversion of 0.6 km simply keep 6 and add zeros till they meet m.

2 Units of Length: km, m, cm, mm

1 What units of measurement are used to represent the following lengths?

1. Length of the Fly River……1050 [km]
2. Length of a swimming pool……25 [m]
3. Width of a textbook……25.7 [cm]
4. Thickness of an exercise book……4 [mm]

2 Let's integrate the relationship of the units of length.



3 Fill in the ☐ with a number.

1. 6 m = [600] cm
2. 2 km = [2000] m
3. 124 cm = [1.24] m
4. 0.5 cm = [5] mm

Convert Unit

0.6 km = [600] m

	km			m		cm	mm
	0	6					
		6	0	0			

Use the unit converting tool in the appendix and find out.
In this situation, 6 is in the first decimal place, so move the strip inside on the unit converting tool and set the number 1, one place below km. Then, recognise the number of 0 and read the place value for 6.

☐×☐−☐= 159

Lesson Flow

1 Review the previous lesson.

T Introduce the Main Task. (Refer to the BP)

2 Choose the appropriate units of length.

T Introduce the task 1.

S Choose appropriate units to fill in the boxes.

3 2 Think about the relationship among units of length.

T How many times of 1 mm is 1 cm ?

S 10 times.

T What about 1cm and 1 m?

S 100 times.

T How about 1 m and 1 km?

S 1000 times.

TN Explain the relationship of the units of length using the diagrams in the textbook for better understanding.

4 3 Solve the activities.

T Help those students who cannot convert unit correctly to use the unit conversion table.

TN 1

	km			m		cm	mm
				6			

6 0 0

2

	km			m		cm	mm
	2						

2 0 0 0

3

	km			m		cm	mm
				1	2	4	

1. 2 4

4

	km			m		cm	mm
						0	5

0. 5

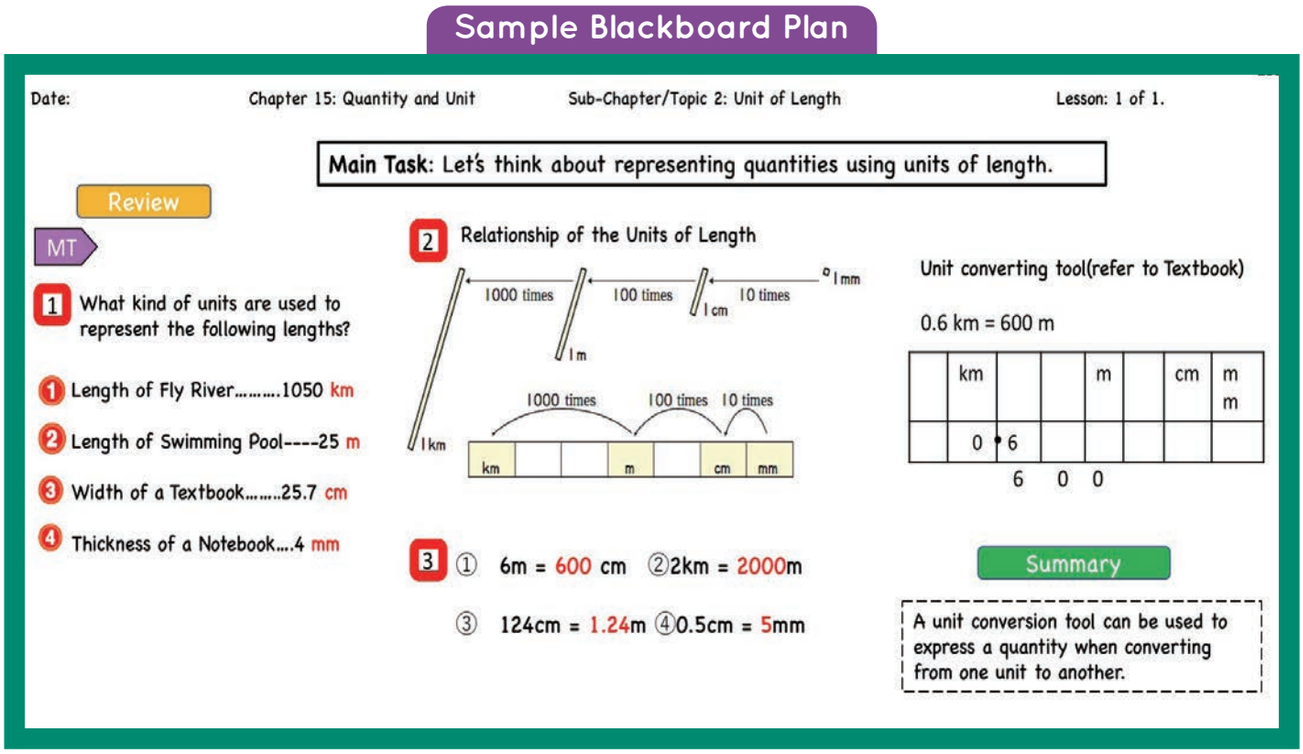
5 Summary

T What have you learned in this lesson?

S Present ideas on what they have learned.

T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan



Unit 15

Unit: Quantity and Unit
Sub-unit: Units of Area: km², ha, a, m², cm²
Lesson 1of 1

Textbook Page : 160
Actual Lesson 120

Sub-unit Objectives
- To understand the relationship between unit of area and unit of length.

Lesson Objectives
- To summarise the units of area

Prior Knowledge
- Unit of area (km², ha, a, m² and cm²)

Preparation
- Table of Units and relationship of units

Assessment
- Use the appropriate units of area considering the distance. F
- Represent the relationship between units of area and units of length. F
- Summarise the relationship of the units of area. S

Teacher's Notes
Compare length with area, as length increases by 10 times, the area increases by 100 times.

3 Units of Area: km², ha, a, m², cm

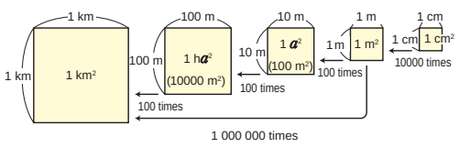
1 What units are used to represent the following areas?

1. Area of Central Province……29998 [km²].
2. Area of a tennis court……2 [a, m²].
3. Area of a surface of swimming pool in a school……375 [m²].
4. Area of a postage stamp……5.5 [cm²].

You learned that there are units of area like **cm²**, **m²**, **km²**, **a** and **ha** in grade 4.

1 a = 100 m² 1 ha = 100 a = 10000 m²

2 Units of area are made based on units of length.
Let's integrate the relationship of units of area.



Side length of a square	1 km	100 m	10 m	1 m	1 cm
Area of a square	1 km²	1 ha 10000 m²	1 a 100 m²	1 m²	1 cm²

Convert Unit

7 km² = [700] ha

	km²		ha		a		m²				cm²
	7										
	7		0		0						

160 = □ ÷ □ − □

Lesson Flow

1 Review the previous lesson.

T Introduce the Main Task. (Refer to the Blackboard Plan)

2 1 Choose the appropriate unit of area.

T/S Review what they learned about in Area and choose the appropriate unit for the given areas.
S Choose the appropriate unit of area to fill in the boxes.

3 2 Identify the relationship between units of area and length.

T How many times is the length of 10 m compared to 1 m?
S 10 times.
T How many times is the area of 10 m^2 compared to 1 m^2 ?
S 100 times.
T What about between 10 m^2 and 100 m^2?
S 100 times.
T Explain the relationship of the units of length of sides and area using the diagrams in the textbook for better understanding.
When the length of the sides of square become 10 times, the area of the square becomes 100 times.
TN 1 $cm^2 \times 10{,}000 = 1\ m^2$, 1 $m^2 \times 1{,}000{,}000 = 1\ km^2$

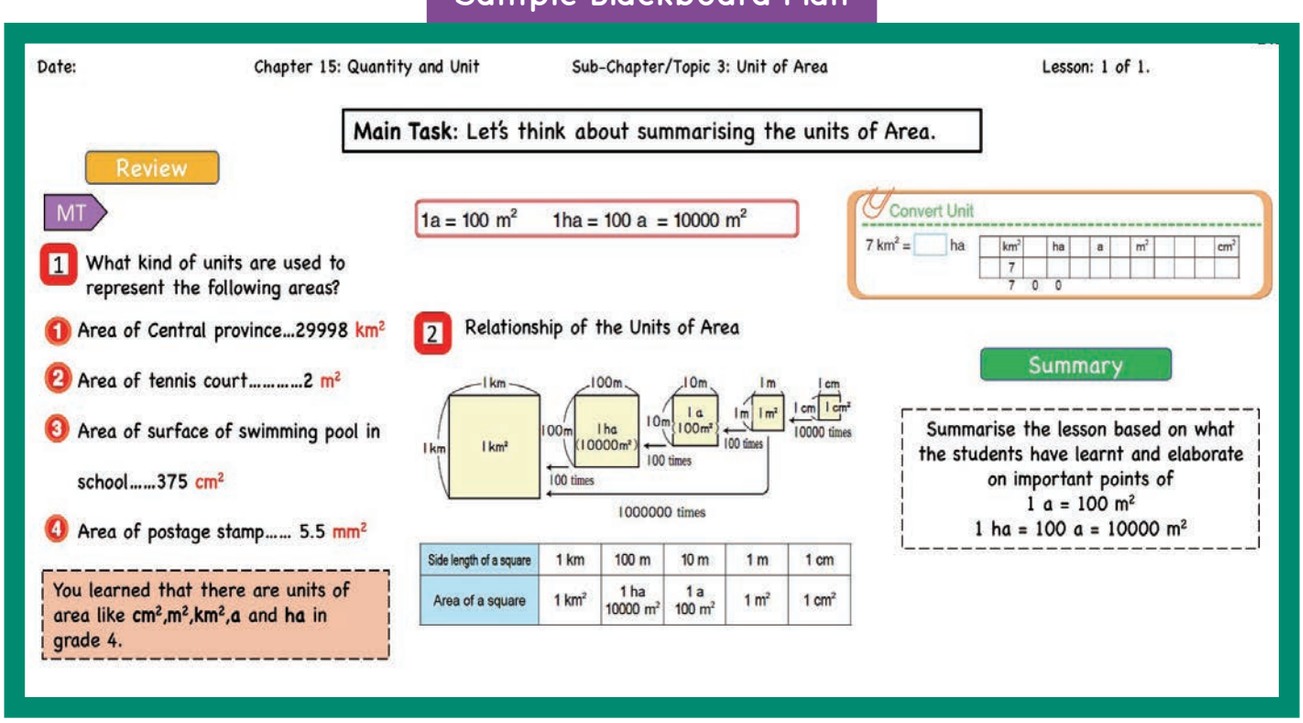
4 Applying the unit conversion tool.

T Ask students to convert 7 km^2 using the conversion tool.
S Convert 7 km^2 to 700 ha.

5 Summary

T What have you learned in this lesson?
S Present ideas on what they have learned.
T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan



Unit 15

Unit: Quantity and Unit
Sub-unit: Unit of Volume: m^3, cm^3, kL, dL, mL
Lesson 1 of 1

Textbook Page : 161
Actual Lesson 121

Sub-unit Objectives
- To understand that there are two types of unit in volume, a unit based on length and a unit based on L.
- To summarise the unit of volume.

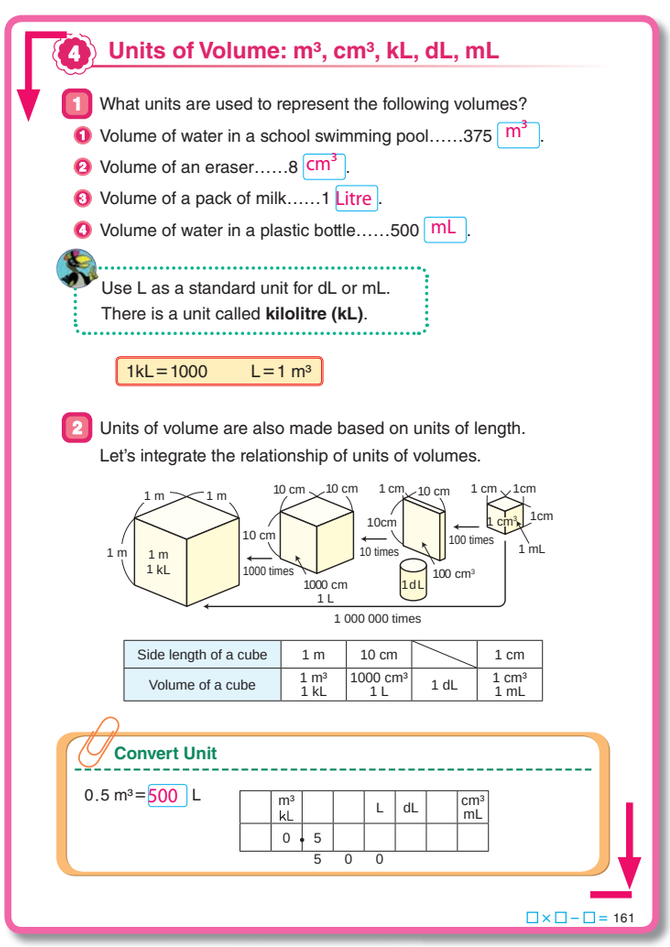
Lesson Objectives
- To understand that there are two types of units in volume, a unit based on length and a unit based on L.
- To summarise the unit of volume.

Prior Knowledge
- Unit of volume (m^3, cm^3, L, mL and dL)

Preparation
- Unit conversion table and relationship of units.

Assessment
- Use the appropriate units of volume considering the size of various materials. F
- Represent the relationship among units. F
- Summarise the relationship of the units of volume. S

Teacher's Notes
Compare length by volume, as length increases by 10 times the volume increases by 1000 times.



4 Units of Volume: m^3, cm^3, kL, dL, mL

1 What units are used to represent the following volumes?

1 Volume of water in a school swimming pool……375 [m^3].

2 Volume of an eraser……8 [cm^3].

3 Volume of a pack of milk……1 [Litre].

4 Volume of water in a plastic bottle……500 [mL].

Use L as a standard unit for dL or mL.
There is a unit called **kilolitre (kL)**.

1kL = 1000 L = 1 m^3

2 Units of volume are also made based on units of length.
Let's integrate the relationship of units of volumes.

Side length of a cube	1 m	10 cm		1 cm
Volume of a cube	1 m^3 1 kL	1000 cm^3 1 L	1 dL	1 cm^3 1 mL

Convert Unit

0.5 m^3 = [500] L

	m^3 kL			L	dL		cm^3 mL
	0	5					
		5	0	0			

□ × □ − □ = 161

Lesson Flow

1 Review the previous lesson.

T Introduce the Main Task. (Refer to the BP)

2 1 Choose appropriate unit of volume.

T/S Review what they learned about in Volume and choose the appropriate unit for the given volumes.

S Choose the appropriate unit of length, width and height to fill in the boxes.

3 Important Point

T/S Explain the important point in the box

4 2 Understand the relationship among units

T How many time is the volume which sides of cube increases 10 cm from 1 cm.

S 1000 times.

T Explain the relationship of length of sides and volume using the diagrams in the textbook for better understanding.
When the sides of cube increase 10 times, the volume becomes 1000 times.

TN Emphasise on the relationship of the units of volume is important.

5 Convert the Units of Volume.

T Help those students who cannot convert units correctly to use the unit conversion table.

S $0.5m^3 = 500L$

	m^3 kL			L		dL		cm^3 mL
	0.	5						
		5	0	0				

6 Summary

T What have you learned in this lesson?

S Present ideas on what they have learned.

T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan

Date: Chapter 15: Quantity and Unit Sub-Chapter/Topic 4: Unit of Volume Lesson: 1 of 1.

Main Task: Let's think about summarising the units of Volume.

Review

MT

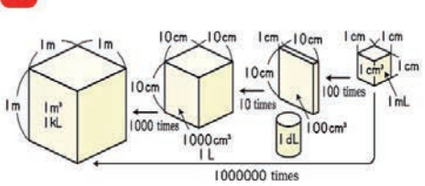
1 What kind of units are used to represent the following volumes?

1. Volume of water in school swimming pool.....375 m^3
2. Volume of a eraser.....8 cm^3
3. Volume of pack of milk.....1 L
4. Volume of water in a plastic bottle.....500 mL

Use L as a standard unit for dL, or mL.
There is a unit called **kiloliter** (kL).

$1kL = 1000\ L = 1m^2$

2 Relationship of the Units of Volume



Side length of a cube	1 m	10 cm		1 cm
Volume of a cube	$1\ m^3$ 1 kL	$1000\ cm^3$ 1 L	1dL	$1cm^3$ 1 mL

Convert Unit

$0.5\ m^3 =$ ☐ L

m^3 kL			L	dL		cm^3 mL
0	5					
	5	0	0			

Summary

Summarise the lesson based on what the students have learnt and elaborate on important points of
1 kL = 1000 L = 1 m^2

Unit 15

Unit: Quantity and Unit
Sub-unit: Unit of Weight: t, kg, g, mg
Lesson 1of 1

Textbook Page : 162
Actual Lesson 122

Sub-unit Objectives

- To recognise the unit milligram(mg).
- To understand the relationship between volume of water and weight.

Lesson Objectives

- To recognise the unit milligram(mg).
- To understand the relationship between volume of water and weight.
- To summarise the unit of weight.

Prior Knowledge

- Unit of weight (t , kg and g)

Preparation

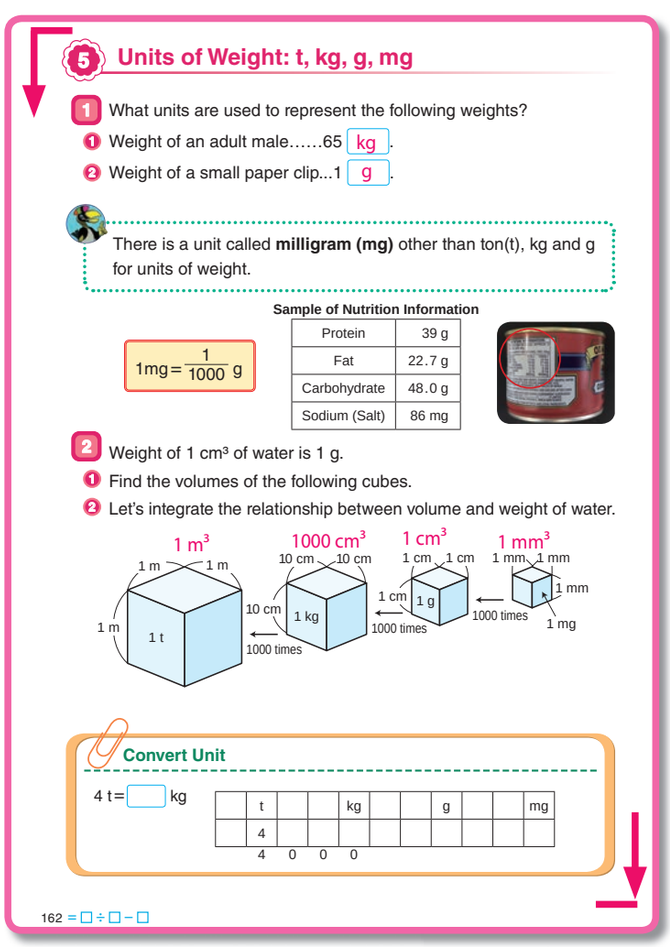
- Unit conversion table and relationship of units

Assessment

- Use the appropriate units of weight considering the characteristic of the materials. F
- Represent the relationship between volume of water and weight. F
- Summarise the relationship of the units of weight. S

Teacher's Notes

As unit of length increases so does the unit of weight.



5 Units of Weight: t, kg, g, mg

1 What units are used to represent the following weights?

1 Weight of an adult male……65 kg.

2 Weight of a small paper clip...1 g.

There is a unit called **milligram (mg)** other than ton(t), kg and g for units of weight.

