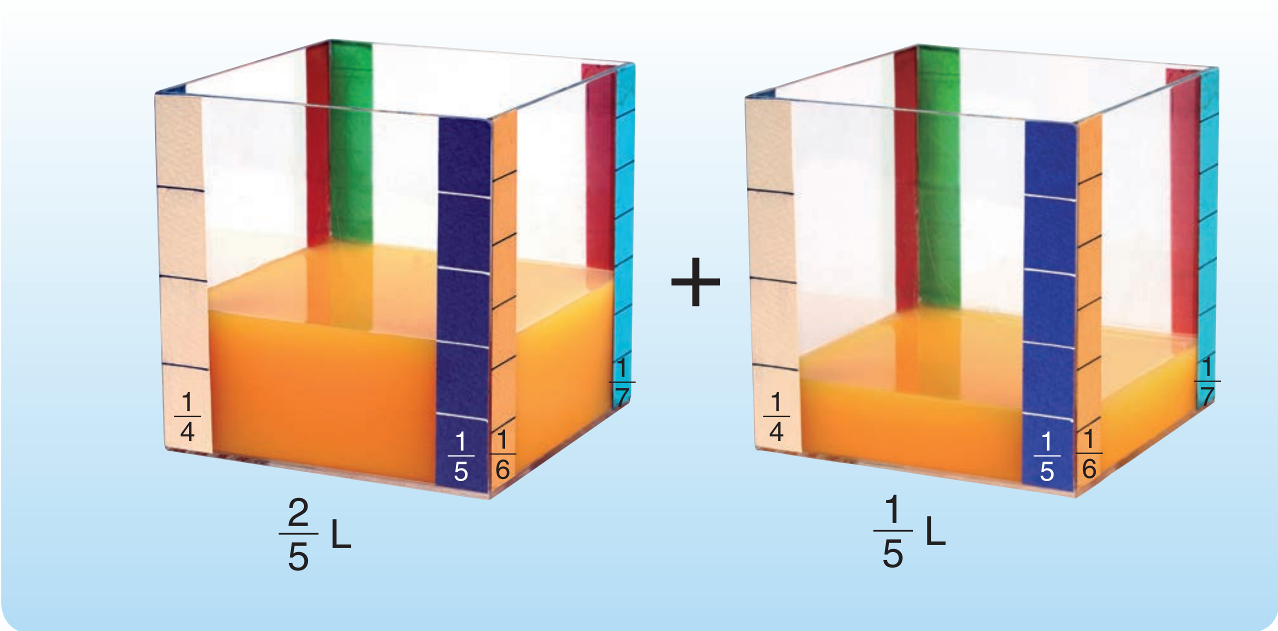
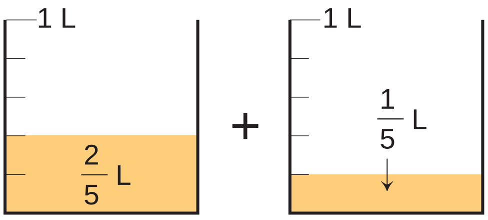
9 Addition and Subtraction of Fractions

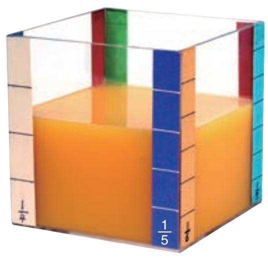
1 Addition of Fractions

1 There are $\frac{2}{5}$ L and $\frac{1}{5}$ L of orange juice in the containers.
How many litres are there altogether?

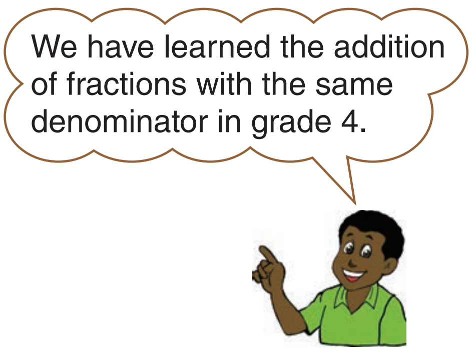


① Let's write a mathematical expression.



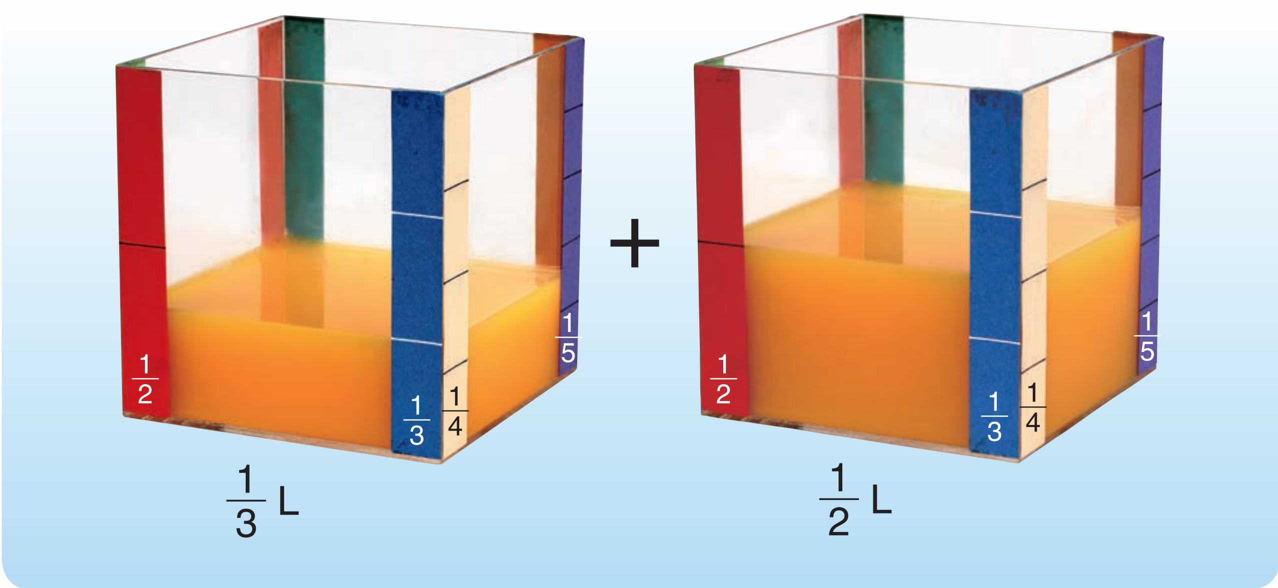


Expression:

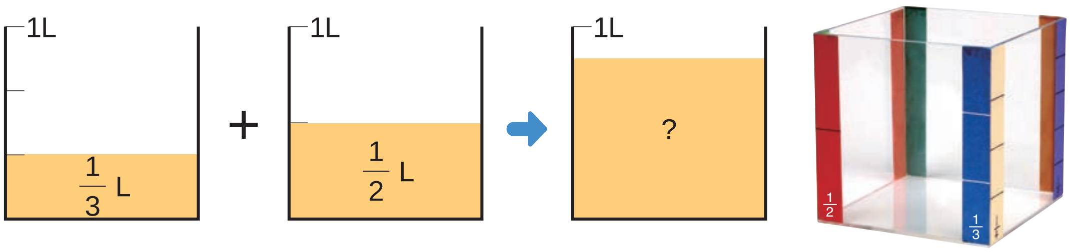


② Let's calculate.

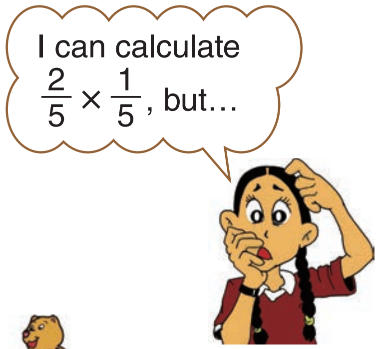
2 There are $\frac{1}{3}$ L and $\frac{1}{2}$ L of orange juice in the containers.
How many litres are there altogether?



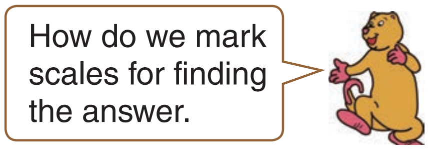
1 Write the mathematical expression.



Expression: ______

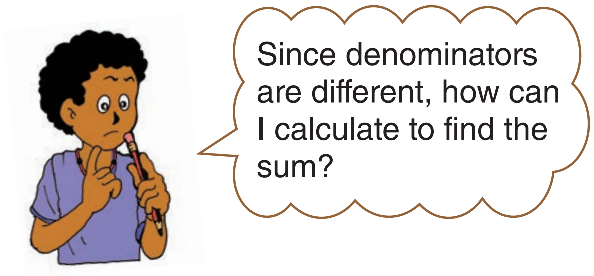


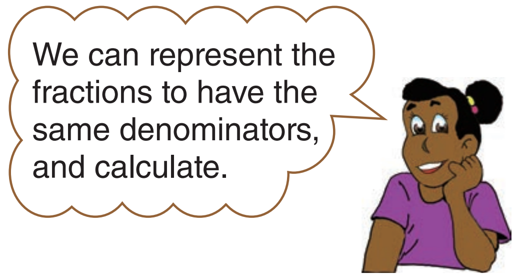
2 Let's think about how to calculate.



Let's think about how to add and subtract fractions with different denominators.

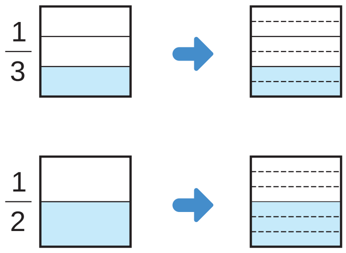
3 Let's explain how to calculate $\frac{1}{3} + \frac{1}{2}$ by using the following figure below.



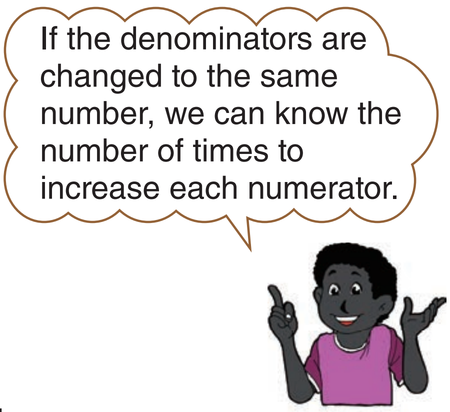


$$\frac{1}{3} + \frac{1}{2} = \frac{\square}{\square} + \frac{\square}{6}$$

$$= \square$$



For adding fractions with different denominators, we can calculate the answer by changing the representation of fractions to have the same denominator.



3 Let's think about how to calculate $\frac{1}{10} + \frac{1}{6}$.

$$\frac{3}{10} + \frac{1}{6} = \frac{\square}{\square} + \frac{\square}{\square}$$

$$= \frac{\square}{\square}$$

$$= \square$$

If the answer can be simplified, you should simplify it to its simplest fraction.

Exercise

① $\frac{2}{3} + \frac{1}{4}$ ② $\frac{1}{2} + \frac{1}{5}$ ③ $\frac{2}{5} + \frac{1}{6}$

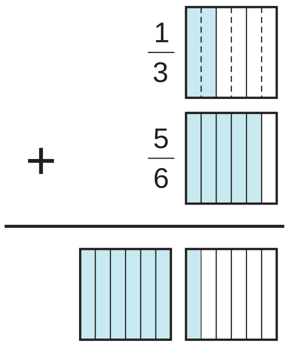
④ $\frac{1}{2} + \frac{1}{10}$ ⑤ $\frac{5}{12} + \frac{1}{3}$ ⑥ $\frac{1}{4} + \frac{3}{20}$

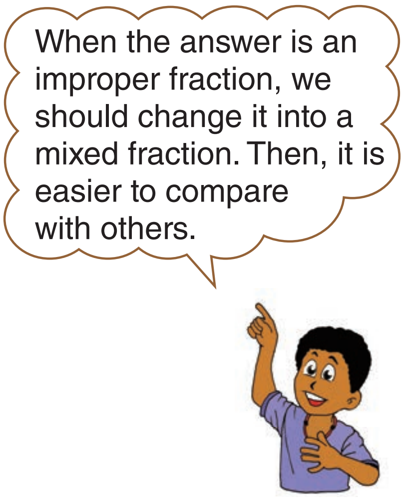
4 Let's think about how to calculate.

$$\frac{1}{3} + \frac{5}{6} = \frac{\square}{\square} + \frac{\square}{6}$$

$$= \frac{\square}{\square}$$

$$= \square$$





5 Put $1\frac{1}{3}$ g of goods into a $1\frac{2}{3}$ g box.

How many kilograms are there altogether?

1. Vavi thinks about how to calculate as follows.

   Let's explain how she calculate.

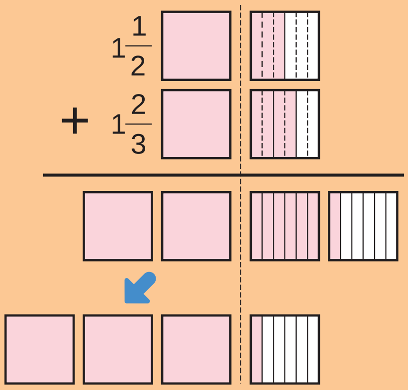
Vavi's Idea

Add the parts of whole numbers and parts of proper fractions, respectively.

$$1\frac{1}{2} + 1\frac{2}{3} = 1\frac{\square}{6} + 1\frac{\square}{6}$$

$$= \square\frac{\square}{6}$$

$$= \square\frac{\square}{6}$$



2. Kekeni first changed the mixed fractions into improper fractions, and then added them.

   Let's calculate the fractions by using Kekeni's idea.

Exercise

① $\frac{3}{8} + \frac{7}{10}$ ② $\frac{4}{5} + \frac{13}{15}$ ③ $\frac{11}{12} + \frac{1}{4}$

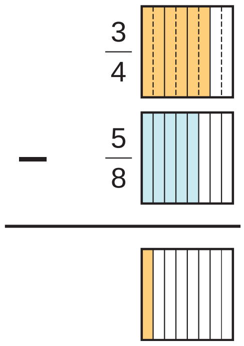
④ $1\frac{5}{6} + 1\frac{1}{2}$ ⑤ $2\frac{1}{6} + 1\frac{1}{2}$ ⑥ $1\frac{2}{3} + 2\frac{3}{4}$

1 Subtraction of Fractions

1 There are $\frac{3}{4}$ L of juice and $\frac{5}{8}$ L of milk.
What is the difference in Litres between the juice and milk.

① Find equivalent fractions and compare the volumes and then write an expression.

$\frac{3}{4} = \frac{\square}{\square}$ and then, $\frac{3}{4} \square \frac{5}{8}$



② Let's think about how to calculate.

$\frac{3}{4} - \frac{5}{8} = \frac{\square}{\square} - \frac{\square}{\square}$

$= \square$

We should change them to fractions with the same denominators.

To subtract fractions with different denominators, we can calculate by changing the representation of fractions to have the same denominator.

2 Let's think about how to calculate $\frac{5}{6} - \frac{3}{10}$.

$\frac{5}{6} - \frac{3}{10} = \frac{\square}{\square} - \frac{\square}{\square}$

$= \frac{\square}{\square}$

$= \square$

How is it different from **1**?

Exercise

① $\frac{6}{7} - \frac{3}{4}$　② $\frac{5}{8} - \frac{1}{4}$　③ $\frac{2}{3} - \frac{1}{6}$

④ $\frac{3}{4} - \frac{7}{10}$　⑤ $\frac{2}{5} - \frac{1}{15}$　⑥ $\frac{7}{15} - \frac{3}{10}$

3 Let's think about how to calculate $\frac{7}{5} - \frac{5}{6}$.

$$\frac{7}{5} - \frac{5}{6} = \frac{\square}{\square} - \frac{\square}{\square}$$

$$= \square$$

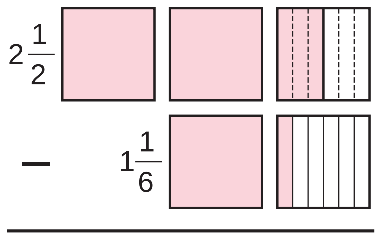
We can calculate "improper fractions minus proper fractions" in the same way.

4 Let's think about how to calculate $2\frac{1}{2} - 1\frac{1}{6}$.

$$2\frac{1}{2} - 1\frac{1}{6} = 2\frac{\square}{\square} - 1\frac{1}{6}$$

$$= \square\frac{\square}{\square}$$

$$= \square$$



5 Yamo has $2\frac{1}{2}$ L of juice. In a week she drank $1\frac{5}{6}$ L.
How much juice is left?

❶ Write an expression. ______________________

❷ Let's calculate.

I should change to improper fractions. What do you think?

Even if you reduced to mixed fractions, you cannot subtract $\frac{5}{6}$ from $\frac{3}{6}$.

Mero's Idea

Change mixed fractions into improper fractions.

$$2\frac{1}{2} = \frac{\square}{2}, \quad 1\frac{5}{6} = \frac{\square}{6}$$

Then, $2\frac{1}{2} - 1\frac{5}{6} = \frac{\square}{2} - \frac{\square}{6} = \frac{\square}{6} - \frac{\square}{6} = \frac{\square}{6}$

Now simplify it, $\frac{\square}{6} = \frac{\square}{\square}$

Ambai's Idea

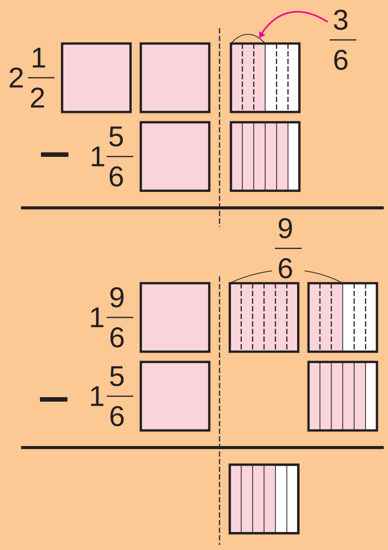
Calculate the parts of whole numbers and proper fractions, respectively.

$$2\frac{1}{2} - 1\frac{5}{6} = 2\frac{3}{6} - 1\frac{5}{6}$$

We cannot subtract $\frac{5}{6}$ from $\frac{3}{6}$,

Borrow 1 from 2. $2\frac{3}{6} = 1\frac{9}{6}$

$$1\frac{9}{6} + 1\frac{5}{6} = \frac{\square}{6} = \frac{\square}{\square}$$



Activity

Exercise

① $4\frac{7}{8} - 1\frac{1}{7}$ ② $7\frac{3}{4} - 2\frac{1}{6}$ ③ $5\frac{2}{3} - 2\frac{1}{6}$

④ $5\frac{1}{3} - 2\frac{3}{4}$ ⑤ $5\frac{1}{6} - 3\frac{9}{10}$ ⑥ $7\frac{1}{4} - 6\frac{11}{12}$

EXERCISE

1 Let's calculate.

Pages 122 to 128

① $\frac{2}{7}+\frac{1}{4}$ ② $\frac{3}{5}+\frac{4}{7}$ ③ $\frac{1}{4}+\frac{5}{6}$

④ $\frac{5}{6}+\frac{2}{3}$ ⑤ $1\frac{3}{8}+1\frac{1}{2}$ ⑥ $2\frac{5}{6}+4\frac{9}{14}$

⑦ $\frac{7}{9}-\frac{1}{6}$ ⑧ $\frac{11}{12}-\frac{7}{8}$ ⑨ $\frac{8}{7}-\frac{3}{4}$

⑩ $\frac{4}{3}-\frac{1}{4}$ ⑪ $6\frac{5}{7}-2\frac{2}{5}$ ⑫ $3\frac{3}{4}-1\frac{5}{6}$

2 Laka has $\frac{3}{4}$ m rope. Ani has $\frac{4}{5}$ m rope.

Pages 123 to 125

① Which is longer and by how many metres?

② What is the total length when you put the two ropes together?

3 Is the following calculation correct? If it is wrong, explain why?

Pages 123 to 125

$$\frac{1}{3}+\frac{2}{5}=\frac{3}{8}$$

Grade 5

Do you remember?

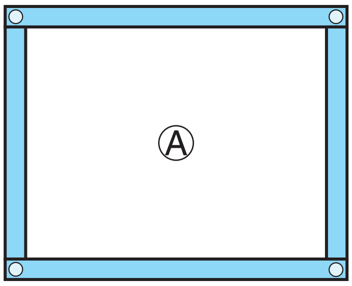
Let's calculate.

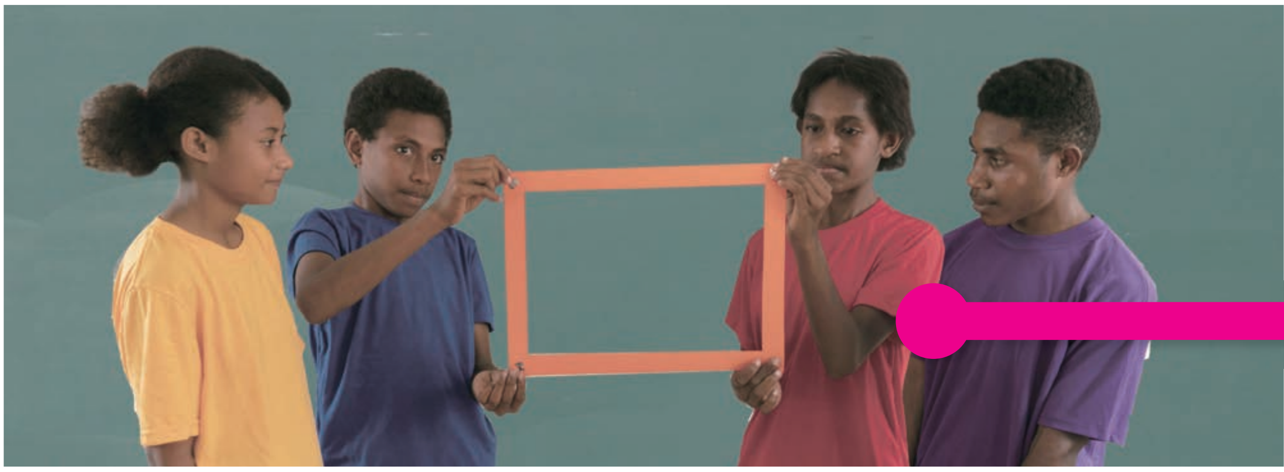
① 4.9×1.3 ② 3.4×0.7 ③ 0.7×0.4 ④ 3.01×4.2

⑤ 24÷1.2 ⑥ 3.3÷5.5 ⑦ 2.45÷0.7 ⑧ 3.25÷1.3

10 Area of Figures

Lora made a frame out of cardboard as shown on the right.
The frame can change freely by moving.
Let's think about the area of quadrilaterals made by the frame.

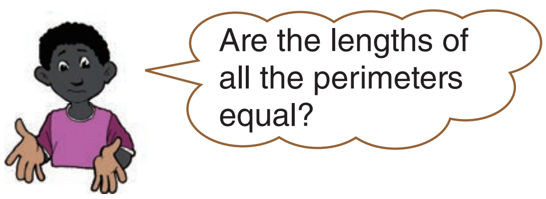


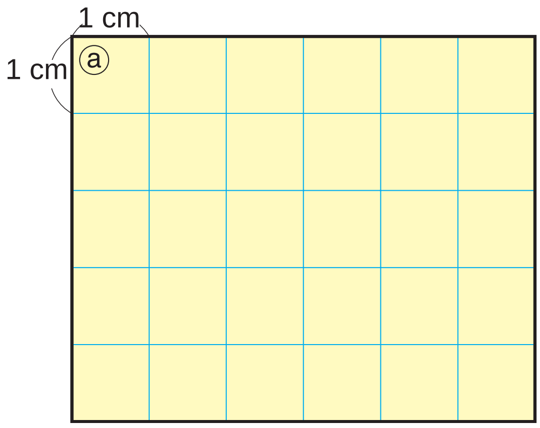


1 Area of Parallelogram

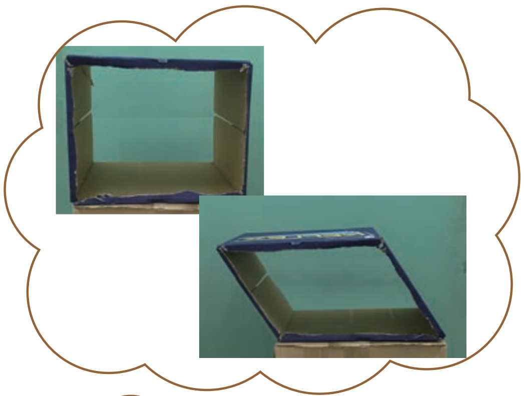
1 There are quadrilaterals ⓐ, ⓑ and ⓒ.

① Let's measure the length of all sides of quadrilaterals respectively.

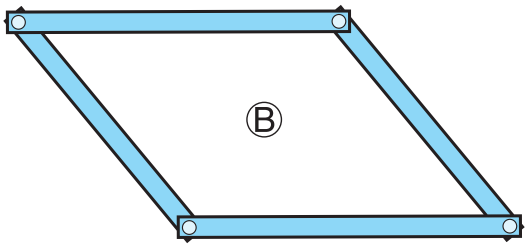




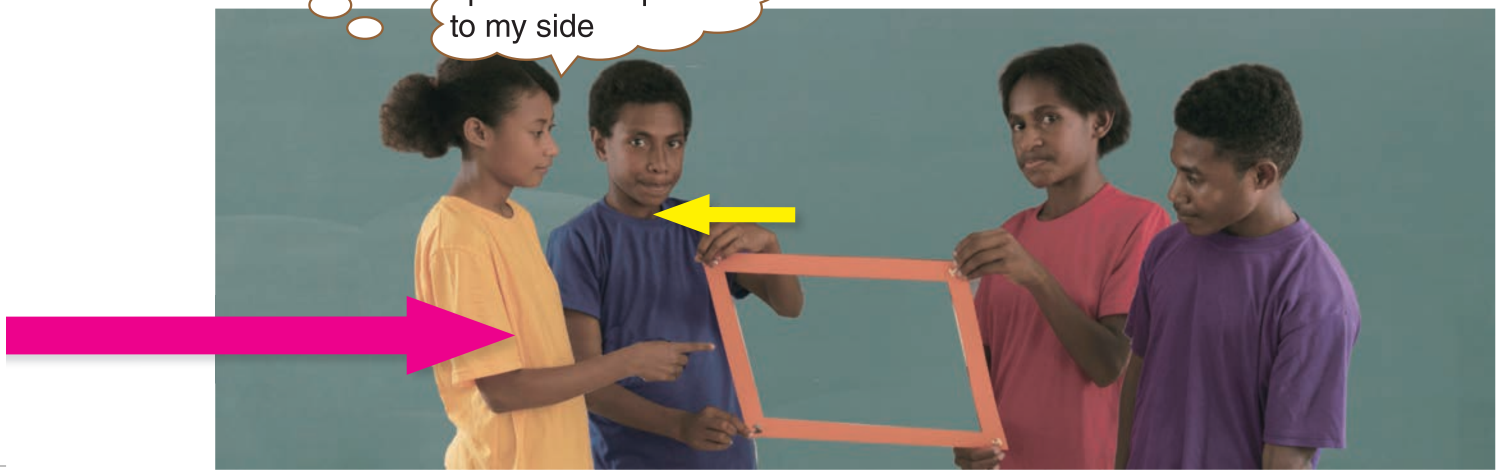
② Let's compare the areas of all quadrilaterals ⓐ, ⓑ and ⓒ.



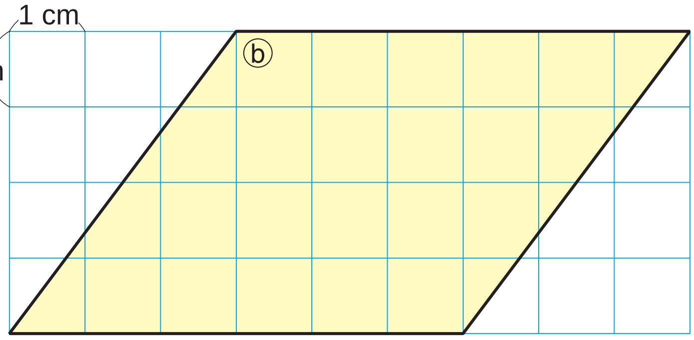
Which shape has the larger area of quadrilaterals Ⓐ or Ⓑ?

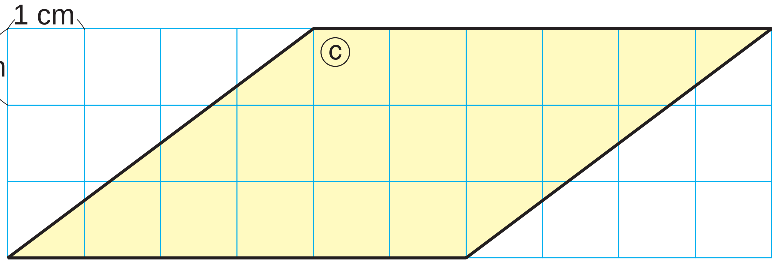


I pulled the top corner to my side



What does the area of a parallelogram depend on?





3 Let's think about how to calculate the area of each parallelogram.

Activity

Let's think about how to find the area of triangles and parallelograms.

Vavi's Idea

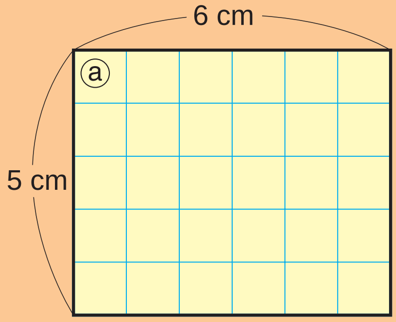
Since ⓐ is a rectangle, the area is calculated by the formula.

Area of ⓐ = length × width

= ☐ × ☐

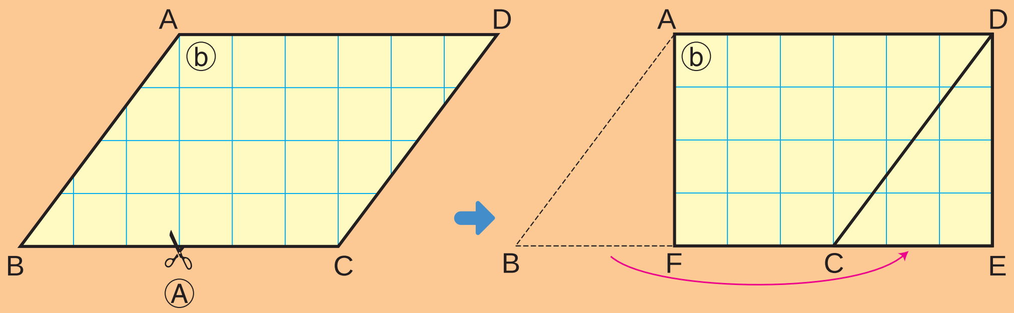
= ☐

Answer ☐ cm^2



Naiko's Idea

If we change a parallelogram into a rectangle,we can calculate.



The area of the parallelogram ABCD is the same as the area of rectangle AFED.