$1\text{mg} = \frac{1}{1000}\text{ g}$

Sample of Nutrition Information

Protein	39 g
Fat	22.7 g
Carbohydrate	48.0 g
Sodium (Salt)	86 mg

2 Weight of 1 cm³ of water is 1 g.

1 Find the volumes of the following cubes.

2 Let's integrate the relationship between volume and weight of water.

1 m³ (1 m, 1 m, 1 m, 1 t) — 10 cm, 1000 times → 1000 cm³ (10 cm, 10 cm, 1 kg) — 1 cm, 1000 times → 1 cm³ (1 cm, 1 cm, 1 g) — 1000 times → 1 mm³ (1 mm, 1 mm, 1 mm, 1 mg)

Convert Unit

4 t = ☐ kg

	t			kg			g			mg
	4									
	4	0	0	0						

162 = ☐ ÷ ☐ – ☐

Lesson Flow

1 Review the previous lesson.

T Introduce the Main Task. (Refer to the BP)

2 ❶ Choose appropriate unit of weight.

T/S Review what they learned about in Weight and choose the appropriate unit for the given weights.

S ❶ - ❷ Choose the appropriate unit of volume and weight to fill in the boxes.

3 Important Point

T/S Explain the important point in the box .....

4 The unit of mg.

S Express 1 mg = $\frac{1}{1000}$ g where mg is introduced in the composition of ingredients in food.

5 ❷ Relationship between volume of water and weight.

S ❶ Find the volume of each cube.

T Explain the relationship between volume of water and weight using the diagrams in the textbook for better understanding.

S 1 mg of water is equal to 1 mm^3

S 1 g of water is equal to 1 cm^3,

S 1 kg of water is equal to 1000 cm^3

S 1t of water is equal to 1 m^3

T/S ❷ Discuss the relationship between volume and weight of water.

6 Change the unit of weight.

T Help those students who cannot convert unit correctly to use the unit table.

S 4 t = 4000 kg

	t			kg			g		mg
	4			6					

4 0 0 0

7 Summary

T What have you learned in this lesson?

S Present ideas on what they have learned.

T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan

Date: Chapter 15: Quantity and Unit Sub-Chapter/Topic 5: Unit of Weight Lesson: 1 of 1.

Main Task: Let's think about summarising the units of Weight and its Relationship with Volume.

Review

MT

1 What kind of units are used to represent the following weights?

❶ Weight of an adult male.....65 kg

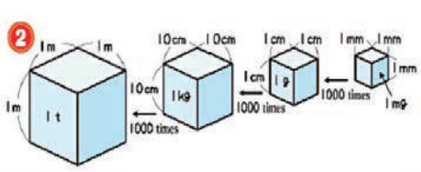
❷ Weight of a small paper clip...1 gram

There is a unit called **milligram (mg)**, other than t, kg, and g, for units of weight.

1 mg = $\frac{1}{1000}$ g

Protein	39 g
Fat	22.7 g
Carbohydrate	48.0 g
Sodium (Solt)	86 mg

2 ❶ Find the volumes of the following cubes.
1mg of water is equal to 1mm^3
1g of water is equal to 1cm^3,
1kg of water is equal to 1000cm^3
1t of water is equal to 1m^3



Volume of water	1 cm3 1 mL	1000 cm 1L	1m3 1kL
Weight	1g	1000g 1kg	1000kg 1t

Convert Unit

4 t = ☐ kg

	t			kg			g		mg
	4								

4 0 0 0

Summary

Summarise the lesson based on what the students have learnt and elaborate on important points of

1 mg = $\frac{1}{1000}$ g

Unit 15

Unit: Quantity and Unit
Sub-unit: Metric system
Lesson 1 and 2 of 2

Textbook Page : 163
Actual Lesson 123 & 124

Sub-unit Objectives

- To summarise the structure of the metric system.

Lesson Objectives

- To understand the structure of the metric system.

Prior Knowledge

- Units of metric system

Preparation

- Conversion table

Assessment

- Express the relationship amongst units in the metric system. F
- Explain the Metric system. S
- Complete the exercises correctly. S

Teacher's Notes

Metric system is based on 10. As the base increases or decreases by 10 the unit also changes.

6 Metric System

1 Group together items that have units of length, area, volume or weight with the prefix: kilo (k), hecto (h), deci (d), centi (c), milli (m).

	k	h	deca da		d	c	milli m
	1000	100	10	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
Length	km			metre m		cm	mm
Area		ha		a			
Volume	kL			L	dL		mL
Weight	kg			g			mg

k represents 1000 times, **h** represents 100 times, **da** represents 10 times, **d** represents $\frac{1}{10}$ times, **c** represents $\frac{1}{100}$ times and **m** represents $\frac{1}{1000}$ times.
Use units like **m** for metre or **kg** for kilogram as standard units.
The system of units that are multiples of 10 is called the **metric system**.

Exercise

1 Fill in the ☐ with a number.

① 1 m² = 10000 cm²
② 1 kL = 1000 L = 1000000 mL
③ 1 m³ = 1000000 cm³
④ 1 t = 1000 kg

2 There is a rectangular shaped farm with length 50 m and width 20 m.
What is the area of this farm in m²? $20 \times 50 = 1000\ m^2$
Also measure the area in are (a) and hectare (ha).
$1000\ m^2$, 10a, 0.1ha

☐×☐−☐= 163 248

End of Chapter Test Date:

Chapter 15: Quantity and Unit	Name:	Score / 100

1. Find the appropriate number for the ☐. [4 x 10 marks = 40 marks]

(1) 0.36 g = 360 mg (2) 0.47 dL = 47 mL

(3) 520 ha = 5.2 km^2 (4) 810 kg = 0.81 t

2. You have 3.8 L of water in a kettle. How many glasses do you need if you pour 200 mL for each glass? [10 marks]

3.8L = 3800 mL
3800 ÷ 200 = 19
Answer: 19 glasses

3. The length of a field is 100 m and the width is 32 m. [10 marks]

(1) Find the area of the field in areas [a].
100 × 32 = 3200
1a = $100m^2$
Answer: 3.2 a

(2) Find the weight of peanuts harvested in the field in tons if the land can cultivate 50 kg of peanuts per a.
50x 3.2 = 160
Answer: 0.16 t

4. The length of a sidewalk is 150 m and the width is 3 m. [2 x 15 marks = 30 marks]

150 × 30 = 4500 (m^2)

(1) The length of a sidewalk will be covered by square tiles with a side of 30 cm. Find the total number of tiles covering the sidewalk.
0.3 × 0.3 = 0.09 (m^2)
4500 ÷ 0.09 = 50000
Answer: 50000 tiles

(2) Each tile weights 2.5 kg. Find the total weight of the tiles covering the sidewalk in t.
50000x 2.5 = 125000
Answer: 125 t

Lesson Flow

1 Review the previous lesson.

T Introduce the Main Task. (Refer to the Blackboard Plan)

2 1 Fill in the blanks and think about the relationship.

T Allow students to study the table.
S Think about the relationship amongst units and fill in the blanks.
T How is the relationship among units?
S The units change according to 10, 100 and1000 times based on 1 (m, a, L and g).
S The units also change according to $\frac{1}{10}$, $\frac{1}{100}$ and $\frac{1}{1000}$ based on 1 (m, a, L and g).

3 Important Point

T/S Explain the important point in the box .

4 Complete the Exercise.

S Solve the exercises.
T Confirm students' answers.

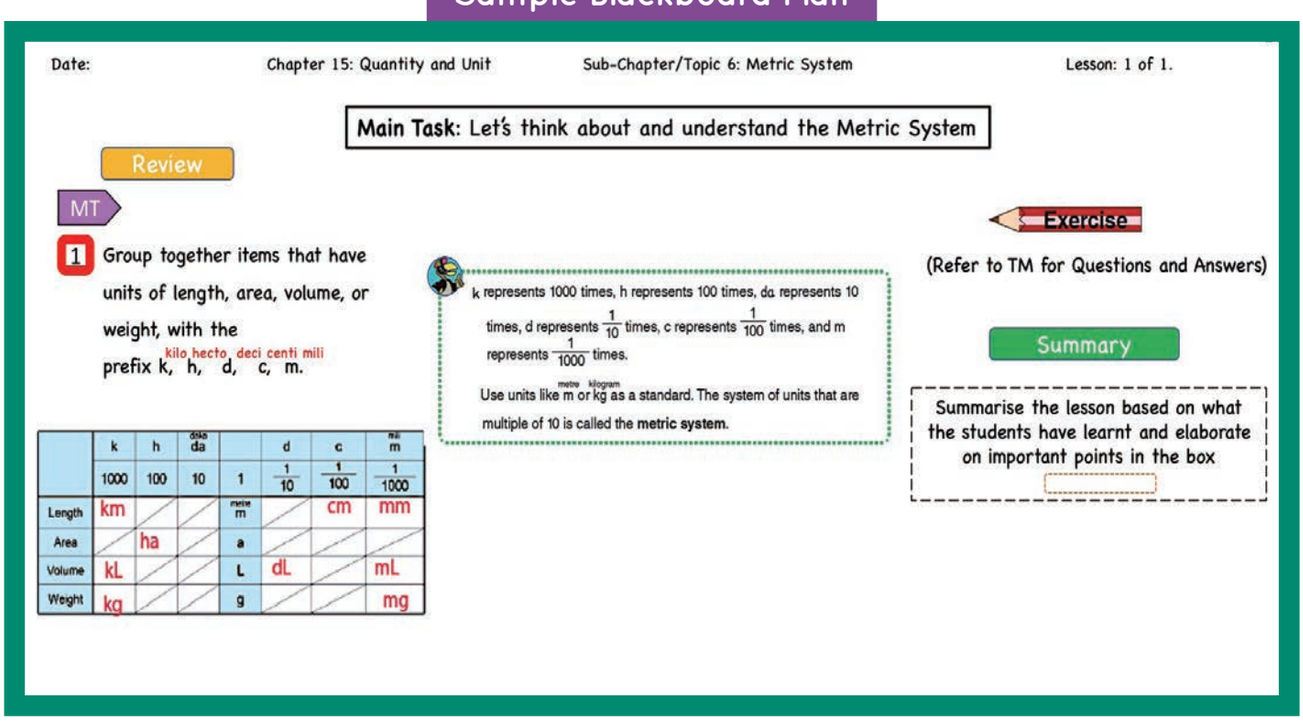
5 Summary

T What have you learned in this lesson?
S Present ideas on what they have learned.
T Use students' ideas to confirm important concepts of this lesson.

6 Complete the Evaluation Test.

TN Use the attached evaluation test to conduct assesment for your class after finishing all the exercises, problems and review as a seperate lesson.

Sample Blackboard Plan



End of Chapter Test **Date:**

Chapter 15: Quantity and Unit	Name:	Score / 100

1. Find the appropriate number for the ☐. [4 × 10 marks = 40 marks]

(1) 0.36 g = ☐ mg (2) 0.47 dL = ☐ mL

(3) 520 ha = ☐ km^2 (4) 810 kg = ☐ t

2. You have 3.8 L of water in a kettle. How many glasses do you need if you pour 200 mL for each glass? [10 marks]

Answer: ☐

3. The length of a field is 100 m and the width is 32 m. [10 marks]

(1) Find the area of the field in areas [a].

Answer: ☐ a

(2) Find the weight of peanuts harvested in the field in tons if the land can cultivate 50 kg of peanuts per a.

Answer: ☐ t

4. The length of a sidewalk is 150 m and the width is 3 m. [2 × 15 marks = 30 marks]

(1) The length of a sidewalk will be covered by square tiles with a side of 30 cm. Find the total number of tiles covering the sidewalk.

Answer: ☐ tiles

(2) Each tile weights 2.5 kg. Find the total weight of the tiles covering the sidewalk in t.

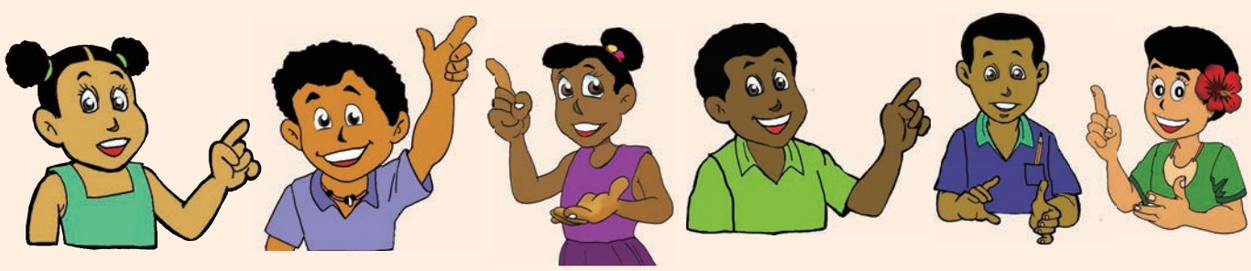
Answer: ☐ t

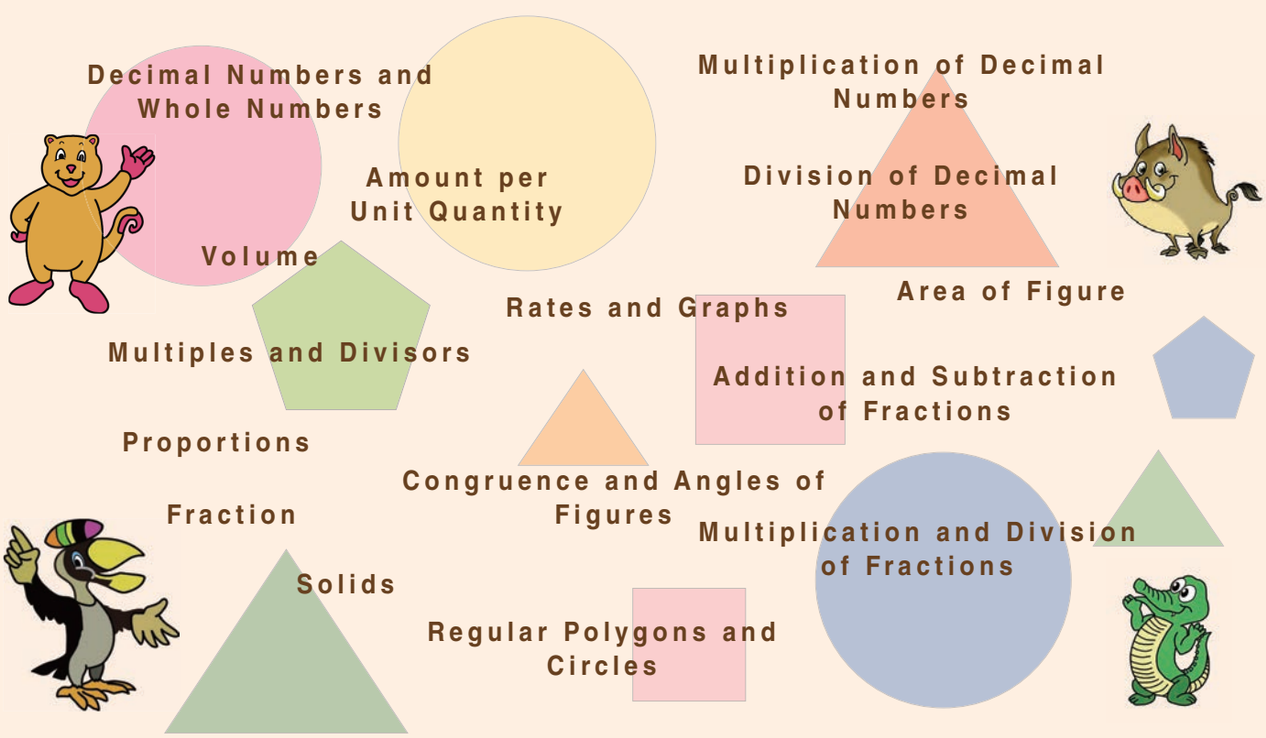
Chapter 16 Summary of the Grade 3 to 6

This chapter is a summary of all the contents from Grade 3 to 6.

It is important for the students to acquire a procedural fluency in mathematics. That is not just understanding facts or procedures but using various procedures depending on the situation.

Various problems learned in Grade 3 to 6 are included in this chapter, so please give sufficient time to students to solve all the problems.





Unit 16

Unit: Summary of Grade 3 to 6 Mathematics
Topic 1: Number and Calculation
Lesson 1 of 4

Textbook Page : 166 and 167
Actual Lesson 125

Unit Objectives

- To review and confirm what students learned in Grade 6.

Lesson Objectives

- To review and confirm about Number and Calculation in Grade 6.

Prior Knowledge

- Number and calculation (Grade 3 - 6)

Preparation

- Revision of Prior Content

Assessment

- Solve the problems remembering what they learned from Grade 3 to 6. F
- Solve the exercises correctly. S

Teacher's Notes

This is a summary lesson of contents learned from Grade 3 to 6.
You are encouraged to be familiar with the contents of this Unit in order to prepare lead up questions that may help students to recall previously learnt contents.

16 Summary of Grade 3 to 6 Mathematics

Recall all the contents that you learned in 4 years of mathematics and try solving the problems below. After you finish, check by using the answers at the back of the textbook and review the ones you got wrong.

Numbers and Calculations

1 Let's integrate whole numbers and decimals. Grade 4

1. What do 3, 5 and 7 represent in the following numbers?
   Ⓐ 35700 30 thousand, 5 thousand and 7 hundred
   Ⓑ 3050070 3 billion, 500 thousand and seventy
   Ⓒ 35.07 30, 5 and $\frac{7}{100}$
   Ⓓ 3.057 3, $\frac{5}{100}$ and $\frac{7}{1000}$
2. How many sets of the numbers in ( ) equal to the following numbers?
   Ⓐ 23000 (100) 230
   Ⓑ 23000 (1000) 23
   Ⓒ 2.3 (0.1) 23
   Ⓓ 2.3 (0.01) 230

2 Let's summarise fractions. Grades 4 and 5

1. Fill in the ☐ with the equality or inequality signs.
   Ⓐ $\frac{2}{5}$ < $\frac{3}{5}$ Ⓑ $\frac{2}{5}$ > $\frac{2}{7}$ Ⓒ $\frac{2}{5}$ = $\frac{8}{20}$
2. Fill in the ☐ with a number. Grade 3
   Ⓐ $\frac{3}{5}$ is 3 times of $\frac{1}{5}$ Ⓑ $\frac{9}{7}$ is 9 times of $\frac{1}{7}$
3. Change the mixed fractions to improper fractions or the improper fractions to mixed fractions. Grade 4
   Ⓐ $1\frac{2}{3}$ $\frac{5}{3}$ Ⓑ $4\frac{3}{5}$ $\frac{23}{5}$ Ⓒ $\frac{7}{4}$ $1\frac{3}{4}$ Ⓓ $\frac{8}{3}$ $2\frac{2}{3}$

3 Let's integrate the relationship of integers, decimals and fractions. Grade 5

1. Change the following integers and decimals to fractions and fractions to decimals.
   Ⓐ 4 $\frac{4}{1}$ Ⓑ 0.7 $\frac{7}{10}$ Ⓒ 3.08 $3\frac{2}{25}$ Ⓓ $\frac{13}{25}$ 0.52 Ⓔ $1\frac{3}{4}$ 1.75
2. Line up the following numbers from the smallest to the largest.
   $\frac{2}{5}$ $\frac{1}{3}$ $\frac{7}{15}$ 0.3 0.41
   0.3, $\frac{1}{3}$, $\frac{2}{5}$, 0.41, $\frac{7}{15}$

4 Let's consolidate calculations. Grades 4 to 6

1. Let's calculate.
   Ⓐ 4+2×6−3 13 (4+2)×6−3 33 4+2×(6−3) 10
   Ⓑ 4.2+1.5 5.7 4.2−1.5 2.7 4.2×1.5 6.3 4.2÷1.5 2.8
   Ⓒ 64.8+1.8 66.6 64.8−1.8 66 64.8×1.8 116.64 64.8÷1.8 2.8
   Ⓓ $\frac{2}{5}+\frac{1}{3}$ $\frac{11}{15}$ $\frac{2}{5}-\frac{1}{3}$ $\frac{1}{15}$ $\frac{2}{5}\times\frac{1}{3}$ $\frac{2}{15}$ $\frac{2}{5}\div\frac{1}{3}$ $\frac{6}{5}$ $(1\frac{1}{5})$
2. Find the value of x. Grade 6
   Ⓐ $8+x=15$ $x = 15 - 8$ $x = 7$
   Ⓑ $x \times 7 = 56$ $x = 56 \div 7$ $x = 8$

5 Let's organise the properties of whole numbers. Grade 5

1. Find a number that has 3 divisors from 1 to 50. 4, 9, 25, 49
2. Find the least common multiple and greatest common divisor for following pairs of numbers.
   Ⓐ (12, 18) 36 and 6
   Ⓑ (8, 16) 16 and 8

166 = ☐ ÷ ☐ ÷ ☐

☐ ÷ ☐ − ☐ = 167

Lesson Flow

1 ❶ Express the value of whole numbers, decimal numbers and fractions.

T Introduce the summary unit.
S ❶Solve by writing the values of 3, 5 and 7 in the given numbers.
S ❷ Identify sets of numbers in given whole numbers and decimal numbers.

2 ❷ Summarise the value of Fractions.

T Which fraction is larger? $\frac{1}{10}$ or $\frac{1}{2}$?
S $\frac{1}{2}$
TN Confirm the answer and get them to continue with the activities.
S ❶ Compare fractions and identify which is larger and which is smaller.
S ❷ Calculate the number of times a fraction is.
T Revise changing mixed fractions to improper fractions and vice versa.
S ❸ Complete the activity.

3 ❸ Review the relationship of Integers, Decimals and Fractions.

T Intergers and decimals can be expressed as fractions and fractions can be also be expressed as decimals.Does the value change?
S The value remains the same.
S Solve activities ❶ to ❷.

4 ❹ Calculate Whole Numbers, Decimal Numbers and Fractions.

S ❶ Calculate the operations correctly.
S ❷ Calculate to find the value of x.

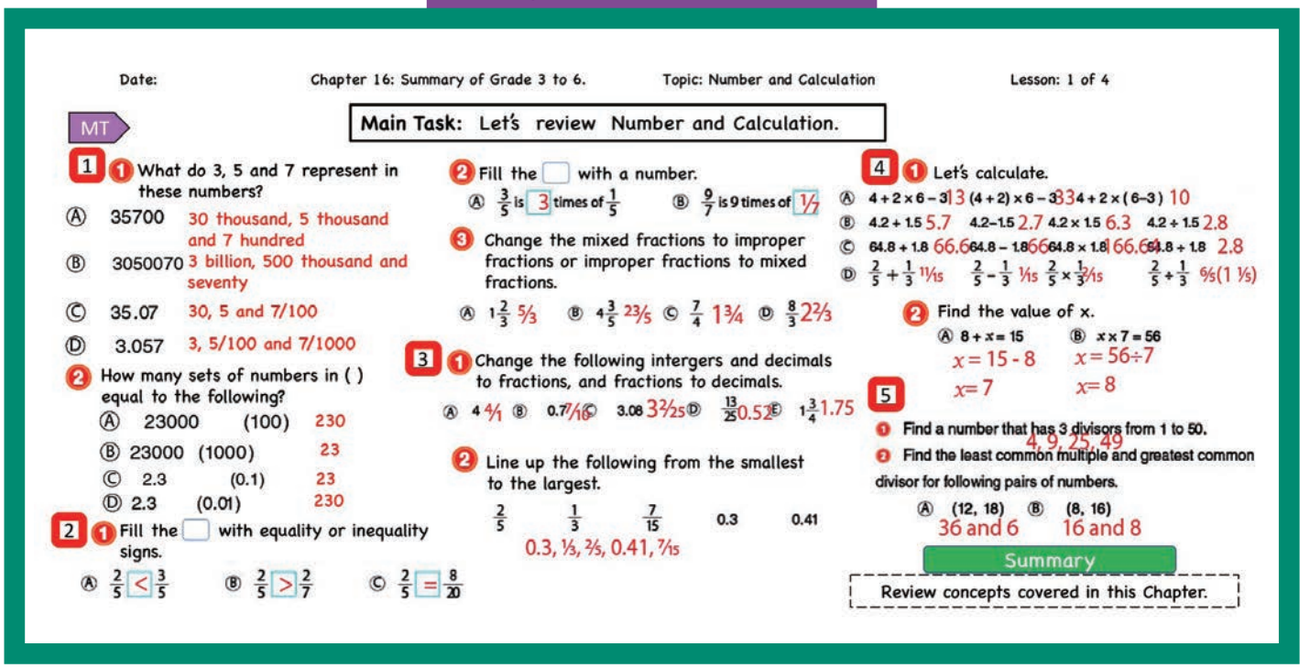
5 ❺ Review the properties of Whole Numbers.

TN Get the students to give examples of common divisors and common multiples.
S Solve activities ❶ to ❷ by identifying divisors, common multiples and common divisors.

6 Summary

T What have you learned in this lesson?
S Present ideas on what they have learned.
T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan



Unit 16

Unit: Summary of Grade 3 to 6 Mathematics
Topic 2: Quantity and Measurement
Lesson 2 of 4

Textbook Page : 168 and 169
Actual Lesson 126

Unit Objectives

- To review and confirm what students learned in Grade 6

Lesson Objectives

- To review and confirm about Quantity and Measurement in Grade 6.

Prior Knowledge

- Quantity and Measurement (Grade 3-6)

Preparation

- Revision of Prior Content

Assessment

- Solve the problems remembering what they learned from Grade 3 to 6. F
- Solve the exercises correctly. S

Teacher's Notes

This is a summary lesson of contents learned from Grade 3 to 6.
You are encouraged to be familiar with the contents of this Unit in order to prepare lead up questions that may help students to recall previously learnt contents.

Quantity and Measurement

Grades 4 to 6

1 Let's integrate quantities of units that are used around you.

1 Fill in the ☐ with the appropriate unit.

Ⓐ Area of the cover of a mathematics textbook is about 470 [cm²].

Ⓑ Volume of milk in a pack is about 200 [mL].

Ⓒ Weight of an egg is about 50 [g].

Ⓓ The longest river in Papua New Guinea is the Fly River and it is about 1050 [km].

2 Solve the following problems.

Ⓐ Raka walked 1.6 km. How many more metres does she have to walk in order to say that she has walked 2 km? 2 − 1.6 = 0.4, 0.4 km = 400 m, Answer: 400 m

Ⓑ There is a flowerbed in the shape of a rectangle with a length of 3 m and width of 1 m. What is the area of this flowerbed in m² and cm²? 1 x 3 = 3, 100 x 300 = 30000, Answer: 30000 cm²

Ⓒ There are 4 plastic bottles that contain 500 dL.
How much water in total can they contain in L and dL?
500 x 4 = 2000, 2000mL = 2 L = 20 dL, Answer: 2 L / 20 dL

Grades 4 to 6

2 Let's recall how to calculate area.

1 Write a mathematical formula of how to calculate an area of the following shapes.

Area of a rectangle = [l] × [w]

Area of a square = [side] × [side]

Area of a parallelogram = [b] × [h]

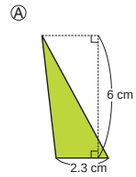
Area of a triangle = [b] × [h] ÷ [2]

Area of a circle = [r] × [r] × [3.14]

2 Draw 2 figures with an area of 20 cm².

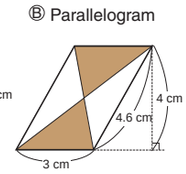
3 Find the area of the coloured part.

Ⓐ



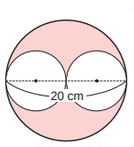
2.3 x 6 ÷ 2 = 6.9
Ans: 6.9 cm²

Ⓑ Parallelogram



3 x 4 ÷ 2 = 6
Ans: 6 cm²

Ⓒ



10 x 10 x 3.14 = 6.9
− 5 x 5 x 3.14 x 2 = 157
Ans: 157 cm²

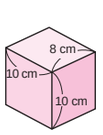
Grade 5

3 Let's recall how to calculate volume.

1 Write mathematical formulas for calculating the volume of a rectangular prism and a cube. l x w x h (rectangle), side x side x side (cube)

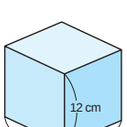
2 Find the volume of the following solids.

Ⓐ



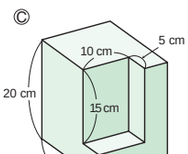
10 x 8 x 10 = 800
Ans: 800cm³

Ⓑ



12 x 12 x 12 = 1728
Ans: 1728cm³

Ⓒ



15 x 15 x 20 - 5 x 10 x 15 = 3750
Ans: 3750cm³

Grade 6

4 Let's recall what we learned about speed.

1 Represent the relationship of speed, distance and time in a mathematical sentence. speed=distance÷time

2 Tom walks at a speed of 4 km/hour.
He started walking to get to a place that is 8 km away.
After 1.5 hours, how many more km does he have to walk to reach his destination? 4 x 1.5 = 6, 8 − 6 = 2 Ans: 2km

168 = ☐ ÷ ☐ ÷ ☐

☐ ÷ ☐ − ☐ = 169

Lesson Flow

1 Review the previous lesson.

2 ① Review quantities and relationships of Units of Meassurement.

T Introduce the summary unit.
T What are the 2 types of quantities?
S Discrete quantities and continuous quantities.
S ① Identify the appropriate units used to measure quantities.
S ② Solve the problems using the correct units.

3 ② Review calculating the Area of various figures.

S ① Recall and write the formula for calculating area of various figures.
T How can we draw figures with an area of 20 cm²?
S By using formula to determine the lengths of sides, base and heights of the shapes.
S ② Draw 2 different figures with an area of 20 cm².
S ③ Use appropriate formula to calculate the area of shaded parts of figures.

4 ③ Review calculating the Volume of various solids.

TN Ensure that students remember that when calculating the volume of solids/prisms, they should consider calculating the **base area x height**.
S ① Recall and write the formula for calculating the volume of a cube and rectangular prism.
S ② Calculate the volume of the different solids.

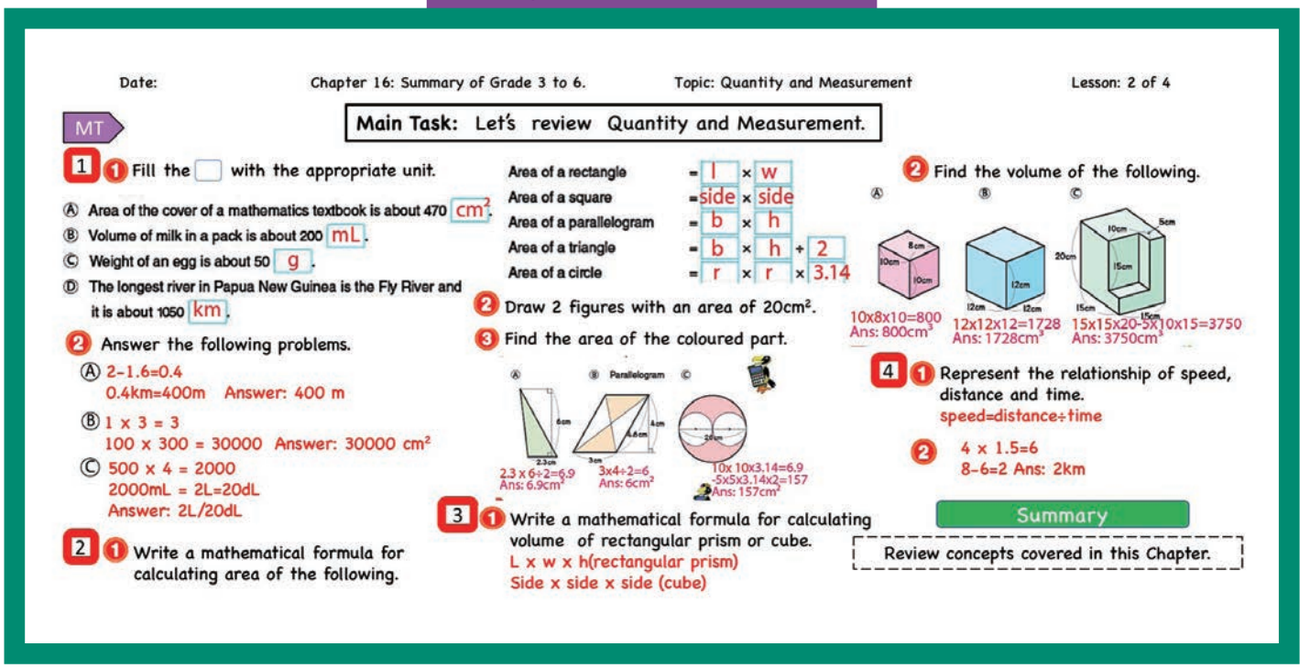
5 ④ Review the relationshop of Speed, Distance and Time.

S ① Represent the relationship of speed as **speed = distance ÷ time**.
S ② Read the problem and calculate to solve.

6 Summary

T What have you learned in this lesson?
S Present ideas on what they have learned.
T Use students' ideas to confirm important concepts of this lesson.

Sample Blackboard Plan



Unit 16

Unit: Summary of Grade 3 to 6 Mathematics
Topic 3: Shapes and Figures
Lesson 3 of 4

Textbook Page : 170 and 171
Actual Lesson 127

Unit Objectives

- To review and confirm what students learned in Grade 6.

Lesson Objectives

- To review and confirm about Figures in Grade 6.

Prior Knowledge

- Figures (Grade 3 - 6)

Preparation

- Revision of Prior Content

Assessment

- Solve the problems remembering what they learned from Grade 3 to 6. F
- Solve the exercise correctly. S

Teacher's Notes

This is a summary lesson of contents learned from Grade 3 to 6.
You are encouraged to be familiar with the contents of this Unit in order to prepare lead up questions that may help students to recall previously learnt contents.

Shapes and Figures

1 Let's organise the characteristics of figures. Grades 4 and 5

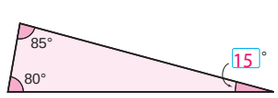
1 Select the figures that have the properties of the following for these four quadrilaterals.

Parallelogram, Rhombus, Rectangle, Square

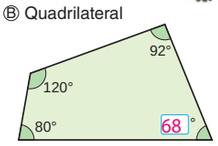
Ⓐ 2 pairs of sides that are parallel. parallelogram,rectangle,rhombus, square
Ⓑ All 4 angles that are right angles. rectangle, square
Ⓒ 4 sides that are equal in length. square, rhombus
Ⓓ 2 diagonal lines that are perpendicular. square, rhombus
Ⓔ Sum of adjacent angles are 180°. square, rectangle, rhombus,parallelogram

2 Fill in the ☐ with the correct angle size. Grade 5

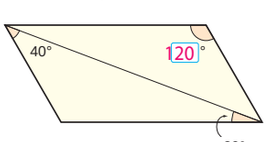
Ⓐ Triangle



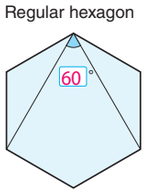
Ⓑ Quadrilateral



Ⓒ Parallelogram



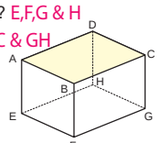
Ⓓ Regular hexagon



170 = ☐ ÷ ☐ ÷ ☐

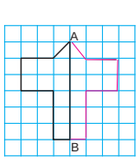
3 Investigate the rectangular prism on the right. Grade 4

Ⓐ Which surface is parallel to face ABCD? E,F,G & H
Ⓑ Which side is parallel to side AB? EF,DC & GH

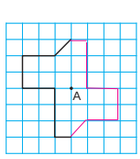


2 Draw the following figures. Grade 6

1 Figure with AB as the line of symmetry.

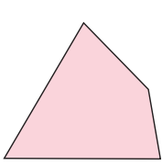


2 Figure with point A as a point of symmetry.

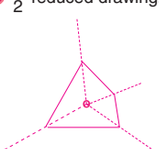


3 Trace the figure below and draw similar figures with the following conditions:

1 Twice enlarged drawing.



2 $\frac{1}{2}$ reduced drawing.



☐ ÷ ☐ − ☐ = 171

Lesson Flow

1 Review the previous lesson.

2 ① Review the properties of Figures.

T Introduce the summary unit.
T What are some properties of an equalateral triangle.
S All sides equal, all angles equal and angle sum = 1800
S ① Identify figures using the given properties.
S ② Use the properties of each figure to identify the unknown angles.
S ③ Investigate the properties of the rectangular prism.

3 ② Review the properties of Point and Line Symmetry.

TN Students should be able to define or describe point and line symmetry in their own words.
S ① Recall and draw the figure with line symmetry.
S ② Recall and draw the figure with point symmetry.

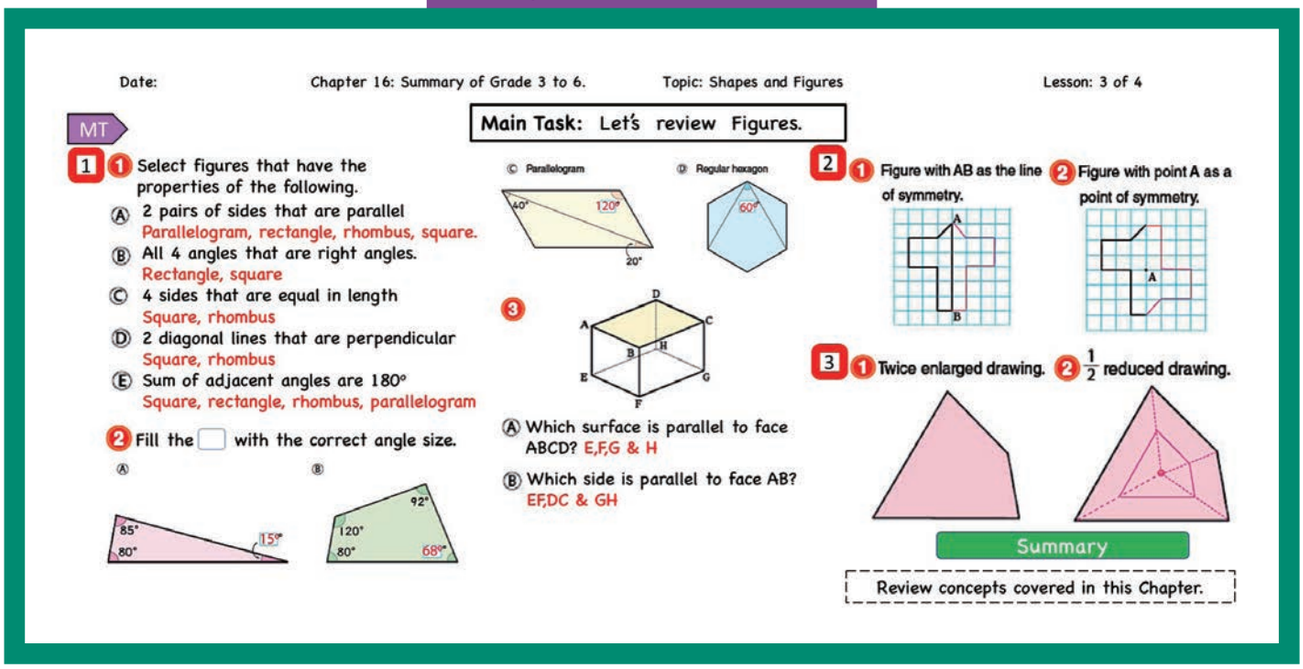
4 ③ Review the properties of Reduced and enlarged drawings.

S ① Recall and draw a twice enlarged figure of the one given.
S ② Recall and draw a $\frac{1}{2}$ reduced figure of the one given.