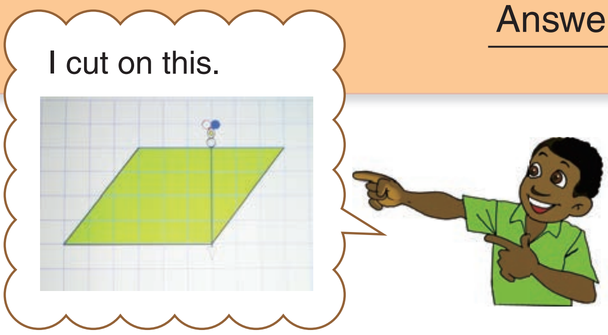
The area of parallelogram ⓑ = the area of rectangle AFED

= AF × FE

= ☐ × ☐

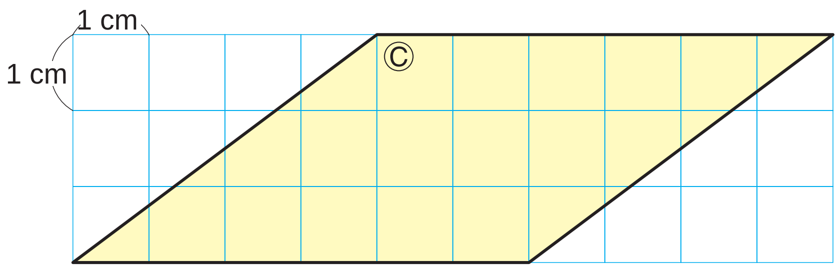
= ☐

Answer ☐ cm^2

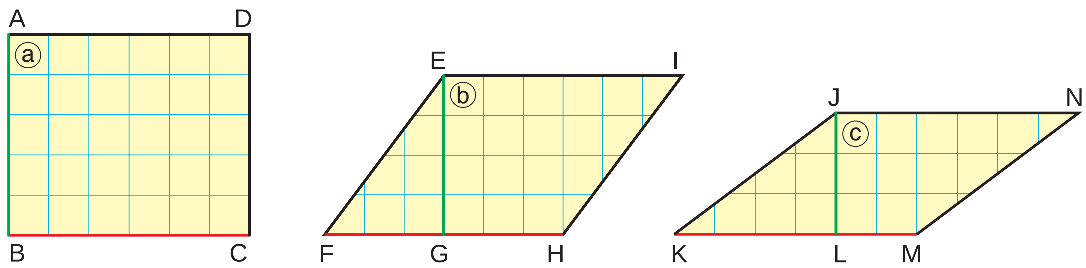


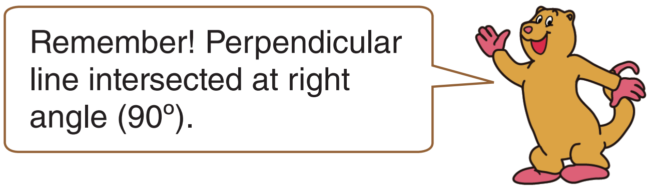
Activity

4 Check the lengths of the parallelogram used in ⓒ to find the height and the area.

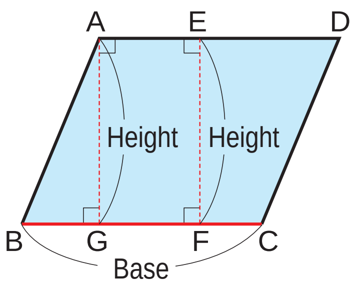


5 Which lengths do you use to find the area of quadrilaterals ⓐ, ⓑ and ⓒ?



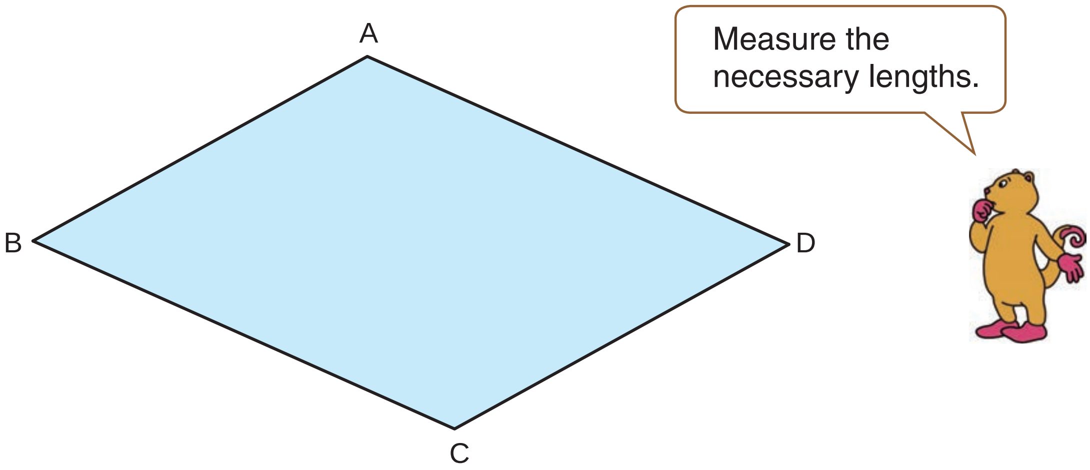


Mark one side of a parallelogram the **base**.
Lines AG, EF and other lines, which are perpendicular to base BC, are all the same length.
The length of these line are called **height** against the base BC.



The area of parallelogram = base × height

2 Let's find the area of the parallelogram below.



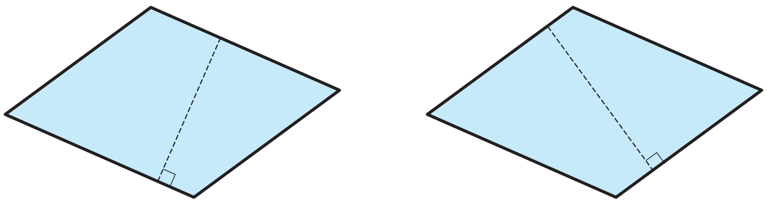
1. When side BC is the base, find the area by measuring the height.

   Area = ☐ × ☐ = ☐ (cm²)

2. When side CD is the base, find the area by measuring the height.

   Area = ☐ × ☐ = ☐ (cm²)

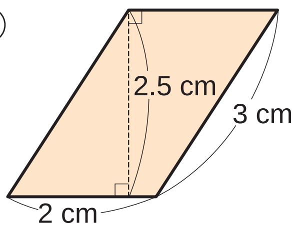
The height depends on the base.



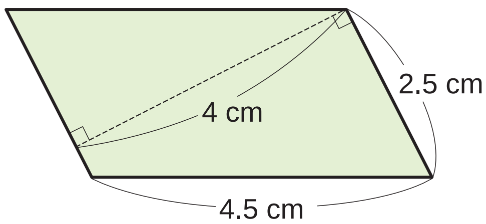
Exercise

Let's find the area of the following parallelograms.

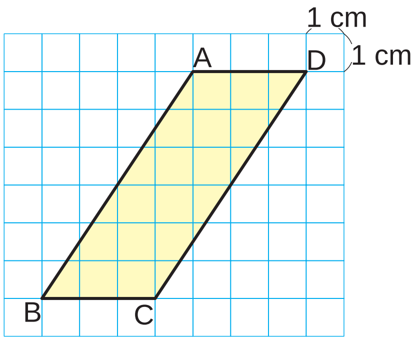
①



②

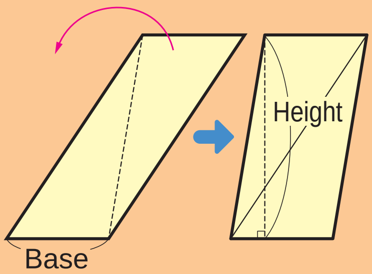


1 Let's think about how to find the perpendicular height of the parallelogram with side BC as the base.

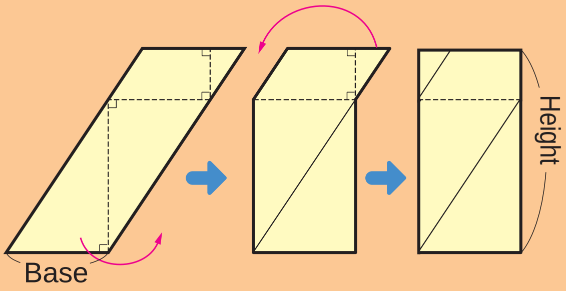


1 Explain how to find the perpendicular height by looking at the figures below.

Sare's Idea

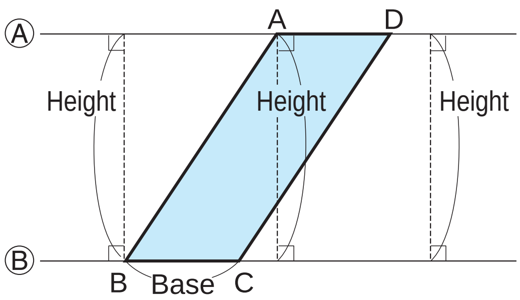


Kekeni's Idea

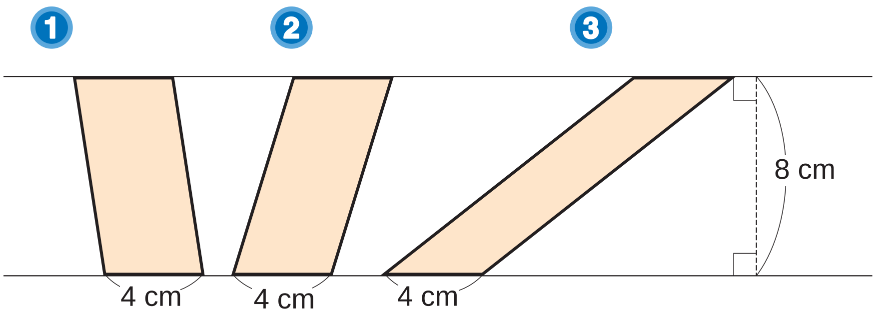


2 What is the area of the parallelogram in cm^2?

When side BC is the base, the distance between lines Ⓐ and Ⓑ is the height of parallelogram ABCD.

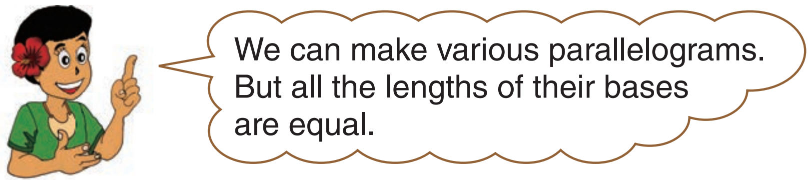


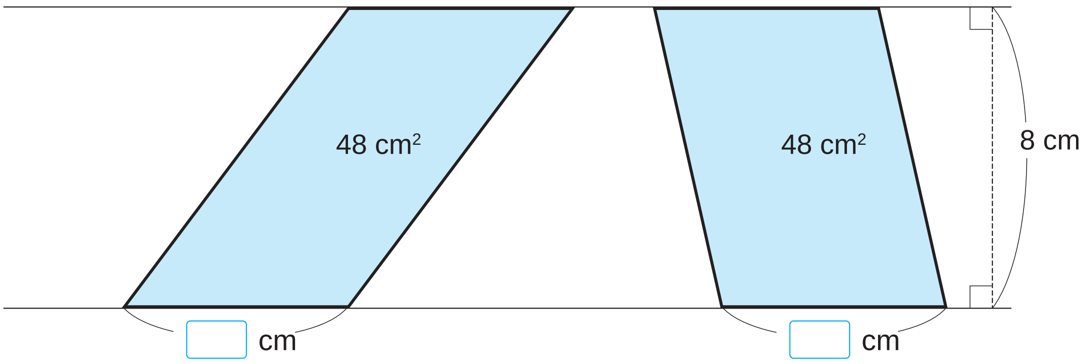
4 Let's find the area of each parallelogram below.



If the lengths of bases and heights of parallelograms are equal, their areas are also equal.

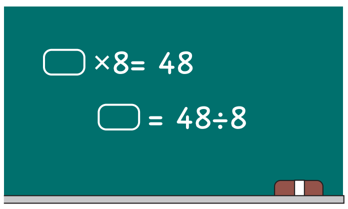
5 We want to make a parallelogram with an area of 48 cm^2 and a height of 8 cm. How long should be the base in cm?





Let's think about how to find the base by using the formula for the area of parallelogram.

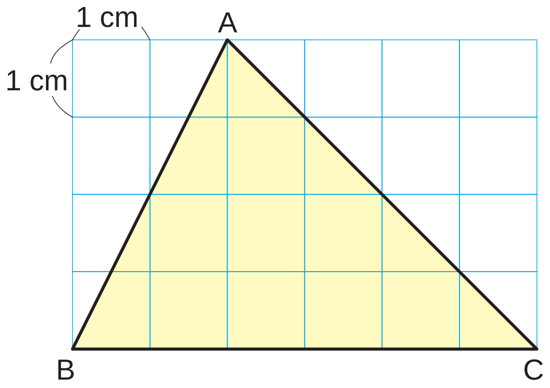
☐ × 8 = 48
(Base) (Height) (Area)

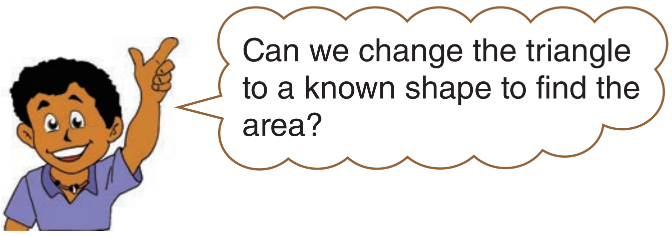


2 Area of Triangles

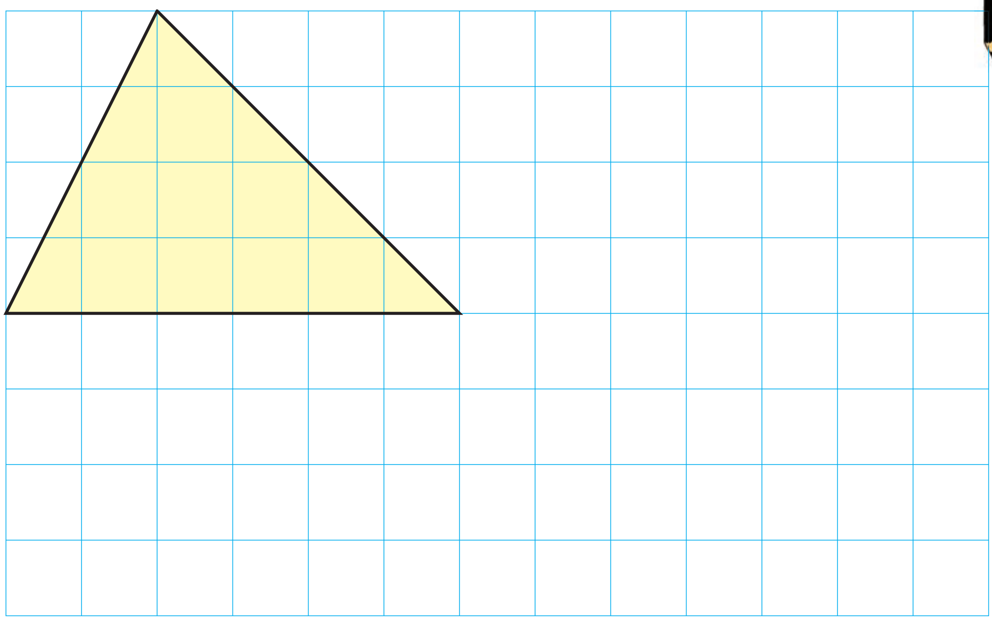
1 Let's find the area of the triangle below.

① Let's think about how to find the area.



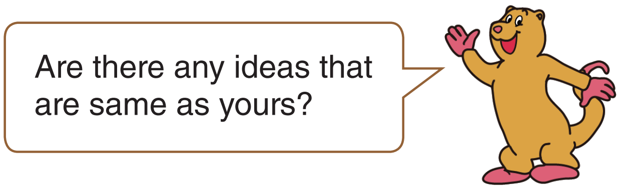


Write down your idea.

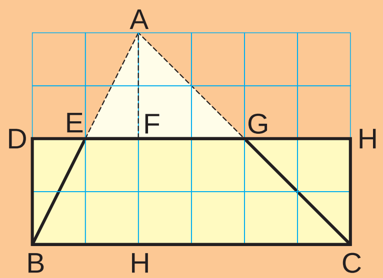


Activity

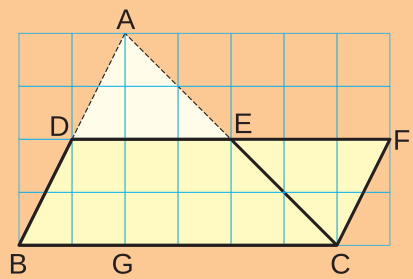
❷ Explain the ideas of the 4 children.



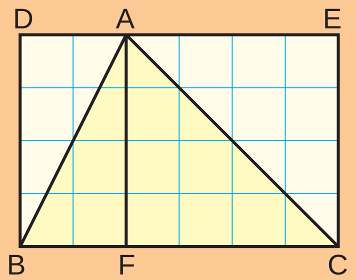
Ambai's Idea



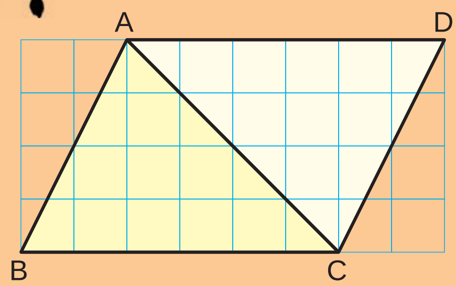
Gawi's Idea



Naiko's Idea



Kekeni's Idea



❸ Which of the ideas of the 4 children in ❷ are similar or different?

Ⓐ Whose idea changes the triangle into a rectangle?

Ⓑ Whose idea changes the triangle into a parallelogram?

Ⓒ Whose idea changes the triangle into another figure with the same area?

Ⓓ Whose idea changes the triangle into another figure with 2 times its area?

4. Look at the ideas that change the triangle into a rectangle or a parallelogram and find the sides that have the same length as in the original triangle.
5. Think about how to find the area of a triangle.

Ambai's Idea

Since the length of the rectangle is half of AH,
$(AH \div 2) \times BC$

Gawi's Idea

Since the height of the parallelogram is half of AG,
$Base \times (AG \div 2)$

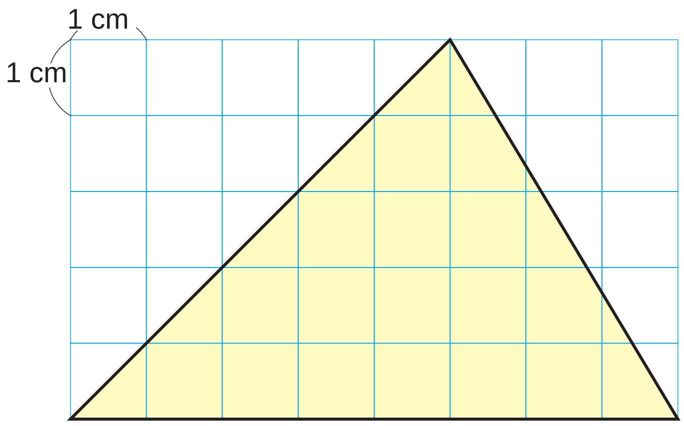
Naiko's Idea

Since the area of the triangle is half of the area of rectangle DBCE and the length of the rectangle is AF,
$(AF \times BC) \div 2$

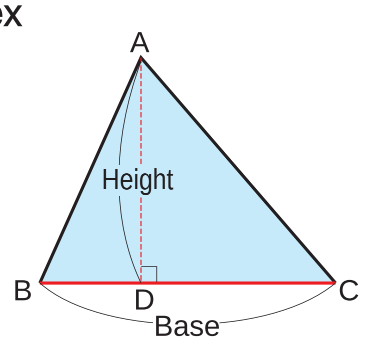
Kekeni's Idea

The area is half of the area of parallelogram ABCD,
$Base \times Height \div 2$

2 Measure the lengths needed to find the area of the triangle below and then calculate the area.

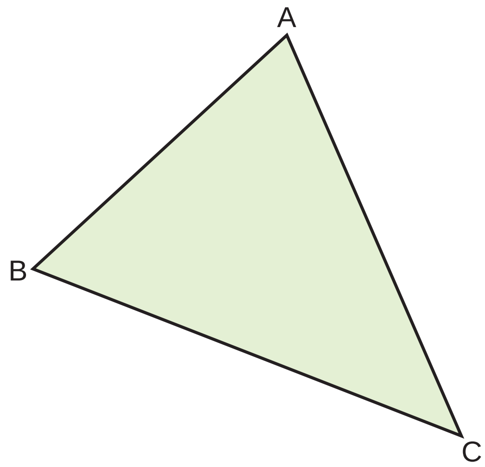


Draw a perpendicular line AD from the vertex A to the opposite side BC of the triangle. Side BC is called the base and line AD is called the **height** of the triangle.



Area of triangle = (base × height) ÷ 2

3 Let's find the area of the triangle below by measuring the necessary lengths.



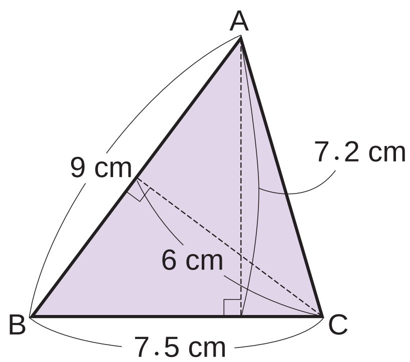
When each of the 3 sides is the base, what are the heights of the triangles, respectively?

Exercise

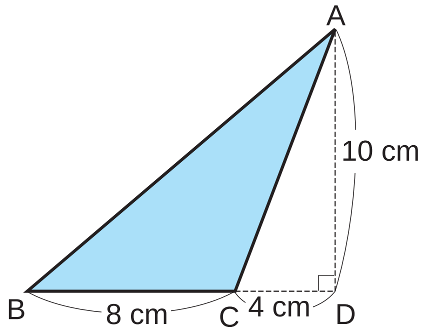
Let's find the area of triangle, as follows:

① when side BC is the base.

② when side AB is the base.

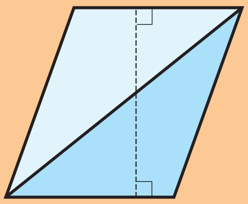


4 Let's think about how to find the area of a triangle with side BC as the base on the right.

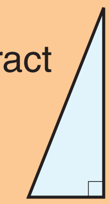
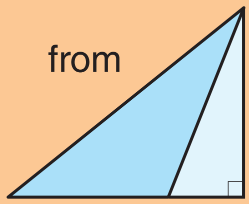


1 Explain Sare's and Yamo's ideas.

Sare's Idea

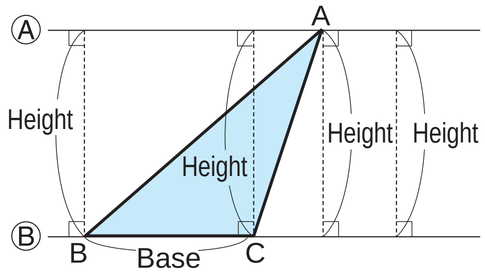


Yamo's Idea

Subtract  from 

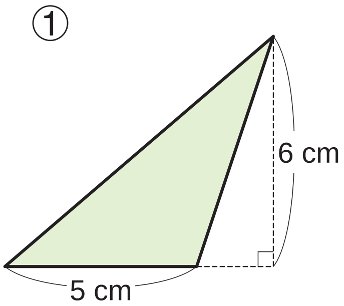
2 Find the area of triangle that has a base of 8 cm and a height of 10 cm by using the area formula and then compare with the result obtained in **1**.

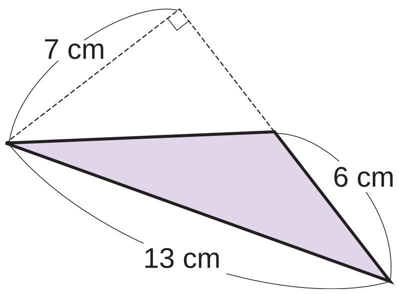
Draw a straight line Ⓐ through vertex A and parallel to side BC. The distance between line Ⓐ and line Ⓑ is the height of the triangle when side BC is the base.



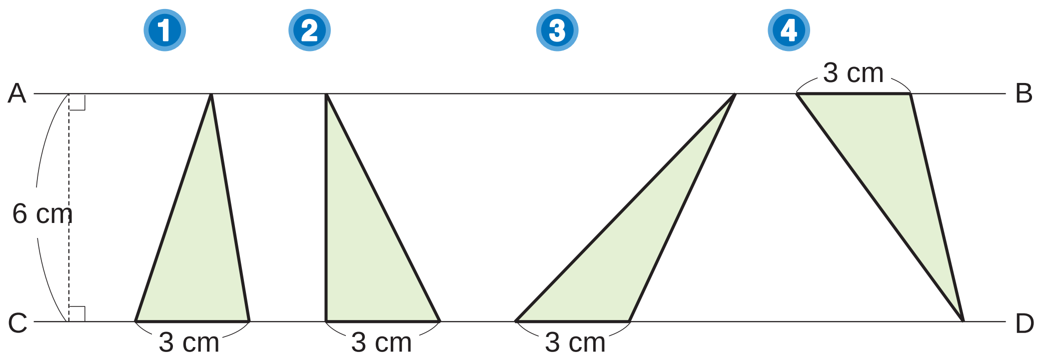
Exercise

Let's find the area of these triangles.

① 

② 

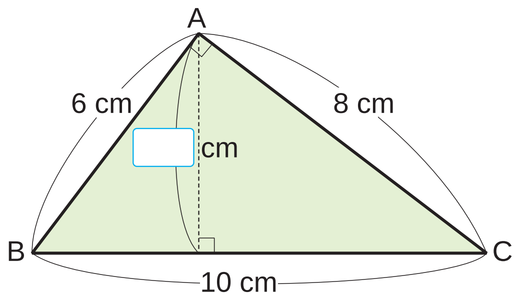
5 In the figure below, straight lines AB and CD are parallel.
Let's find the area of each triangles below.



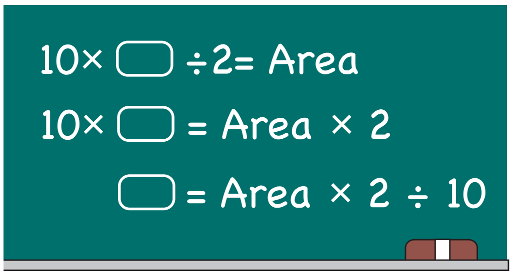
If the lengths of bases and heights of triangles are equal, their areas are equal.

6 The figure on the right is a right angle triangle.

1. Let's find the area.
2. When side BC is the base, calculate the height of the triangle.

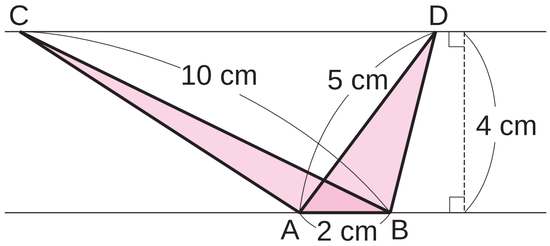


10 × ☐ ÷ 2 = Area
(Base: 10; Height: ☐)



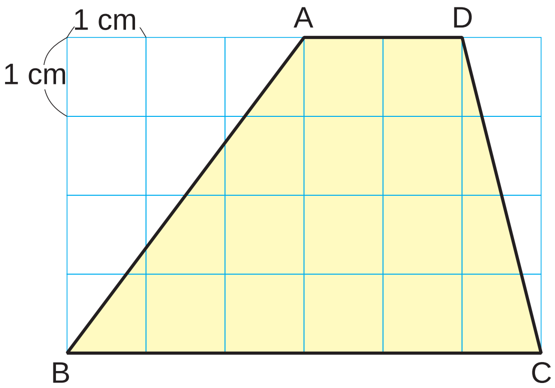
Exercise

Let's find the area of these triangles when sides AD and BC are the base, respectively.



3 Area of Trapezoids

1 Let's think about how to find the area of the trapezoid below.



What known shapes can be used to find the area?

Vavi's Idea

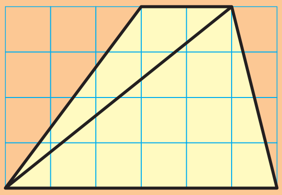
I changed a trapezoid into a parallelogram.

How does she think after that? Let's explain Vavi's idea using expressions and figures.

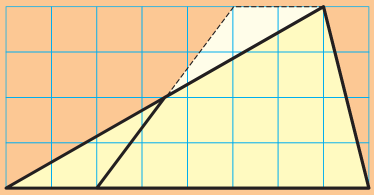
Activity

1. Let's explain the ideas of the 4 friends below and write expression to find the area.

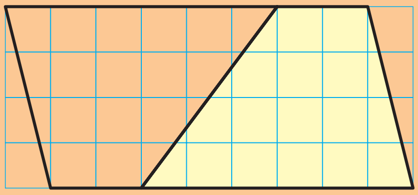
Ambai's Idea



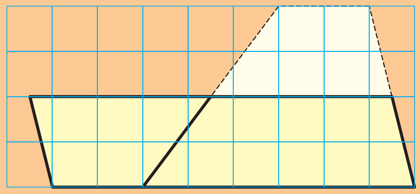
Gawi's Idea



Sare's Idea



Yamo's Idea



Activity

2. Discuss how the ideas of 4 friends are similar or different.

3. Let's think about a formula to find the area of the trapezoid using the ideas in 1.

Mero's Idea

Using the area formula of triangle,

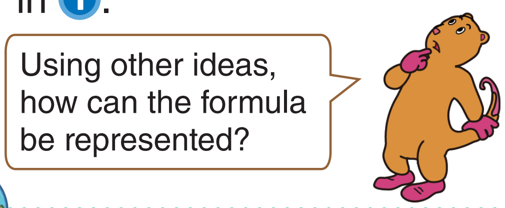
Base × Height ÷ 2

↓ ↓ ↓

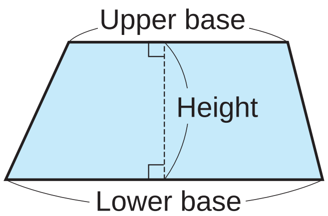
(2 + 6) × ☐ ÷ 2

↓ ↓ ↓ ↓

(lower side + upper side) × Height ÷ 2



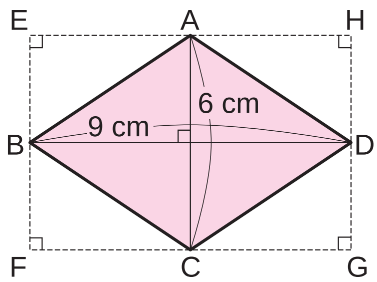
The 2 parallel sides of trapezoid are called the **upper base** and the **lower base**, the distance between their sides is called the **height**.



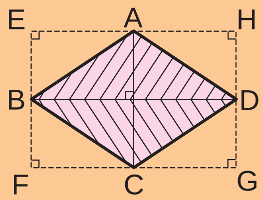
Area of trapezoid = (upper base + lower base) × height ÷ 2

4 Area of Rhombuses

1 Let's think about how to find the area of a rhombus.

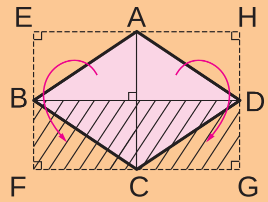


Gawi's Idea



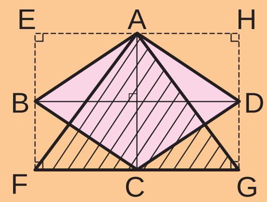
Divide a rhombus into 2 triangles,
$9\times(6\div2)\div2\times2$
Area of triangle

Kekeni's Idea



Change a rhombus into the rectangle, since the area can be calculate by length × width,
$(6\div2)\times9$

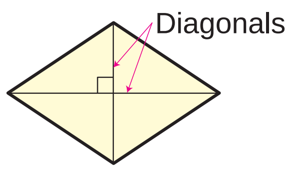
Naiko's Idea



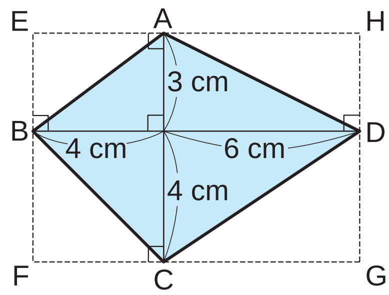
Change a rhombus into the triangle, since the base is FG and the height is AC,
$9\times6\div2$

The area of rhombus can be found by using the length of 2 diagonals.

Area of rhombus = (diagonal × diagonal) ÷ 2

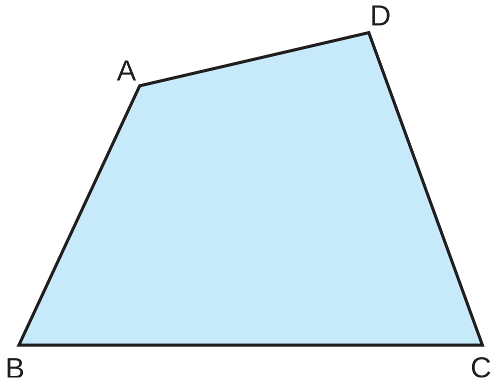


2 Let's think about how to find a quadrilateral with diagonals that have a perpendicular intersection, as shown on the right.



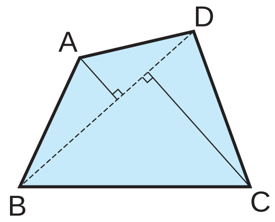
5 Think About How to Find the Area

1 How can we find the area of the quadrilateral as shown on the right?



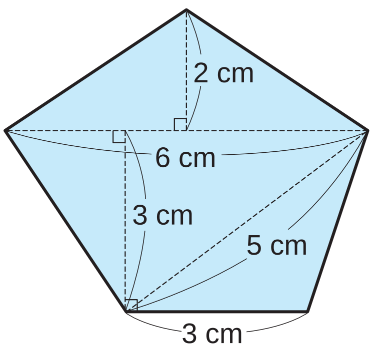
Let's find the area by measuring the necessary lengths.

The area of quadrilaterals and pentagons can be found by dividing into several triangles.