5 Summary

T What have you learned in this lesson?
S Present ideas on what they have learned.
T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan



Unit 16

Unit: Summary of Grade 3 to 6 Mathematics
Topic 4: Data & Relations
Lesson 4 of 4

Textbook Page : 172 and 173
Actual Lesson 128

Unit Objectives

- To review and confirm what students learned in Grade 6.

Lesson Objectives

- To review and confirm about Relationship of Numerical Quantities in Grade 6.

Prior Knowledge

- Relationship of Numerical Quantities (Grade 3 - 6)

Preparation

- Revision of Prior Content

Assessment

- Solve the problems remembering what they learned from Grade 3 to 6. F
- Solve the exercise correctly. S

Teacher's Notes

This is a summary lesson of contents learnt from Grade 3 to 6.
You are encouraged to be familiar with the contents of this Unit in order to prepare lead up questions that may help students to recall previously learnt contents.

Data and Relations

Grade 5

1 Let's organise how to represent the relationship of numerical quantities.

1 What graph should you use to represent the following?

Ⓐ Types of imported goods and ratio of imported amount. pie graph

Ⓑ Change in amount of exports. line graph

Ⓒ Oil Palm plantation in each country. bar graph

2 The table on the right represents the number of publications of books and magazines in a year.

Grade 5

Ⓐ What is the percentage of monthly magazines out of all publications for each year?

1995 48%
2005 52%

Ⓑ Represent the ratio of each publication on a bar graph for each year and discuss what you noticed.

Number of Magazines in 1995 and 2005
(Unit : One hundred million)

	1995	2005
Special magazine	14.6	12.6
Weekly magazine	19.4	13.3
Monthly magazine	31.2	28.2
Total	65.2	54.1

3 Dan mixes 35 g of flour and 14 g of sugar to make sweet flour balls.

Grade 6

Ⓐ If Dan says that the quantity of sugar is 2, how much is the quantity of flour?

35 : 14 = 5 : 2

Ⓑ You want to make soya flour with the same sweetness. There is 140 g of soya flour, how many g of sugar do you need?

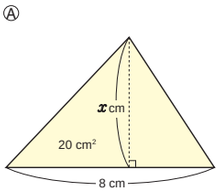
5 : 2 = 140: x 140 ÷ 5 = 28
2 x 28 = 56 Ans: 56 g

2 Represent quantities with a mathematical sentence or a graph.

Grades 5 and 6

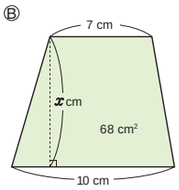
1 Represent the area of the following triangle and trapezoid using a mathematical sentence with x and solve for x.

Ⓐ



8 x x ÷ 2 = 20 x = 5

Ⓑ



(7+10) x x ÷2 = 68 x = 8

2 Let's investigate the relationship of x and y in the following table (a) and (b).

Grade 6

(a)

Number of people x	2	3	4	6	8
Length of a string per person y (m)	12	8	6	4	3

(b)

Length of a string x (m)	1	2	3	4	5
Weight of a string y (g)	8	16	24	32	40

Ⓐ In which case is y directly proportional to x? (b)
In which case is y inversely proportional to x? (a)

Ⓑ Represent the relationship of x and y for table (a) and (b) in a mathematical sentence. (b) x x y = 24 (a) y=8 x x

Ⓒ Draw a graph that represents a proportional relationship.

72 = □ ÷ □ ÷ □

□ ÷ □ – □ = 173

Lesson Flow

1 Review the previous lesson.

2 ① Review the relationship of Numerical Quantities.

T Introduce the summary unit.
T What are some ways of organising data?
S Representing them using tally and numerical tables, frequency tables and graphs.
S ❶ Identify the appropriate graphs that can be used to represent different kinds of data.
S ❷ Answer questions using information on the table.
S ❸ Solve the problem using the relationship of the given ratio.

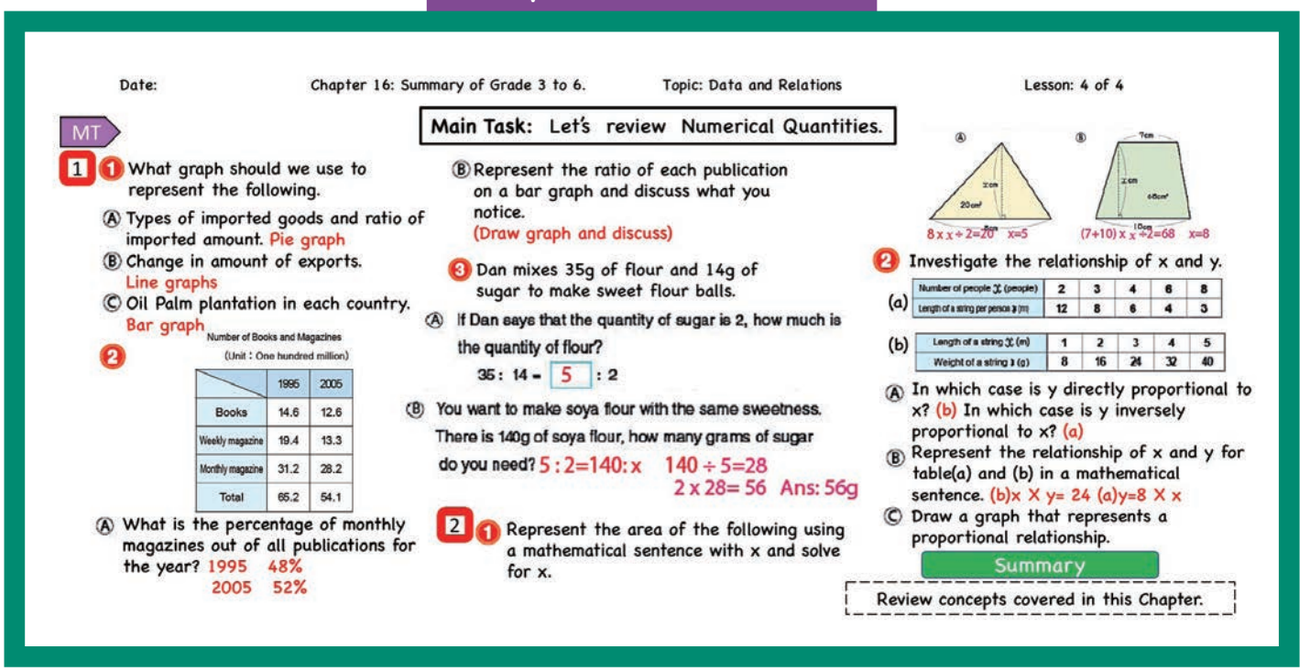
3 ② Review representing quantities using Mathematical Sentences and graphs.

S ❶ Represent the area of the figures in a mathematical sentence using x and solve to find the value of x.
S ❷ Investigate the proportional relationship of x and y in the tables and draw a graph of proportion.

4 Summary

T What have you learned in this lesson?
S Present ideas on what they have learned.
T Use students' ideas to confirm the important concepts of this lesson.

Sample Blackboard Plan



Unit 16

Unit: Summary of Grade 3 to 6 Mathematics
Supplementary Topic: Mathematics Adventure

Textbook Page : 174 to178
Actual Lesson

Introdcution to Supplementry Topic

Sub-Unit: Mathematics Adventure is a supplementary topic for students to explore mathemaics skills and ideas through strories. Students will travel some places in the world with Prof. Steven and our friends to find beautiful shapes and patterns, endangered animal species, interesting objects and buildings and many more.

Supplementary Topic Objectives

- To apply mathematics knowledge and skills which were learned to solve problems around us.
- To apply daily life experiences to solve problems

Topic Objectives 1

- To find symmetry shapes around us.
- To investigate symmetry shapes using mirrors.
- To think about maths sentences when the number of squares and figures is x.
- To calculate estimation of areas in place values in 10 000.
- To think about combinations of colouring maps using 4 colours.

Topic Objectives 2

- To calculate the length of a real spiral bridge.
- To investigate the net of complicated shapes and sketch .
- To investigate the volume of complicated shapes.
- To learn about Roman numbers.
- To learn subtraction of ancient Roman numbers.
- To learn about mathematics and information.
- To learn the system of Morse code.
- To think about the timing of Morse code.

Preparation

- Copy of Japanese map, copy of pieces of puzzle

Matehmatics Adventure has two parts.
Part 1 consists of Topic 1 to 4 and Part 2 with Topics 5 to 8. In the adventure, students will visit places like Japan, Tunisia, Europe and the Arctic ocean as indicated in the 2 maps. In each Topic they will apply mathematical skills in real life situations in these interesting places as part of their adventure. (See maps below)

At the end of every topic, there are pieces of a puzzle which can be obtained by cutting out after answering the given question correctly. Each puzzle is a piece of the key for the adventure and will be completed at the end of the adventure where the puzzles will be pieced together to reveal the key.

1 Beautiful Shapes

World Heritage Sites include a number of ancient buildings. Most of them have beautiful symmetric structures.
The Palace of Versailles in Paris, Itsukushima Shrine in Japan, Angkor Wat Ruins in Cambodia are some of the examples. Let's find other examples.


The Palace of Versailles


Itsukushima Shrine


Angkor Wat

There are a number of symmetric structures in our surroundings.

The Tokyo Tower and the National Parliament are also symmetric in structure.

The shape of a car is also symmetric from the front view.

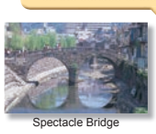
A Symmetry-structure is beautiful and stable.

While we are walking in town, we can see buildings with beautiful glasses and the reflection in the glasses is symmetric to the real objects.

Yes, I also saw a picture of Mt. Fuji, which is symmetric Mt. Fuji reflected on the lake, is known as upside-down Fuji.

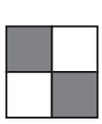

Reflection of Fuji

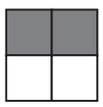
In Nagasaki, there is a bridge called Spectacle Bridge because the Bridge looks like spectacles when its reflected on the surface of the river.

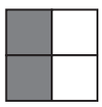

Spectacle Bridge

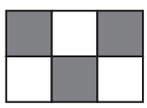
We can see these reflections only when the waters in the lakes and rivers are clear.

Here, let's identify symmetric shapes which can be created by reflection in a mirror.
Let's explore the position of the mirror where we can create the images of the same shapes for (1) to (4).



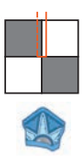
(1) 

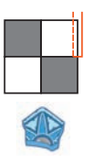
(2) 

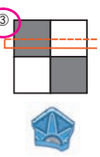
(3) 

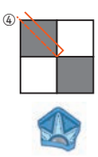
(4) 

Where should we place the mirror to create the view on the right?
The side represented by – – – is the front side of the mirror.

① 

② 

③ 

④ 

• Let's trace and cut out the fragments on page 198 and paste on the last page.

Let's go to the next place to find the fragments of the key!

2 Mosaic Patterns

There was a country named Carthage which prospered about 2600 years ago in the Mediterranean Sea.
Beautiful mosaic patterns still remain on the floors and walls there even after the country was conquered by the Roman Empire.


Mosaic patterns on the floor in Carthage

There are a number of small square tiles.

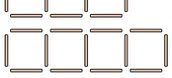
Various paintings were carefully developed by the tiles. How many tiles are necessary for developing them?

If we represent these square tiles by the same size sticks, how many sticks do we need?

If 1 square,  4 sticks.

If 2 squares,  7 sticks.

If 3 squares,  10 sticks.

If 4 squares,  ?

If we increase the number of squares, how many sticks do we need?
How about if the number of square is four?

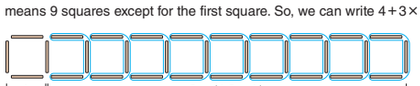
13 sticks.

Have you counted by each?

No, the number of sticks was increasing by 3, so I calculated by adding 3 to the last answer which is 10 + 3.

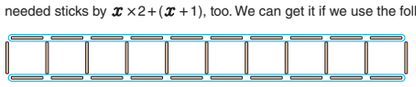
Now, how many sticks do we need for 10 squares?

We started with 4 sticks for 1 square and the number of sticks increased by 3 if the number of squares increased by 1, so we can get an answer by 4 + 3 × 9. "9" means 9 squares except for the first square. So, we can write 4 + 3 × (10 − 1), too.

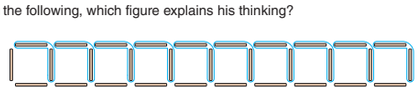


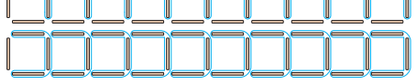
I see. If doing so, we can get the number of sticks by the number of squares at once.If we use symbols, we can represent the number of squares by x and the expression for the number of needed sticks is $4 \times 3 \times (x - 1)$.

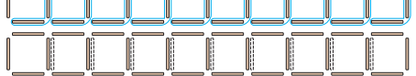
If the number of squares is represented by (x, we can represent the number of needed sticks by $x \times 2 + (x + 1)$, too. We can get it if we use the following figure.



A friend developed the expression $x \times 4 - (x - 1)$. How did he think about it? In the following, which figure explains his thinking?

A 

B 

C 

A  B  C 

• Let's trace and cut out the fragments on page 198 and paste on the last page.

Let's go to the next place to find the fragments of the key!

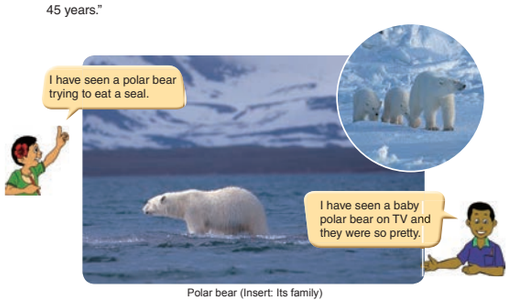
Unit 16

Unit: Summary of Grade 3 to 6 Mathematics
Supplementary Topic: Mathematics Adventure

Textbook Page : p.168~169
Actual Lesson 115

3 Polar Bear Facing the Crunch

Polar Bears are animals which live in the coast of the Arctic circle.
The average height of the bear is 2.4 m and its weight is about 750 kg.
But, the number has been gradually decreasing and the government of the United States declared them as endangered species in May, 2008. During the announcement they said, "in the Arctic Ocean, the sea ice which is necessary for polar bears moving and catching food has been decreasing in the past decades because of the impact of Global warming.
If the situation is not changed, they face the danger of extinction in about 45 years."



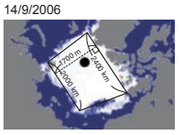
Polar bear (Insert: Its family)

That's right. The main food for polar bears is seals. So, they search places to catch their food, moving on the sea ice.
But the sea ice has been decreasing too.
Furthermore, polar bears do not hibernate and so eat food to save fat during the winter and survive by burning its fat during the summer.
But, the summers are getting longer and longer every year.

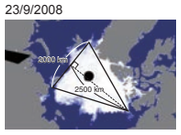
Global warming of the earth has various impacts on the lives of different species.

These are pictures of the sea ice in the Arctic Ocean which were taken from the top view of the North Pole by an artificial satellite.
These pictures were shot in September when there is less amount of the sea ice than any other month.

14/9/2006



23/9/2008



Based on these pictures, the shape of the ice in the picture on the left is a trapezoid and a triangle in the picture on the right.
From these figures, let's find the areas of the ice every year in rounded numbers to the ten thousands place. The earth is a sphere.
The actual area of the ice is bigger than what we can see.

The area of the sea ice in September, 2006

$(2000 + 2400) \times 1700 \div 2 = 3740000\ km^2$

The area of the sea ice in September, 2008

$2000 \times 2500 \div 2 = 2500000\ km^2$

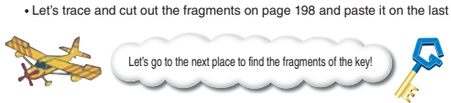
$3740000 - 2500000 = 12400000$ (Difference)
$12400000 \div 3740000 = 0.331$ (Fraction as decimal)

By how many percents did the area of the sea ice in September, 2008 decreased since September, 2006?

$124 \div 374 = 0.331 \times 100 = 33\%$ (Percentage)

A. about 20 % B. about 24 % C. about 33 % D. about 40 %

• Let's trace and cut out the fragments on page 198 and paste it on the last page.



□ ÷ □ = 179

180 = □ × □

4 Dividing a Map by Colouring

What are you doing?

We are recording the World Heritage Sites and Japanese towns that are frequently visited by tourists on the blank map.

If we divide the provinces by colours, it will be easy to see.

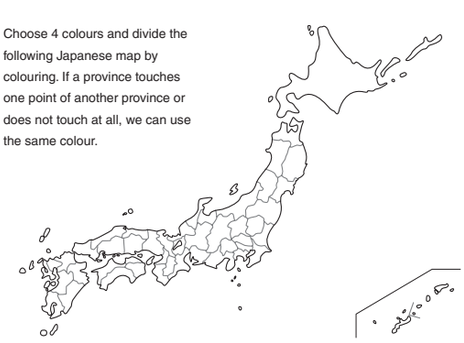
How many coloured pencils do you think is necessary so as not to make adjoined provinces coloured the same?

I am thinking, about 10 colours.

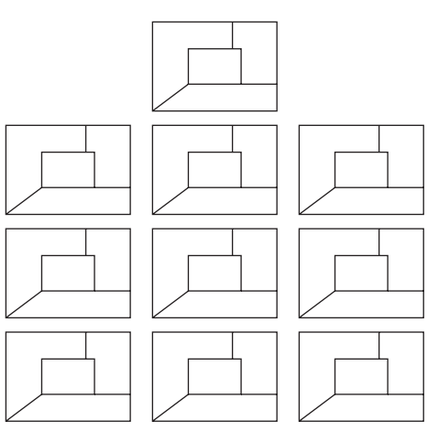
In fact, we can make adjoined provinces on any map painted by different colours if we have 4 colours.

Really?

Choose 4 colours and divide the following Japanese map by colouring. If a province touches one point of another province or does not touch at all, we can use the same colour.



Have you finished? I will give you a problem. If you colour the following figures with the same 4 colours, how many patterns can be made?
Let's try and find out.



If the number of figures on this page is not enough, draw them in your exericse book. How many patterns can you draw?
Compare it with your friends' colouring.

$4 \times 3 \times 2 \times 1 = 24$

(1) 6 patterns (2) 10 patterns (3) 16 patterns (4) 24 patterns

• Let's trace and cut out the fragments on page 198 and paste it on the last page and make the key complete.

□ ÷ □ = 181

182 = □ × □

5 Length of a Spiral

There is a bridge in Spain that is quite interesting. It is called the Vizcaya Bridge and was declared a World Heritage Site in 2006.

Vizcaya Bridge

The bridge hangs gondolas.

Why would they need to make a bridge for gondolas?

The height of this bridge is 50 m. There are a lot of vessels below this bridge and they are used for the industries around this district. Therefore it is necessary to make the bridge girder high.
Another reason is that there are already many buildings built by the river and there is not enough space to build a road up to this height.

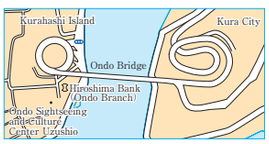
I see.

There is a similar bridge like this in Japan.

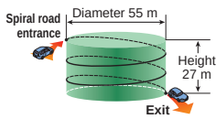
Ondo Bridge

Where is it?

It is the Ondo Bridge in Hiroshima. It connects Kura City on the mainland to Kurahashi Island. This bridge is also built in a place where there are a lot of ships, so people call this place "Ginza in Ondo." Therefore it is necessary to make the bridge girder high. On the Mainland side, it is elevated but on the Kurahashi Island side it is as low as the sea level. There is not enough land to make a long road on the Kurahashi Island side. Consequently, people built a spiral shaped road, so they can go right underneath the bridge.



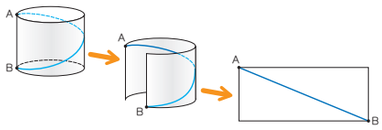
When you draw a spiral road using a cylinder, it will look like the picture on the right. The diameter of the bottom face is 55 m and the height is 27 m.



People go around the cylinder 2 and a half times.

The question is how long is the length of this spiral road.

We can find it using an extended elevation.
For example, a spiral from point A, which is on the top of the top face, to point B, placed directly below point A, is a diagonal line of the rectangle on an extended elevation.



But it is 2 and a half rounds for this problem.

We can line up 3 side faces.

14.5 x 3000 = 43500
43500 cm = 435 m

It will look like the picture on the right if you draw it in $\frac{1}{3000}$ reduced drawing.

How long in metres is the length of the spiral road at Ondo Bridge?

(1) About 300 m (2) About 335 m (3) About 400 m (4) About 435 m

• Let's trace and cut out a key fragment on page 199 and paste on the last page.

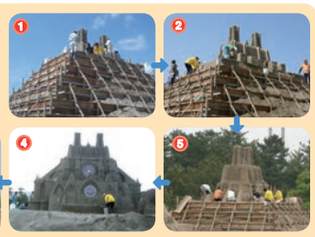
□ ÷ □ = 185

186 = □ × □

6 Sand Castle Art

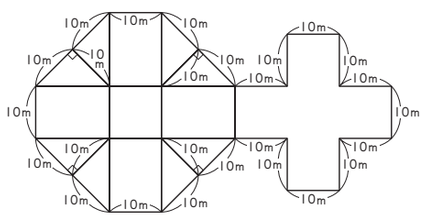
One of the three major sand hills in Japan, is Fukiage Beach in Minami-Satsuma City, Kagoshima Prefecture.
There is an event called Sand Festival every year and people make famous buildings or persons around the world including Japan using sand. In 2008, they built the Westminster Cathedral in England, the Palace of Versailles and the Notre Dame de Paris in France.

How is the Notre Dame de Paris built?

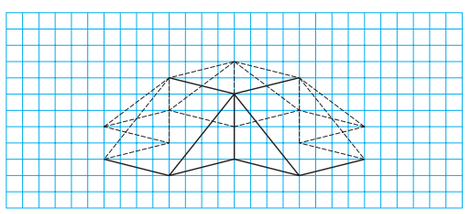


They harden the sand first and then it is dug out.

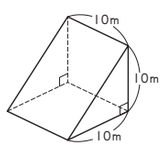
That's right. They first build a rough approximation on a board, put sand in it and harden it. Then, they remove the board one by one and build it high.
Now, it is time for a question. If you make a base, which looks like the shape of the built structure in this picture, how much is the volume in m³?



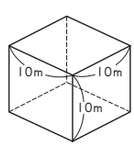
First, complete the blueprint below. Leave the part where you cannot see with a dotted line and connect the line of the part where you can see.
Build the figure on the previous page into a structure.



This shape is made with 4 parts of triangular prisms and 1 cube, which are shown below.



10 x 10 ÷ 2 x 10 = 500



10 x 10 x 10 = 1000

Calculate the volume of this solid and tell your friend how you calculated.

Total Volume
2000 + 1000 = 3000 m³

(1) 2500 m³ (2) 3000 m³ (3) 3500 m³ (4) 4000 m³

• Let's trace and cut out a key fragment on page 199 and paste on the last page.

□ ÷ □ = 187

188 = □ × □

Unit 16

Unit: Summary of Grade 3 to 6 Mathematics
Supplementary Topic: Mathematics Adventure

Textbook Page : p.168~169
Actual Lesson 115

7 Numbers Used in Ancient Rome

Out of the many world heritage sites with high historical value, Lyon and Rome in Italy are the places where many heritage of the Roman Emperor are found.


Historic District in Rome


Historic District in Lyon

Do you know how numbers are represented in ancient Rome?

I don't know. How are they represented?

The 2 pictures below show numbers used in ancient Rome, called Roman numerals. These numbers are still used today.

What are these numbers used for?


Milestone in ancient Rome

Clock

Have you ever seen symbols like I, II, III, IV, V, VI, VII, VIII, IX, X, XI and XII on a watch dial? These symbols represent; 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12.
Another example is shown at the end of a movie.
Example: Copyrights MCMLXXXVIII
Do you understand what they represent?

First VII seems like it represents 8, when you look at the clock face.
Probably X represents 10. But I don't really understand the rule.

I understand. Roman numerals correspond to numbers like below.

I	V	X	L	C	D	M
1	5	10	50	100	500	1000

They write a bigger number from the left and the sum of all digits is the number that this Roman numeral represents.

However, the left symbol is smaller for IV.

When a smaller number is written on the left side of a bigger number, you subtract the number written before from the number written after.
For example, in IV you subtract 1 from 5, which represents 4.
You can also write it like IIII.

Then, for CM you subtract 100 from 1000, which means 900.

I got it. When you think it as M CM LXXX VIII, it means 1000 + 900 + 80 + 8 = 1988.

The way of representing numbers adopts an idea of positional notation.
Here is an exercise. Calculate the mathematical sentence written in Roman numerals below and also write the answer in Roman Numerals.

MCMLXXXVII + MCMXCIX
1000+900+80+7+1000+900+90+9=3986

(1) M M D C C C L X X VII
(2) M M M D C C C L X X X VII
(3) M M M C M L X X X VI
(4) M M C M L X X X VII

3986

• Let's trace and cut out a key fragment on page 199 and paste on the last page.


Let's go to the next place to find the fragments of the key!

8 Challenge to Space

The view of the earth from space

Let's look back on this adventure. We started our journey from where we are to an exciting adventure that brought us all around the world.

Mathematics has power to answer gloomy questions. We learned about the earth and now I want to know about space.

When you look out into space, there might be several planets where intelligent life forms live like on the earth.
The Voyager space probe, launched in 1977 from America, carried a record to show the existence of life forms and cultures on the earth. It has 115 photos and the "Sounds of Earth", that includes the sounds of waves, winds, thunders and noises of birds and animals. In addition, it even contains world music and 55 languages. It included performances of the Japanese bamboo flute for world music and the Japanese language.


Record in Voyager

It was a message for other celestial life forms, to let them know about the nature and civilization of the earth. It will be wonderful if somebody out there finds them.

There is an interesting sound in one message. It is called the Morse code, which is represented with dots and dashes.
Morse invented the electrical telegraph system in the 19th century.
It is not used much today, but it is useful under noisy situations because it is represented with 2 simple sounds.

Morse Code

A	•–	G	––•	M	––	S	•••	W	•––
B	–•••	H	••••	N	–•	T	–	X	–••–
C	–•–•	I	••	O	–––	U	••–	Y	–•––
D	–••	J	•–––	P	•––•	V	•••–	Y	––••
E	•	K	–•–	Q	––•–				
F	••–•	L	•–••	R	•–•				

Rules for the Morse Code

(1) A dash is equal to 3 dots.
(2) The space between parts of the same letter is equal to one dot.
(3) The space between two letters is equal to three dots.
(4) The space between two words is equal to seven dots.

When you send a word below using Morse code, how long is the length of the Morse code? Count it with the number of dots.

– –	–•	–	••••	•••
M	A	T	H	S

U is "••–". There will be a dot between "•" and "•" and "•" and "–".
A dash equals to 3 dots, so it will be 7 dots.
The space between two letters is equal to 3 dots. Therefore, the number of dots will be like below.

M	A	T	H	S
7	3 5	3 3	3 7	3 5

The word that was included to the records of the Voyager space probe using Morse code is,

"ad astra per aspera"

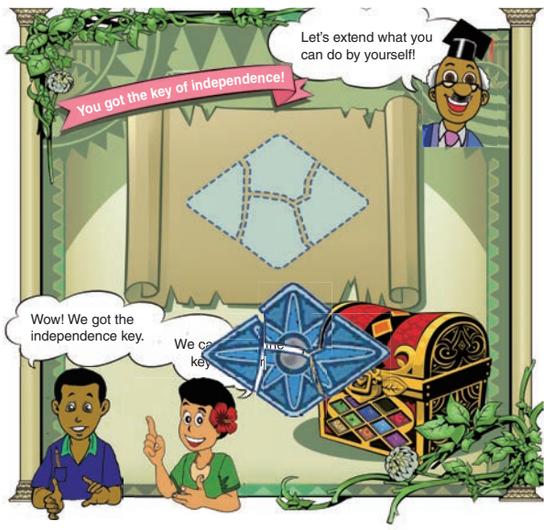
which means "Through hardships to the stars" in Latin. When you write this word with Morse code, it will look like below.
If you state 1 dot is $\frac{1}{3}$ second, how long is the length of the word in seconds? Read the rules and find out.

•–	–••	•–	•••	–	•–•	•–	•––•	•	•–•
a	d	a	s	t	r	a	p	e	r

•–	•••	•––•	•	•–•	•–
a	s	p	e	r	a

(1) 36 seconds
(2) 39 seconds
(3) 46 seconds
(4) 49 seconds

• Let's trace and cut out a key fragment on page 199, paste on the last page and complete the key.



Parliament House of Papua New Guinea

The current Parliament building was officially opened by His Royal Highness, Prince Charles, on 8th August 1984. We can find many symmetrical design in this significant building. There are 4 parts of the building, each part of the building represents the 4 region's symbols. Entrance style of a Maprik Haus Tambaran (house of spirits from East Sepik Province) is a representation of Momase region. Circular cafeteria as Highlands design principles and a mosaic features unmistakably PNG motifs. Can you notice any symmetrical figures from the inserted pictures of the Parliament House?



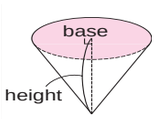
At the end of the Adventure Part 1, there will be 4 blue pieces of the puzzle that should be collected after answering the given questions correctly.
Each puzzle piece when combined together will reveal the key of Independence. Having these keys means that the students can utilise the necessary knowledge and skills learned to move onto Adventure Part 2.

Examples of symmetry;

- The image of the parliament house and its refelection are symmetric.
- The front view of the parliament house shows that half of one side of the building and its steps is symmetrical to the other half.
- The carving of the bird of paradise is symmetrical when a line of symmetry is drawn down the centre.
- The two sides of the doors and its designs are symmetrical as well.

Mining pots in Papua New Guinea

Since 1970, the mining industry has dominated PNG's economy. Mineral exports are gold, copper, silver, nickel and cobalt. PNG mines are spread across the country, the largest of which include: Ok Tedi Copper and Gold Mine, Porgera Gold Mine, Lihir Gold Mine, Hidden Valley Gold Mine, Simberi Gold Mine, Tolukuma Gold Mine and Ramu Nickel Mine. The Porgera Gold Mine is a large gold and silver mining operation in Enga province, Papua New Guinea. The open pit mine moves about 160 000 tonnes of rock material.



The mining pit is a like cylinder shape as shown in the picture. The blast left a crater of 400 metres wide and 150 metres deep. Estimate the volume of the rock and soil that were removed using the method of calculation learned in this grade.

At the end of the Adventure Part 2, there will be 4 yellow pieces of the puzzle that should be collected after answering the given questions correctly.
Each puzzle piece when combined together will reveal the key of Hope and marks the successfull completion of this grade. Having these keys means that the students can utilise the necessary knowledge and skills learned to advance on to the next grade level and apply these skills to solve problems in their daily lives.

Amount of soil removed

Volume of cone = $\frac{1}{3}$ x base x height

$= \frac{1}{3}$ x (200 x 200 x 3.14) x 150

$= \frac{1}{3}$ x 125600 x 150

$= \frac{1}{3}$ x 18 840 000

= 6 280 000 Answer: 6 280 000 m^3

Let's have fun Math Game for improving Math Skills

Some interesting games are introduced in the Teacher's Manual for improving students' mathematics thinking skills. Teachers are encouraged to facilitate these games during lesson time, recess, lunch and after lessons. There are three (3) games, materials and answers introduced from page 265 to 279. The first game is an example of addition, subtraction and multiplication in a number card game to improve students' mental calculation skills. The second game is square calculations and the third game is Sudoku as a mathematics puzzle.

Let's Play Number Card Game

Math game 1

Objective: Students will be able to do mental calculations of addition (up to 9 + 9), subtraction (up to 18 − 9) and the multiplication (up to 9 × 9).

When to play

It is very effective if you play the game 5 minutes at the beginning of every lesson.

How to play

1. Addition

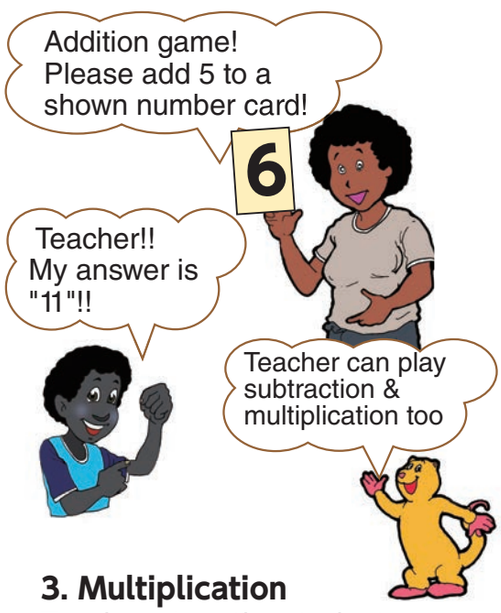
Teacher gives the students a number to be added. Teacher shows different number cards and the students do mental calculation to add the number mentioned to the number shown as quickly as possible.

Example:
Teacher: "Please add 5 to the shown number card". Show a number card (3).
Students: "8"
Teacher: Show a number card (6).
Students: "11"

2. Subtraction

Teacher gives the students a number to be subtracted from. Teacher shows different number cards and the students do mental calculation to subtract the number mentioned to the number shown as quickly as possible.

Example:
Teacher: "Please subtract the number shown
on the card from 15".
Teacher: Show a number card (8).
Students: "7"
Teacher: Show a number card (6).
Students: "9"