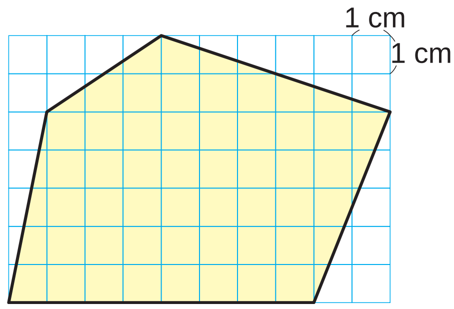


2 Let's find the area of pentagons below.

①



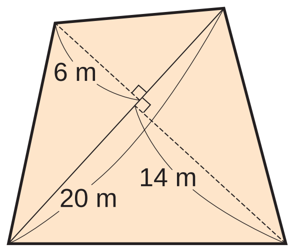
②



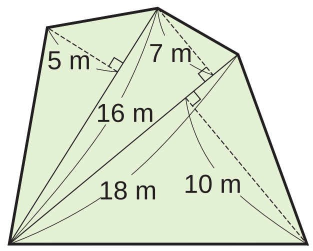
Exercise

Let's find the area of a quadrilateral and a pentagon as shown on the right.

①



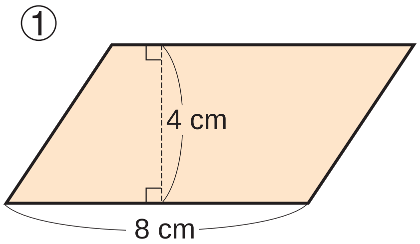
②

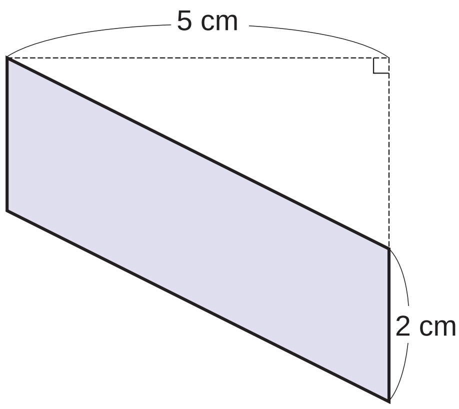


EXERCISE

1 Let's find the area of these parallelograms.

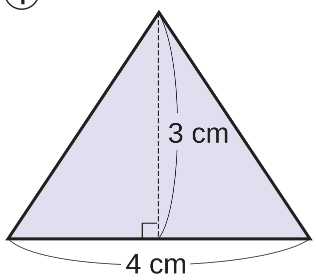
Pages 130 to 136

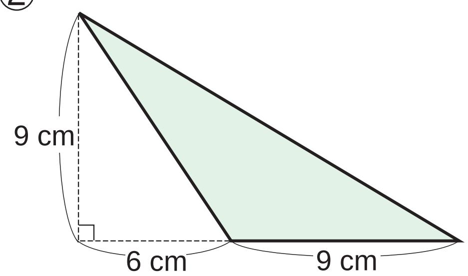
① 

② 

2 Let's find the area of these triangles.

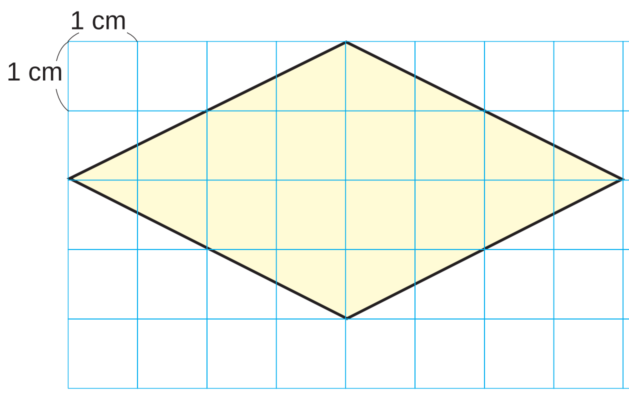
Pages 137 to 142

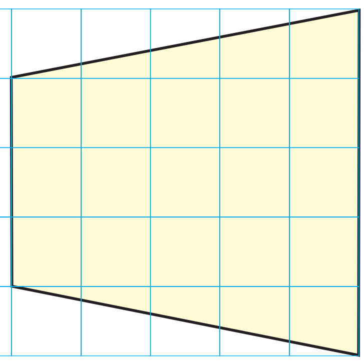
① 

② 

3 Let's find the area of these figures.

Pages 143 to 146

① 

② 

Grade 4 Do you remember?

Let's calculate.

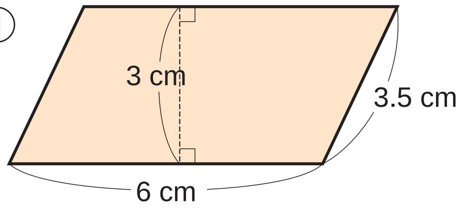
① 32 ÷ 2	② 48 ÷ 4	③ 60 ÷ 15	④ 84 ÷ 21
⑤ 258 ÷ 3	⑥ 624 ÷ 4	⑦ 306 ÷ 17	⑧ 837 ÷ 31

PROBLEMS

1 Let's find the area of these shapes.

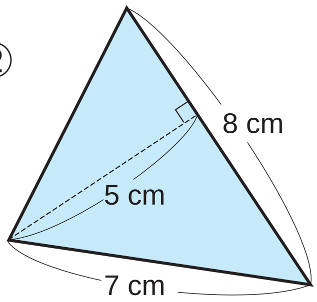
● Finding the base and the height, and using formula.

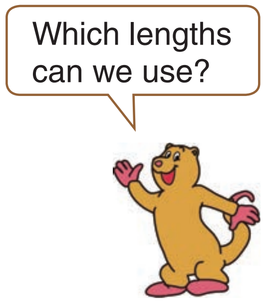
①



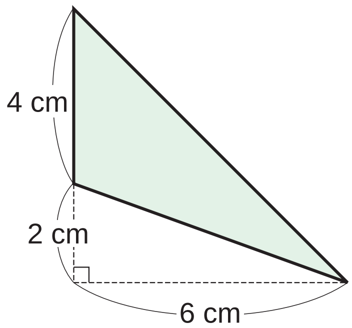
Parallelogram

②

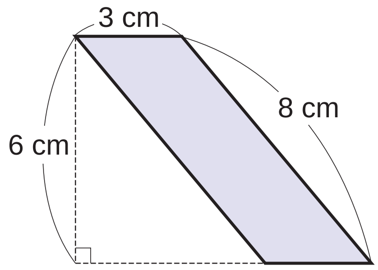




③



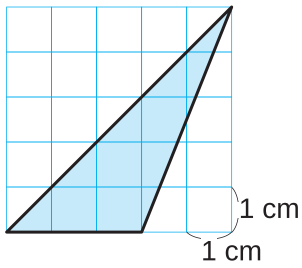
④



Parallelogram

2 Let's draw a triangle with an area same as the area of the triangle on the right and explain the reason why they are equal.

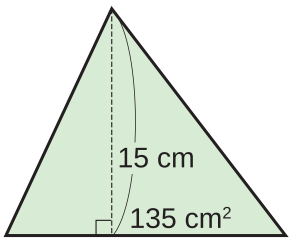
● Drawing a triangle with the same area.



3 The triangle on the right has a height of 15 cm and an area of 135 cm².

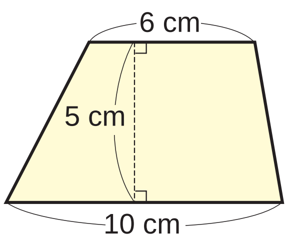
How many cm long is the base?

● Finding the height or the base when the area is given.

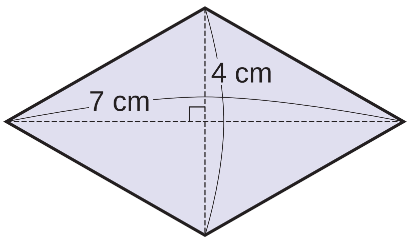


4 Let's find the area of these shapes.

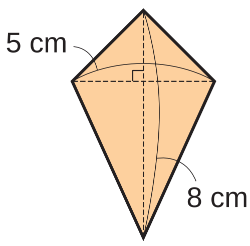
● Finding the area.



Trapezoid



Rhombus



Mathematics Practices in Papua New Guinea

Topic 3: Traditional Measuring System

In the past, people had no idea what the Metric System was. They did not use modern means of measurement such as rulers or tape measures to measure distances, watches or clock to measure time and scale or balances to measure weights. In traditional mathematics, people used simple materials. Nature and their body parts to measure distances or length, time and mass. To measure time they used the sun by reading their shadow, the chickens crowing and the sounds of birds. They also used bush ropes to tie knots which represented the days or months. When measuring distances or length they used ropes, arm length and pacing. Pacing was very useful when building houses. They measured the weight of something by lifting and comparing with another thing which is heavy or light. There weren't any units used for length, time and mass. All these means of measurement in traditional mathematics were simple and without cost.

Sticks used to measure area.

Traditional ropes used in making bilums.

Although the metric system was introduced recently in our societies, people still value and use these traditional measuring systems. The application of the skills and knowledge are passed on to the next generation for use. The skills involved develops the ability of a person to make good estimations in calculations.

Let's think of other ways to measure in which your people used in the past.

Share what your people used in the past with your friends.

Source: Ethnomathematical Lessons for PNG by Mathematics students of UPNG-Goroka campus, 1993.

11 Multiplication and Division of Fractions

1 Operation of Fractions × Whole Numbers

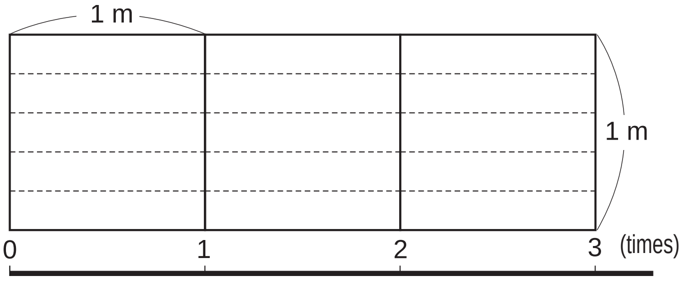
1 Flowerbeds are sprinkled with a bucket of water. When we use a large bucket, we can sprinkle 2 m² for each time. When we use a small bucket, we can sprinkle $\frac{2}{5}$ m² for each time.

Area (m²)	2	?
Number of sprinkles(times)	1	3

(×3 → ×3)

① If we sprinkle three times with a large bucket, what m² can we sprinkle water?
Write an expression and find the number.

② If we sprinkle three times with the small bucket, how many m² can we get? Let's colour in the figure below.



Area (m²)	$\frac{2}{5}$	?
Number of sprinkles (times)	1	3

(×3 → ×3)

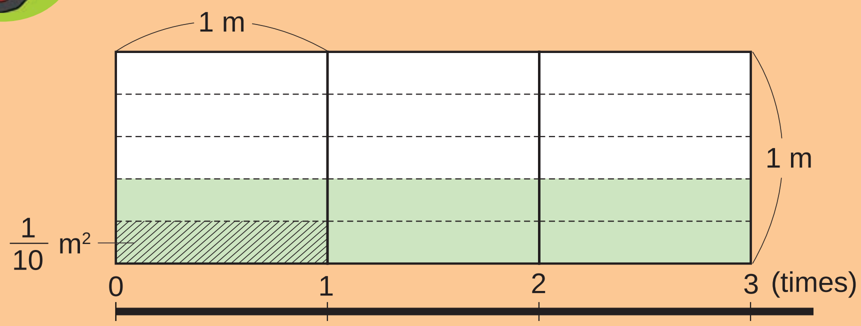
③ Let's write an expression of ②. [ ]

④ Let's think about how to calculate.

Activity

Let's think about situations where you multiply fraction by a whole number and how to calculate it.

Sare's Idea



$\frac{2}{5}$ m² is 2 sets of $\frac{1}{5}$ m². $\frac{2}{5}\times 3$ is 3 sets of $\frac{2}{5}$ m².

So, $\frac{2}{5}\times 3$ is (2×3) sets of $\frac{1}{5}$. $\frac{2}{5}\times 3=\frac{2\times 3}{5}=\square$.

Yamo's Idea

Represent this fraction by division,

we get $\frac{2}{5}=2\div 5$.

$$\frac{2}{5}\times 3=(2\div 5)\times 3$$
$$=(2\times 3)\div 5$$

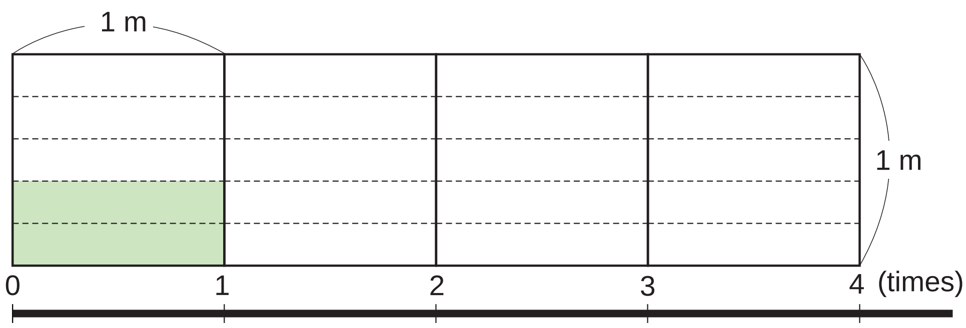
Represent this expression as one fraction,

we get $\frac{2}{5}\times 3=\frac{2\times 3}{5}=\square$.

$(2\div 5)\times 3=0.4\times 3=1.2$
$(2\times 3)\div 5=6\div 5=1.2$
so, the $\div 5$ and $\times 3$ part can be switched.

Activity

2 Sprinkling 4 times with the small bucket in **1**, how many m² can you water? Let's write an expression and calculate.



When we multiply a proper fraction by a whole number, multiply the numerator by the whole number and leave the denominator as it is.

$$\frac{▲}{●} \times ■ = \frac{▲ \times ■}{●}$$

3 Let's compare method Ⓐ with Ⓑ for calculating $\frac{2}{9} \times 3$.

Ⓐ $\frac{2}{9} \times 3 = \frac{2 \times 3}{9}$

$= \frac{\cancel{6}^{2}}{\cancel{9}_{3}}$

$= \square$

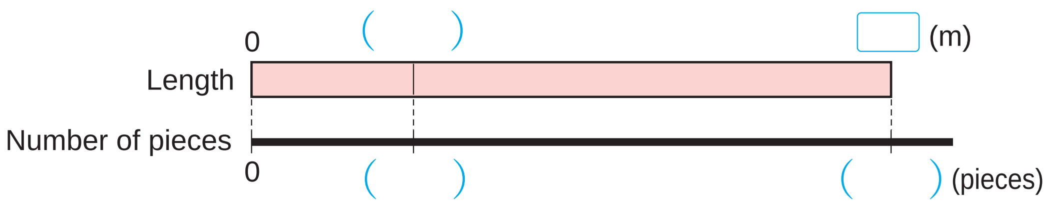
Ⓑ $\frac{2}{9} \times 3 = \frac{2 \times \cancel{3}^{1}}{\cancel{9}_{3}}$

$= \square$

The calculation will be simpler if you simplify the fraction as you calculate.

4 We make 4 pieces of rope that are $\frac{7}{5}$ m long each.
What is the total length of the 4 pieces of ropes?

❶ The diagram below shows this problem situation.
Fill in the (   ) with a number.



❷ Let's calculate the length of the rope.

Exercise

① $\frac{2}{5} \times 2$ ② $\frac{5}{3} \times 4$ ③ $\frac{3}{8} \times 2$ ④ $\frac{7}{6} \times 4$

5 We make 4 pieces of rope that are $1\frac{2}{5}$ m long each. What is the total length of the 4 pieces of rope?

1. Write an expression to find the total length of the rope.
2. Approximately how long is the length of the 4 pieces of rope?
3. Let's think about how to calculate.

Length (m)	$1\frac{2}{5}$	?
Number of pieces	1	4

(×4 from $1\frac{2}{5}$ to ?; ×4 from 1 to 4)

Gawi's Idea

Calculate by splitting $1\frac{2}{5}$ into 1 and $\frac{2}{5}$.

$$1\frac{2}{5}\times 4 \left\langle \begin{array}{l} 1\times 4 \\ \frac{2}{5}\times 4 \end{array} \right\rangle \square\frac{\square}{\square}$$

$$= \square\frac{\square}{\square}$$

Kekeni's Idea

Calculate by changing $1\frac{2}{5}$ into an improper fraction.

$$1\frac{2}{5}\times 4 = \frac{7}{5}\times 4$$

$$= \square$$

$$= \square\frac{\square}{\square}$$

It's easy to estimate the approximate value in Gawi's idea.

To represent mixed fraction is simpler to understand the size.

When multiplying a mixed fraction by a whole number, you can calculate as same as proper fraction × whole number by changing mixed fractions to improper fractions.

Exercise

① $1\frac{3}{7}\times 2$ ② $1\frac{5}{8}\times 4$ ③ $2\frac{2}{3}\times 15$ ④ $2\frac{5}{6}\times 12$

2 Operation of Fractions ÷ Whole Numbers

1 When sprinkling flowerbeds with a bucket of water, some buckets can sprinkle ☐ m² two times.
How many m² can these buckets sprinkle at once?

① Complete the problem by filling in the ☐.

It is easy if it is an even whole number. For example, if it is 4 m² you can calculate 4÷2.

I can also calculate 0.8 m² easily by 0.8÷2.

Can we calculate in the case of fractions? If it is $\frac{4}{5}$ m², what happens?

② When ☐ is $\frac{4}{5}$ m², write an expression.

☐

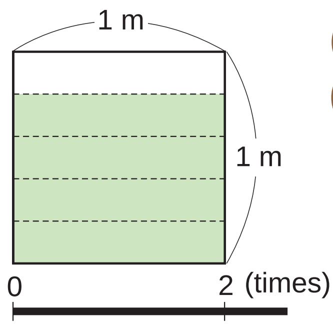
÷2

Area (m²)	?	$\frac{4}{5}$
Number of sprinkles (times)	1	2

÷2

③ Let's think about how to calculate.

Can we calculate the expression by following the rule of division.



How many $\frac{1}{5}$ are in the diagram?

We can calculate the expression in the same method as multiplying fractions.

Activity

Phrase

"For example, ~"

When we express a general idea concretely, we use it.

Ambai's Idea

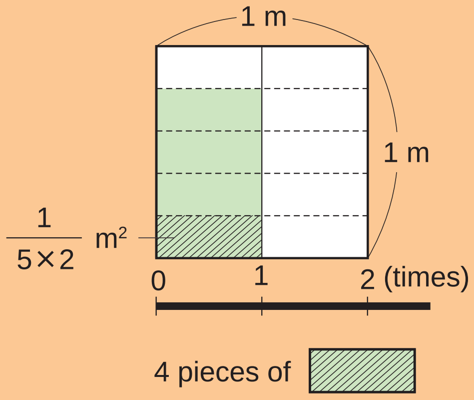
The amount of ▨ is $= \frac{1}{5\times2}$ m².

The amount sprinkled once is

$$4 \text{ of } \frac{1}{5\times2} \text{ m}^2$$

$$\frac{4}{5}\div2=\frac{4}{5\times2}$$

$$=\square$$



Gawi's Idea

In division, there is a rule that the quotient is changed if we multiply divisor and dividend by the same number, respectively.

$$\frac{4}{5}\div2=\left(\frac{4}{5}\times5\right)\div(2\times5)$$

$$=4\div(2\times5)$$

$$=4\div(5\times2)$$

Represent the expression by the fraction,

$$\frac{4}{5}\div2=\frac{4}{5\times2}$$

$$=\square$$

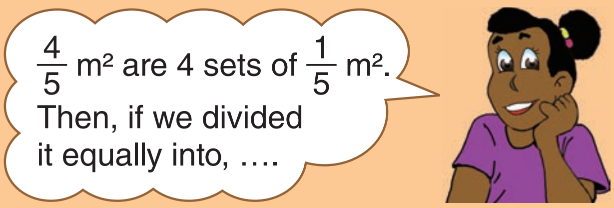
Vavi's Idea

In multiplication of fraction × whole number, since we multiply a numerator by whole number.

Using this idea, we divide a numerator by whole number.

$$\frac{4}{5}\div2=\frac{4\div2}{5}$$

$$=\square$$



2 To make a juice of $\frac{3}{4}$ L, we need 5 oranges.
How much juice can we make with 1 orange?

1 Write a mathematical expression.

☐

Amount of juice (L)	?	$\frac{3}{4}$
Number of oranges	1	5

(÷5 from 5 to 1; ÷5 from $\frac{3}{4}$ to ?)

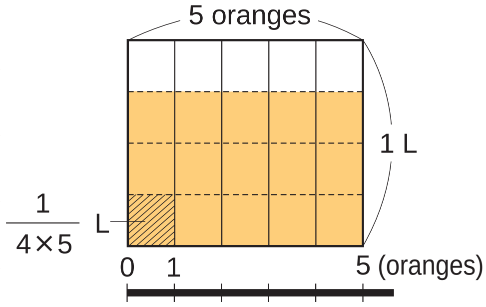
2 Let's calculate.

Whose idea do we use?

We cannot divide the numerator, 3 by 5 in Vavi's idea.

Then, let the numerator be divisible by 5.

We may apply Ambai and Gawi's idea in this problem.



3 Calculate using Vavi's idea on the left.
Change it into a fraction that has the same value and the numerator is divisible by 5.

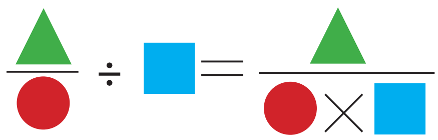
$$\frac{3}{4}\div5=\frac{3\times5}{4\times5}\div5$$

$$=\frac{3\times5\div5}{4\times5}$$

$$=\frac{3}{4\times5}$$

$$=\square$$

When we divide a proper fraction by a whole number, we multiply the denominator by the whole number and leave the numerator as it is.



3 Let's compare method Ⓐ with Ⓑ for calculating $\frac{10}{7} \div 4$.

Ⓐ $\frac{10}{7} \div 4 = \frac{10}{7 \times 4}$

$= \frac{\cancel{10}^{5}}{\cancel{28}_{14}}$

$= \square$

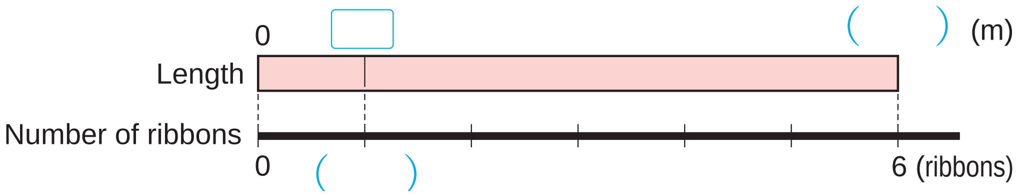
Ⓑ $\frac{10}{7} \div 4 = \frac{\cancel{10}^{5}}{7 \times \cancel{4}_{2}}$

$= \square$

The calculation will be easier if you reduce the fraction as you calculate.

4 There is a $\frac{8}{9}$ m long tape.
We make 6 ribbons which are all the same in length from this tape.
How many metres is each ribbon?

1 The diagram shown below expresses the situation.
Let's fill in the (　　) with numbers.



2 Calculate the length of each ribbon.

Length (m)	?	$\frac{8}{9}$
Number of ribbons	1	6

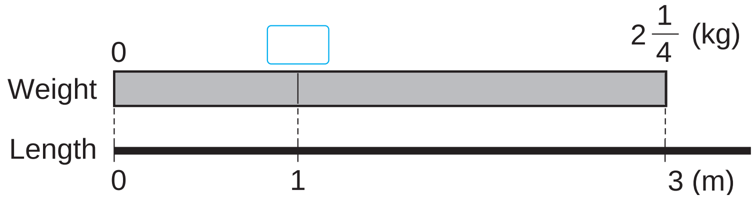
(÷6 arrows from 6 to 1 and from $\frac{8}{9}$ to ?)

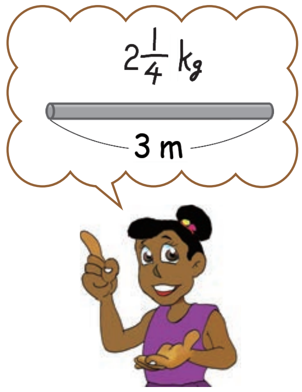
Exercise

① $\frac{1}{2} \div 4$　② $\frac{3}{4} \div 2$　③ $\frac{5}{6} \div 4$　④ $\frac{7}{8} \div 5$

⑤ $\frac{2}{3} \div 2$　⑥ $\frac{6}{7} \div 3$　③ $\frac{7}{4} \div 3$　④ $\frac{8}{3} \div 4$

5 There is an iron rod which is 3 m long and weighs $2\frac{1}{4}$ kg.
How much does 1 m weigh?





① Let's write a mathematical expression.

② Is the weight per metre greater than 1 kg?

③ Let's think about how to calculate.

Weight (kg)	?	$2\frac{1}{4}$
Length (m)	1	3

(÷3 arrows from 3 to 1 and from $2\frac{1}{4}$ to ?)

$$2\frac{1}{4} \div 3 = \frac{\square}{4} \div 3$$

$$= \frac{\square}{4 \times 3}$$

$$= \frac{\square}{4}$$

Where you can simplify the fraction, please do so.

When you divide a mixed fraction, you can calculate in the same way as proper fraction ÷ whole number by changing a mixed fraction to an improper fraction.

④ Let's calculate by splitting into whole number and fraction.

$$2\frac{1}{4} \div 3 \quad \begin{cases} 2 \div 3 = \frac{2}{3} \\ \frac{1}{4} \div 3 = \frac{1}{4 \times 3} = \frac{1}{12} \end{cases} \quad \frac{2}{3} + \frac{1}{12} = \square + \square$$

$$= \square$$

Exercise

① $1\frac{2}{3} \div 4$ ② $2\frac{5}{8} \div 6$ ③ $2\frac{2}{7} \div 8$ ④ $3\frac{1}{2} \div 7$

EXERCISE

1 Summarise how to calculate fraction × whole number and fraction ÷ whole number.

Pages 152 and 156

① $\dfrac{2}{7}\times 3=\dfrac{\square\times\square}{\square}$

$=\square$

② $\dfrac{5}{7}\div 3=\dfrac{\square}{\square\times\square}$

$=\square$

2 Let's calculate.

Pages 152 and 153

① $\dfrac{2}{5}\times 5$ ② $\dfrac{7}{9}\times 6$ ③ $\dfrac{7}{6}\times 8$ ④ $2\dfrac{3}{4}\times 12$

⑤ $\dfrac{5}{12}\times 3$ ⑥ $\dfrac{3}{7}\times 28$ ⑦ $\dfrac{9}{14}\times 7$ ⑧ $3\dfrac{3}{10}\times 30$

3 Gilbert drinks $\dfrac{5}{6}$ L of milk each day.
How many litres will be drank in 3 days?

Page 152

4 Let's calculate.

Pages 152 to 158

① $\dfrac{5}{6}\div 4$ ② $\dfrac{4}{7}\div 2$ ③ $\dfrac{3}{10}\div 6$ ④ $\dfrac{2}{5}\div 7$

⑤ $\dfrac{3}{2}\div 2$ ⑥ $\dfrac{10}{7}\div 10$ ⑦ $1\dfrac{3}{8}\div 3$ ⑧ $2\dfrac{5}{8}\div 3$

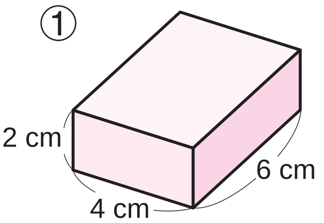
5 Divide $\dfrac{7}{6}$ L of pineapple juice equally into 3 bottles.
How many L will there be in each bottle?

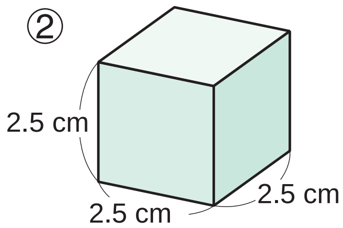
Page 158

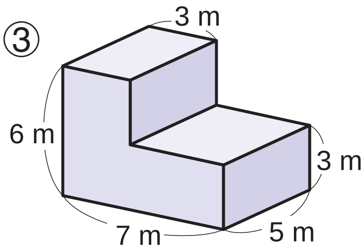
Grade 5

Do you remember?

Let's find a volume of the figures below.

①


②


③


PROBLEMS 1

1 Find wrong calculations below and correct them.

● Understanding how to calculate.

① $\frac{2}{5}\times 10=\frac{\overset{1}{\cancel{2}}}{5\times\underset{5}{\cancel{10}}}=\frac{1}{25}$

② $\frac{7}{8}\div 4=\frac{7\times\overset{1}{\cancel{4}}}{\underset{2}{\cancel{8}}}=\frac{7}{2}$

2 Let's calculate.

● Calculating fraction × whole number and fraction ÷ whole number.

① $\frac{1}{6}\times 5$　　② $\frac{5}{8}\times 6$　　③ $\frac{7}{6}\times 12$

④ $\frac{4}{9}\div 3$　　⑤ $\frac{12}{13}\div 4$　　⑥ $\frac{10}{9}\div 6$

3 There is a $\frac{7}{10}$ m long tape. Divide the tape equally among 5 students. How many m of the tape will each student receive?

● Writing an expression of fractions and answering.

4 The length of a rectangle is $\frac{11}{6}$ cm and the width is 3 cm. Find the area of the rectangle.

● Finding the area with fraction.

PROBLEMS 2

1 Let's represent time as a fraction.

● Represent the time using fractions.

① How many hours are there in 20 minutes? Express as a fraction. Write the reason.

② How many days are there in 8 hours? Express as a fraction.

③ How many minutes are there in $\frac{15}{4}$ seconds? Write an expression and calculate.

Take a break with Mathematics for fun

Square Calculation

① Fill in the table below.
Calculate horizontal number with the vertical number, (multiplier × multiplicand).

×	0	1	2	3	4	5	6	7	8	9	10
0	0		0		0		0		0		0
10	0		20		40		60		80		100
2	0		4		8		12		16		20
5		5		15		25		35		45	
8	0		16		32		48		64		80
3		3		9		15		21		27	
6	0		12		24		36		48		60
7		7		21		35		49		63	
4	0		8		16		24		32		40
9		9		27		45		63		81	
1		1		3		5		7		9	

② Think about what rules are there and discuss with your friend.

③ If there are differences in the order of multiplication, discuss and compare.

④ What happens to the products when the multiplicands and the multipliers are reversed?

12 Proportions

(1) The length and the width of rectangles which are made by the same rope.

(2) The length and weight of wires.

1 Quantities Changing Together

There are quantities when one quantity changes, the other quantity also changes together in our surrounding.

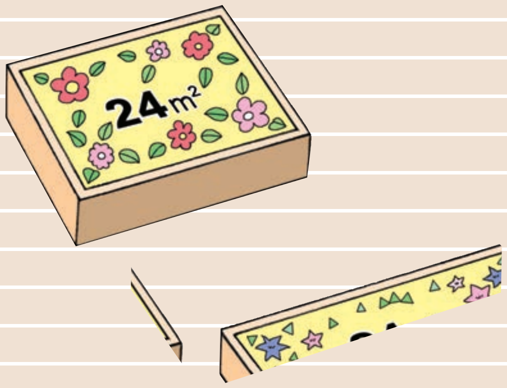
1 Yawa transferred 100 oranges from a box to a basket sent by his grandmother.

1. Let's illustrate to explain the situation.
2. Write down the number of oranges in a box, the number of oranges in a basket and the total in the table.

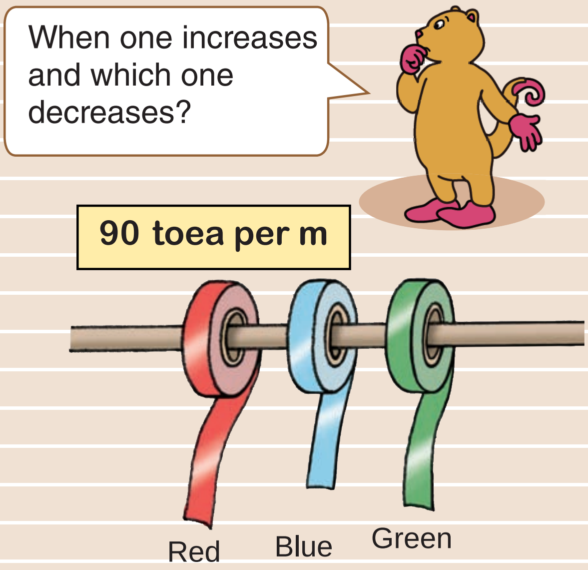
Numbers of Oranges in a Box and in a Basket

Number of oranges in a box	100	80				
Number of oranges in a basket	0	20	40	60	80	100
Total	100	100				

3. When they transferred oranges from a box to a basket, which quantities changed together?
   Which quantities remain unchanged?
4. Put the number of oranges in a basket □ and the number of oranges in a box ○, write a mathematical sentence with the relationship between □ and ○.



(3) The length and the width of rectangles which have the same area.



(4) The length and the cost of ribbons.

2 There are many boxes of the same shapes and sizes. Pile up the boxes on a stand with a 10 cm height table and measure the whole height.

1. Let's illustrate to explain the situation.
2. Write down the number of boxes, the height of boxes piled up and the whole height on the table.

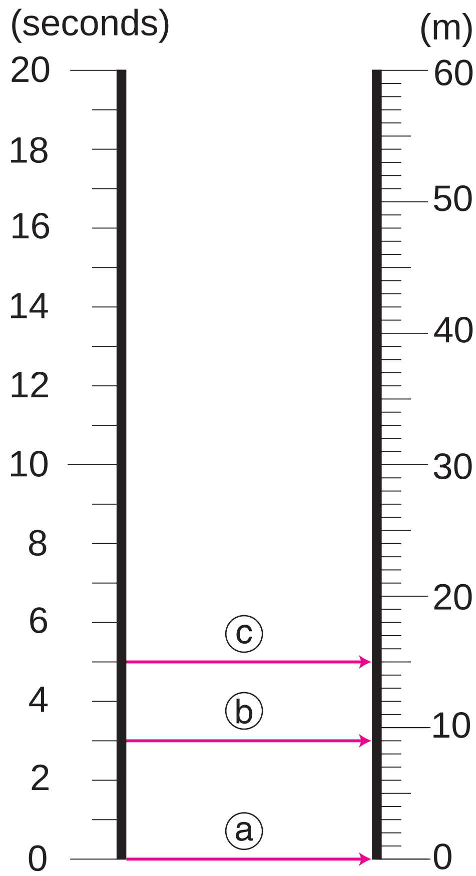
Number of Boxes and Height

Number of boxes	0	1	2	3	4	5	6	7
Height of boxes (cm)	0	6	12	18				
Whole height (cm)	10	16	22	28				

3. When we pile up 1 box, how many cm does the height increase?
4. When we pile up 7 boxes, what cm is the whole height?
5. When we pile up boxes, which quantities change? Which quantity remains unchanged?
6. Put the number of boxes □ and the whole height ○ cm, then write a mathematical sentence with the relationship between □ and ○.
7. Let's calculate the whole height in 8 boxes by using the mathematical sentence.

2 Proportions

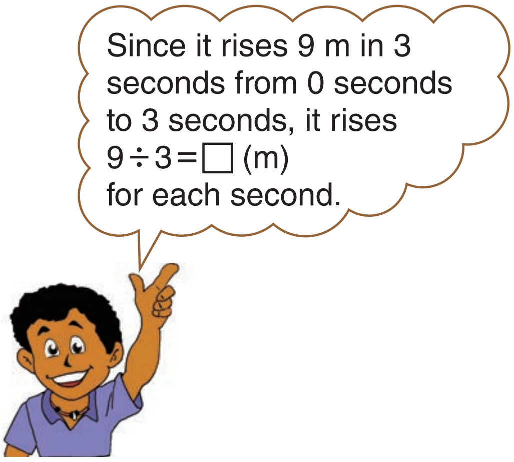
1 In Port Moresby, a hotel has 19 floors and people use elevators to move up and down.
The height of the building is 60 m from ground level.
When the elevator moves up, we recorded the time and the height on the table.

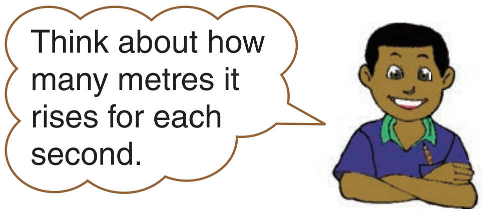


The Time and the Height

Time (seconds)	0	3	5	9	10	16	18	20
Height (m)	0	9	15	27	30	48	54	60
	ⓐ	ⓑ	ⓒ					

1. When the time is 3 seconds, we represent it with an arrow (→) that the height is 9 m as shown in ⓑ in the diagram on page164. Its height is 9 m.
2. How many metres does the elevator rise in one second?
3. How can you tell the heights when the times are 12 seconds and 15 seconds respectively?





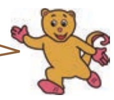
4. Draw a table between the time spent from the start and the height risen by the elevator.

The Time and the Height

Time (seconds)	0	1	2	3	4	5	6	7
Height (m)								

The time spent from the start is □ seconds and the height risen is ○ m. When the time □ increases, then the height ○ also increases.

❺ When the time □ seconds increases 2 times, 3 times, 4 times and so on, we record how the height changes together. Fill in the ▭ with a number.



4 times
3 times
2 times

Time □ (sconds)	1	2	3	4	5	6	7	8
Height ○ (cm)	3	6	9	12	15	18	21	24

▭ times
▭ times
▭ times

❻ When the time □ seconds increases 2 times, 3 times, 4 times and so on, how does the height change?

If there are 2 changing quantities □ and ○, □ **changes 2 times, 3 times** and so on and ○ **also changes 2 times, 3 times** and so on, then ○ is **proportional** to □.

Exercise

The cost of □ laplap that cost, 15 kina each is ○ kina.

① When □ are 1, 2, 3 and more, find the corresponding values and write the results in the table.

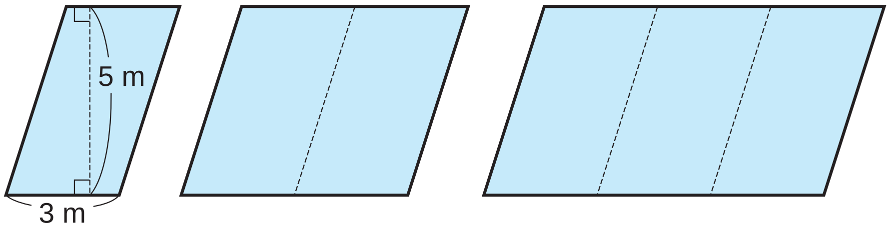
The Number of Laplap and Their Cost

The Number of laplap □	1	2	3	4	5	6	7	8
Costs ○ (kina)	15							

② What is the cost of laplap proportional to?

2 There are some congruent parallelograms that have 3 cm base and 5 cm height.

Make larger parallelograms by connecting them as shown below and find their areas.



1 Write the formula for the area of parallelogram

□ = □ × □

Let's investigate which 2 quantities change together and which quantity remains unchanged?

2 Write the mathematical sentence by using □ cm as the base and ○ cm^2 as the area.

3 Write down the relationship between the base and the area of parallelogram on the table.

The Base and the Area of a Parallelogram

Base (cm)	3	6				
Area (cm^2)						

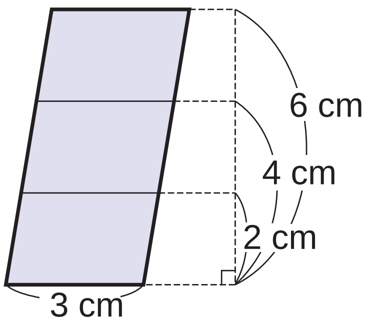
4 Is the area of parallelogram proportional to the base? Let's write the reason.

Exercise

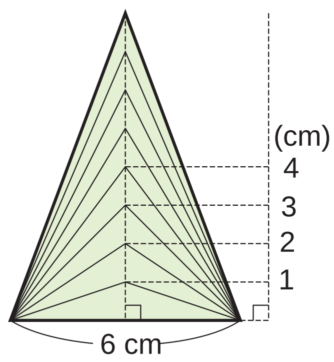
The height of a parallelogram is increased as shown on the right.

① Write the relationship between the height and the area on a table.

② Let's write what you have learned from the table.



3 The height of the triangle is increased in steps of 1 cm as shown on the right.
Find the area of each triangle.



1 Write the formula for the area of the triangle and investigate which quantities change together. What remains unchanged?

☐ = ☐ × ☐ ÷ ☐

2 Write down the relationship between the height and the area of the triangle on the table.

The Height and the Area of the Triangle

Height (cm)	1	2	3						
Area (cm^2)	3								

3 Is the area of triangle proportional to the height? Let's write the reason.

4 Write a simpler expression using ☐ cm as the height and ◯ cm^2 as the area in **1**.

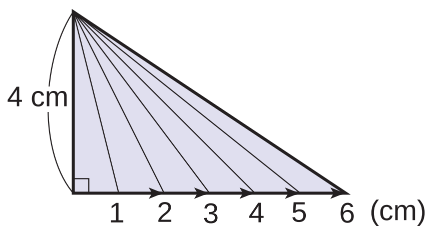
5 When the area of the triangle is 30 cm^2, what is the height in cm?

Exercise

The base of the right triangle on the right is extended in the steps shown below.

① Write the relationship between the base and the area of the triangle on a table.

② When the area of the triangle is 16 cm^2, what is the base in cm?



PROBLEMS

1 In the 2 quantities in ①, ② and ③, which quantity is proportional to the other?
If 2 quantities are proportional, write the mathematical sentence as the relationship of □ and ○.

● Understanding the meaning of proportion.

① □ cm as the side and ○ cm^2 as the area of a square.
② □ cm as the length and ○ cm^2 as the width of rectangle with 26 cm long around.
③ □ balls and its total cost ○ kina when we buy balls that cost 30 kina each.

2 Let's investigate the relationship between length in metres and weight in grams of wire that weights 20 g for 1 m.

● Representing expressions as quantities which are directly proportional.

① Write down the relationship □ m long and ○ g weight on the table.

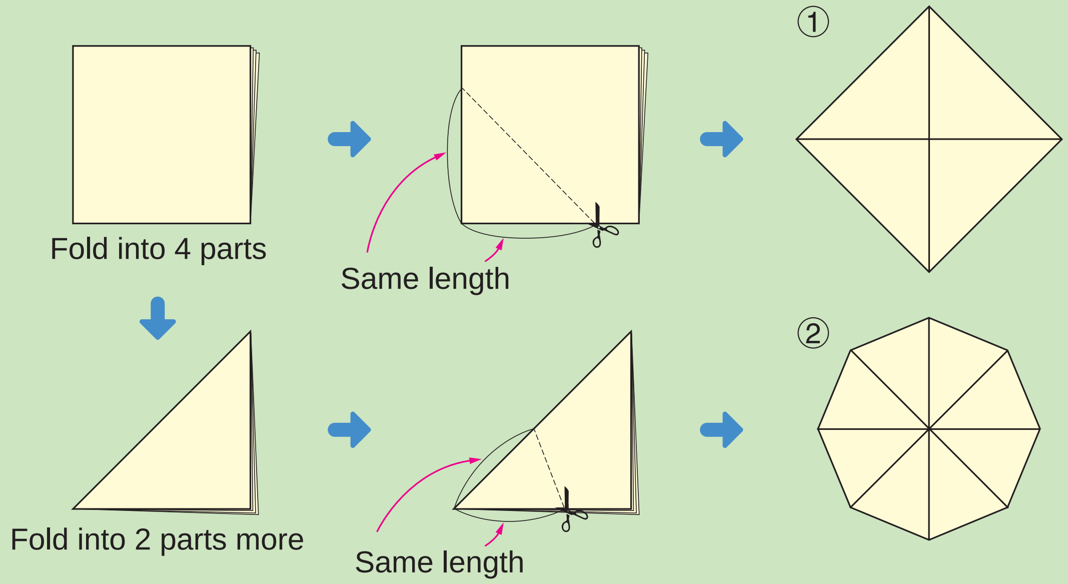
The Length and the Weight of the Wire

Length □ (m)	1	2	3	4	5	6
Weight ○ (g)						

② What will be directly proportional to what?
③ When □ increases by 1, by how much does ○ increase?
④ Write the mathematical sentence as the relationship of □ and ○.
⑤ When the length is 2.4 m, find a corresponding weight.

13 Regular Polygons and Circles

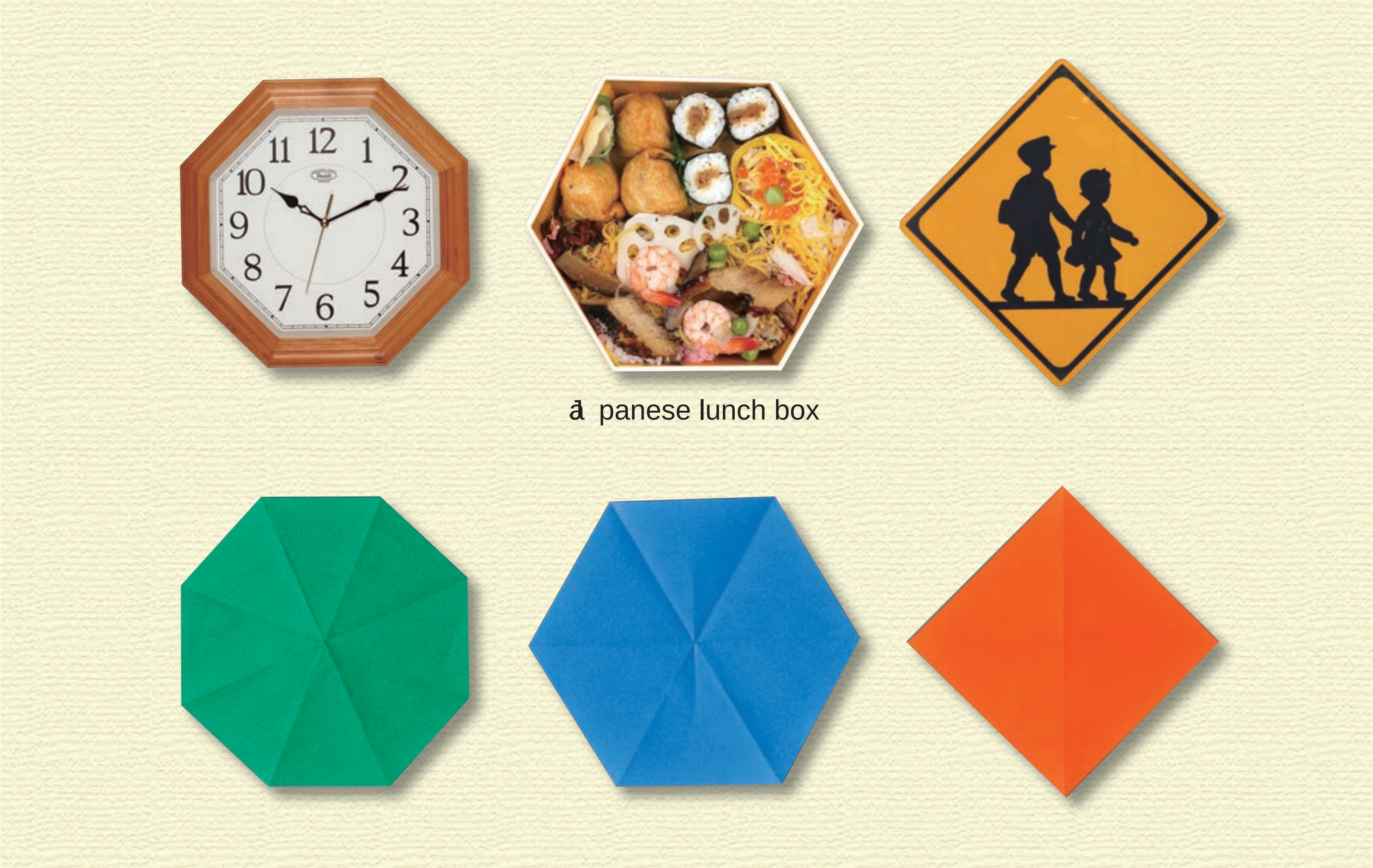
Let's fold papers as follows, cut and spread to make shapes.

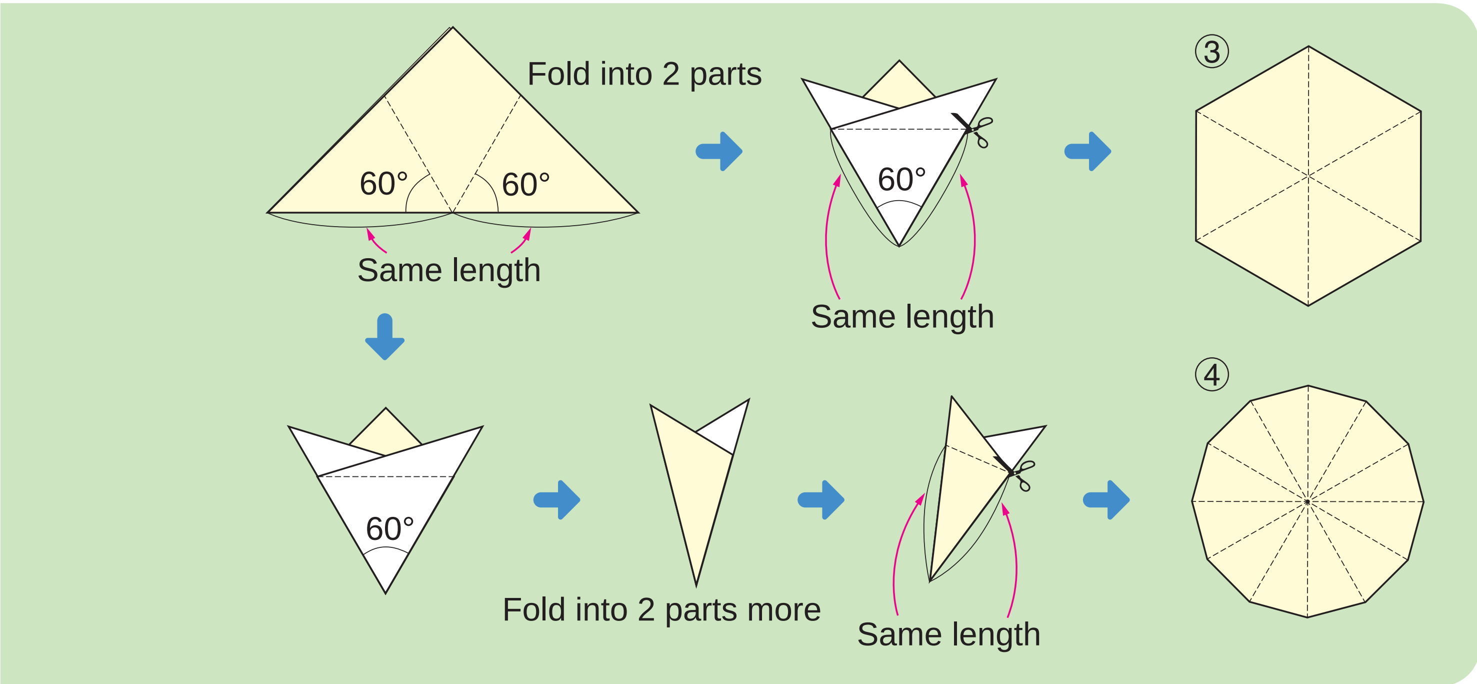


Activity

❶ Have you seen the shapes in ① to ④?

Let's look for those shapes around you.



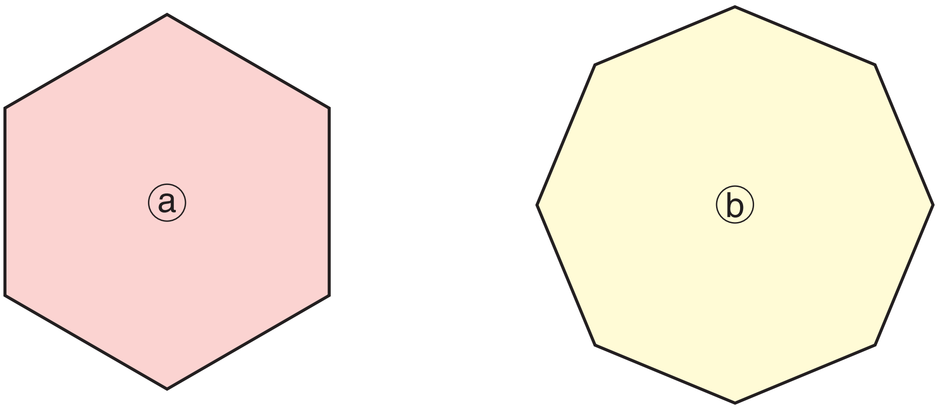


❷ What is common amongst the 4 shapes ① to ④?
What are the differences?

Activity

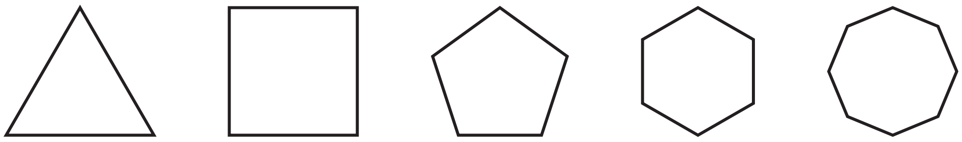
1 Regular Polygons

1 The polygons below were made in the previous pages.
Let's look at their sides and the angles.



1. How many sides and angles are there, respectively?
2. Measure the length of sides of these polygons.
3. Measure the size of the angles of these polygons.

A polygon with all equal sides and all equal size of angle is called regular polygon.



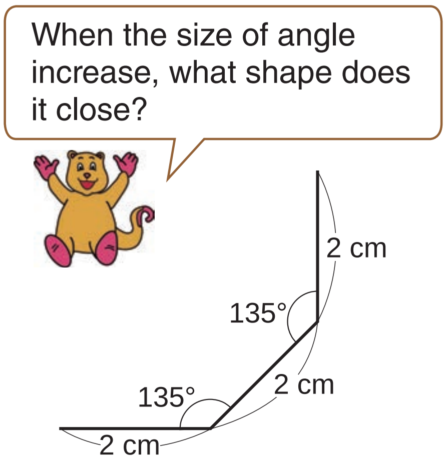
Equilateral triangle | Regular quadrilateral (square) | Regular pentagon | Regular hexagon | Regular octagon

Let's investigate properties of regular polygon and how to draw them.

2 Summarise the number of sides and the size of an angle of regular polygons.

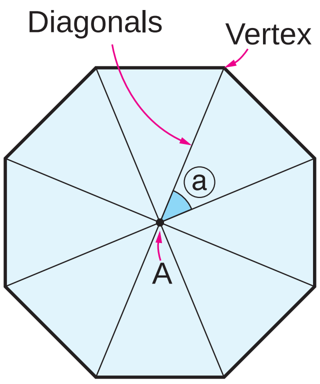
	Equilateral triangle	Regular quadrilateral (square)	Regular pentagon	Regular hexagon	Regular octagon
Number of sides					
Size of angle					

3 Let's investigate the regular polygons.

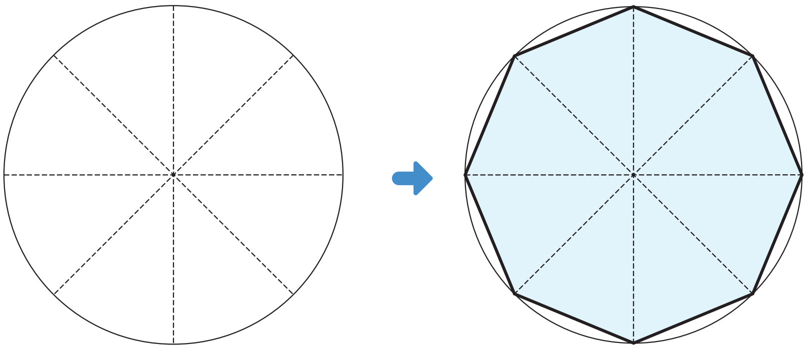


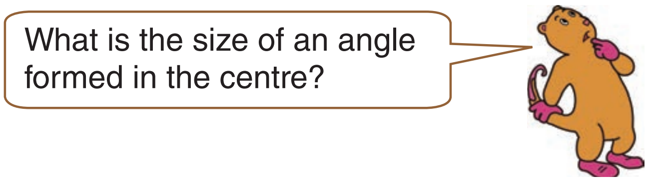
1. Draw three regular polygons with 2 cm sides and the following sizes of angles.
   Ⓐ 90°　Ⓑ 120°　Ⓒ 135°

2. In regular polygons drawn, draw diagonals by connecting the opposite vertices.

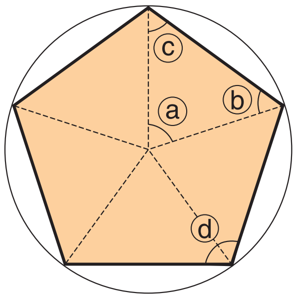


3. Compare the lengths between point A and vertices : Point A is the intersection of diagonals.
4. What kind of triangle is formed by diagonals? Are they congruent?
5. What is the size of an angle ⓐ of a regular octagon on the right?
6. Divide the angle around the center of circle into 8 equal parts, draw a regular octagon.





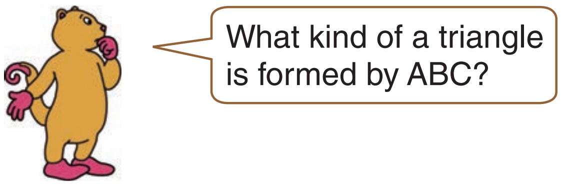
4 Let's draw a regular pentagon by dividing the angles around centre of circle into 5 equal parts.

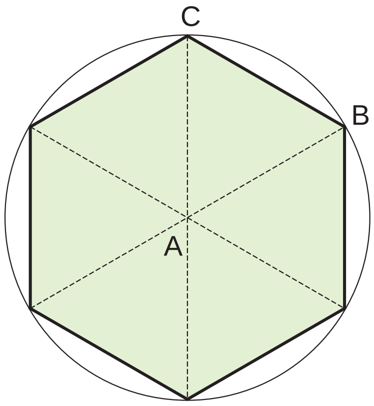


1. What is the size of angle ⓐ?
2. Find the size of angles ⓑ, ⓒ and ⓓ.
3. Write down the properties of a regular pentagon in your exercise book.

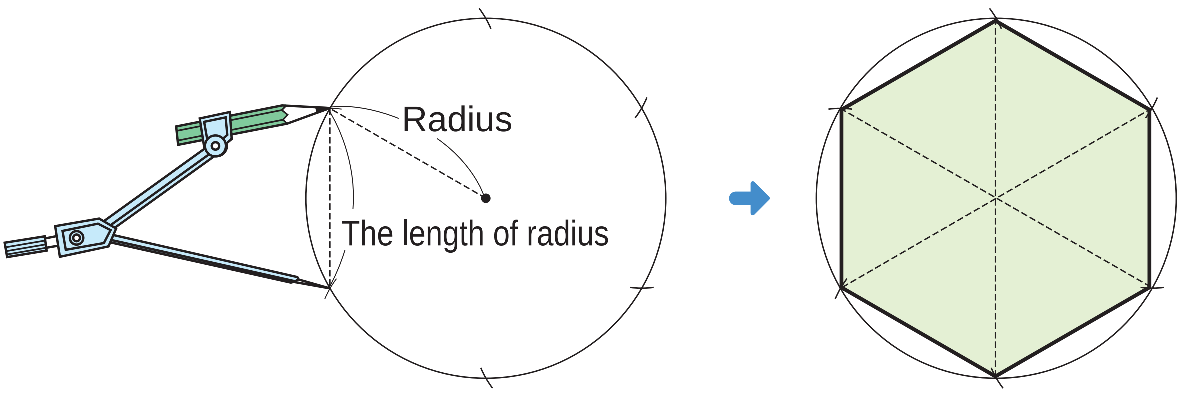
5 Let's think about how to draw a regular hexagon.

1. Draw a regular hexagon by dividing the angle around the centre of the circle into 6 equal parts.





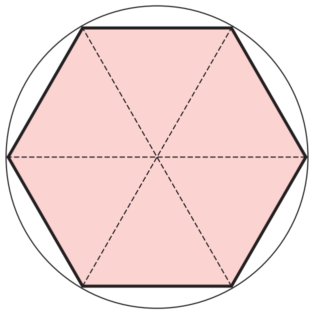
2. Draw a regular hexagon by dividing the circumference by the length of radius, using a compass below.



3. Explain the reason why we can draw by using a compass.
4. Write down the properties of a regular hexagon in your exercise book.

2 Diameters and Circumferences

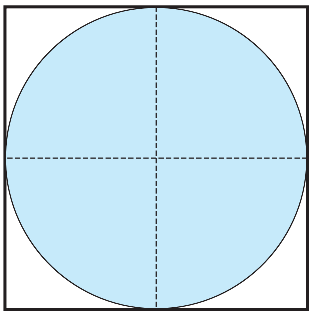
1 Draw a regular hexagon into which a circle with a 2 cm radius fits.



① How many times is the length around a regular hexagon to the diameter of the circle ?

② Let's compare the length around a circle with the length around a regular hexagon.

2 Draw a square into which a circle with 2 cm radius fits.



① How many times is the diameter of the circle to the length around the square?

② Let's compare the length around the circle with the length around the square.

The distance around of a circle is called a **circumference**.
The line that bends like a circumference is called the **curve**.

Let's investigate the relationship between the diameter of the circle and its circumference.

3 From **1** and **2**, what do we know about the relationship between the diameter of the circle and its circumference?

Fill in the ☐ with an inequality sign.

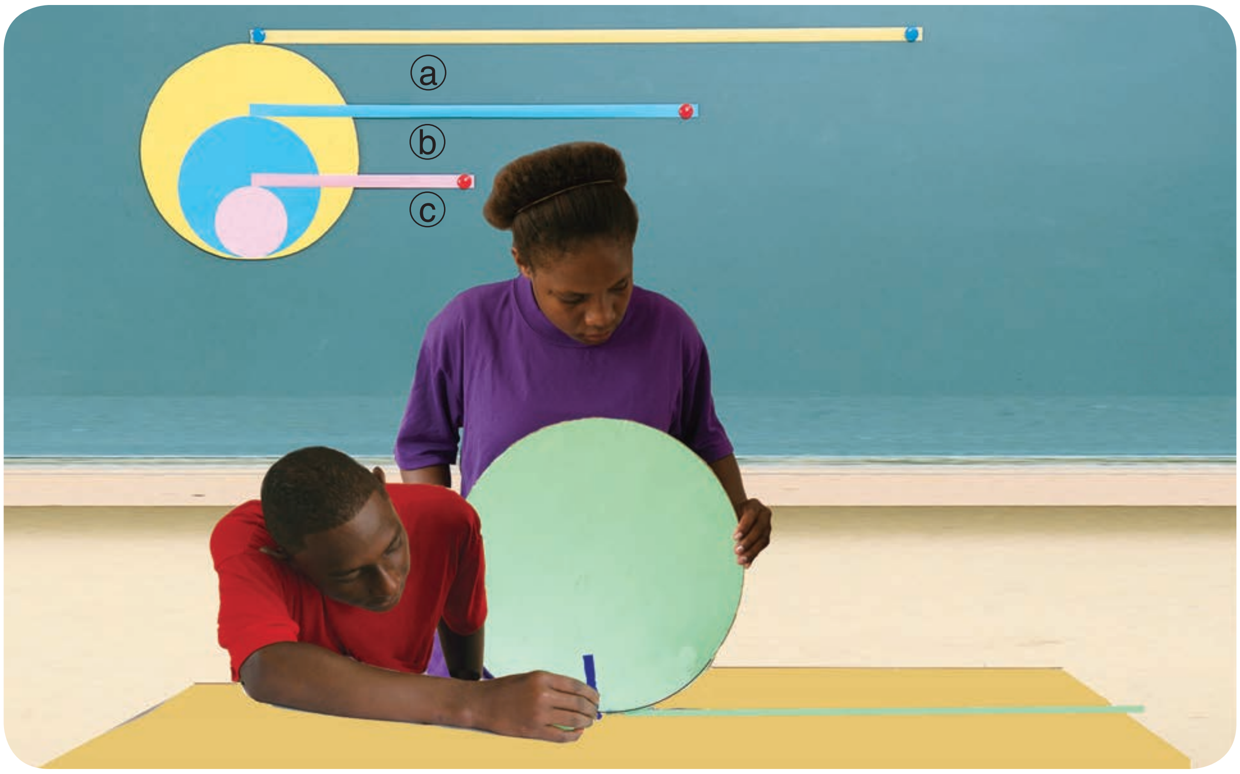
Diameter × 3 ☐ Circumference

Diameter × 4 ☐ Circumference

What do they mean above?

Let's explain by writing in your exercise book.

4 Cut a piece of cardboard to make circle ⓐ, ⓑ and ⓒ which have diameters of 10 cm, 20 cm and 30 cm respectively. Then, roll them one complete rotation and investigate how far they advance.



1. Talk about the distance of the circle rolled and what does it relate to.
2. Estimate how many centimetres a circle with a 40 cm diameter will advance in one rotation.
3. Make sure how many centimetres a circle with a 40 cm diameter advance.
4. Write the results in the table.