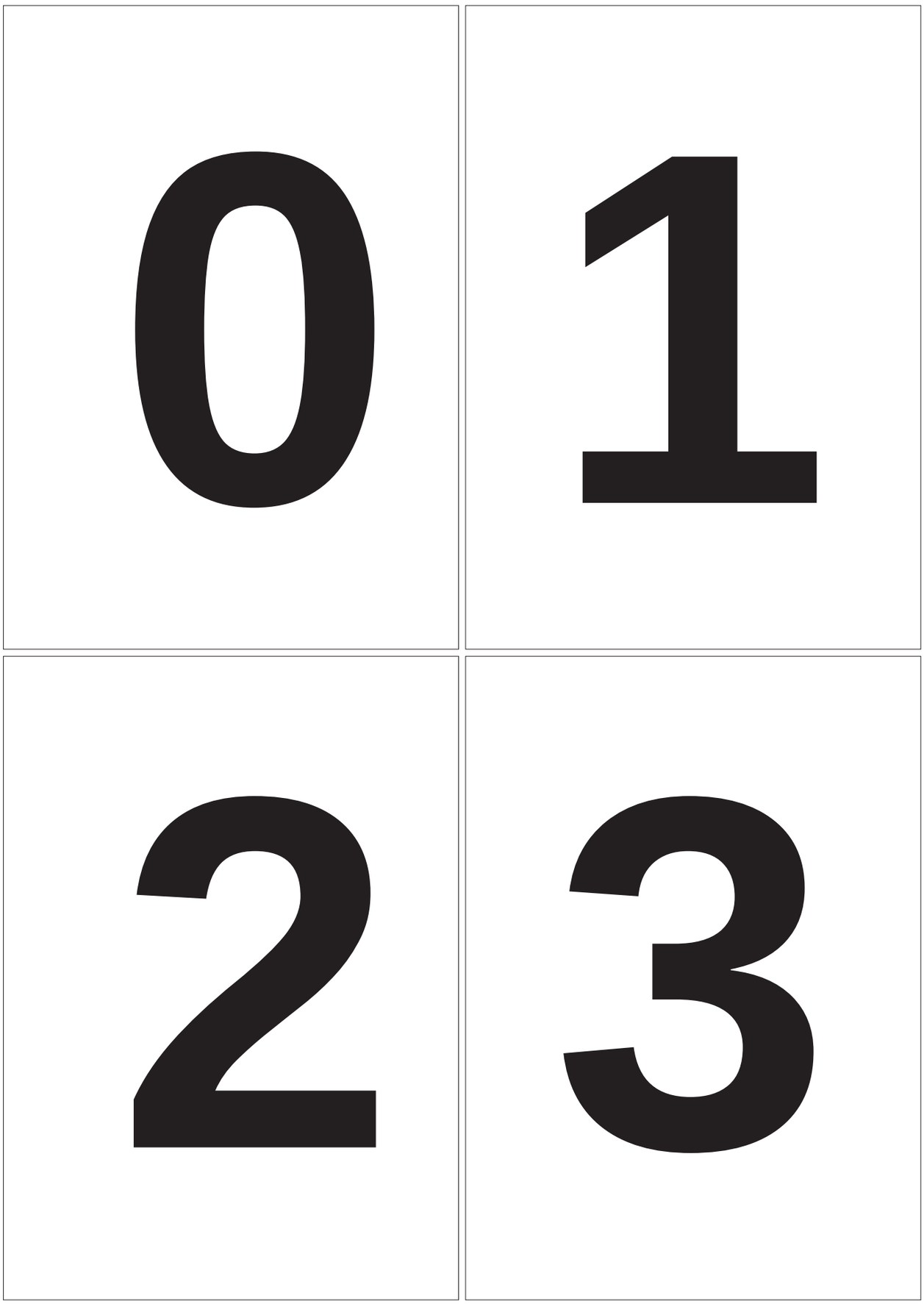


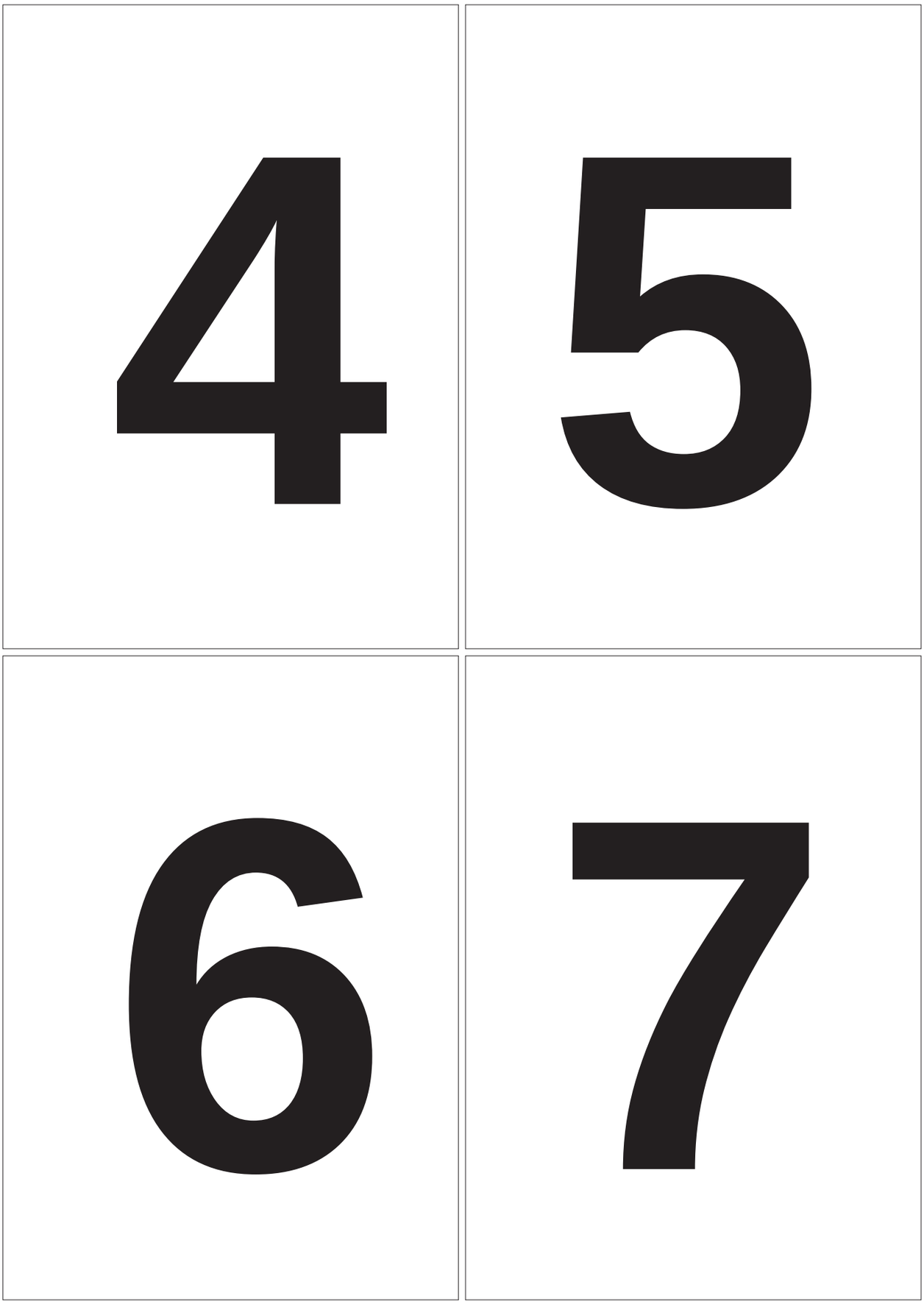
3. Multiplication

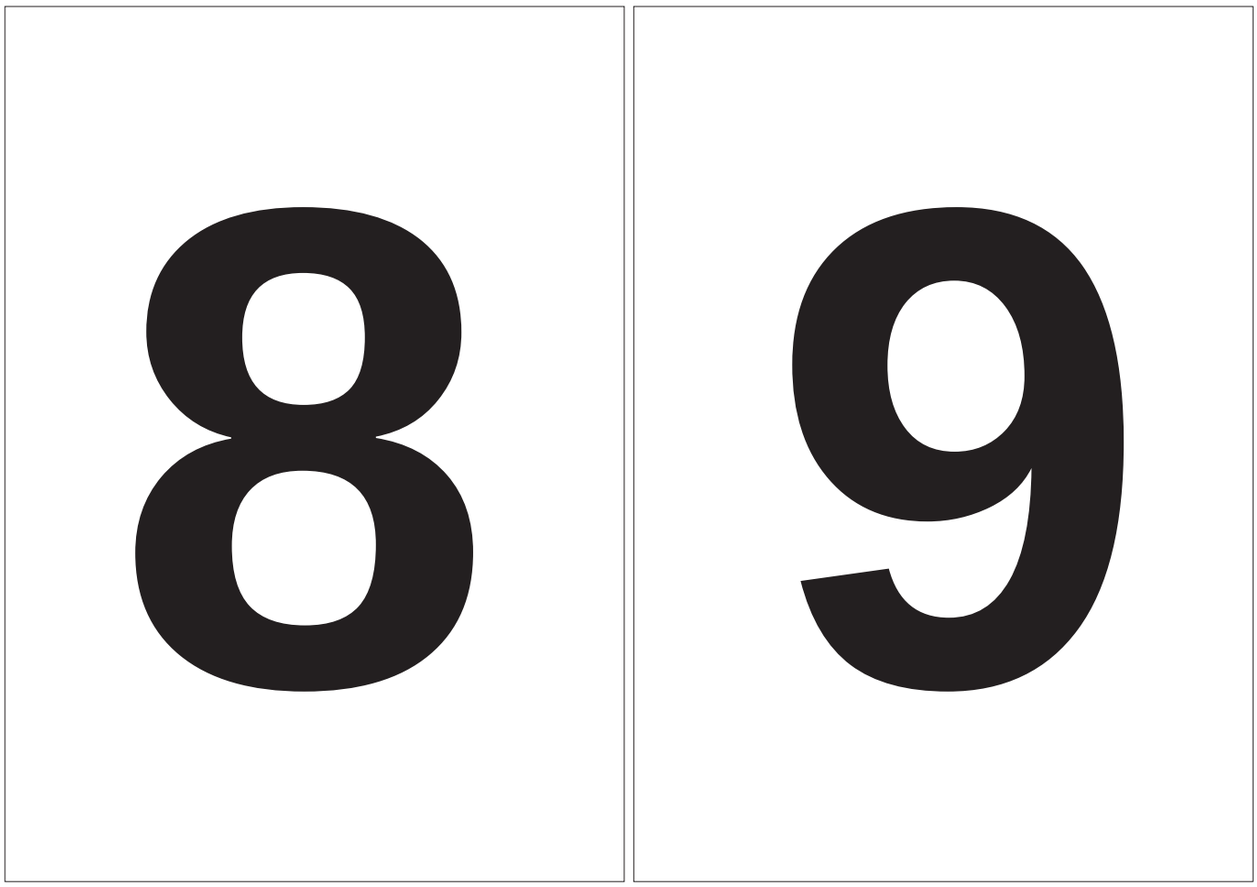
Teacher gives the students a number to be multiplied. Teacher shows different number cards and the students do mental calculation to multiply the number given by the teacher with the number in the card and answer as quickly as possible.

Example:
Teacher: "Please multiply 3 to the shown number card".
Teacher: Show a number card (8).
Students: "24"
Teacher: Show a number card (5)
Students: "15"

Number cards sample, 0 - 9




4
5
6
7


8
9

Math game 2

Let's enjoy SQUARE CALCULATION!!!

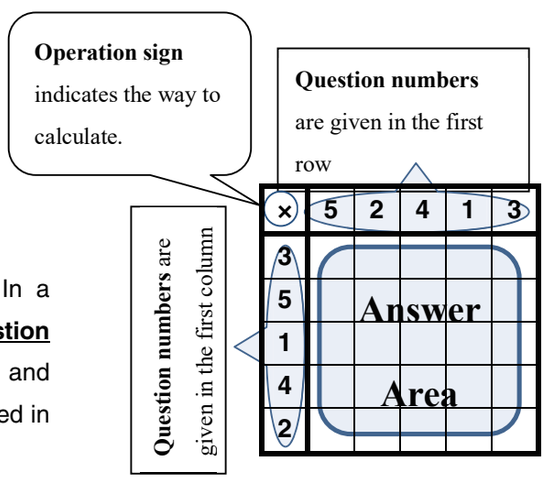
Background

We, the Japanese volunteer teachers have taught mathematics at selected schools for more than 10 years. We observed that PNG students' mathematical ability is poor because they don't understand the basic calculation. Therefore we introduced **a SIMPLE and HELPFUL Activity**. In fact, the activity was adopted in 2010 by the neighboring country, Vanuatu. Since then calculation ability of students in Vanuatu has improved steadily. Besides we have already confirmed the great impact of the activity at the selected schools in PNG as well. We have assurance that the activity will improve students' mathematical ability dramatically.

Objectives of Square Calculation

By using **Square Calculation** students from Grade 3 to 8 will

1. improve calculation on speed and accuracy.
2. improve their concentration.
3. form habit of re-check after they finished their work.



What is Square Calculation?

This activity is named **Square Calculation** after its shape. In a square there is a given **operation sign** (+, − or ×), **question numbers** written in the first row and first column at random and **answer space** for students to fill. Division sign (÷) cannot be used in this activity because remainders appear many times.

Multiplication

Multiply the left numbers by the above numbers.

×	4	5	1	7	9
8	32	40	8	56	72
2	8	10	2	14	18
3	12	15	3	21	27
7	28	35	7	49	63
4	16	20	4	28	36

Addition

Add the above numbers to the left numbers.

+	4	5	1	7	9
8	12	13	9	15	17
2	6	7	3	9	11
3	7	8	4	10	12
7	11	12	8	14	16
4	8	9	5	11	13

Subtraction

Subtract the above numbers from the left numbers.

−	3	2	8	9	10
18	15	16	10	9	8
11	8	9	3	2	1
15	12	13	7	6	5
20	17	18	12	11	10
16	13	14	8	7	6

Note: Write numbers from 11 to 20 in the first column.

*Note: Students should calculate from left to right and row by row without missing a space in Answer area.

How to use Square Calculation

(A) During activity

Teacher should;

1. select a size of square (5×5, 7×7 or 10×10)[*1] and then write down the square on the blackboard.
2. give the operation sign (+, − or ×) and numbers from 1 to 10 **at random** in the first row and column.[*2]
3. set a time for the activity.[*3]

4. allow the students to work within the set time.
5. give their timing when students have completed the square sheet before the time.
6. stop the students when the time is up.

*1, *3: Refer to the next page “Square Calculation options”.

*2: Only in subtraction choose numbers in the first column from 11 to 20; otherwise, negative answers will appear.

Students should;

1. draw a square grid unless teachers prepare activity sheets
2. copy the operation sign and numbers written in the first column and the first row.
3. write each answer from left to right and row by row without missing a space.
4. raise their hands and write their timing given by the teacher when they have finished.
5. recheck their own answers until time is up.

(B) During correction

Teacher should;

1. allow the students to exchange their activity sheet with neighbors.
2. allow students to read out their answers with questions.
3. read answers on the blackboard as you write.

Students should;

1. mark their friend’s answers by putting ✓ on a correct answer or ○ on a wrong answer and a blank square.
2. write their score on the activity sheet.

Time 0:47 Score 22/25

×	4	5	1	6	9
8	✓	✓	✓	✓	(45)
2	✓	✓	✓	✓	✓
3	✓	✓	✓	✓	✓
7	(14)	✓	✓	✓	✓
4	✓	✓	✓	✓	(32)

Example of correction

(C) During recording

Teacher should;

1. collect their activity sheets.
2. record children’s score into recording sheet at least once a week.

Note: **Bad examples** when the teacher writes question numbers on the blackboard

Don’t use same numbers in the first column or row.

×	4	5	(1)	(1)	9
(3)					
2					
(3)					
7					
4					

Don’t Use numbers over 10 in the first column or row in addition or multiplication.

×	6	(13)	(15)	2	9
2					
(15)					
4					
(18)					
3					

Don’t Use numbers from 1 to 10 in the first column in Subtraction.

−	2	3	5	7	9
4	2	1	(-1)	(-3)	
5					
4					
8					
3					

Note: **Bad examples** when students write answers on their activity sheets.

Don't miss a space.

×	2	5	4	1	3
4	8	20		4	12
1	2	5	4	1	3
3					
5	10	25	20	5	
2	4	10	8	2	6

Don't calculate from top to bottom.

×	2	5	4	1	3
4	8	20	16		
1	2	5	4		
3	6	15	12		
5	10	25			
2	4	10			

Square Calculation options

1. Size of a square (5×5, 7×7, 10×10).
2. Set time as shown in the table on the right.

Size	Time limit
5×5	1-2 min
7×7	2-4 min
10×10	5 min

Sample teaching plan

Teaching plan below is just sample. Teacher can arrange the size, operation sign and time limit depending on students' understanding. But we highly recommend that teacher should choose the smaller size 5×5 and longer time limit 2 min at first and should continue to give the activity with the same operation sign **every day through each term**.

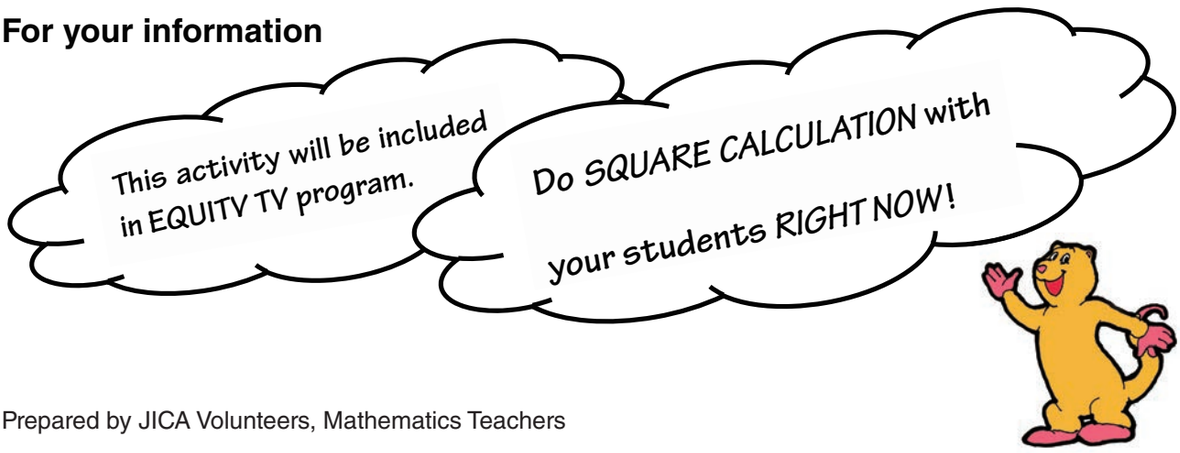
Sample teaching plan for Grade 3

	Term1	Term 2	Term3	Term4
Size	5×5	5×5	5×5	5×5
Operation	Addition	Subtraction	Multiplication	Multiplication
Time limit	2 min	2 min	2 min	1 min

Sample teaching plan for Grade 6

	Term1	Term 2	Term3	Term4
Size	5×5	5×5	5×5	7×7
Operation	Multiplication	Multiplication	Subtraction	Addition
Time limit	2 min	1 min	2 min	3 min

For your information



Prepared by JICA Volunteers, Mathematics Teachers

SQUARE CALCULATION SHEETS (Answer area: 5×5)

Name: ____________________

Class: ______ Date: ______/______

Time: ____:______ Score: ______/

Name: ____________________

Class: ______ Date: ______/______

Time: ____:______ Score: ______/

Name: ____________________

Class: ______ Date: ______/______

Time: ____:______ Score: ______/

Name: ____________________

Class: ______ Date: ______/______

Time: ____:______ Score: ______/

Name: ____________________

Class: ______ Date: ______/______

Time: ____:______ Score: ______/

Name: ____________________

Class: ______ Date: ______/______

Time: ____:______ Score: ______/

Name: ____________________

Class: ______ Date: ______/______

Time: ____:______ Score: ______/

Name: ____________________

Class: ______ Date: ______/______

Time: ____:______ Score: ______/

Name: ____________________

Class: ______ Date: ______/______

Time: ____:______ Score: ______/

SQUARE CALCULATION SHEETS（Answer area: 7×7）

Name: ______________

Class: ________ Date: ____/____

Time: ____:______ Score: ______/

Name: ______________

Class: ________ Date: ____/____

Time: ____:______ Score: ______/

Name: ______________

Class: ________ Date: ____/____

Time: ____:______ Score: ______/

Name: ______________

Class: ________ Date: ____/____

Time: ____:______ Score: ______/

Name: ______________

Class: ________ Date: ____/____

Time: ____:______ Score: ______/

Name: ______________

Class: ________ Date: ____/____

Time: ____:______ Score: ______/

Name: ______________

Class: ________ Date: ____/____

Time: ____:______ Score: ______/

Name: ______________

Class: ________ Date: ____/____

Time: ____:______ Score: ______/

Name: ______________

Class: ________ Date: ____/____

Time: ____:______ Score: ______/

SQUARE CALCULATION SHEETS (Answer area: 10 × 10)

Name: ____________________ Class:_____

Date:____/_____ Time: ____:______ Score: _____/10

Name: ____________________ Class:_____

Date:____/_____ Time: ____:______ Score: _____/10

Name: ____________________ Class:_____

Date:____/_____ Time: ____:______ Score: _____/10

Name: ____________________ Class:_____

Date:____/_____ Time: ____:______ Score: _____/10

Name: ____________________ Class:_____

Date:____/_____ Time: ____:______ Score: _____/10

Name: ____________________ Class:_____

Date:____/_____ Time: ____:______ Score: _____/10

SQUARE CALCULTATION SCORE SHEET

Year		Term	
Class		Teacher	

SIZE	
Operation sign	
TIME LIMIT	

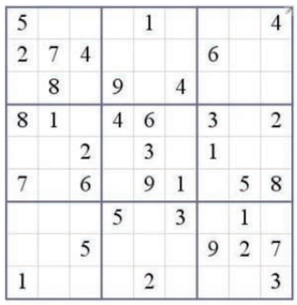
				Week __		Week __		Week __		Week __		Week __	
No.	First Name	Last Name	Gender	Score	Time	Score	Time	Score	Time	Score	Time	Score	Time
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													
31													
32													
33													
34													
35													
36													
37													
38													
39													
40													

Math game 3

Let's play SUDOKU!

What is Sudoku

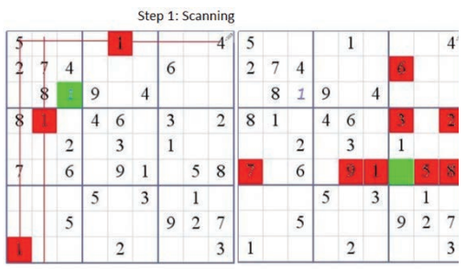
Sudoku is a mathematics puzzled game much like a crossword puzzle designed for a single player. Each little square or cells are partly filled or left incomplete to be filled in which contains a single solution. The objective is to fill a 9 x 9 grid so that each column, each row and each of the nine 3 x 3 region use numbers from 1 to 9.



How to Play Sudoku

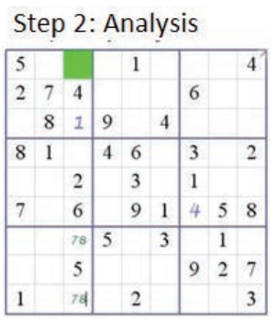
Step 1: Scanning

The easier way to find missing numbers is scanning.
1) Cross-hatching: Scan to find a specific number given in a region, eg; Shaded green
2) Counting: In counting you simply count all the different numbers that is in a row, column and region that connects to one cell. If there is just one number missing then that is what should be in the cell.



Step 2: The Analysis

This method is the matched pair method. It applies when a pair of numbers are the only possible answer to two cells. After scanning you will notice possibilities of the position of two numbers to place in two cells. In this example notice 7 and 8, they can be placed at the bottom regions.



Step 3: Analysis (Certainty from uncertainty)

To derive certainty from uncertainty, like step 2 but this time consider the possibility of number that appear at one place at one time and place in the number. For instance, 7 can be placed in the middle right region.

Step 4: Complete the cells

Complete the cells and remember not to repeat the same number in a column, row or region.

Let's play Sudoku!!