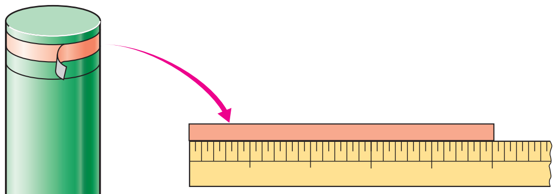
	ⓐ	ⓑ	ⓒ	
Diameter (cm)	10	20	30	40
Circumference (cm)				

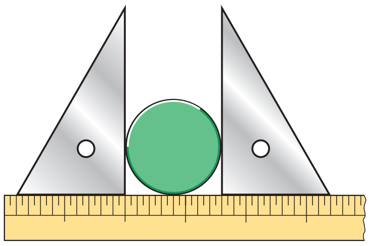
5. When the diameter increases by 2 times, 3 times and 4 times, how does the circumferences change?

Activity

5 Let’s investigate the relationship between the circumferences and diameters of various circles.

1 Measure the circumferences and diameters easily.


Measure the circumference.


Measure the diameter.

2 Write the results on the table.

	Cardboard ⓐ	Cardboard ⓑ	Cardboard ⓒ	Can	Packing tape	
Circumference (cm)						
Diameter (cm)	10	20	30			

3 Is the circumference and the diameter proportional?

If the diameter increases by 2 times, then the circumference also increases by 2 times.

If the diameter increases by 3 times and 4 times, then the circumference also increases by…. It seems that 2 quantities are proportional.

4 What do we have to know to find the circumference from the diameter?

I can find it, if I know the circumference with 1cm diameter.

÷10

Circumference (cm)			
Diameter (cm)	1	10	

÷10

For example, divide the circumference with 10 cm diameter by 10. I can find the circumference with 1cm diameter.

⑤ Approximately, how many times is the diameter to the circumference? Calculate to the nearest hundredth by rounding the thousandth.

	Cardboard ⓐ	Cardboard ⓑ	Cardboard ⓒ	Can	Packing tape	
Circumference (cm)						
Diameter (cm)	10	20	30			
Circumference ÷ Diameter						

Circumference ÷ Diameter is the same number regardless of a circle's size.

The above number is called ratio of circumference.

Ratio of circumference = circumference ÷ diameter

The ratio of circumference is a number that continues infinitely like 3.14159 ……, we usually use 3.14.

⑥ Let's write an expression of the relationship between ◯ and □, where the circumference is ◯ cm and the diameter is □ cm.

6 How many cm long is the circumference of the circle with the diameter of 8 cm?

Circumference = diameter × 3.14

Exercise

Let's find the circumference of these circles.

① A circle with a 15 cm diameter.

② A circle with a 25 cm radius.

7 The circumference of a figure as shown on the picture is 62.8 cm.

❶ If the diameter of the figure is ◯ cm, write the mathematical sentence by using the formula in **6**.

❷ What is the diameter of the figure in cm?

◯×3.14=62.8

Exercise

1 Let's find the diameter of a circle with these circumferences.

① 28.26 cm ② 31.4 cm ③ 37.68 cm

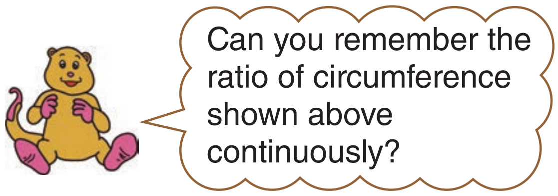
2 The photograph on the right shows an image of the mining site at Porgera Gold Mine in Enga Province. The circumference of this opencast mine is 1550 m. Let's find the diameter to the nearest whole number by rounding to the tenths.

How Many Metres is the Diameter of this Rain tree?

Six students formed a circle around a big rain tree as shown in the picture on the right.
Approximately, how many metres is the diameter of this tree?
Each student covers a length of about 1.4 m. Let's calculate the diameter by 3 instead of 3.14 as the ratio of circumference.

The History of the Ratio of Circumference

3.14159265358979323846264338327950288419716939937510582097494459230781640628620899862803482534211706798214808651328230664709384460955058223172535940812848111745028410270193852110555964462294895493038196442881097566593344612847564823…

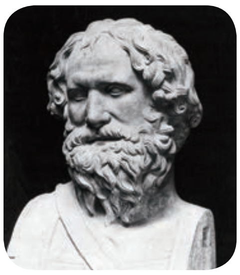


The ratio of circumference is represented as decimal numbers 3.14159265358979…, which continues without end. Nowadays, this number has been computed to the 1 trillion 241 billion and 100 million digits by the supercomputer. But it was very difficult to calculate this number in ancient times.

(1) Many years ago, 3 was used as the ratio of circumference.

(2) About 4000 years ago, $3\frac{1}{8}$ and $3\frac{31}{81}$ were used in Egypt and some other countries.

(3) About 2000 years ago, Archimedes in Greece found that the ratio of circumference is larger than $3\frac{10}{71}$ and smaller than $3\frac{1}{7}$.



Archimedes

(4) In China about 1500 years ago, Zu Chongzhi used the fractions $\frac{22}{7}$ and $\frac{355}{113}$.

(5) In Japan about 300 years ago, Takakazu Seki calculated the ratio of circumference that was slightly smaller than

3.14159265359

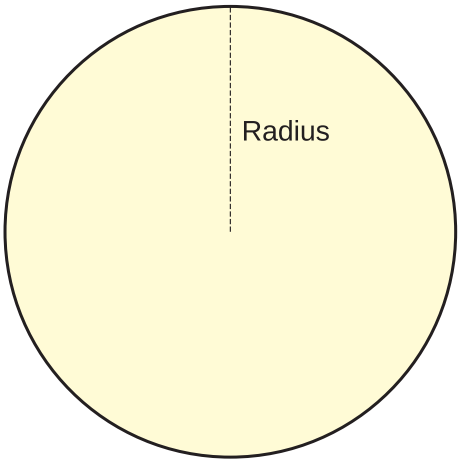
Takakazu Seki

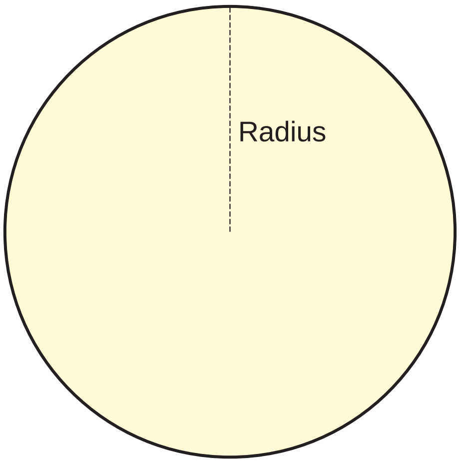
Let's change the fractions in (2) to (4) into decimal numbers.

EXERCISE

1 Let's draw regular polygons based on a circle. Pages 173 to 175

① Regular hexagon ② Regular pentagon





2 Let's find the circumferences of these circles. Pages 176 to 178

① A circle with a 6 cm diameter.

② A circle with a 5 cm radius.

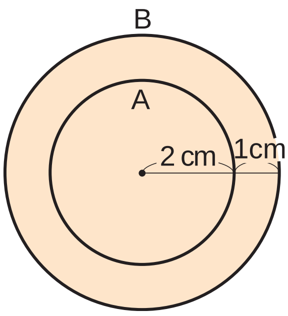
3 Let's find the diameters of these circles. Pages 175 to 179

① A circle with a 6.28 circumference.

② A circle with a 12.56 circumference.

Pages 176 to 178

4 There are 2 circles A and B as shown on the right. One has a 2 cm radius, and the other has a radius 1 cm larger than the radius of circle A. How many cm is the circumference of circle B larger than the circumference of circle A?



Grade 5

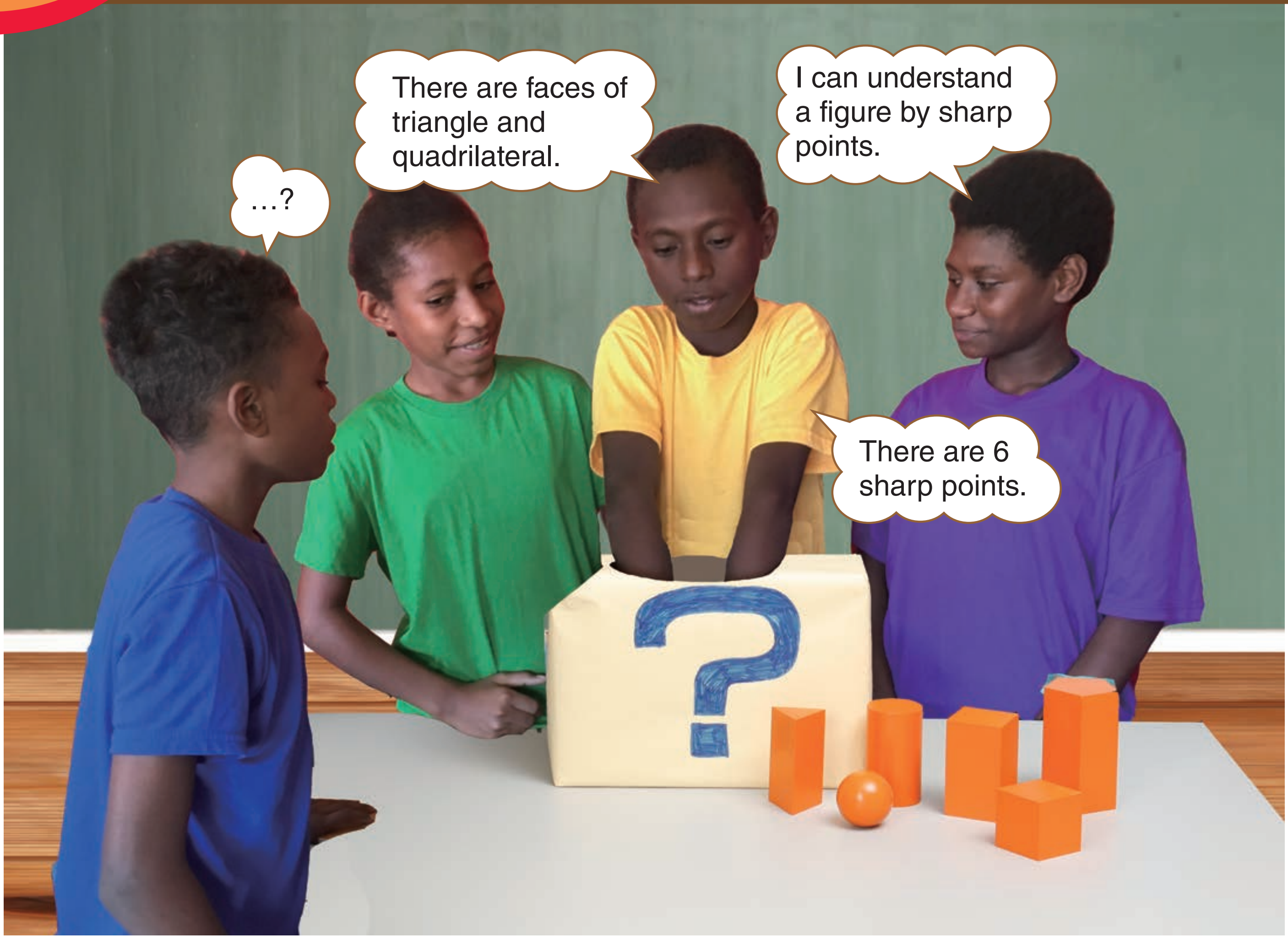
Do you remember?

Let's calculate.

① 5×1.6 ② 28×3.5 ③ 17×0.78

④ 1.2×2.3 ⑤ 7.6×4.3 ⑥ 3.18×6.2

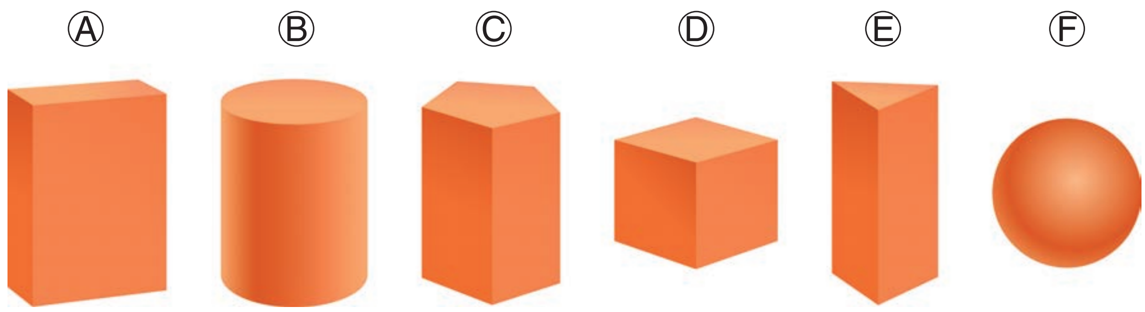
14 Solids



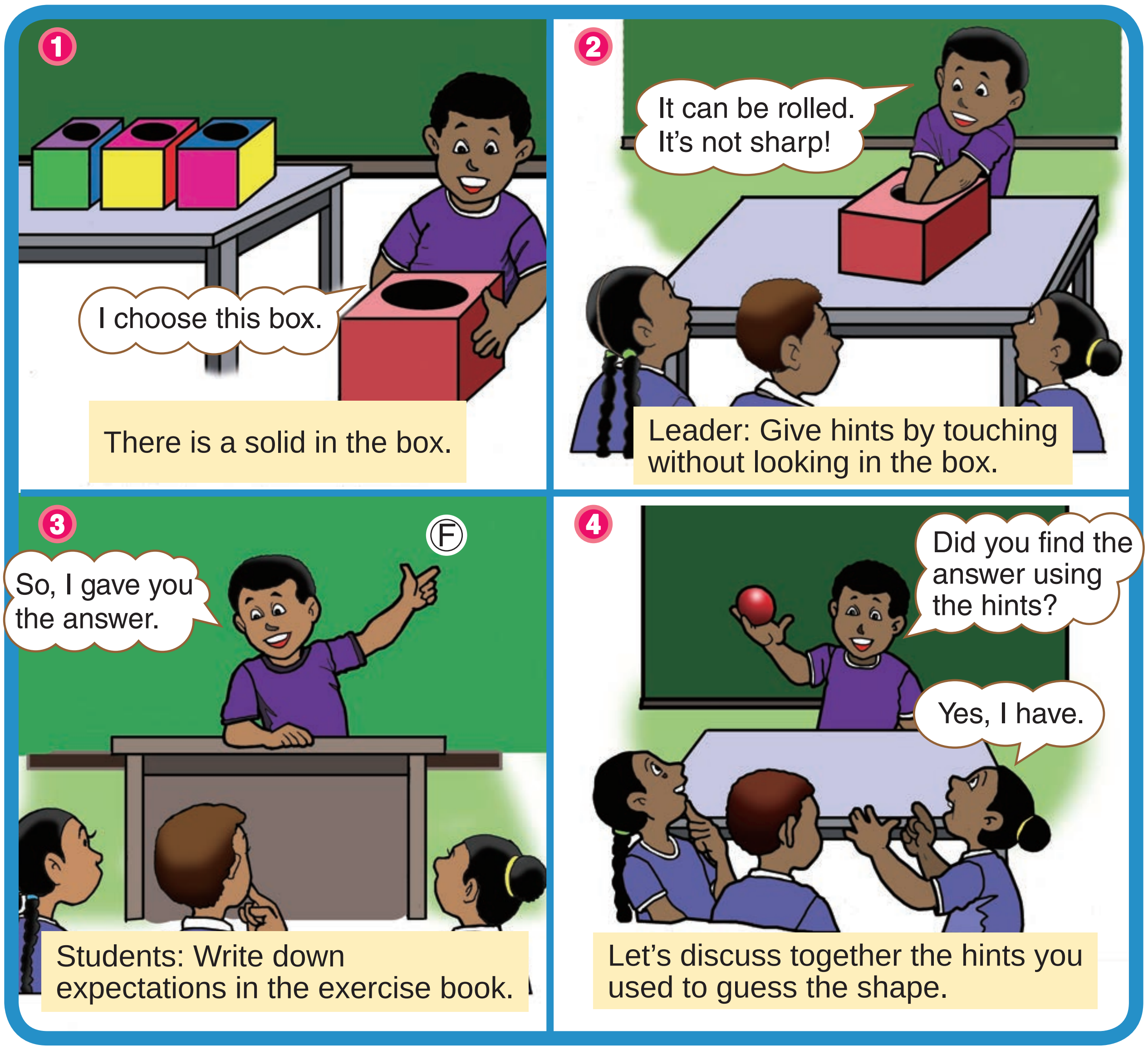
Activity

▷▷ Play a shape guessing game.

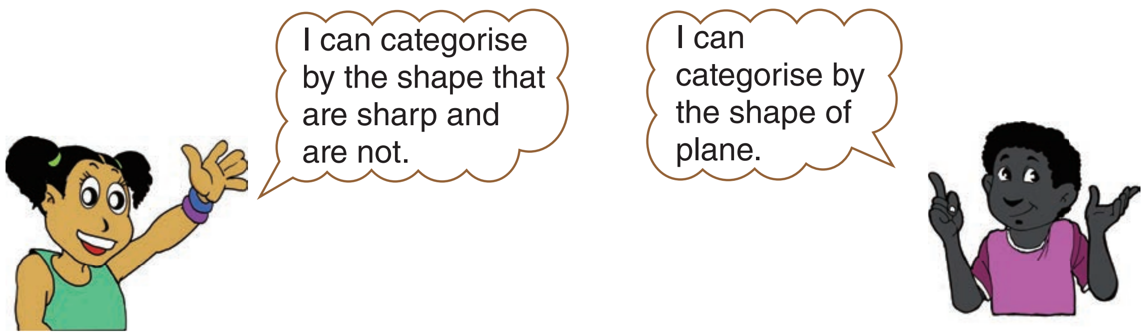
Let's explore shape in the box by using hints.



The surface that bends and is not plane is called a **curved surface**. The shape that is covered by planes or curved surfaces is called a **solid**.



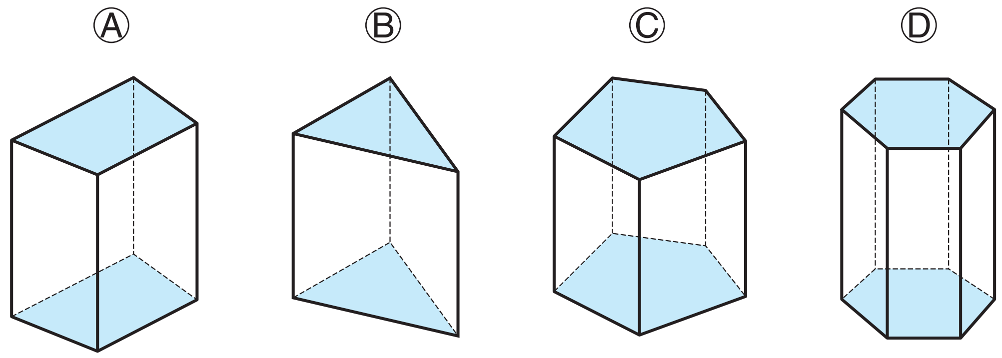
Let's categorise solids Ⓐ to Ⓕ in various ways. Write "how to categorise" and "the reason".



Let's investigate properties of solids.

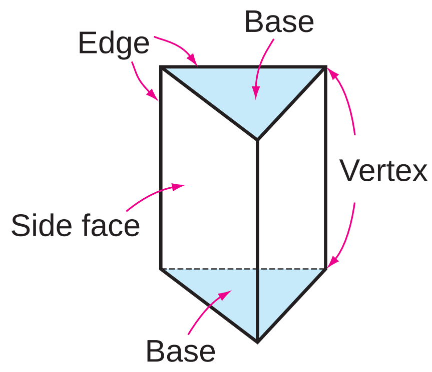
1 Prisms and Cylinders

1 In solids covered by planes only, let's look at the following solids that have parallel faces.



1. For each solid, what is the shape of the coloured parallel faces? Compare the sizes of each pair, respectively.
2. What is the shape of the faces that are not coloured? How many are there?
3. Which faces are perpendicular?

The solids like Ⓐ, Ⓑ, Ⓒ and Ⓓ are called **prisms**.
The 2 parallel congruent faces of prism are called **bases** and the rectangular faces around the bases are called **side faces**.



When the bases are triangles, quadrilaterals or pentagons, their prisms are called **triangular prism, quadrilateral prism or pentagonal prism**, respectively.
Cubes and rectangular prisms are types of prisms.

❹ Say the names of the shapes Ⓐ, Ⓑ, Ⓒ and Ⓓ.

❺ Summarise the vertices, edges and faces of prisms.

	Triangular prism	Quadrilateral prism	Pentagonal prism	Hexagonal prism
Shape of bases	Triangle			
Shape of side faces	Rectangle			
Number of vertices	$3\times2=6$			
Number of edges	$3\times2+3=9$			
Number of faces	$2+3=5$			

Are there any rules?

Let's look at each row of the table made in 1, ❺ above.

2 Put primes as triangular prism, quadrilateral prism and so on □ side faces in prism, the number of vertices is represented as follows.

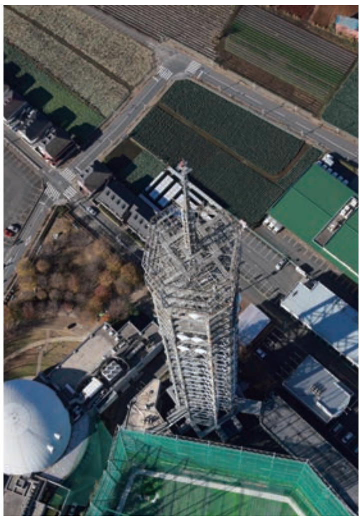
Number of vertices $=\square\times2$

❶ Represent the number of edges by using □.

If we distinguish the sides on the bases and on the side faces....

❷ Represent the number of faces by using □.

Any prism has two bases.



Skytower West Tokyo
(Nishi-Tokyo City, Tokyo)

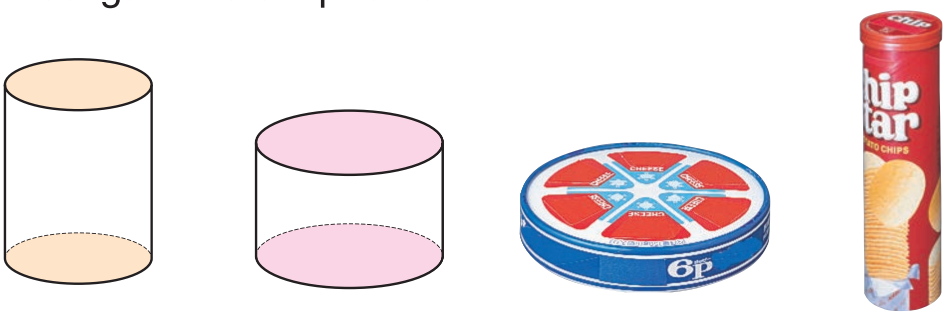
❸ Check expressions to find the number whether they one correct, in the case of octagonal prism.

Octa means 8.

3 Let's look at each column of the table made in **1** and activity **5** on page 185.
Let's discuss what the relationships are among the numbers of vertices, edges, faces and □ side faces in the prisms.

In the **triangular** prism, the sum of the number of vertices **3** which corresponds to 3-sides prism is the number of edges.

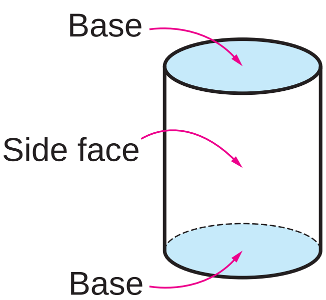
4 Let's investigate the shapes below.

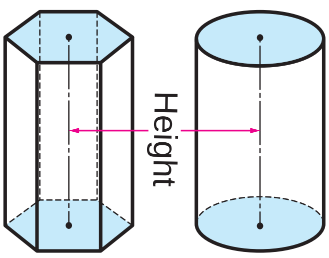


1 What types of faces are they covered by?

2 Compare the shapes and the sizes of the 2 parallel faces.

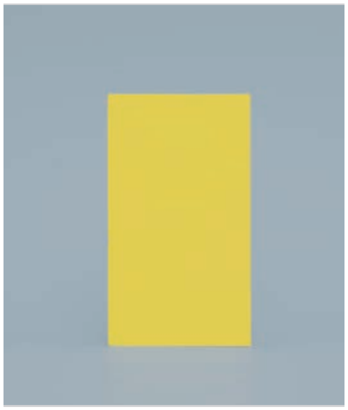
The shape shown on the right is called a **cylinder**.
The 2 parallel congruent faces shaped as circle of a cylinder are called **bases** and the curved surface around the bases is called **side face**.
The length of the line that are between the 2 bases and perpendicular to the 2 bases of prism or cylinder is called **height** of prism or cylinder, respectively.

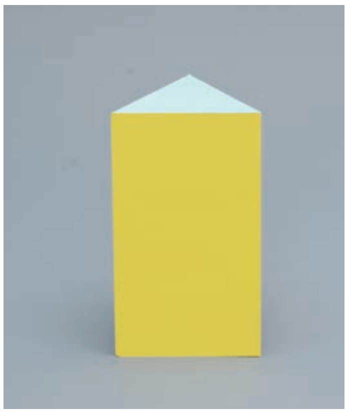




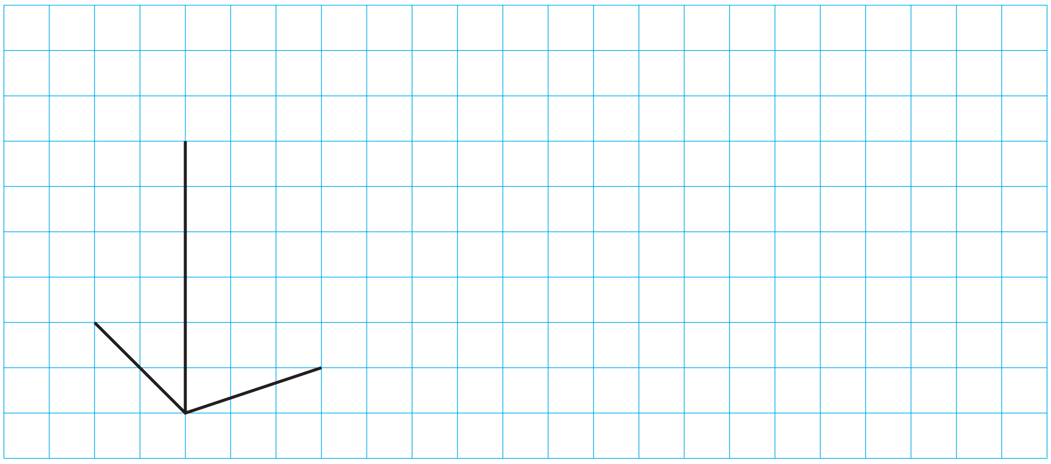
② Sketches and Nets of Prisms and Cylinders

Sketch





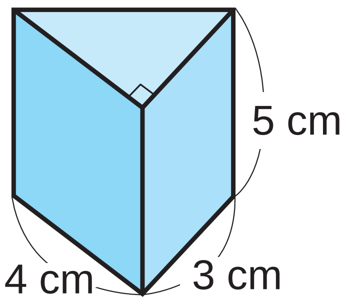
1 Let's draw a sketch so that you can see the whole triangular prism at once.



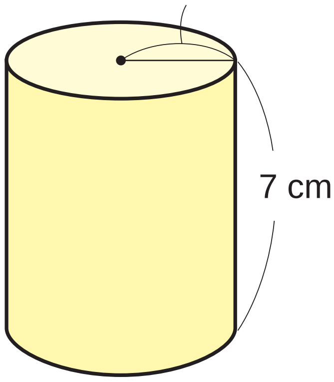
Exercise

Let's draw the sketch of these solids.

①

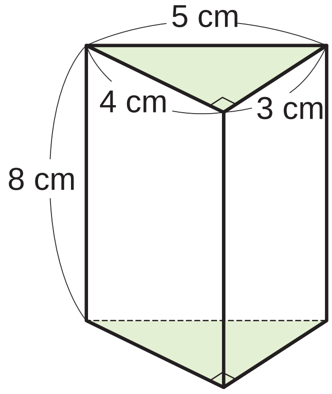


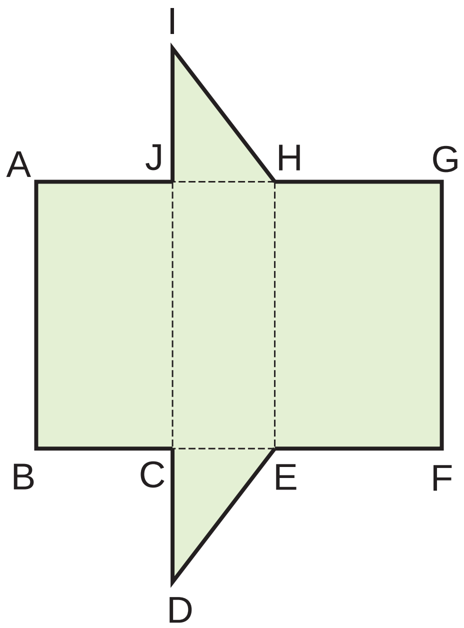
②

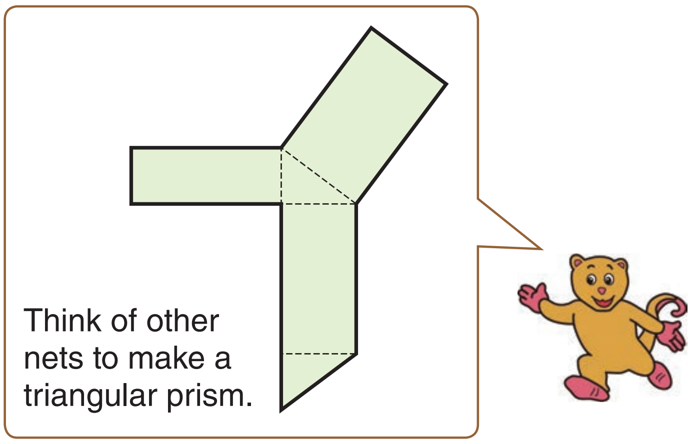


Net

2 Let's draw the **net (development)** on the cardboard to make a triangular prism as shown on the right.



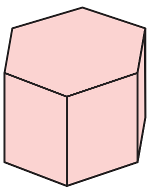


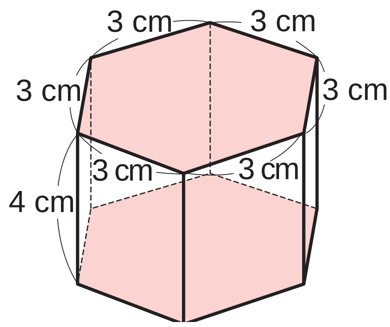


1. Which parts are the bases and the side face in a net?
2. Where does the height correspond in a net?
3. How many cm are the lengths of side AB, BC and DE?
4. When you make the shape, which points does point A overlap?
5. Fold the net.

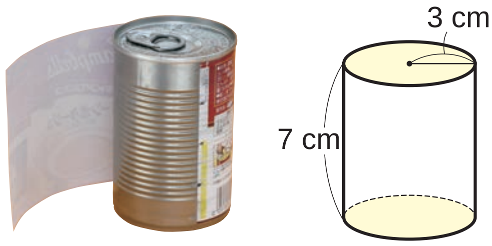
Exercise

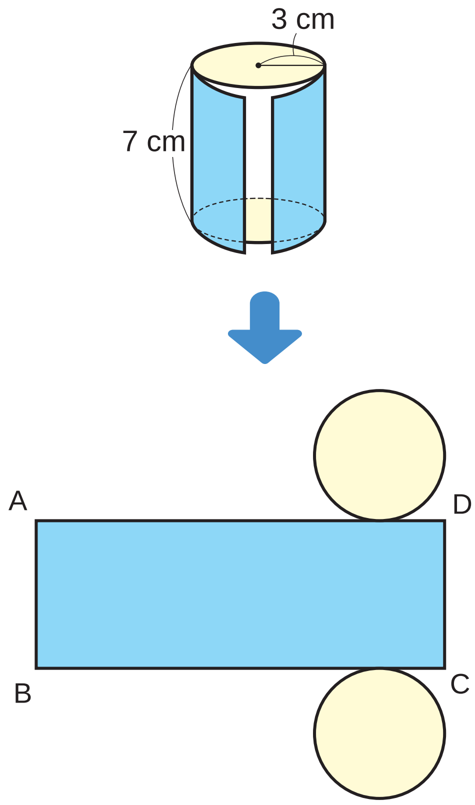
The solid on the right shows a hexagonal prism with the base of a regular hexagon. Let's draw the net and make it.