Source: Sudoku, Solving It for Beginners and the Experienced, https://www.instructables.com

Let's try these Sudoku, Challenge for Early Beginners

No.1

1	7	4			8	6		5
6	3					2		
	8		1	9		7	3	
			8					
5				1		8		
	6	3			9	1	4	
		1	3	8				9
		8				4	2	
				5			1	

No.2

6		3	5					7
			7				9	8
7								
		1				8	2	
2	4				1	7		
8	5			2				6
			6		5		3	
1	8		4		2	5		
5					9			

No.3

			1	9				
4	9		7					1
8	1	3					9	
6	2	7	4	8				
9			2			8		
				6				5
				2	3			
3	5	1		4			2	6
	8		9			5		

No.4

4				8		1	6	7
			6		3		8	2
	2	8				9	5	3
1						8	7	
								1
	7			2	4	5	3	
		5	3	6	1		4	
3						6		8
	9		2		8		1	

No.5

1		4	8					5
3								9
	8					6		
4		6	7	9		8	5	
5	2		4	6	8			
7	9	8	5		3			
		1	9	4	5	2		8
	7			8			4	
			3		1			

No.6

		2			4			
	4		6			7	8	9
	9		8			1		4
2	5		4				3	8
			2	9	1	4	7	
			3					
1	8			2				3
9		3						
		7	1					

Answers for Challenge for Early Beginners

No.1

1	7	4	2	3	8	6	9	5
6	3	9	7	4	5	2	8	1
2	8	5	1	9	6	7	3	4
4	1	7	8	2	3	9	5	6
5	9	2	6	1	4	8	7	3
8	6	3	5	7	9	1	4	2
7	4	1	3	8	2	5	6	9
3	5	8	9	6	1	4	2	7
9	2	6	4	5	7	3	1	8

No.2

6	1	3	5	9	8	2	4	7
4	2	5	7	1	6	3	9	8
7	9	8	2	4	3	1	6	5
3	6	1	9	5	7	8	2	4
2	4	9	8	6	1	7	5	3
8	5	7	3	2	4	9	1	6
9	7	2	6	8	5	4	3	1
1	8	6	4	3	2	5	7	9
5	3	4	1	7	9	6	8	2

No.3

5	7	6	1	9	2	4	8	3
4	9	2	7	3	8	6	5	1
8	1	3	6	5	4	7	9	2
6	2	7	4	8	5	3	1	9
9	3	5	2	7	1	8	6	4
1	4	8	3	6	9	2	7	5
7	6	9	5	2	3	1	4	8
3	5	1	8	4	7	9	2	6
2	8	4	9	1	6	5	3	7

No.4

4	5	3	9	8	2	1	6	7
9	1	7	6	5	3	4	8	2
6	2	8	4	1	7	9	5	3
1	6	2	5	3	9	8	7	4
5	3	4	8	7	6	2	9	1
8	7	9	1	2	4	5	3	6
2	8	5	3	6	1	7	4	9
3	4	1	7	9	5	6	2	8
7	9	6	2	4	8	3	1	5

No.5

1	6	4	8	3	9	7	2	5
3	5	7	6	2	4	1	8	9
2	8	9	1	5	7	6	3	4
4	1	6	7	9	2	8	5	3
5	2	3	4	6	8	9	1	7
7	9	8	5	1	3	4	6	2
6	3	1	9	4	5	2	7	8
9	7	5	2	8	6	3	4	1
8	4	2	3	7	1	5	9	6

No.6

8	1	2	9	7	4	3	5	6
3	4	5	6	1	2	7	8	9
7	9	6	8	5	3	1	2	4
2	5	1	4	6	7	9	3	8
6	3	8	2	9	1	4	7	5
4	7	9	3	8	5	2	6	1
1	8	4	7	2	6	5	9	3
9	2	3	5	4	8	6	1	7
5	6	7	1	3	9	8	4	2

Let's try these Sudoku, Challenge for Beginners

No.1

			2			1		
1	4	5		9				
	6		8					5
			4					
4		1	6		2			
		2	1	8			3	9
	2					6		7
					8		5	
			5				2	3

No.2

		4	8	3				
				4	6	8		
	8	3				9		
		5			8			3
	1	7	5					8
	2	8		1		5	9	4
		9			3			1
	5							
8		6	2			4		

No.3

		5		8		7		
				2		4		
4	1			9	7	3		5
				3	8	5	6	
6								
				6			7	2
	6					2		4
2	4				1		8	

No.4

1				9				
				7			3	
			2		6	1	4	
3	8							
2			9	5	3		1	
							5	
6	1			2				8
			6					5
9				8		6		

No.5

1				9				
				7			3	
			2		6	1	4	
3	8							
2			9	5	3		1	
							5	
6	1			2				8
			6					5
9				8		6		

No.6

	1		2		5		6	
	6	7		9				
2		9	4					
						9		
				1				5
	5				6	2	1	
1		4	5					
	9							
6	3						7	1

Answer for Challenge for Beginners

No.1

8	3	9	2	7	5	1	4	6
1	4	5	3	9	6	7	8	2
2	6	7	8	1	4	3	9	5
7	8	3	4	5	9	2	6	1
4	9	1	6	3	2	5	7	8
6	5	2	1	8	7	4	3	9
5	2	8	9	4	3	6	1	7
3	1	6	7	2	8	9	5	4
9	7	4	5	6	1	8	2	3

No.2

9	6	4	8	3	5	1	2	7
1	7	2	9	4	6	8	3	5
5	8	3	1	7	2	9	4	6
4	9	5	6	2	8	7	1	3
3	1	7	5	9	4	2	6	8
6	2	8	3	1	7	5	9	4
2	4	9	7	8	3	6	5	1
7	5	1	4	6	9	3	8	2
8	3	6	2	5	1	4	7	9

No.3

3	2	5	1	8	4	7	9	6
7	9	6	3	2	5	4	1	8
4	1	8	6	9	7	3	2	5
1	7	2	4	3	8	5	6	9
6	5	9	7	1	2	8	4	3
8	3	4	5	6	9	1	7	2
9	6	1	8	7	3	2	5	4
2	4	3	9	5	1	6	8	7
5	8	7	2	4	6	9	3	1

No.4

1	3	2	4	9	5	7	8	6
4	6	9	1	7	8	5	3	2
5	7	8	2	3	6	1	4	9
3	8	5	7	1	2	9	6	4
2	4	6	9	5	3	8	1	7
7	9	1	8	6	4	2	5	3
6	1	3	5	2	9	4	7	8
8	2	7	6	4	1	3	9	5
9	5	4	3	8	7	6	2	1

No.5

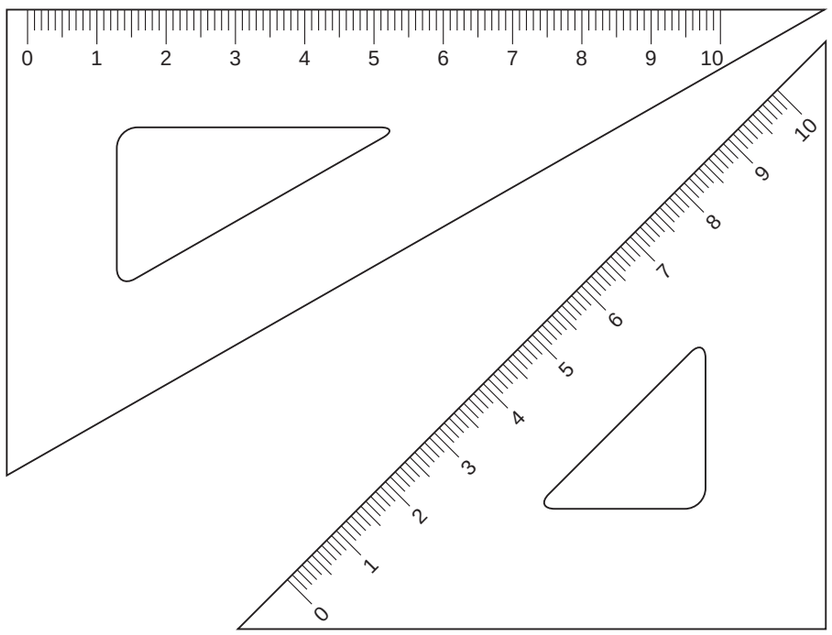
7	1	4	8	3	9	6	5	2
6	2	9	1	5	4	7	3	8
5	8	3	2	6	7	1	4	9
4	3	1	9	7	2	5	8	6
8	6	7	4	1	5	2	9	3
2	9	5	6	8	3	4	1	7
3	5	2	7	9	1	8	6	4
1	4	6	3	2	8	9	7	5
9	7	8	5	4	6	3	2	1

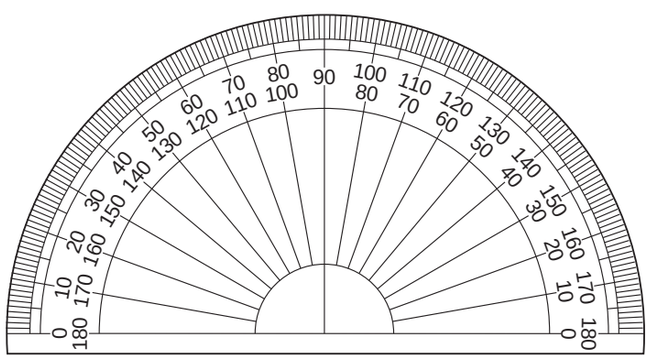
No.6

4	1	3	2	8	5	7	6	9
5	6	7	1	9	3	4	2	8
2	8	9	4	6	7	1	5	3
3	4	1	7	5	2	9	8	6
7	2	6	8	1	9	3	4	5
9	5	8	3	4	6	2	1	7
1	7	4	5	3	8	6	9	2
8	9	2	6	7	1	5	3	4
6	3	5	9	2	4	8	7	1

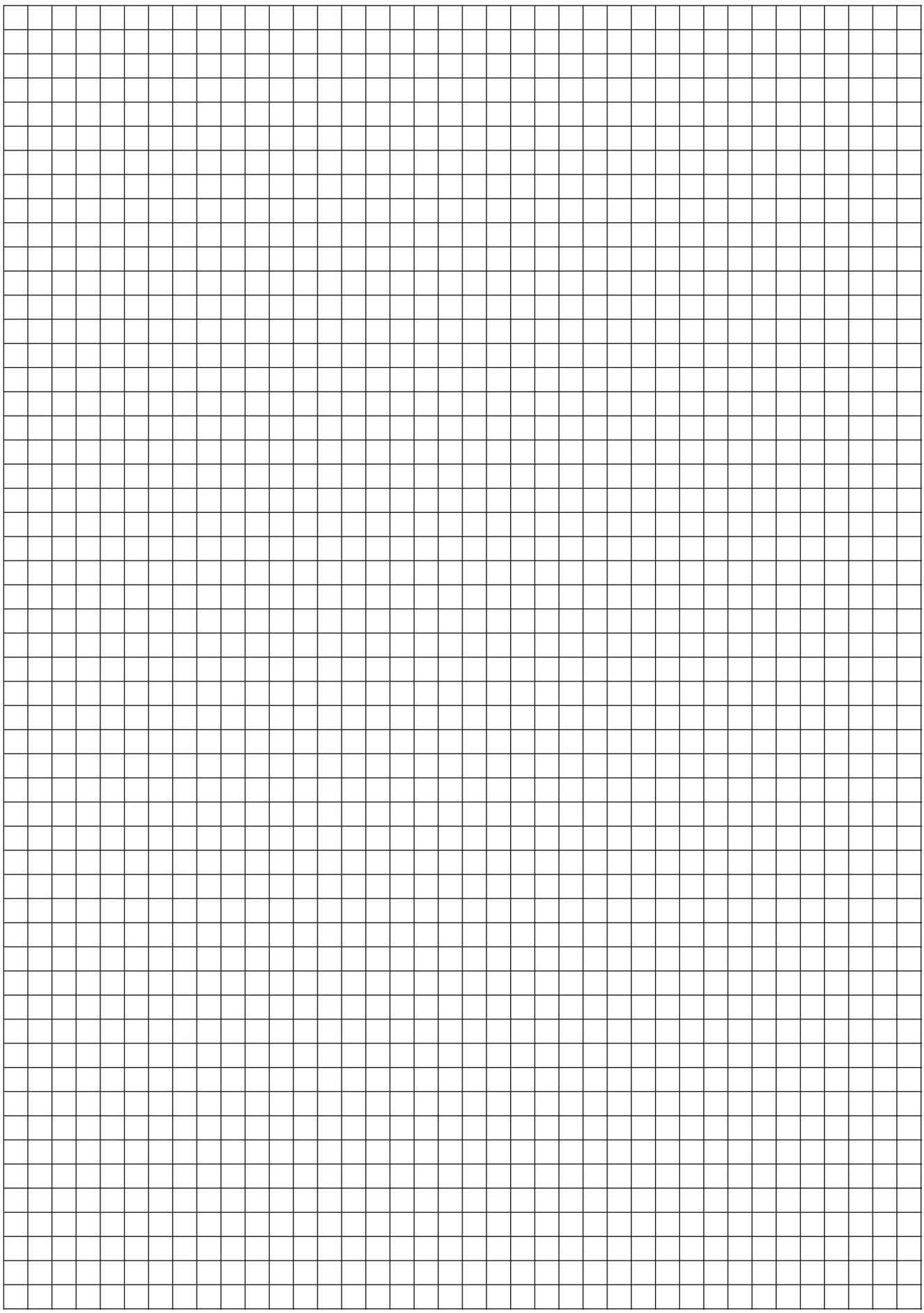
http://数独無料問題集pdf.com/muryomondaishu.htm