3 Let's think about how to draw the net of the cylinder as shown on the right.



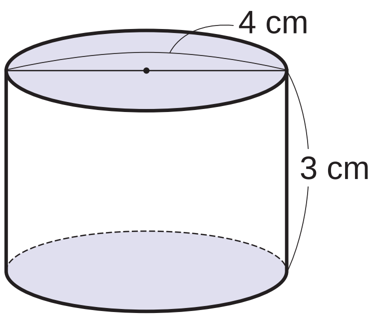


1. First roll up a sheet of paper with side face as shown on the right and then spread the paper to draw the net. What is the shape of the net of the side face?
2. Which are the height of a cylinder equal to in a net. How many cm is it?
3. Which part of the base is the length of line AD equal to?
4. Fold the net.

The **net** of side face of a cylinder is rectangular, the length is equal to the height of a cylinder and the width is equal to the circumference of the base.

Exercise

Let's draw the net of the cylinder on the right and fold it.



EXERCISE

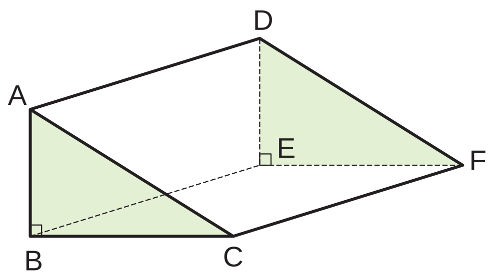
1 There is a solid as shown on the right.

Pages 184 to 186

① What type of shape is it?

② How many faces and edges are there respectively?

③ Which faces are parallel to face ABC and are perpendicular to face ABC, respectively?



④ Which sides of the solid are used to measure the height?

2 Let's summarise prisms in the table below.

Page 186

	Heptagonal prism	Octagonal prism	Nonagonal prism	Decagonal prism
Number of vertices				
Number of edges				
Number of faces				

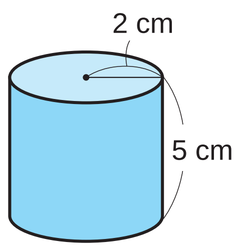
3 Let's look at the solid shown on the right.

Pages 186 and 189

① Name the solid.

② Find the width of side face when you draw the net.

Calculate the number using 3.14 as the ratio of circumference and round this to the nearest hundredth.



③ Draw a net.

What is the difference to the net on what we learned?

Grade 5

Do you remember?

Let's calculate.

① 8÷0.5　② 18÷4.5　③ 56÷1.6

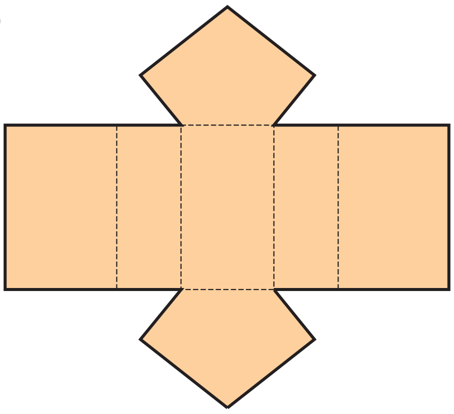
④ 6.4÷0.8　⑤ 8.06÷3.1　⑥ 45.9÷5.1

PROBLEMS

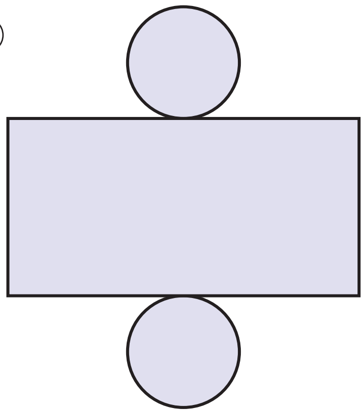
1 What solids can we make the shapes from these nets?

● Imagine the solid from a net.

①



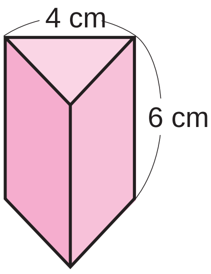
②



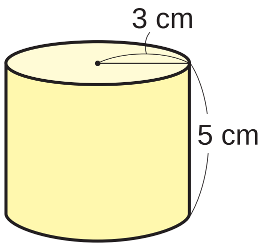
2 Let's draw the following net.

● Drawing the net.

① A triangular prism that has the base of an equilateral triangle with 4 cm side and 6 cm height.

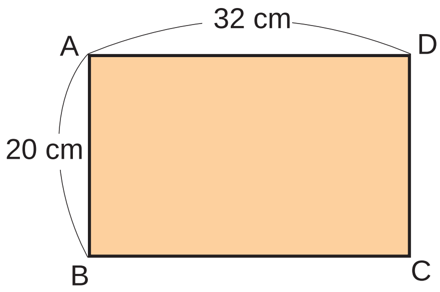


② A cylinder that has the base of a circle with 3 cm radius and 5 cm height.



3 Using a rectangular cardboard as shown below, make a cylinder by overlapping sides AB and CD. How many cm is the diameter of the circle to make the bases? Calculate using 3.14 as the ratio of the circumference and round this to the nearest hundredth.

● Finding a diameter of circle of the base.



15 Rates and Graphs

A group of students played a netball game The table below shows the shooting data of Jaydan and others.

ả ydan	●	×	●	×	●	●	×	●		
Tom	●	●	×	×	●	×	●	×	×	●
Madu	×	●	●	●	×	×	●	●	×	●

● Scored shots
× missed shots

Let's think about how to compare the results and discuss about your opinions.

If I compare the numbers of scored shots,…

Although the number of shots is different, is this enough?

Activity

Let's think about how to compare the result of shots.

1 Rates

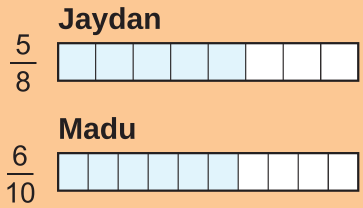
1 Let's compare the shooting record on page 192 by expressing as numbers.

	ǎ ydan	Tom	Madu
Number of score	5	5	6
Total Number of shots	8	10	10

1. Compare Jaydan's results with Tom's.
2. Compare Tom's results with Madu's.
3. Think about how to compare the Jaydan's with Madu's.

Mero's Idea

Express them on graphs of the same length.



Yamo's Idea

Change fractions to decimal numbers.

Jaydan $\frac{5}{8} = 5 \div 8$

$= 0.625$

Madu $\frac{6}{10} = 6 \div 10$

$= 0.6$

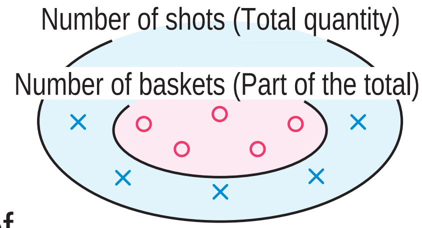
Kekeni's Idea

Reduce fractions.

Jaydan $\frac{5}{8} = \frac{25}{40}$ Madu $\frac{6}{10} = \frac{24}{40}$

4. Explain the ideas of the 3 students by using words.
5. Express the Tom's result as number.

If we put the total number as the number of shots, the number of scores will be one part of this total.



Shooting result = Number of scores ÷ Number of shots

Part of the total (Number of scores)

Total quantity (Number of shots)

2 The table below shows the record of Sandra's shot.
Express the result as numbers.

Game 1	○ ○ ○ ○ ○
Game 2	× × × × × × ×

The number expressing the result of the shots is between 0 and 1.

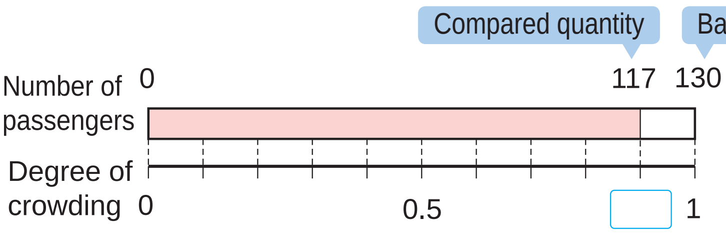
3 Let's investigate the number of passengers on planes in a day.
Which plane is more crowded?

Number of Passengers and Seats

	Small plane	Large plane
Number of passengers	117	442
Number of seats	130	520

The degree of crowding is represented as a number that allows comparing the number of passengers when the number of seats is made 1.

1 Let's find the degree of crowding for the small plane.

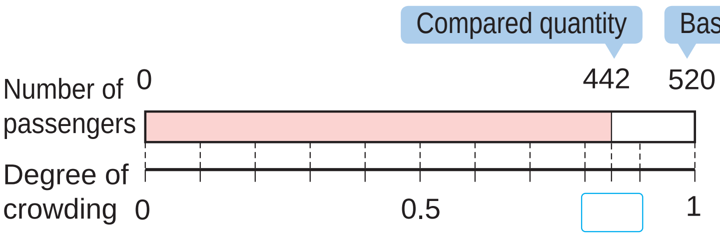


Number of passengers	130	117
Degree of crowding	1	?

÷130 ÷130

117 ÷ 130 = □

2 Let's find the degree of crowding for the large plane.



Number of passengers	520	442
Degree of crowding	1	?

÷520 ÷520

□ ÷ □ = □

The result of the shots in **1** is expressed by how many the derived quantities when the base quantity is made 1.

A number that is expressed by the derived quantity when the base quantity is made 1, like a shooting result or crowding, is called rate.

Rate = compared quantity ÷ base quantity

The degree of crowding for the small plane in the previous page is

117 ÷ 130 = 0.9

A degree of crowding for the 0.9 means that the number of passengers is 0.9 when we make the total number of seats 1.

Small Plane

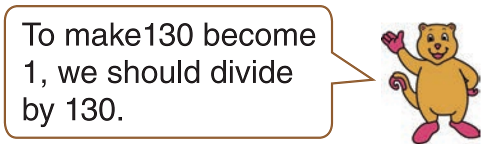
	Number of seats	Number of passengers
Number of passengers	130	117
Rate	1	0.9

÷130 ÷130

Large Plane

	Number of seats	Number of passengers
Number of passengers	520	442
Rate	1	0.85

÷520 ÷520



Exercise

1 Let's find the rates.

① A rate of correct answer, when 6 out of 10 problems were answered correctly.

② A rate of games won when a team won 6 out of 6 soccer games.

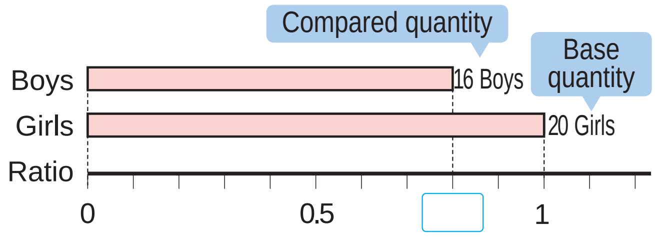
③ The rate of winning goals, when Tali missed 7 goals out of 7 shots.

2 There are 75 students at a party including Ben. There are 15 students from the grade 5. Let's find the rate of the grade 5 students based on the total number of the students at the party.

The Rate of two Quantities

We can express the proportion between two quantities even if one of them is not a part of the other.

4 There are 16 boys and 20 girls in Kuman's class. Let's find the rate of the number of boys to the number of girls.



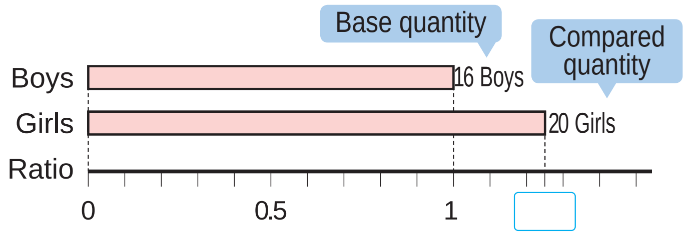
	Boys	Girls
Number of students	16	20
Rate	?	1

(÷20, ÷20)

16 ÷ 20 = □

Compared quantity / Base quantity / Rate

5 In Kuman's class in **4**, let's find the rate of the number of girls to the number of boys.



	Boys	Girls
Number of students	16	20
Rate	1	1.25

(÷16, ÷16)

20 ÷ 16 = □

Compared quantity / Base quantity / Rate

The rate will change if we change the base quantity. In some cases, the rate will become larger than 1.

Exercise

A 50 m building was constructed across the street from a 20 m building.

① Find the rate of the height of the 20 m building based on the 50 m building.

② Find the rate of the height of the 50 m building based on the 20 m building.

2 Percentages

1 There are 40 passengers in a bus that has 50 seats.

① Find the degree of crowding in the bus.

$40 \div 50 = \square$

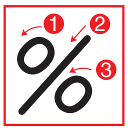
② Let's express this rate by making the basic quantity 100.

2 times

$40 \div 50 = \square \div 100$

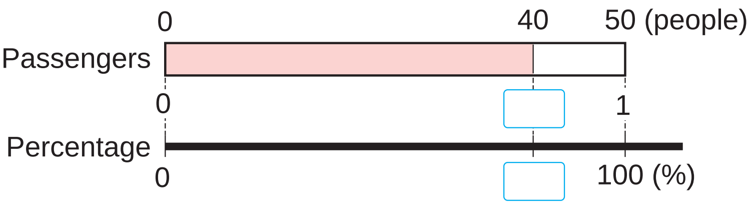
$\square$ times

We often express a rate by making the basic quantity 100.
This expression is called percentage.
The rate 0.01 is a decimal number, which is called 1 percent and is written as 1%.



Percentage = Rate × 100

③ If we multiply a rate that is expressed as a decimal number by 100, it will become a percentage.
Let's express the degree of crowding of the bus as a percentage.



Number of passengers (people)	40	50
Rate (decimal numbers)	?	1
Percentage (%)	?	100

(÷50 from number of passengers to rate, ×100 from rate to percentage)

$40 \div 50 \times 100 = \square$ (%)

2 Patrick and his friends kept a record of the vehicles on the road in front of their school for 20 minutes.

Record of Type of Vehicles

	Number of vehicles	Percentage (%)
Cars	63	45
Trucks	35	
Buses	21	
TAXI	7	
Others	14	
Total	140	

1. Let's express the rate of each type of vehicle to the total number of vehicles.
2. What is the total of all the percentages?

Exercise

Let's change the following rate from decimal numbers to percentages, and from percentages to decimal numbers.

① 0.75 ② 0.8 ③ 0.316 ④ 16 % ⑤ 2 %

Rates Larger than 100 %

3 Conference rooms in Steven's guest house can hold 120 people. Let's find the degree of crowding in each conference room.

1. Find the degree of crowding for the Kumul conference room.
   $108 \div 120 \times 100 = \square$ (%)
2. Find the degree of crowding for the Muruk conference room.
   $144 \div 120 \times 100 = \square$ (%)

Today's Number of guests in conference rooms.

Kumul : 108 guests
Muruk : 144 guests

When the number of guests is more than the capacity, the percentage is larger than 100 %.

Exercise

Investigate the degree of crowding on the bus for one day.

Number of Passengers and Capacity of the Bus

	AM 8:00	AM 10:00	Afternoon
Number of passengers (people)	65	18	26
Capacity (people)	50	50	50

① Let’s express the degree of crowding at each time.

② At what time is the bus most crowded?

4 Henry made 1 run in 4 turns at batting in a softball game. The rate of the total number of runs to bats is called **batting average**.

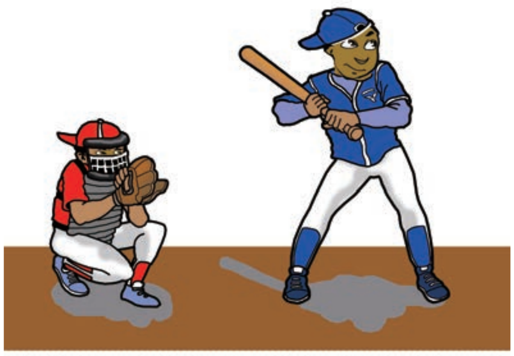
1 Let’s find Henry’s batting average.

Runs		Bats		Batting average
:		:		:
1	÷	4	=	☐

Result of Softball

	Bats	Runs
Henry	4	1
Takale	5	2
Sam	5	5

2 Let’s find the batting average for Takale and Sam’s batting average.



Batting average is to use one of the evaluation criteria for softball or baseball players.

3 Problems Using Rates

Problems of Finding Compared Quantities

1 Jonah is painting a wall that has an area of 24 m².
He has painted 25 % of the wall.
How many m² did he paint?

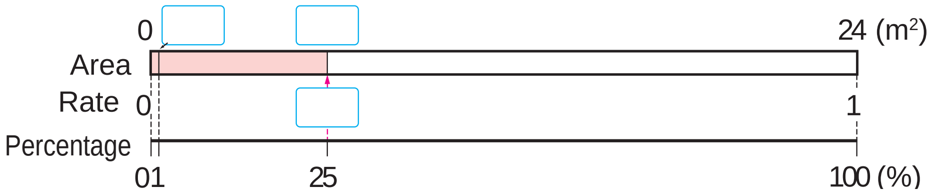
1 Let's find by using these ideas.

① If he painted 24 m², it would be 100 % of the total area.

② 1% of the area is
$24 \div 100 = 0.24$

③ 25 % of the area is $0.24 \times 25 =$ ☐.

	Base quantity	1%	Compared quantity
Area (m²)	24	0.24	?
Percentage (%)	100	1	25
	①	②	③



2 Find by changing 25 % to a decimal number.

$24 \times 0.25 =$ ☐

24: Base quantity; 0.25: Rate; ☐: Compared quantity

Area (m²)	24	?
Rate	1	0.25

×0.25 (from 24 to ?), ×0.25 (from 1 to 0.25)

Compared quantity = Base quantity × Rate

Exercise

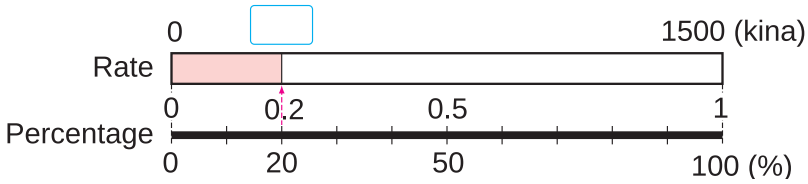
1 In a lottery, 5 % of the tickets are prize winning tickets.
If they make 80 tickets, how many prizes will be needed?

2 A conference room has a capacity of 80 guests in each row. When the degree of crowding is 110%, how many guests are there in each row?

2 A home centre is having a clearance sale.

① Sonia's father bought a water tank at a 20 % discount that had an original price of 1500 kina.

How much did he pay less than the original price?



$1500 \times 0.2 = \square$

Base quantity   Rate   Compared quantity

Cost	1500	?
Rate	1	0.2

(×0.2)

② If the original price of the water tank was 1500 kina, how much did he pay?

Find the cost by using the ideas of these 2 students.

Vavi's Idea

Since it is a 20 % discount,

$1500 \times 0.2 = \square$

is the amount discounted.

$1500 - \square = \square$

Naiko's Idea

Since it is a 20 % discount, he can buy the water tank at 80 % of the original price.

$1500 \times (1 - 0.2)$

$= 1500 \times 0.8$

$= \square$

Exercise

When we buy something from the store, we have to pay a GST (Goods & Services Tax) that is 5 % of the sales price. When we buy a bicycle for 500 kina, how much do we have to pay in total?

Problems Finding Basic Quantities

3 Namari's family has a flower garden that is part of a large field. The area of the garden is 60 m², which is 20 % of the total area of the field.

How many m² is the field?

1 Let's find the area by using these ideas.

① 20 % of the area of the field is 60 m².

② 1% of the area is
$60 \div 20 = 3$

③ 100 % of the area is
$3 \times 100 = \square$

(×100 from 1% to Base quantity; ÷20 from Compared quantity to 1%)

	Base quantity	1%	Compared quantity
Area (m²)	?	3	60
Percentage (%)	100	1	20

③ ×100 ② ÷20 ①

2 Put the total area of the field in m². Write a mathematical expression to calculate the area of the flower garden and then find the correct number for $\square$ using the calculation of **3**, **1**.

① Since 20 % of the area is 0.2, $\square \times 0.2 = \square$.

② $60 \div 0.2 = \square$
(Base quantity, Rate, Compared quantity)

(÷0.2)

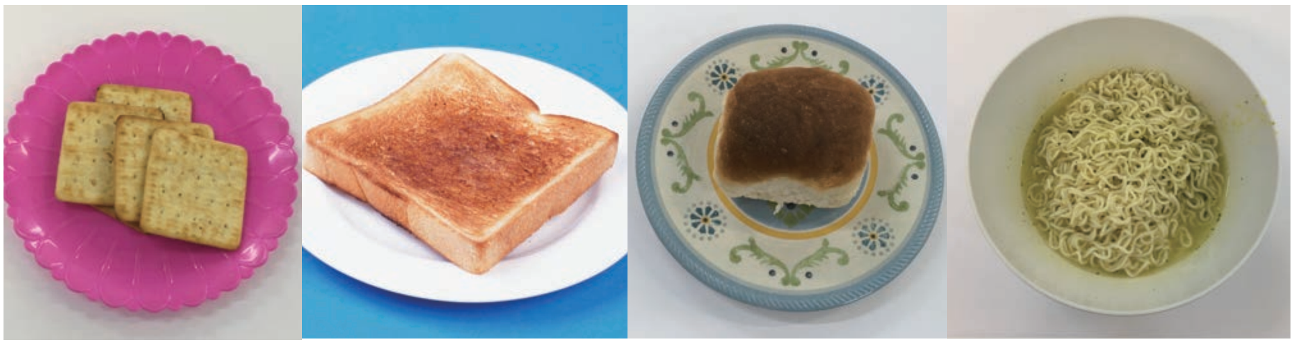
Area (m²)	?	60
Rate	1	0.2

(÷0.2)

Exercise

1 There is a fundraising where 15 % of the tickets sold are winning tickets. If there are 30 winning tickets, how many tickets are needed in all?

2 A boat carried 122 passengers on Friday. The degree of crowding was 120%. What is the required number of passengers the boat should carry?

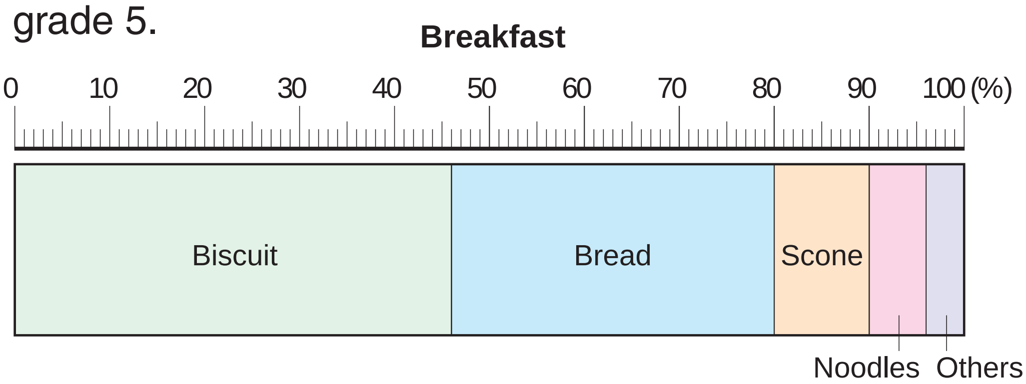


Biscuit Bread Scone Noodles

4 Graphs Expressing Rates

Band Graph

1 The graph below shows the result of breakfast taken by students in grade 5.



1. What is the percentage of biscuit compared to the total number of students?
2. What percentage is bread, cereal and noodles compared to the total number of students, respectively?
3. There are 50 students in the grade 5.
   Let's find the number of students for each type.

A graph that expresses the total as a rectangle-like band is called **band graph**.
With a band graph, it is easy to see the rate of each part of the total because the size of each part is shown by the area of its rectangle.

How to Draw a Band Graph

2 The tables below show the types of traffic accidents causes by students in Eriku, Lae.
Let's draw band graphs to express these numbers.

Causes of Accidents in Grade 1

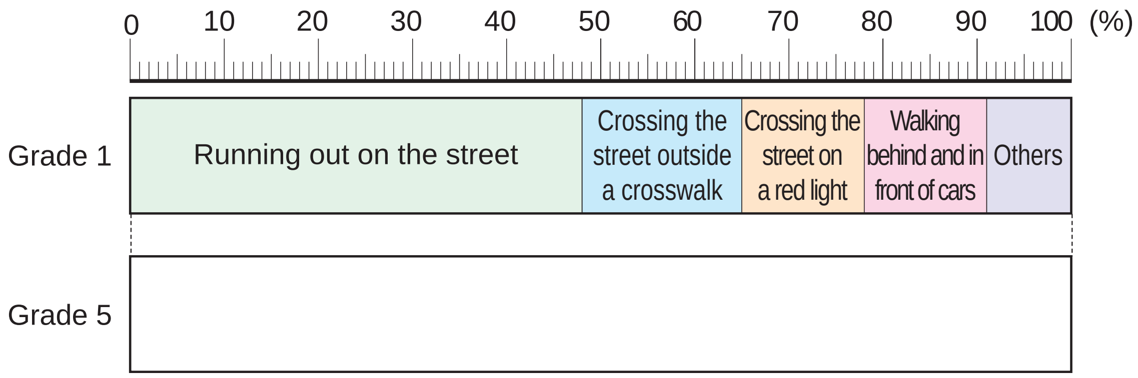
Cause	Number of students	Percentage (%)
Running out on the street	11	
Crossing the street outside a crosswalk	4	
Crossing the street on a red light	3	
Walking behind and in front of cars	3	
Others	2	
Total	23	

Causes of Accidents in Grade 5

Cause	Number of students	Percentage (%)
Running out on the street	8	
Crossing the street outside a crosswalk	9	
Crossing the street on a red light	4	
Walking behind and in front of cars	2	
Others	5	
Total	28	

1. Let's find the rate of each cause of accidents to the nearest hundredth by rounding to the thousandth.
   Then find each percentage and write them in the table.
2. Draw a band graph of the grade 5.
   Other is drawn last even if it is a large number.

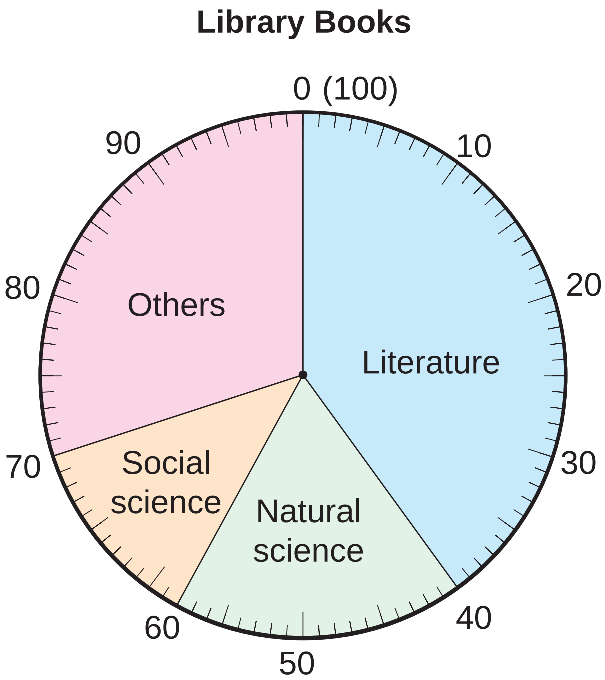
Number of Children by Cause of Accident

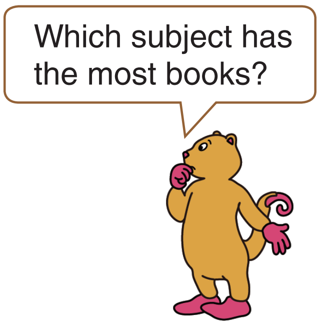


3. Let's discuss your findings based on the two band graphs.

Circle Graph

3 The graph below shows the types of library books at Ray's school and their rates.





1. What is the percentage of literature compared to the total number of books?
2. What are the percentages of natural sciences and social science books compared to the total number of books?
3. There are 3 600 books at the library.
   How many books are there in each field?

A graph that is drawn as a circle is called a **pie graph**.
With a pie graph, it is easy to see the rate of each part of the total because the size of each part is shown by its area.

How to Draw a Circle Graph

4 The table below shows the types of injuries that occurred during a year at Asaro Primary School. Draw a pie graph to show these numbers.

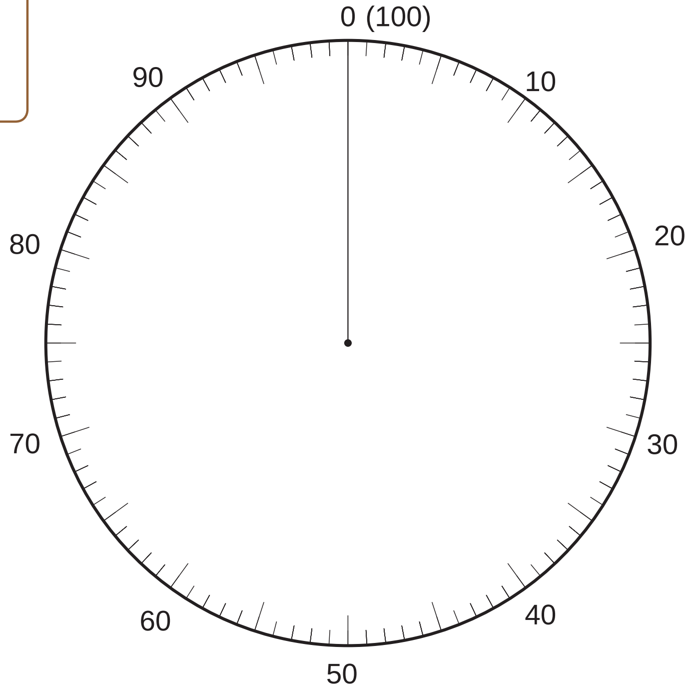
1. Let's find the total rate of each injury to the nearest tenth by rounding to the hundredth. Then find their percentages and write them in the table.
2. Let's draw the pie graph. "Others" is drawn last even if its rate is large.

Types of Injuries

Injuries	Number	Percentage (%)
Cuts	250	
Bruises	202	
Scratches	176	
Sprains	75	
Fractures	58	
Others	89	
Total	850	

Fill in the pie graph by starting at the top and moving clockwise.

Types of Injuries



Check these numbers at your school.

EXERCISE

1 Let's find the following rates.

Page 195

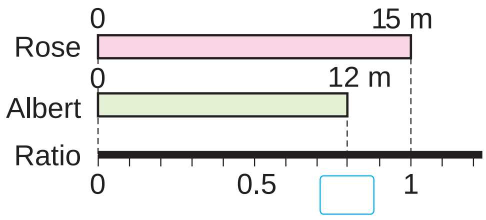
① When there are 7 correct answers for 10 problems, what is the rate of correct answers?

② They played 4 games and won all 4. What is the rate of winning games?

2 Rose has a 15 m tape. Albert has a 12 m tape.

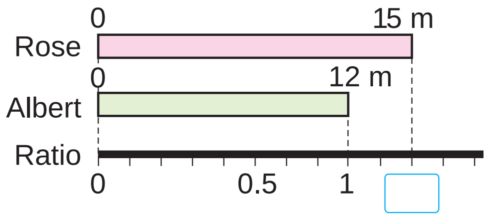
Page 196

① Let's find the rate of the length of Albert's tape to the length of Rose's tape.



② Let's find the Rate of the length of Rose's tape to the length of Albert's tape.

Pages 200 and 201



3 Mikes buys a bicycle that has a price of 600 kina, he has to pay 630 kina because of the Good & Service Tax.
What percentage of the selling price is the money you pay?

4 There are 300 eggs, 4 % of the eggs are broken.
How many eggs are broken?

Page 197

Grade 5
Do you remember?

Let's calculate.

① $\frac{1}{5}+\frac{7}{10}$ ② $\frac{5}{6}+\frac{2}{9}$ ③ $1\frac{1}{2}+2\frac{1}{4}$ ④ $2\frac{3}{8}+1\frac{5}{12}$

⑤ $\frac{3}{4}-\frac{1}{2}$ ⑥ $\frac{9}{10}-\frac{3}{4}$ ⑦ $\frac{7}{6}-\frac{2}{3}$ ⑧ $5\frac{1}{7}-2\frac{4}{5}$

16 Summary of Grade 5

Applying mathematics in daily life

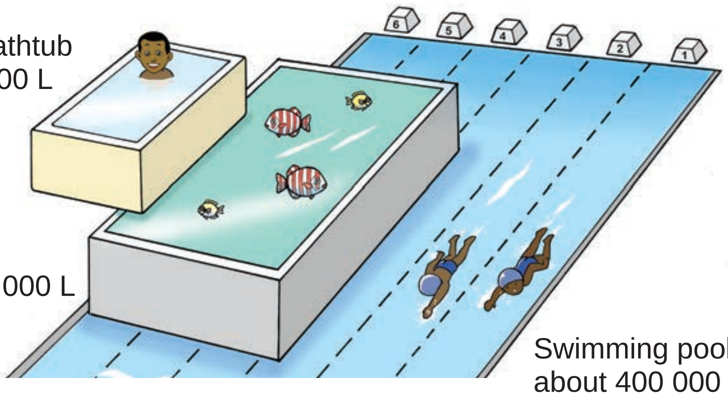
Different types of garbage come from the kitchen every day. There is much more garbage than packing materials and vegetables. Water used to wash rice, leftover noodle soup, tea and the oil used to fry fish will all eventually reach rivers, seas and the ocean. As bodies of water are polluted, fish and other living things will no longer be able to survive.