Triangle rulers and protractor

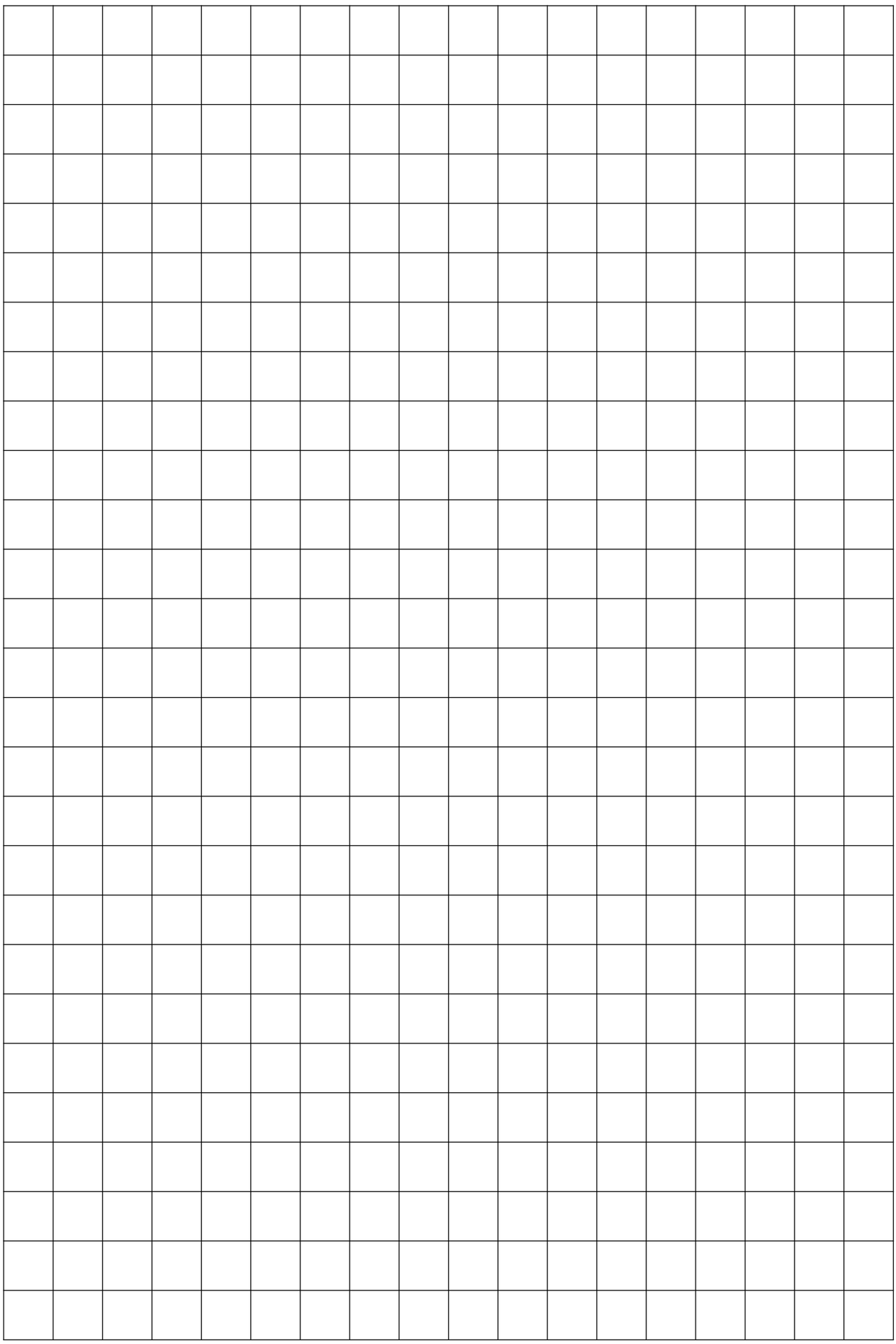




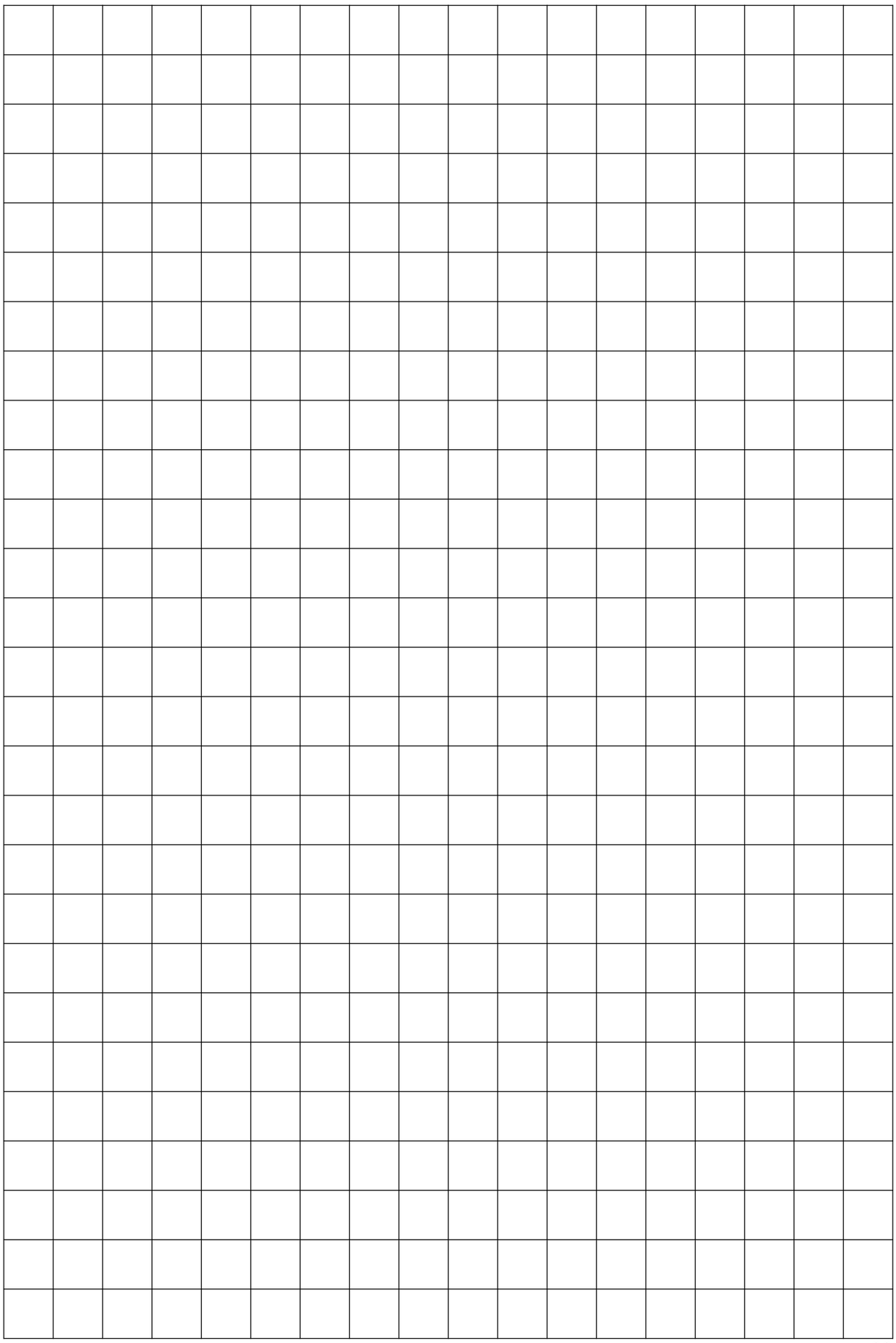
5mm^2 grid



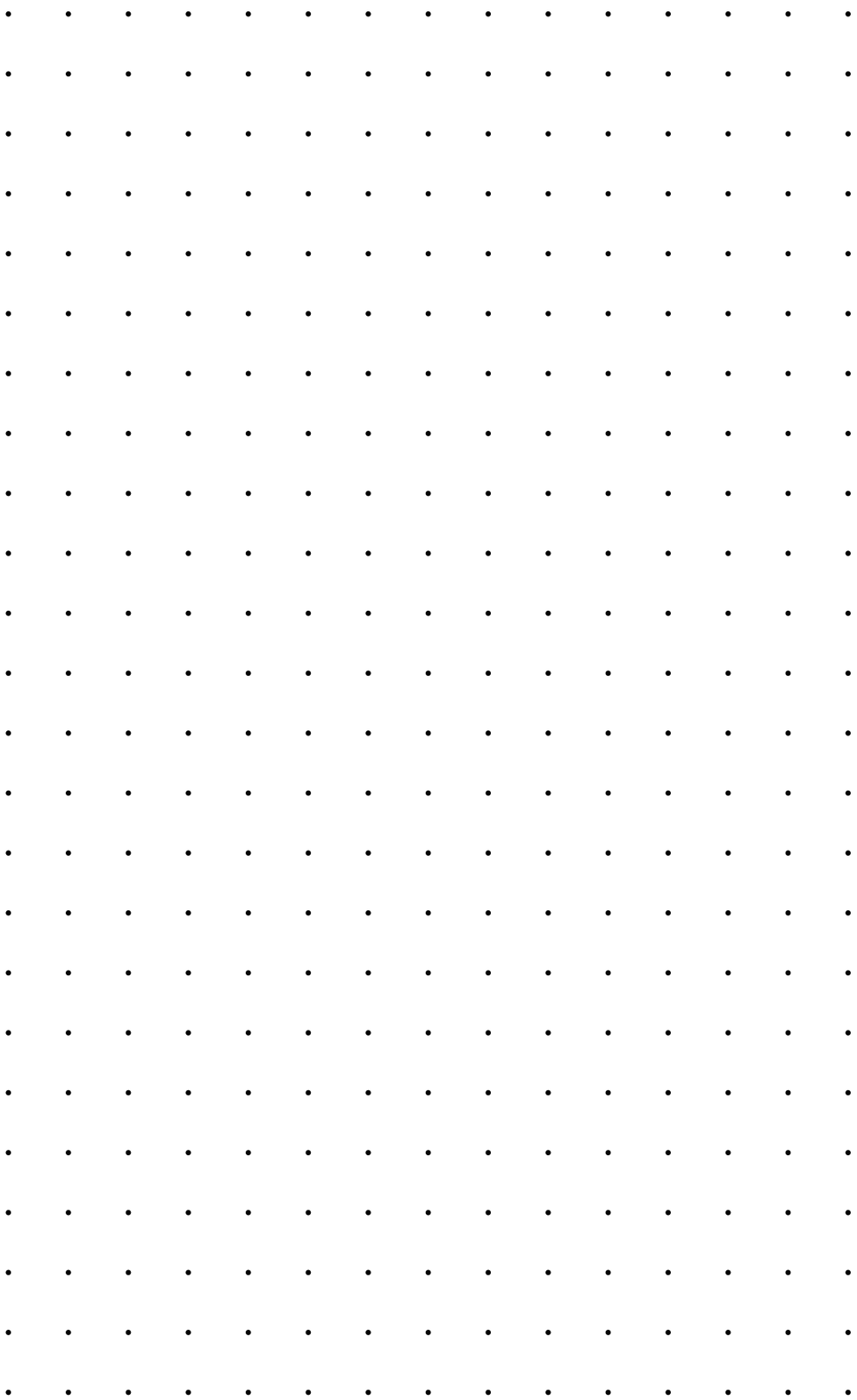
1cm^2 grid



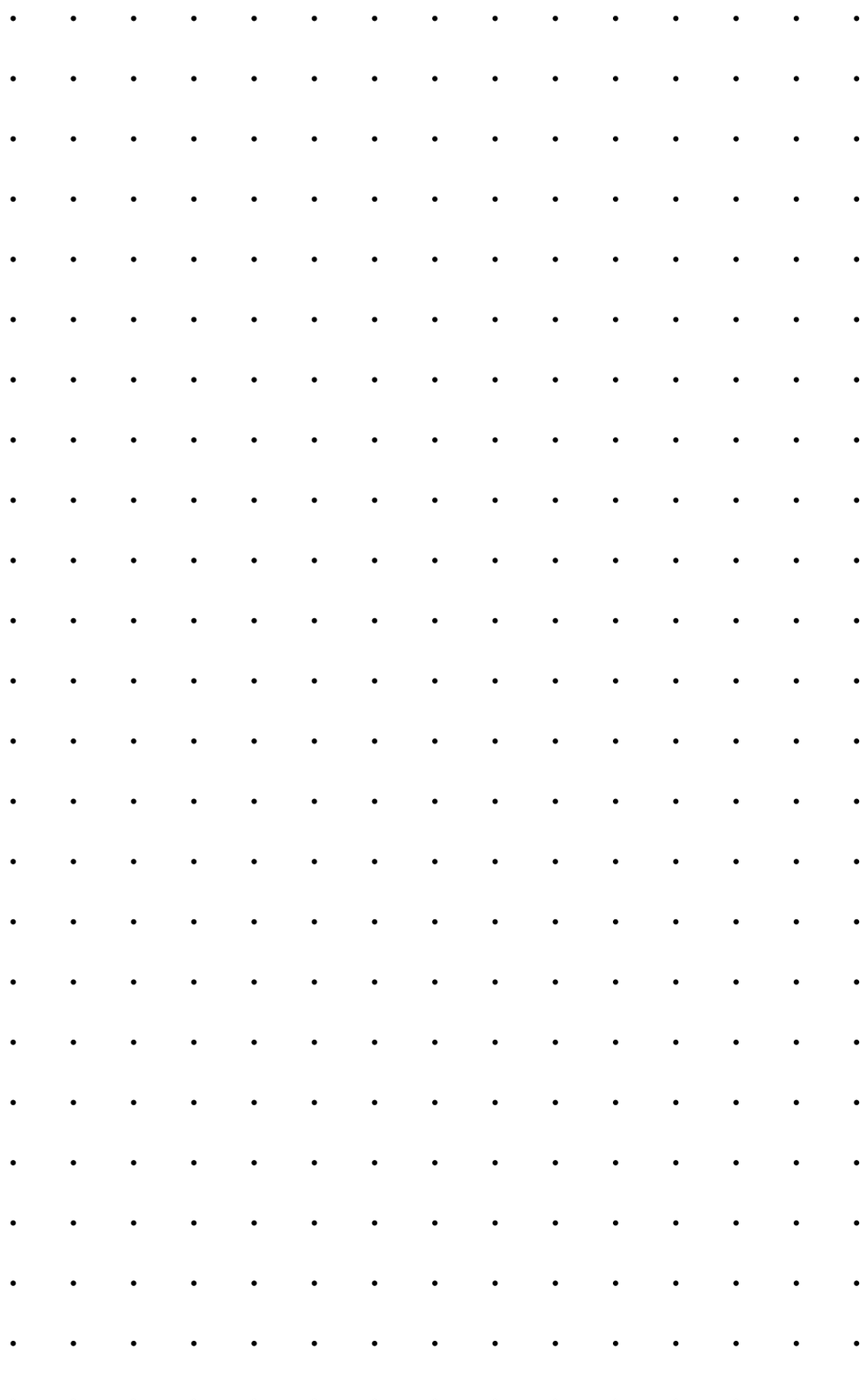
1cm^2 grid



1cm^2 dotted grid



1cm^2 dotted grid



Structure of learning contents in Mathematics from Elementary Prep to Grade 8

Number and Operation

Elementary Prep – Elementary 2

Elementary Prep - Elementary 2

- Natural numbers up to 120

- Natural numbers up to 120
- Additions and subtraction of one-digit numbers
- Additions and subtractions of simple 2-digit numbers

Elementary 1

- Natural numbers up to 1000

- Simple fractions

- Additions and subtractions of 2-digit numbers
- Additions and subtractions of simple 3-digit numbers

Elementary 2

- Natural numbers up to 10000

- Meaning of multiplication
- Multiplication table
- Multiplication of simple 2-digit numbers

Grade 3 – Grade 4

Grade 3

- Natural numbers less than 100 000
- Addition and subtraction of natural numbers (with carrying & borrowing)
- Multiplication of natural numbers
- Meaning of division
- Division in the simple case where divisors are 1-digit numbers

- The meaning and the representations of decimal numbers
- Addition and subtraction of decimal numbers (the tenths place)
- The meaning and the representation of fractions
- Simple addition and subtraction of fractions with same denominator less than 1

Grade 4

- Natural numbers less than billion
- Round numbers, round up and round down
- Division in the case where divisors are 2-digit numbers
- Acquisition and utilization of 4 operations of natural numbers

- Addition and subtraction of decimal numbers (the tenths and the hundredths places)
- Multiplication and division of decimals by whole numbers
- Addition and subtraction of fractions with same denominators (proper fraction, mixed numbers)

Grade 5 – Grade 6

Grade 5

- Even and odd numbers, prime numbers, multiples and whole numbers

- Multiplications and divisions by decimal (tenths and hundredths pace, etc)
- Addition and subtraction of fractions with different denominators

Grade 6

- Multiplication and division of fractions
- Calculations that involve both fractions and decimals
- Consolidation and utilization of the 4 basic operations of decimals and

Grade 7 – Grade 8

Grade 7

Positive numbers, negative numbers
- Necessity and meaning of positive and negative numbers (set of numbers and the 4 fundamental operations)
- Four basic operations with positive and negative numbers

Algebraic expressions using letters
- Necessity and meaning of using letter
- How to express multiplication and division
- Additional and subtraction with linear expressions
- Representing with algebraic expressions with letters (representations in inequality)

Linear equations with one unknown
- Meaning of equations and their solutions
- Property of equality and how to solve equations
- Solving and using linear equations (proportional expressions)

Grade 8

Calculations of 4 basic operations with expressions using letters
- Calculations of addition and subtractions with simple polynomials, as well as multiplication and division with monomials

Simultaneous linear equations with unknowns
- Necessity and meaning of simultaneous linear equations with two unknowns and the meaning of their solutions
- Meaning of simultaneous equations and their solutions
- Solving simultaneous equations and applying them

Quantities and Measurements

Elementary Prep – Elementary 2	Grade 3 – Grade 4	Grade 5 – Grade 6	Grade 7 – Grade 8
Elementary Prep • Comparing amount of length, area, volume (arbitrary) • Telling clock times (O'clock)	**Grade 3** • Unit of length (km) • Unit of weight (g, kg, t) • Calculations with time	**Grade 5** • Area of triangles, rectangles, parallelograms, trapeziums and rhombi • Unit of volume (cubic cm, cubic m, mL, kL) • Volumes of cuboids and cubes • Mean of measurements • Per unit quantity	**Grade 7** • Volume cylinders
Elementary 1 • Unit of length (cm, mm, m) • Reading times • Additions and subtractions of 2-digit numbers • Additions and subtractions of simple 3-digit numbers	**Grade 4** • Unit of area (square cm, square m, square km, a, ha) • Finding area of rectangle and square • Unit of angle (degree)	**Grade 6** • Area of approximate shape • Area of circle • Volume of prisms • Metric system • Speed	
Elementary 2 • Unit of volume (L, dL, mL) • Unit of time (day, hour, minute, second)			

Geometrical figure

Elementary Prep – Elementary 2	Grade 3 – Grade 4	Grade 5 – Grade 6	Grade 7 – Grade 8
Elementary Prep • Observing and composing the shapes of planer figures and solid figures	**Grade 3** • Isosceles triangle, equilateral triangles • Angle	**Grade 5** • Polygons and regular polygons (irregular polygons) • Congruence of triangles and quadrilaterals • Circular constant • Prism, cylinders, sketches, nets	**Grade 7** Plane figures • Fundamental methods for constructing of figures and their applications • Moving figures (parallel translation, symmetric transformation, rotation) Space figures • Positional relationship between straight lines and planes • Structure of space figures and their representation on the plane (sketches, nets, projection drawings) • Length of arc of a sector and area of the sector • Surface area and volume of prisms, cones and spheres
Elementary 1 • Triangles, quadrilaterals, rectangles, squares, right triangles • Shape of a box	**Grade 4** • Perpendicular and parallel • Parallelogram, rhombus, trapezium • Cube, cuboid	**Grade 6** • Line symmetry, point symmetry • Enlarged and reduced figures	**Grade 8** Basic plane figures and properties of parallel lines • Properties of parallel lines and angles • Properties of angles of polygons Congruence of plane figures • Congruence of plane figures and conditions of congruence of triangles • Necessity, meaning and methods of proof • Basic properties of triangles and parallelograms
Elementary 2 • Circle, sphere			

Mathematical Relations

Elementary Prep – Elementary 2	Grade 3 – Grade 4	Grade 5 – Grade 6	Grade 7 – Grade 8
Elementary Prep • Representing the number of objects using pictures and figures	**Grade 3** • Representing the situations where divisions are used by algebraic expressions • Making connections between algebraic expressions and diagrams, Algebraic expressions that use empty boxes • Tables and graphs (Bar + Columns) in numerical representation	**Grade 5** • Simple proportional relations • Relations of two quantities that are expressed by simple algebraic relations • Percentage, pie charts	**Grade 7** Direct proportion and Inverse proportion • Meaning of functional relationship • Application of direct proportion and inverse proportion Dispersion of data and representative value of data • Necessity and meaning of histogram and representative values • Applying histogram and representative values
Elementary 1 • Relationship between addition and subtraction • Basic table and graphs	**Grade 4** • Algebraic expressions that contain some of the 4 basic operations and expressions with brackets and formulas • Expression with empty boxes and empty triangles • Relationship between two number/quantities as they vary simultaneously • Points, broken line graphs	**Grade 6** • Algebraic expressions using letters such as x or a • Proportional relationship • Proportion and inverse proportion • The average of data, frequency distribution, histgram	**Grade 8** Linear functions • Phenomena and linear functions • Tables, algebraic expressions and graphs of linear functions • Linear equations with two unknowns and functions • Using linear functions Probability • Necessary and meaning of probability and finding the probability
Elementary 2 • Representing situations where multiplication is used • Tables and bar graphs in pictorial/ symbols			

Mathematics Grade 6 Teacher's Manual Development Committees

The Mathematics Teacher's Manual was developed by Curriculum Development Division (CDD), Department of Education in partnership with Japan International Cooperation Agency (JICA) through the Project for Improving the Quality of Mathematics and Science Education (QUIS-ME Project). The following stakeholders have contributed to manage, write, validate and make quality assurance for developing quality Textbooks and Teacher's Manuals for students and teachers of Papua New Guinea.

Joint Coordinating Committee members for QUIS-ME Project

Dr. Uke Kombra, Secretary for Education - Chairperson, Mr. Walipe Wingi, Deputy Secretary - Deputy Chairperson, Mr. Baran Sori, Mr. Samson Wangihomie, Mr. Titus Romano Hatagen, Mr. Godfrey Yerua, Mrs. Annemarie Kona, Mr. Camilus Kanau, Mr. Joseph Moide, Mr. Peter Kants, Late Mr. Maxton Essy, Mr. Steven Tandale, Ms. Hatsie Mirou, Mr. Paul Ainui, Mr. Packiam Arulappan, Mr. Allen Jim, Mr. Nopa Raki, Mr. Gandhi Lavaki, Mr. John Kakas, Mrs. Philippa Darius, Mr. Alex Magun, Ms. Mary Norrie, Mr. James Namari, Ms. Kila Tau, Mr. Moses Hatagen Koran, Ms. Colette Modagai, Ms. Dorothy Marang, Mr. Dan Lyanda, Representatives from Embassy of Japan and JICA PNG Office, Mr. Akinori Ito, MPS, Mr. Chiko Yamaoka and other Project Experts

Steering Committee members for QUIS-ME Project

Mrs. Annemarie Kona, First Assistant Secretary - Chairperson, Mr. Steven Tandale - Assistant Secretary, CDD - Deputy, Chairperson, Ms. Hatsie Mirou, Mr. Paul Ainui, Mr. Gandhi Lavaki, Mr. John Kakas, Mrs. Philippa Darius, Mr. Alex Magun, Ms. Mary Norrie, Mr. James Namari, Ms. Kila Tau, Mr. Moses Hatagen Koran, Ms. Mary Phillips, Mr. Nopa Raki, Mr. Geoff Gibaru, Ms. Jean Taviri, Mr. Glen Benny, Mr. Akinori Ito, MPS, Mr. Chiko Yamaoka, Mr. Satoshi Kusaka, Mr. Ryuichi Sugiyama, Mr. Kenichi Jibutsu, Ms. Masako Tsuzuki, Dr. Kotaro Kijima and Representatives from Textbook writers and JICA PNG Office

Curriculum Panel

Mr. Steven Tandale, Assistant Secretary - Chairperson, Mr. Gandhi Lavaki, Mr. John Kakas, Mrs. Philippa Darius, Mr. Anda Apule, Mr. Alex Magun, Ms. Mary Norrie, Mr. Gilbert Ikupu, Mr. John Wek, Ms. Betty Bannah, Ms. Mirou Avosa, Mr. Rupuna Pikita and Ms. Clemencia Dimain

Editorial & Contents Supervisors

Prof / Dr. Masami Isoda, Mr. Satoshi Kusaka, Ms. Kyoko Kobayashi, Mr. Katsuaki Serizawa and Mr. Akinori Ito, MPS, Prof. Hiroki Ishizaka, Prof. Yoichi Maeda and Prof. Takeshi Sakai and Ms. Mary Norrie

Writers & Proofreaders (Curriculum Officers & Textbook writers - Math working group)

Ms. Mary Norrie - Math Working Group Leader, Mr. James Namari, Ms. Kila Tau, Mr. Anda Apule, Ms. Hilda Tapungu, Ms. Ileen Palan, Mr. Armstrong Rupa, Mr. Gibson Jack, Ms. Pisah Thomas and Ms. Michelle Pala

Chief Proofreader, Illustrators, Photos & Desktop Publishing

Ms. Clemencia Dimain (Chief Proofreader), Mr. Micheal John (Illustrator), Mr. David Gerega, Mr. Vitus Witnes (Graphic designers), Mr. Armstrong Rupa, Mr. Gibson Jack, Mr. Satoshi Kusaka, Ms. Yoshiko Osawa and Ms. Michiyo Ueda (Desktop Publishing), Mr. Chiko Yamaoka (Photographer) and Gakko Tosho Co.,Ltd. (Photos and illustrations)

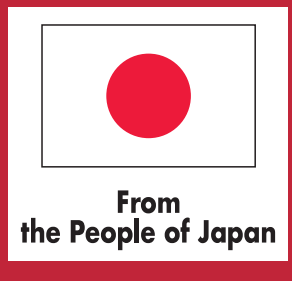
Validation Team (Math working group & Teachers from pilot schools)

Mr. James Namari, Ms. Kila Tau, Mr. Armstrong Rupa, Ms. Ileen Palan, Ms. Michelle Pala, Ms. Serah Robinson, Ms. Martha Dimsok, Mrs Anne Afaisa, Mrs. Magret Itoro, Mrs. Josephine Upas and Mr. Ricky Babona

Cooperation

Japan International Cooperation Agency (JICA), Department of National Planning & Monitoring (DNPM), Bank of PNG, Centre for Research on International Cooperation in Education Development (CRICED) - University of Tsukuba, Naruto University of Education, Gakko Tosho Co.,Ltd. , Gaire Primary School, Iobuna Kouba Primary School, Koki Primary School, Koiari Park Primary School, St. Therese Primary School, Sogeri Primary School and Tubuseria Primary School, South Pacific Post Ltd, QUIS-ME Project Staff; Ms. Rose Leveni, Mr. Samuel Masa, Ms. Angela Koso, Mr. Robert Silovo, Mr. Benstead Talania and Mr. Pascarl Sury

Department of Education
From the People of Japan
JICA
筑波大学 University of Tsukuba
国立大学法人 鳴門教育大学 Naruto University of Education
GAKKO TOSHO CO.,LTD.
IC Net Limited アイ・シー・ネット株式会社
PADECO


From
the People of Japan