1 When I wash rice, I wash it four times and pour away the rice water. When this rice water is poured the first time down the drain, it must be mixed with water to make it clean. I use water from 0.9 cup of a bathtub which contains 300 L of water to make the water clean. The table below shows the amount of water to make the water clean. When the rice water is poured down four times, how many L do we need to make the water clean?

Amount of Water to Clean Rice Water

Number of washing of rice	1	2	3	4
Amount of water to clean rice water(cups)	0.9	0.9	0.6	0.5
Amount of water (L)				

Swimming pool,
Port Moresby, NCD



Camp Welch River,
Central Province

Jais Aben,
Madang Province

2 A bowl of noodle soup is poured down the kitchen sink. About 750 L of water is needed to make the leftover soup clean enough for fish to survive. If a person pours a bowl of noodle soup down the drain every day for a year, how much is the amount of water needed to make the soup clean?

3 A table spoon of oil is 15 mL. When this oil is poured down the drain, it must be mixed with about 5100 L of water to make the water clean.

1. How much water is needed as multiple of the oil?
2. If we use 450 mL of cooking oil in a pot and pour it directly down the drain, how much water will be needed to clean this oil?

Let's think about what we can do to keep the water clean.

Numbers and Calculations

①

1 Let's calculate 100 times and $\frac{1}{100}$ of the following numbers.

① 5.18 ② 0.407 ③ 13.4 ④ 3600

2 Let's calculate. ③ ⑤ ⑧ ⑪

① 8×1.6	② 5×2.2	③ 32×6.4
④ 2.4×1.5	⑤ 5.72×8.1	⑥ 0.4×0.28
⑦ $9 \div 0.5$	⑧ $48 \div 1.6$	⑨ $54 \div 1.8$
⑩ $1.2 \div 0.3$	⑪ $8.05 \div 3.5$	⑫ $0.03 \div 0.15$
⑬ $\frac{3}{4} + \frac{1}{8}$	⑭ $\frac{2}{5} + \frac{3}{7}$	⑮ $2\frac{1}{8} + 1\frac{5}{12}$
⑯ $\frac{5}{6} - \frac{2}{3}$	⑰ $\frac{8}{15} - \frac{4}{9}$	⑱ $3\frac{3}{16} - 1\frac{7}{8}$
⑲ $\frac{3}{7} \times 2$	⑳ $\frac{3}{2} \times 3$	㉑ $\frac{2}{9} \times 3$
㉒ $\frac{3}{5} \div 2$	㉓ $\frac{4}{7} \div 2$	㉔ $\frac{8}{9} \div 4$

3 Let's summarise the properties of whole numbers. ⑦

① How many common multiples of 4 and 6 are there between 50 and 100?

② Let's find the least common multiples and greatest common divisor of the following pairs.

Ⓐ (12, 18) Ⓑ (8, 16)

③ What is the biggest prime number between 1 and 100?

⑧

4 Arrange the following fractions and decimal numbers from the smallest to the largest.

$\frac{4}{5}$ $\frac{17}{8}$ 0.7 1.6 $1\frac{3}{4}$ 3.08

5 A 7.2 cm wire weighs 3.6 g.

1. How many g is the weight of 1cm of this wire?
2. How many g is 3.6 m of this wire?

3 5 

The Secret of □ ÷ 7

Write whole numbers in order in the □ of □ ÷ 7 and calculate the numbers.

1 ÷ 7 = □

2 ÷ 7 = □

3 ÷ 7 = □

4 ÷ 7 = □

5 ÷ 7 = □

6 ÷ 7 = □

7 ÷ 7 = □

8 ÷ 7 = □

9 ÷ 7 = □

⋮

```
      0.1428571
   7 )1.0
       7
       30
       28
        20
        14
         60
         56
          40
          35
           50
           49
            10
             7
             3
```

The aligned dots indicate to continue.

What do you see?

Measurement

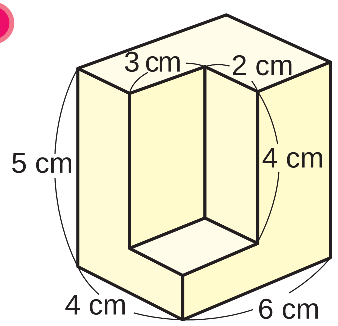
2

1 There are 966 students playing in the large field that has an area of 1680 m². There are 105 students playing in the small field that has an area of 200 m². Which field is more crowded?

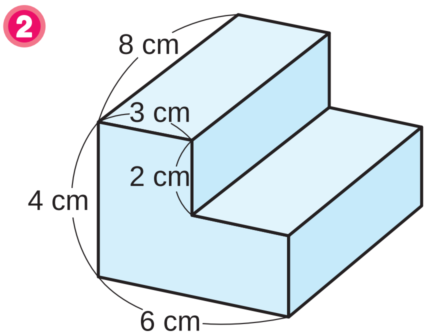
6

2 Let's find the volume of these figures.

1



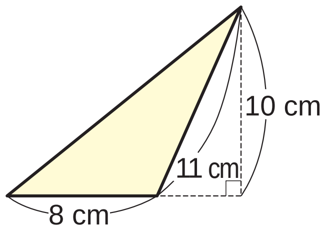
2



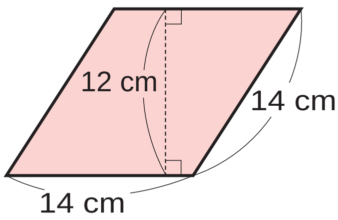
10

3 Let's find the area of these shapes.

1

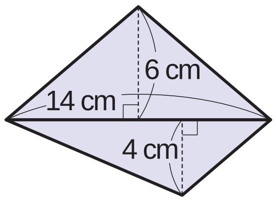


2

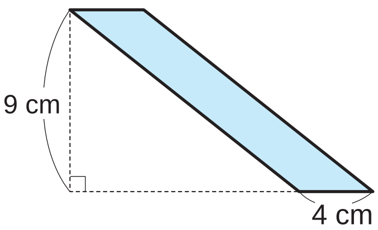


Parallelogram

3

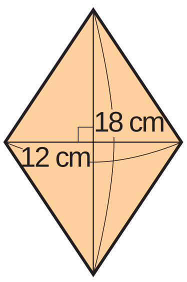


4



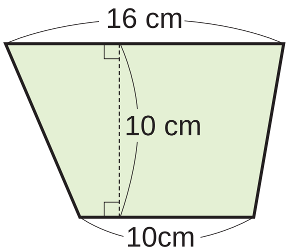
Parallelogram

5



Rhombus

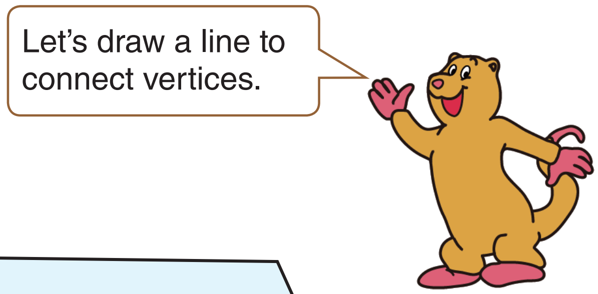
6

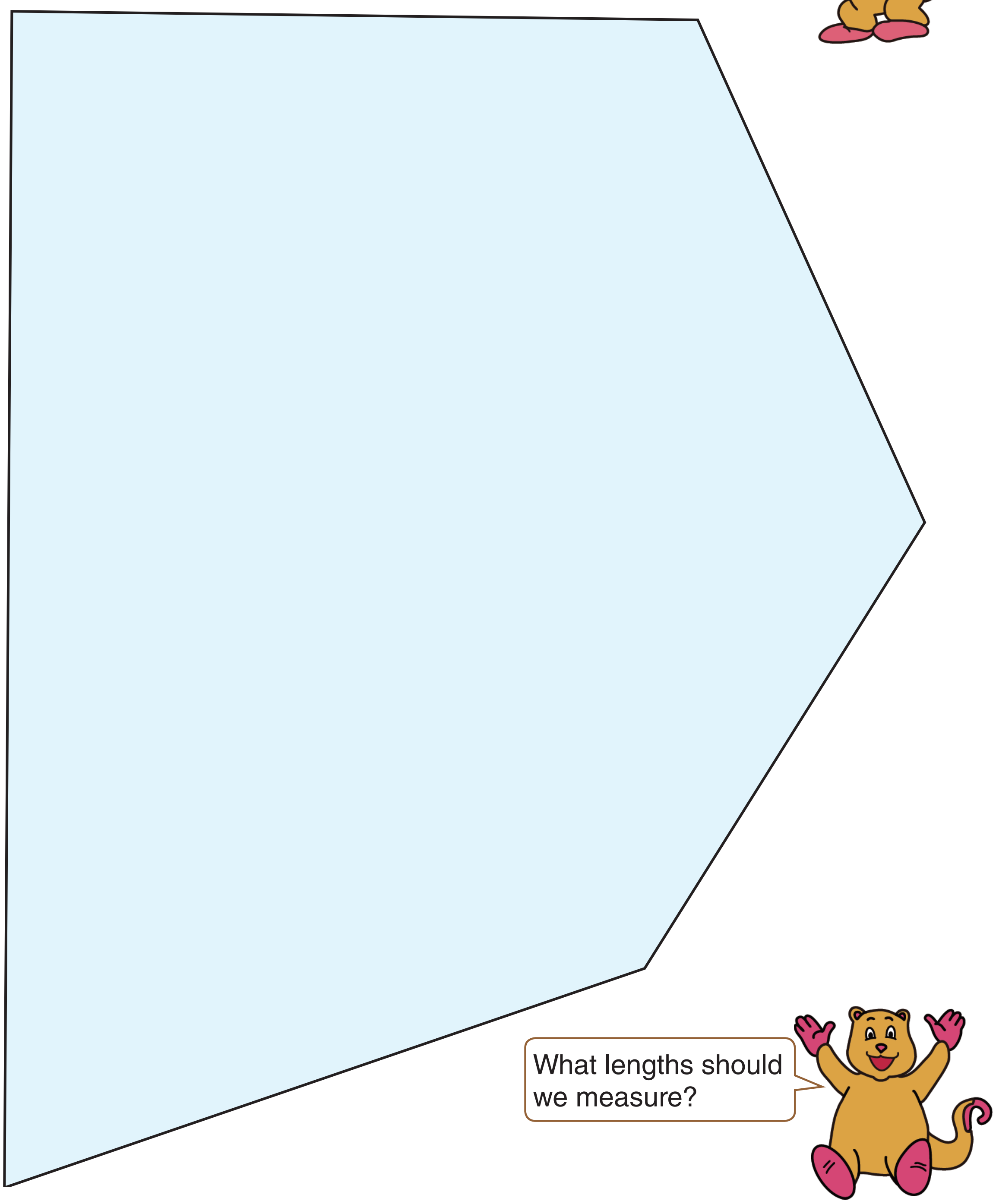


Trapezoid

Let’s Find the Area of Various Shapes !

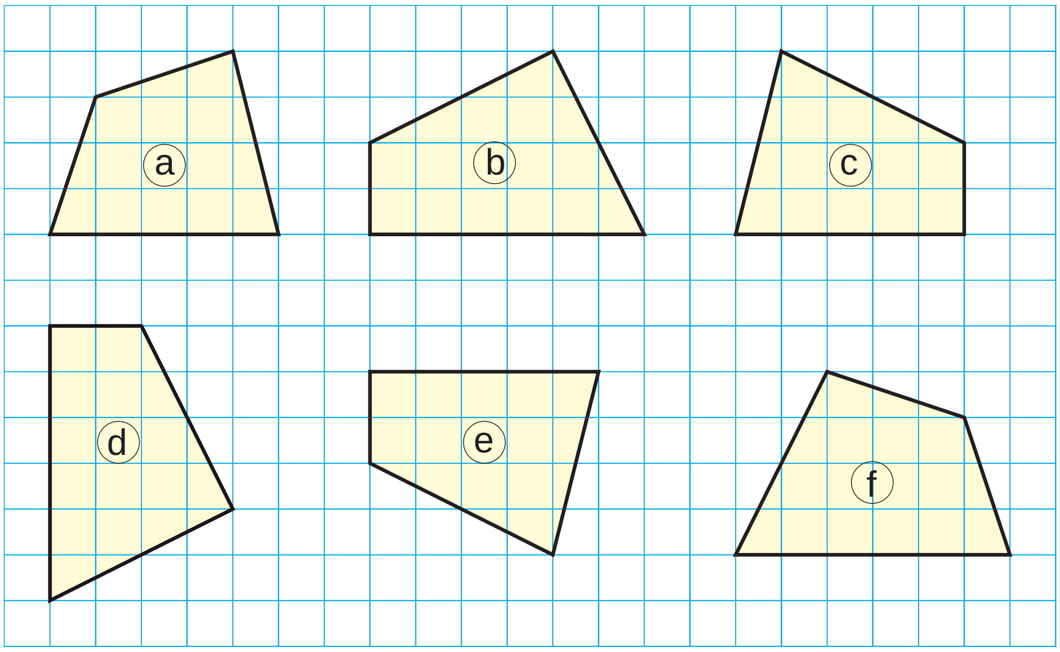
Let’s find the area of the following shape by using what we learned.



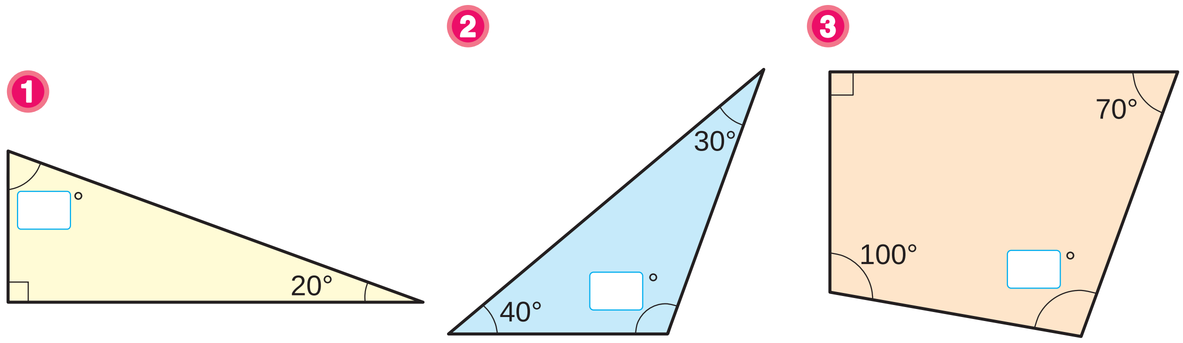


Shapes and Figures

1 Let's find the congruence figures. ④

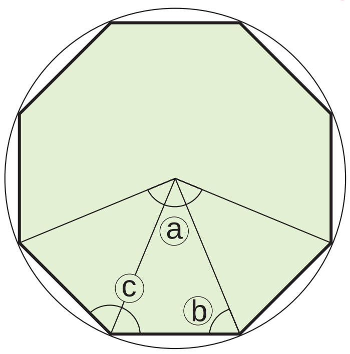


2 Fill the ☐ with a number. ④



3 We draw a regular octagon by dividing the angle around the centre of the circle into 8 equal parts. ⑬

① What is the size of angle ⓐ?
② What is the size of angle ⓑ?
③ What is the size of angle ⓒ?

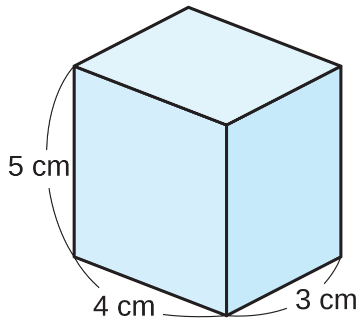


4 Let's find the circumference of these circles. (13)

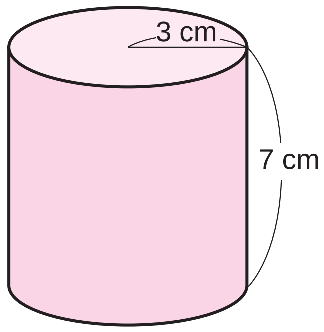
1. A circle with 4 cm diameter.
2. A circle with 5 cm radius.

5 Let's draw the net of these solids. (14)

1.

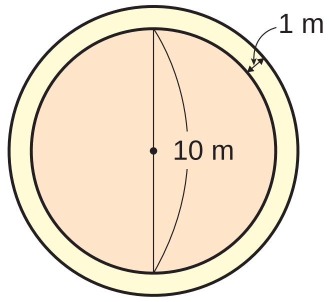


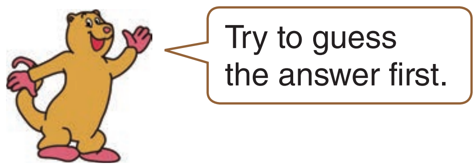
2.

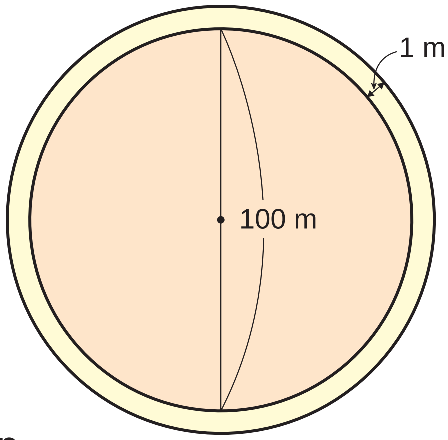


Circles Separated by 1 m

Draw a circle with a 10 m diameter and then draw another circle that is 1 m outside that circle.
How many metres longer is the circumference of the outer circle than the inner circle?







Draw a circle that is 1 m outside a circle with a 100 m diameter.
How many metres longer is the circumference of the outer circle than the inner circle?

Relationships among Quantities

1 Fill in the □ with a number.

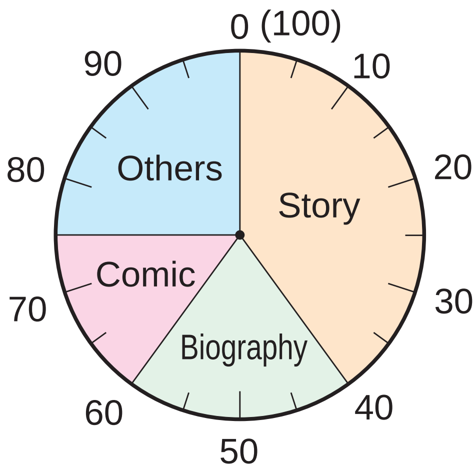
① 36 kg is □ % of 48 kg.

② 80 % of 2.5 m is □ m.

③ 35 % of □ Kina is 1400 Kina.

2 There are 160 books on a shelf.
This graph shows the ratio of each type of books.
How many story, biography and comic books are there?

Each Type of Books



Math Adventure

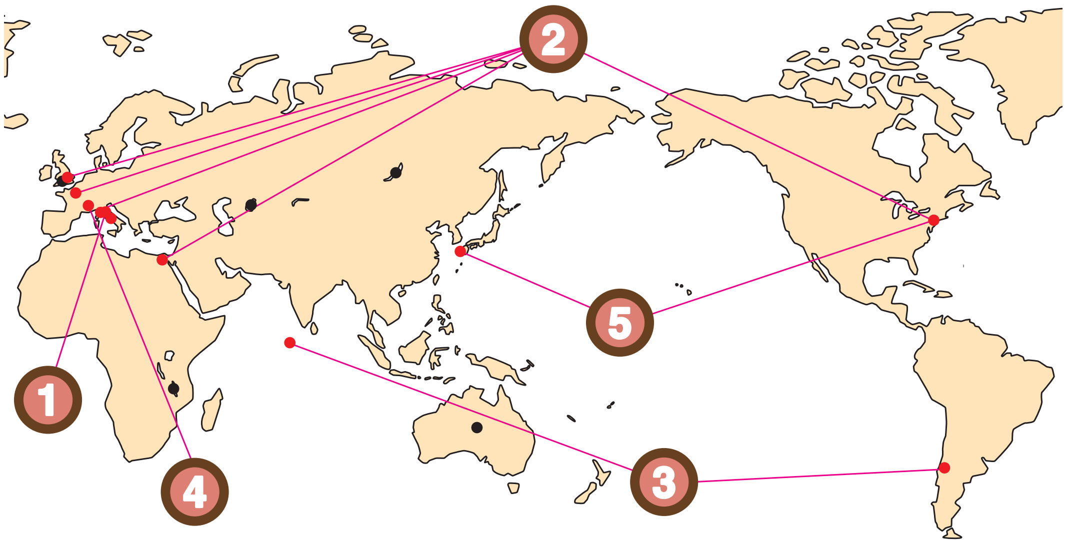
Part 1

All over the world. people are trying to keep valuable buildings and natural environment as 'World Heritage'. Now, let's go on a journey by plane to clear up mysteries in the world.

Professor Steven

The places of the fragments

1. Cathedral from Birds' Eyes
2. World Heritage Site – Comparing Height
3. Sinking Islands
4. Roman Empire Cities with Water Supply
5. Pentagon by Fractions



Let's go to the places to find the fragments of the key !

① Cathedral from Birds' Eyes

Old city area in Florence, Italy, is approved as one of the World Heritage Sites. The building which can be seen from anywhere in this city is St. Maria del Fiore Cathedral.

This Cathedral's appearance varies differently depending on the position of the viewer. What kind of shape can we see from the top view?
The most Christian church's top view is cross-shaped. Appearances of buildings is dependent upon the viewer's positions.

Yes, there is a story that the number of chimneys is viewed as one, but actually there are two.

A cylinder also has a circle shape from the top view, but a rectangle from the side view.

I will give you a problem now. If we create a solid which consists of the front view "┴┴", the side view "田" and the top view "+" using cubic blocks, you can access the fragment key.
The design of solid is on the next page.

Design

A. Front view

		5		
		3		
1		5		1
1		3		1
1	1	5	1	1

B. Side view

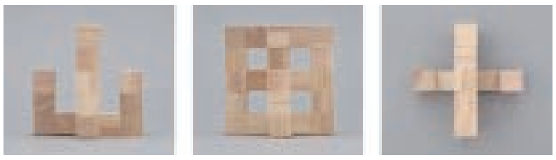
1	1	1	1	1
1		1		1
1	1	3	1	1
1		3		1
1	1	5	1	1

C. Top view

		5		
		3		
3	1	5	1	3
		3		
		5		

The numbers in the design indicate the number of blocks used for the corresponding slots.

We can imagine the shape, can't we? Let's make those shapes.



We did it!

I got the answer without calculation!

Well done. So, divide the numbers of all blocks by the number of slots with numbers in each A, B, and C to get the average for one slots of each.

Why did she get the answer without calculation? Write your reasoning in your exercise book.

Ⓐ Ⓑ Ⓒ

• Let's cut out fragments on page 246 and paste on the last page.

Let's go to the next place to find the fragments of the key!

② World Heritage Sites – Comparing Height

Ⓐ Eiffel Tower

The Eiffel Tower in Paris, France, was built in 1889, when the Paris International exhibition was held. Its roof top height is about 300 metres.

I want to go up there one day.

But, Tokyo Tower is a little bit taller.

Let's find out the heights of the following buildings in World Heritage sites. In this activity, there is a hint to get to another key fragment.

Ⓑ The Leaning Tower of Pisa in Italy:
It has a lean of 5° towards the south.

Ⓒ Big Ben in the England

Ⓓ King Khufu's Pyramid in Egypt

Ⓔ The Statue of Liberty in the United States of America
(the height included a part of plinth)

There are 4 sentences below. If the heights of B to E is represented by □, write expressions for calculating their heights.
The height of the 'Eiffel Tower is known.

① The height which is 1 metre less than the Leaning Tower of Pisa is 0.18 times of the Eiffel Tower.

② The height which is 4 times the Statue of Liberty is 72 metres higher than the Eiffel Tower.

③ The height of Big Ben is 0.72 metre less than the height which is 1.04 times the Statue of Liberty.

④ If we add the heights of King Khufu's Pyramid and the Leaning Tower of Pisa, it is twice the height of Big Ben.

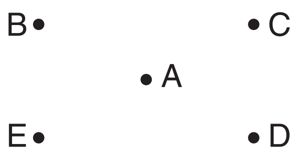
If the height of the Leaning Tower of Pisa is □ m, the height which is 1 metre less than □ m is (□ − 1) m.
The height which is 0.18 times as high as the Eiffel Tower is expressed as 300 × 0.18, therefore, we can make the expression,

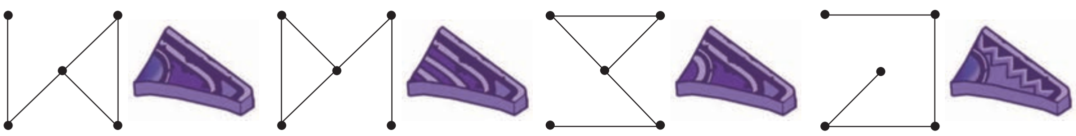
$\square - 1 = 300 \times 0.18$

Using this expression, we can get □.

If the height of The Statue of Liberty is □ m, the height which is 4 times □ is the same as the answer of the addition between 72 and the height of the Eiffel Tower.
Therefore, we can represent it as follows $\square \times 4 =$ (The height of Eiffel Tower) + 72

Likewise, calculate the heights of the 4 buildings and in the order of their heights from tallest, draw lines.
What kind of shapes can we make?





• Let's cut out fragments on page 246 and paste on the last page.

③ Sinking Islands

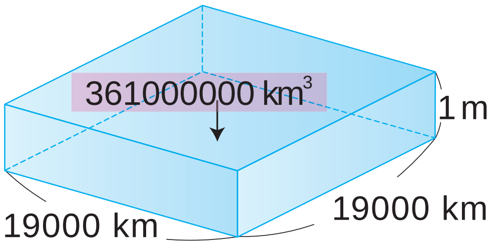
It is said that Global warming leads to the rise in sea level. It is also predicted by some researchers that the sea level will rise to a maximum of 59 cm in the 21^{st} century. In Maldives, in the Indian Ocean, $\frac{4}{5}$ of their land has only less than 1m altitude from the sea level.

It might sink forever if the sea level continuously rises.

The area of the sea on earth is about 361000000 km².

If we think of the area as a square, the length of one side is about 19000 km.

If we think of the following rectangular prism using this square, what km³ of water is necessary for the sea level to rise by one metre? Let's calculate it.



A large amount of water is necessary. If the sea level rises by one metre, most lands of Maldives will sink.

I wonder where this large amount of water comes from. Is it because of Global Warming? It might be as a result of ice melting in the Arctic Ocean.

So, let's experiment! Let's add water and ice in a glass and check the surface of the water.

Check on the surface of water.

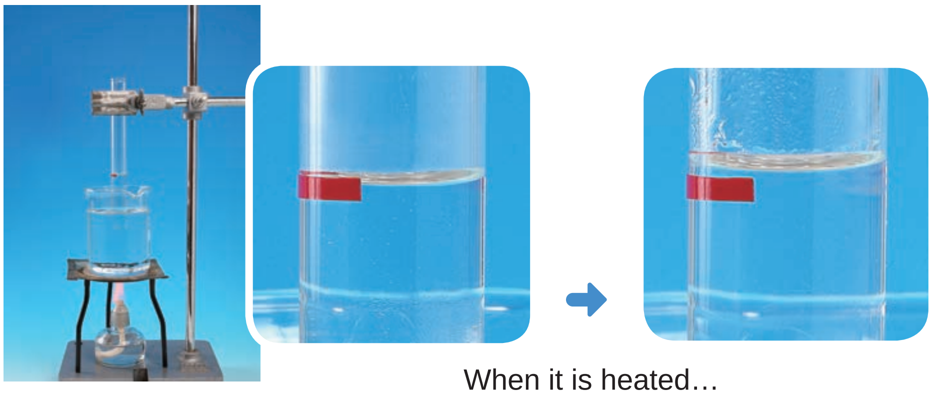
Ice floats on water in a glass.

Leave the glass until the ice melts.

Ah, the surface of water has not risen.

In fact, it is said that one of the causes of the rise in the sea level is “Expansion of the seawater because of Global Warming”.

Right. Water expands when it is heated.



When it is heated…

Another cause of rise in the sea level is “Decrease of glacier”.
It means that ice on land melts and it flows into the sea.
Let’s search how much glacier actually melts.
The glacier on Padagonia icy field in Chile and Argentina melts at a faster speed than any other glacier on the earth.
It is said that in the past 7 years,
42 km^2 of ice is lost every year.
How many 1 m^3 ice cubes have melted over the past 7 years?
This is a hint to find a fragment.

Padagonia icy field

A : 200 billion or less than 200 billion

B : more than 200 billion and less than 250 billion or equal to 250 billion

C : more than 250 billion and less than 300 billion or equal to 300 billion

the size of 1 m^3

- Let’s cut out fragments on page 246 and paste on the last page.

Let’s go to the next place to find the fragments of the key!

4 Roman Empire Cities with Water Supply

There was a country named the Roman Empire in the Mediterranean area more than 2000 years ago. This country constructed water bridges combining roads connecting to various places with water pipes to send water. One water bridge of these constructions still exists in France and is approved as a part of World Heritage.

Roman aqueduct (France)

I am surprised that there were water pipes in such far past!

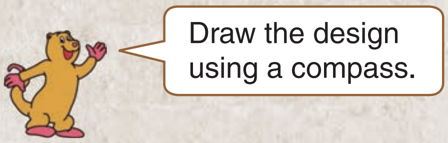
It is amazing that it was constructed by piling stones which enabled water to flow!

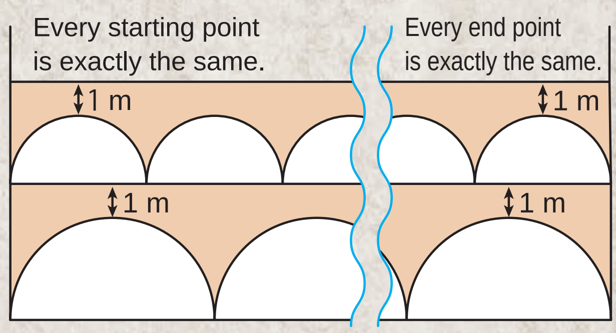
The length of this Water Bridge is 275 m, the height is 49 m and it has 3 levels. The 1^{st} level is supported by 6 arches, the 2^{nd} by 11 and the 3^{rd} by 35.

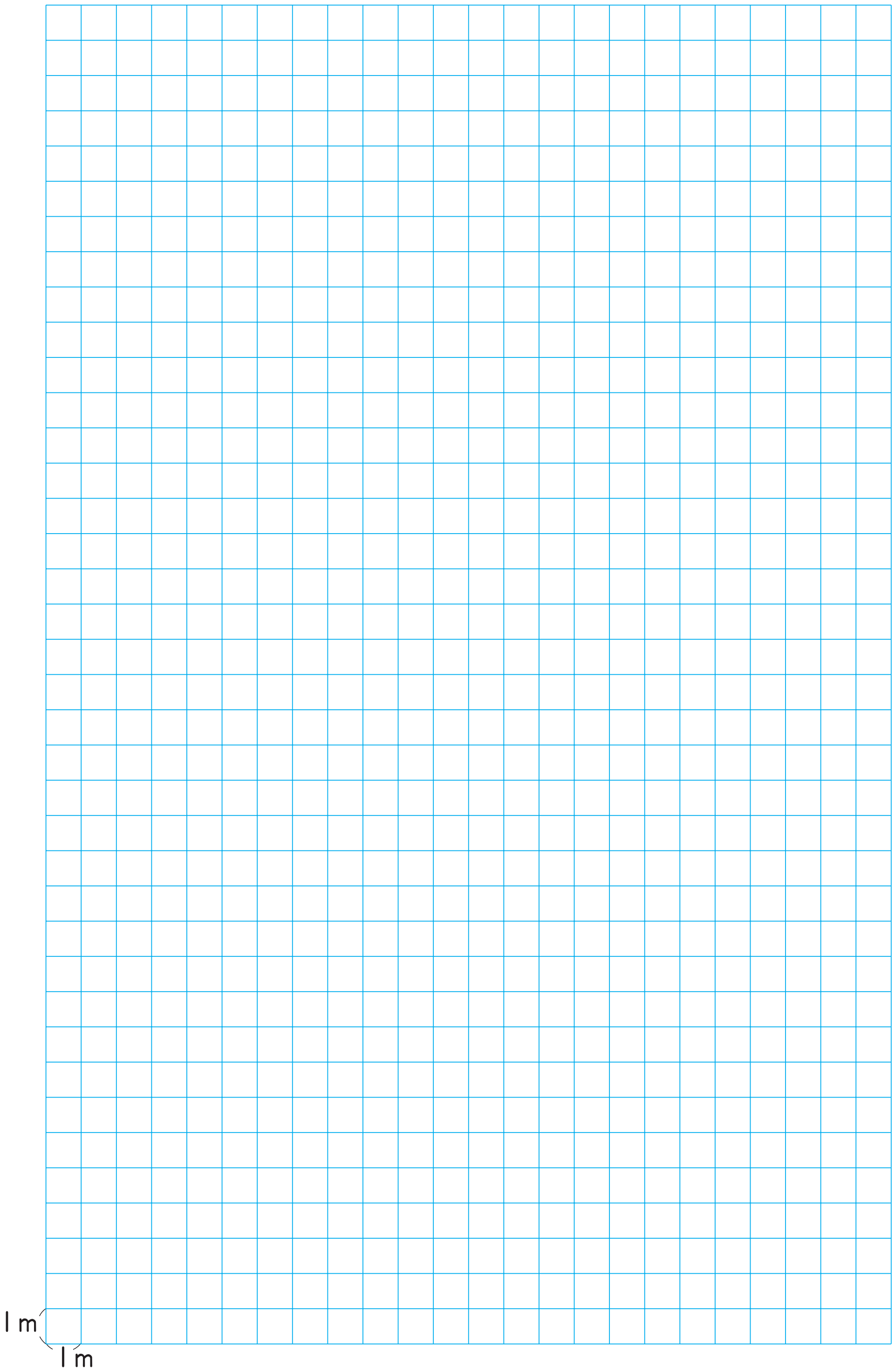
I will tell you a hint to find the key fragment. If you design a water bridge with a length of 24 m, you will find the place of the fragment.

How to design

- The number of arches begins from one in the 1^{st} level and then it increases gradually as the level goes up.
- The width of the arches in each level is the same size and so the total length of every level should be the same.
- The width of the arches should be expressed by a whole number with a unit of “metre.”
- The width of the arches in each level is a divisor of 24.
- The shapes of the arches are semicircles and the difference between the highest point of the semicircles in each level and the bridge of the next level is 1 m.







You can find a fragment at the number which is an answer of multiplication between the number of arches in 3rd level and the number of arches in 6th levels.

① 22 

② 23 

③ 24 

④ 25 

• Let's cut out fragments on page 246 and paste on the last page.

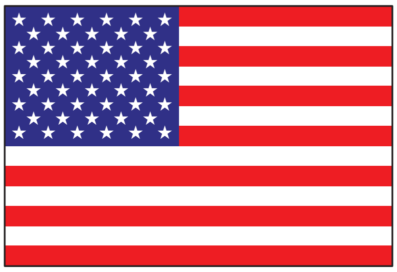
Let's go to the next place to find the fragments of the key!

5 Pentagon by Fractions

The shape of stars is frequently used in the national flags in the world.
The United States, which has “The Statue of Liberty” as a part of World Heritage also use stars indicating each state in their national flag.
In Japan, Nagasaki city also has stars in their flag.

The Statue of Liberty

Peace Statue (Nagasaki city, Japan)



The national flag of the USA

Nagasaki city’s flag

There is an interesting way to draw a star. It is $\frac{5}{2}$.

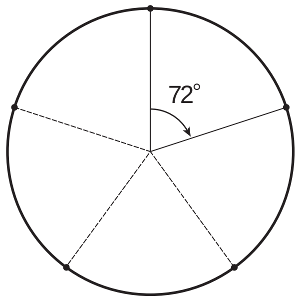
What? How can we draw stars by fractions?

The denominator and the numerator indicate the way to draw it, right?

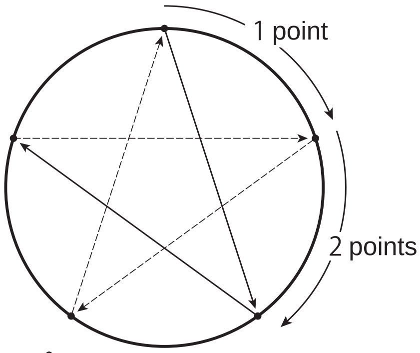
You have an eye on good points. I will show you the way now, so let’s do it together.

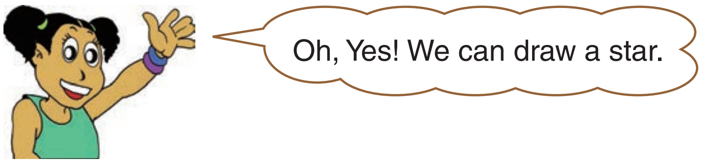
At first, the numerator (5) indicates that drawing 5 points divides a circle equally into 5 sectors.

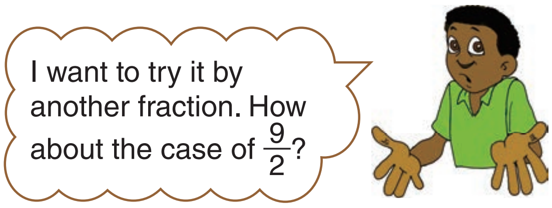
A circle has 360 degrees, so $360 \div 5 = 72$, we can divide by 72 degrees for each.

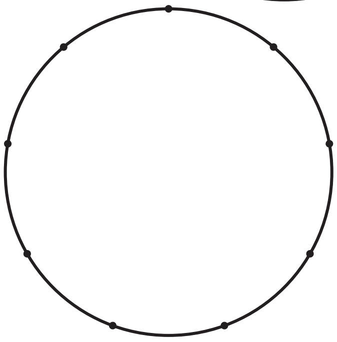


Next, I will explain the meaning of the denominator (2). Decide a starting point and then draw a line connecting the starting point and a point (end point) locating 2 points after the starting point and line connecting the end point with a point locating 2 points after the point again, and continue until it reaches the starting point!





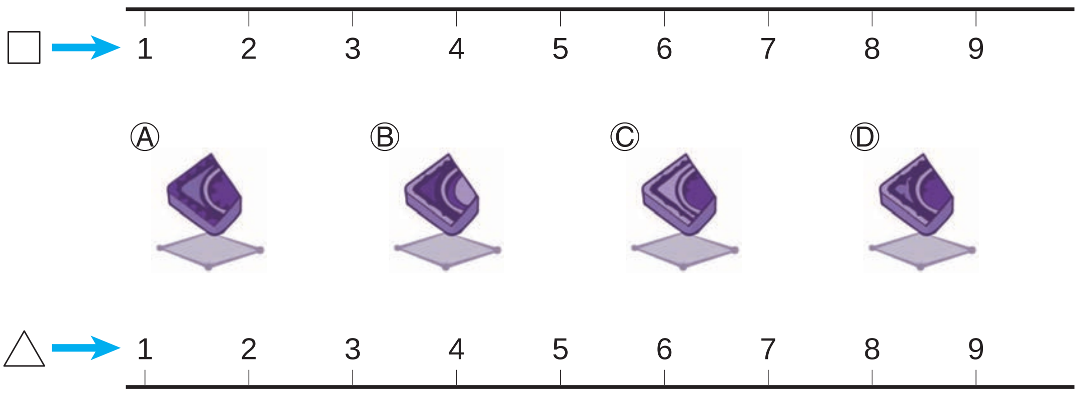




Awesome! If we use $\frac{9}{3}$, we can draw a triangle!

$\frac{9}{3}$ reduces to $\frac{3}{1}$. We divide a circle to 3 sectors and draw a line one by one, so it will surely be a triangle.

So, to find the fragment of the key, we should find it by $\frac{\square}{\triangle}$ which enable us to draw a "square". The line between the denominator and the numerator is found in the following diagram. The fragment can be found on the line you drew.

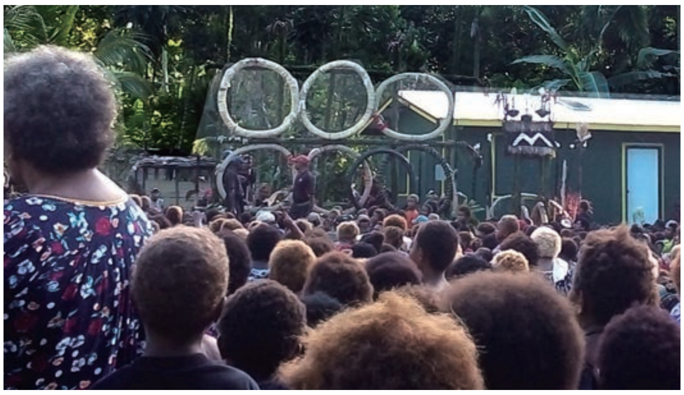


- Let's cut out fragments on page 246 and paste on the last page and make the key completed.

Let's go to the next place to find the fragments of the key!

Value of Toral Shell Money (Tabu)

Papua New Guinea had the practice of buying and selling using their own traditional money before the introduction of Kina and Toea in 1975. Different province and regions in Papua New Guinea have their own way of paying for goods, we call Barter system. When there is need for payments such as bride price ceremony or compensation, the people pay using the goods they produce or raised or pay with the traditional money they have. The Rabaul people use Tabu or shell money as shown in the picture. During a ceremony, rings of Tabu are displayed. The value of Tabu is 10 toea for 12 tabu beads per stick. One arm span is 5 kina. In a bundled ring Tabushell, there are 40 rings with a diameter of 80 cm. If 70 cm of tabu (one arm length) is 5 kina, what is the total value of this bundle ring?



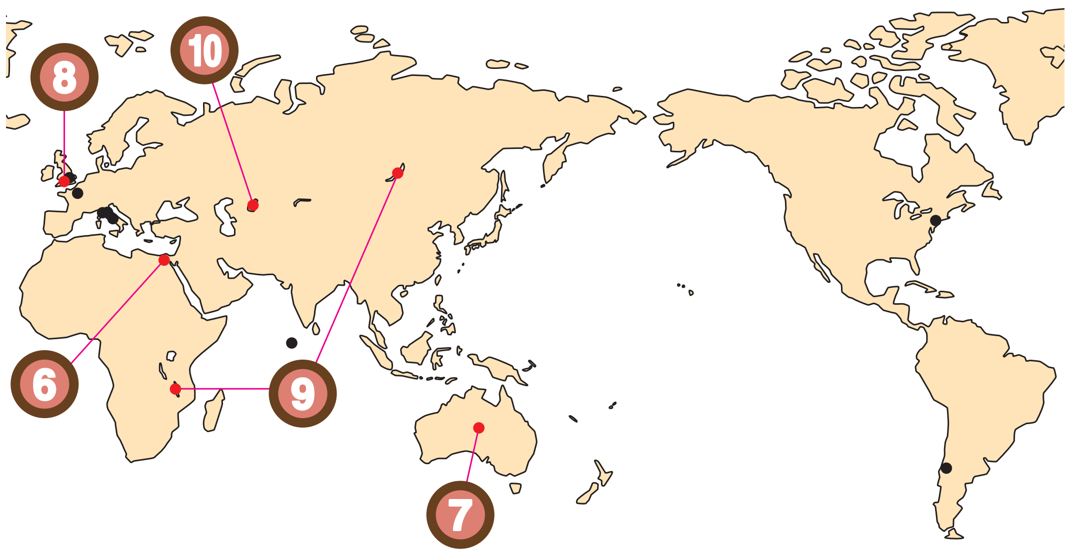
Math Adventure

Part 2

There are phenomena (things) which make us wonder why they happen on earth. We sometimes think ‘why did they make this kind of things. What did the ancient people see and think about while they were making these things?

The places of the fragments

6 The Oldest Scroll of Mathematics
7 Ayers Rock the Center of the Earth
8 A Mysterious Circle of Stones
9 World Heritage – Comparing Areas of the Lakes
10 Disappearing Lake from Map



Let’s go to the places to find the fragments of the key !

6 The Oldest Scroll of Mathematics

There are many sites of the ancient Egyptian Royal Dynasty in Egypt. These huge pyramids are all royal sites.

Pyramids (Egypt)

About 3700 years ago, the scribe Ahmose, who worked under a pharaoh, recorded the mathematics knowledge of that period on a papyrus paper scroll. In 1858, an English explorer Alexander Henry Rhind found the scroll and it was deciphered 20 years later.

The scroll shows questions about various fractions which are written as the sum of different unit fractions.

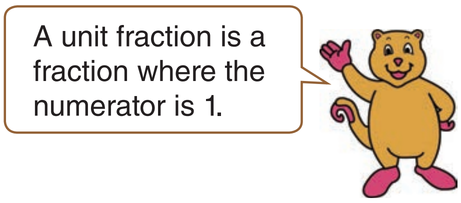
For example, you express $\frac{2}{3}$ as addition of unit fractions as;

$$\frac{2}{3} = \frac{1}{\square} + \frac{1}{\triangle}$$

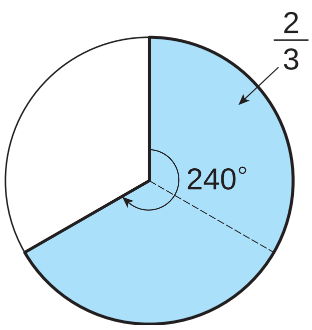
Put different numbers in $\square$ and $\triangle$.

So, we need to express $\frac{2}{3}$ as a sum of different unit fractions.

How about putting any number in the blanks.
See if it's right or not.



Imagine a circle. How many degrees is $\frac{2}{3}$?



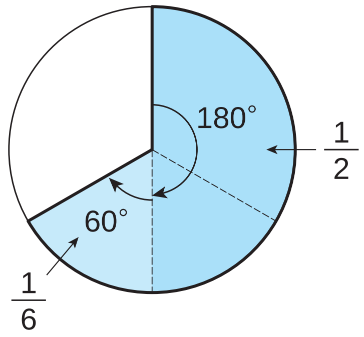
One circle means 360° so dividing it by 3 and two pieces of that are $\frac{2}{3}$.

Then, $360 \div 3 \times 2 = 240$ so, it is 240°.

240° is 180° + 60°, right?

Oh, 180° is, $\frac{180}{360} = \frac{1}{2}$. 60° is $\frac{60}{360} = \frac{1}{6}$.

I see! The answer is $\frac{2}{3} = \frac{1}{2} + \frac{1}{6}$.



This is a quiz to find the key fragment. You can find the hint to the hiding place by expressing $\frac{2}{5}$ as unit fractions.

$\frac{2}{5} = \frac{1}{\bigcirc} + \frac{1}{⬠}$

Let's study the relationship between fractions and angles. You can calculate the addition of fractions by the addition of angles after we study fractions by dividing a circle and the angle.

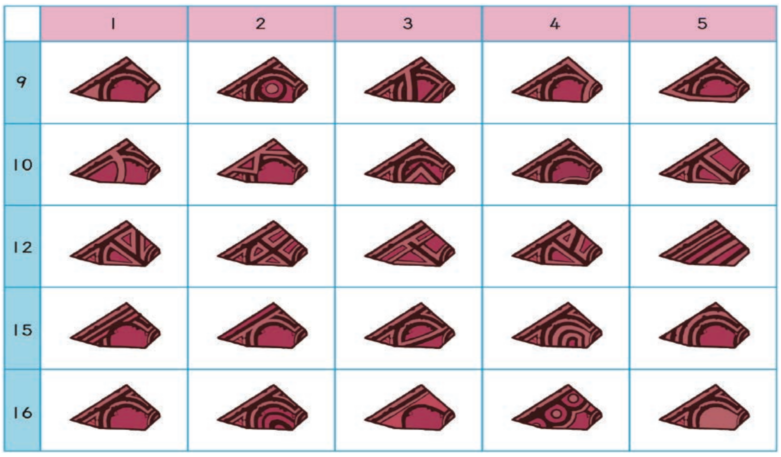
Fraction	1	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{5}$	$\frac{1}{6}$	$\frac{1}{8}$	$\frac{1}{9}$	$\frac{1}{10}$	$\frac{1}{12}$
Angle	360°	180°	120°	90°	72°					

$\frac{1}{15}$	$\frac{1}{16}$	$\frac{1}{18}$	$\frac{1}{20}$	$\frac{1}{24}$					
					14.4°	12°	10°	9°	8°

6°	5°	4°	3°	2°	1°

$\frac{2}{5}$ is 114° so,
I see!

The column represents the denominator of the bigger angle and the row represents the denominator of the smaller angle.



- Let's cut out a fragment on page 247 and paste on the last page.

Let's go to the next place to find the fragments of the key!

7 Ayers Rock the Center of the Earth

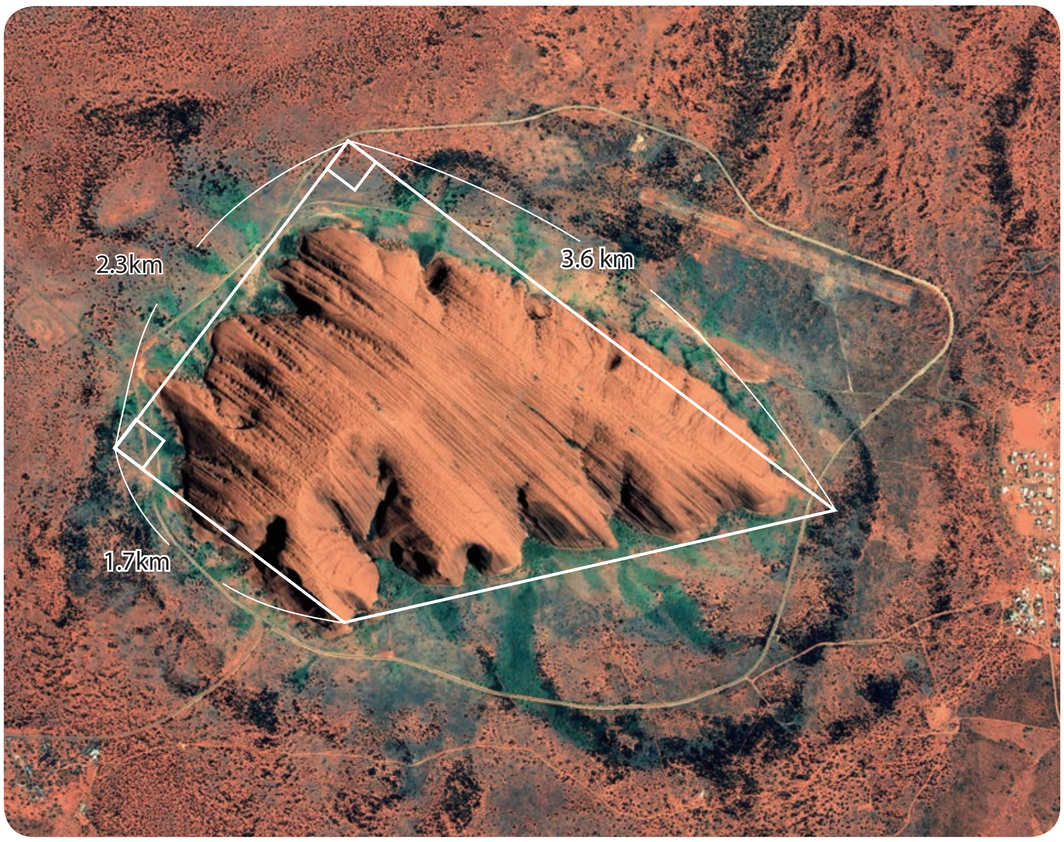
There is a famous rocky mountain called Ayers Rock in Australia.

How big is it?

I can see how big it is as I'm getting closer.

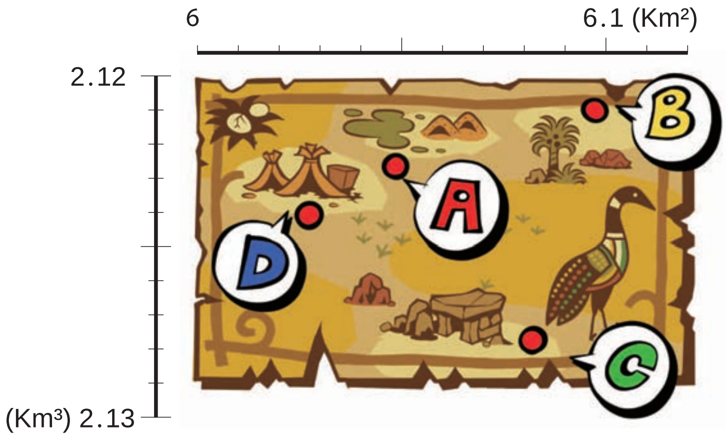
It is a huge monolith. It is said that the monolith is 9 km around, 348 m in height, 3.6 km in length and 2.4 m wide.

Let's consider Ayers Rock to be a trapezoid looked from straight above. The upper base is 3.6 m and the lower base is 1.7 m as shown below.



The location of the key fragment is shown on the following map. The area of Ayers Rock seen from straight above defines a number of the horizontal line and the volume defines a number of the straight lines. (The number of horizontal lines shows an approximate area of Ayers Rock seen from straight above and the number of vertical lines shows the approximate volume.) Round off the value of the volume to three decimal places.

You can find out the location with these two answers.

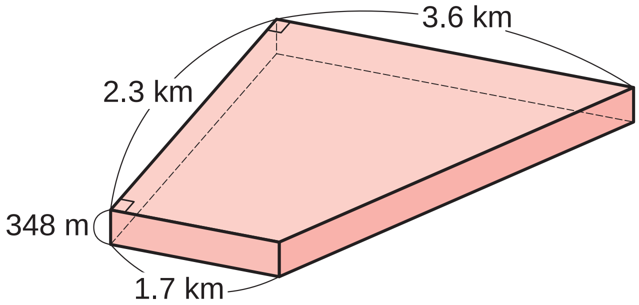


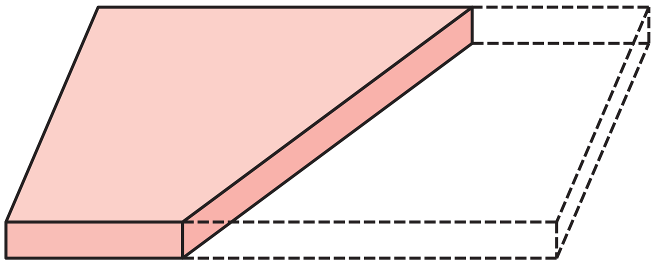
I see, the point where two lines intersect is the place of the fragment!

But, how can we find the approximate area and volume?

Imagine a figure as shown below.

Oh yeah, joining two of these shapes together it becomes a rectangular prism!





• Let's cut out a fragment on page 245 and paste on the last page.

Let's go to the next place to find the fragments of the key!

8 A Mysterious Circle of Stones

At the Stonehenge in the southern part of the England, there are ruins composed of a circle of large stones.
This was built about 3600 to 5000 years ago.
The weight of a stone pillar is about 25 tonnes and there is another stone which weighs 7 tonnes on the top of this.
It seems that these stones were carried from a place about 38 km away from this place. It is said that it took 600 people and 1 year to carry 1 stone.
If there were 1800 people to carry stones, how many years did it take to carry 120 stones?

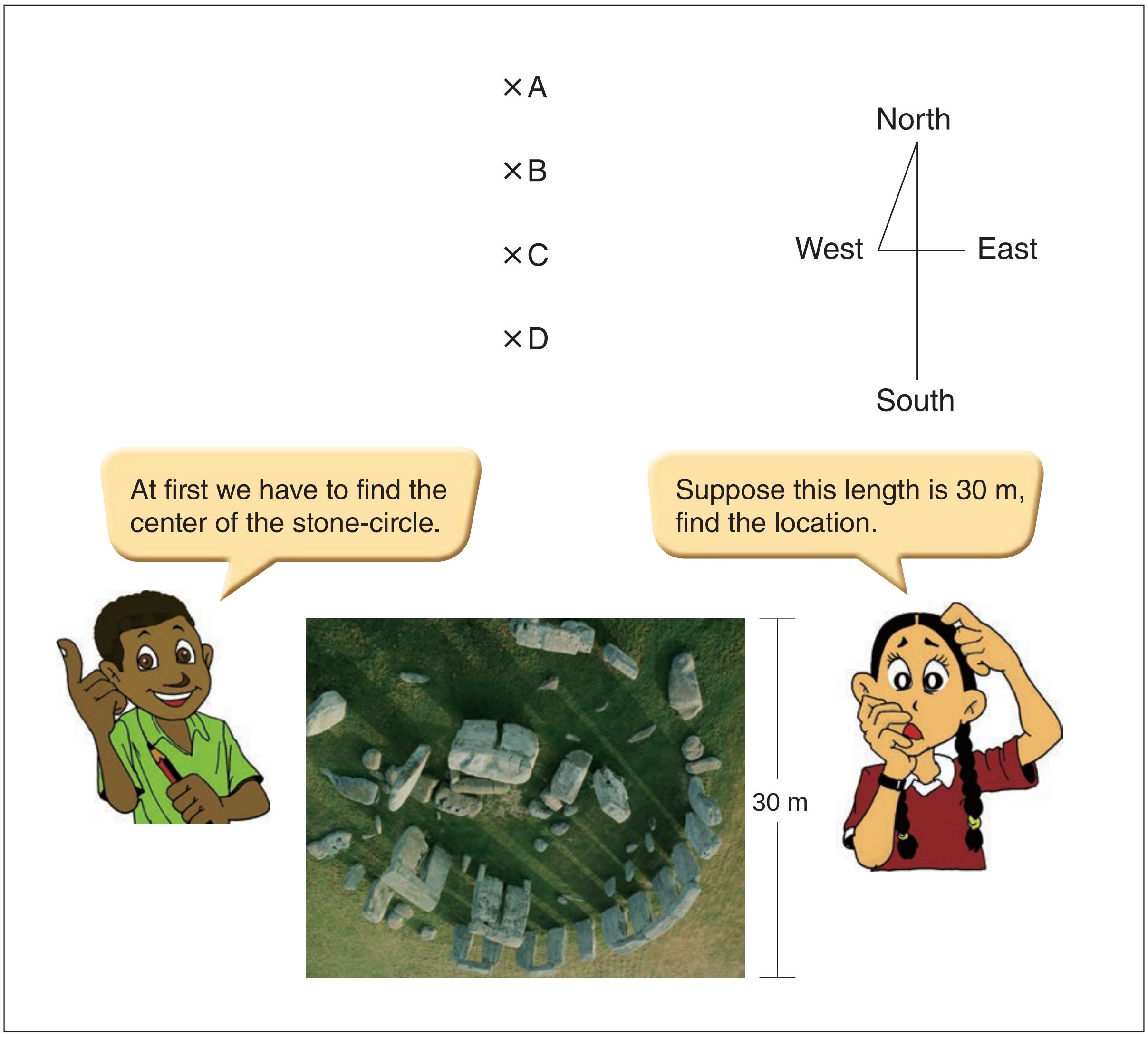
1800 people could carry 3 stones in 1 year.

Then, $120 \div 3 = 40$ so, it takes 40 years.

But how did they carry these stones?

Even in modern science it cannot be explained.

The key fragment is hidden near this stone circle. You will find the location when you go half way round the circumference from the centre of the stone-circle facing North. The stone-circle is 30 m in diameter but in this quiz let the diameter be 5 cm. Draw a figure then find the answer.



Ⓐ

Ⓑ

Ⓒ

Ⓓ

• Let's cut out a fragment on page 245 and paste on the last page.

9 World Heritage – Comparing the Areas of the Lakes

Lake Baikal, Russia

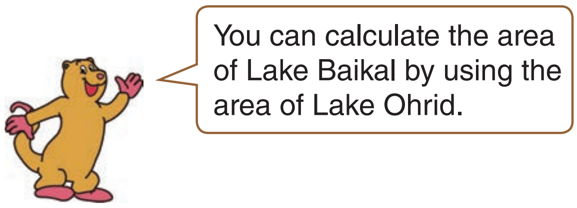
Lake Malawi, Malawi

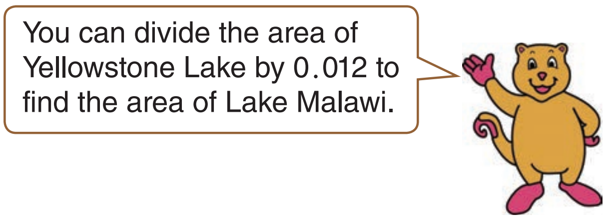
Lake Baikal in Russia and Lake Malawi in Africa are both far away from each other but their shape is similar. This is because the two lakes were made in the same way.

There are many other lakes in the World Heritage list. Lake Ohrid in Macedonia and Yellowstone Lake in the United States are famous. Let's compare the areas of these lakes.

While Lake Ohrid is 350 km² big, Lake Baikal is 90 times bigger. The area of Yellowstone Lake is 1.2 % of Lake Malawi, 360 km².

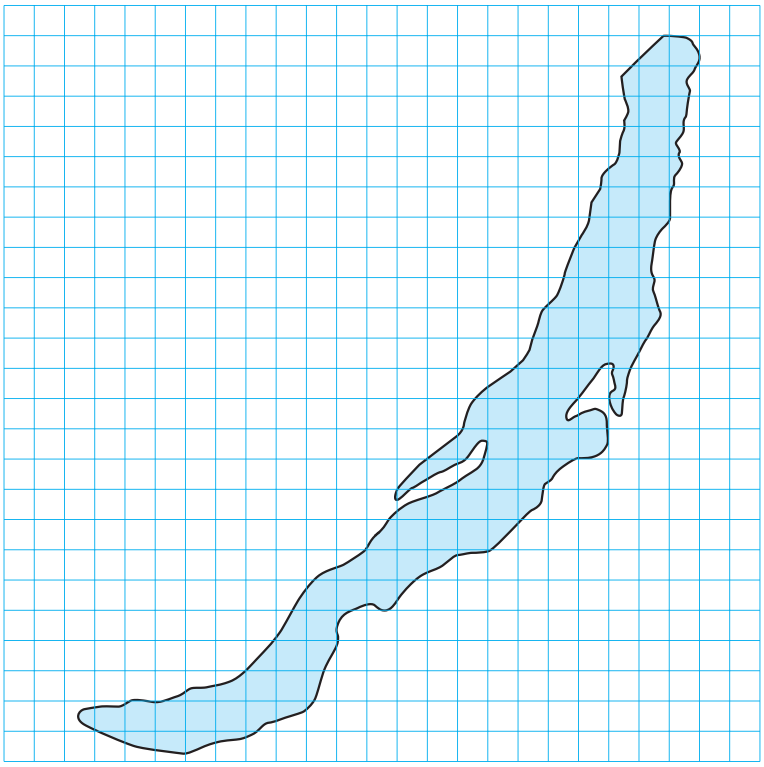
Lake Ohrid and Yellowstone Lake are approximately the same in area.
The areas of Lake Baikal and Lake Malawi are almost the same.
Let's calculate their areas.



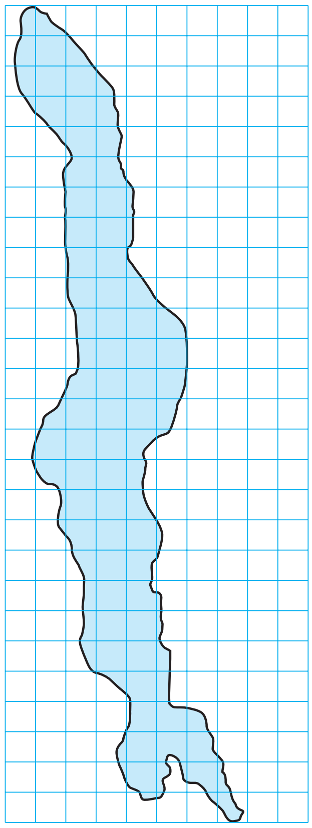


Count the squares on the next page to find the approximate areas of Lake Baikal and Lake Malawi. Compare the calculated value and the counted value of each lake. Which pair has less difference?

Choose the right pair to get a broken piece of the key (The key fragment is hidden in the one with the closer area.).



A：Lake Baikal



B：Lake Malawi

The side of each square is 20 km for each figure.

Both lakes look equal.

The incomplete squares are counted as half an area.

To begin with, put x on incomplete squares and o on complete squares. Then calculate.

We can calculate area of 1 square as $20 \times 20 = 400$ (km^2).

Ⓐ


Ⓑ


• Let's cut out a fragment on page 245 and paste on the last page.

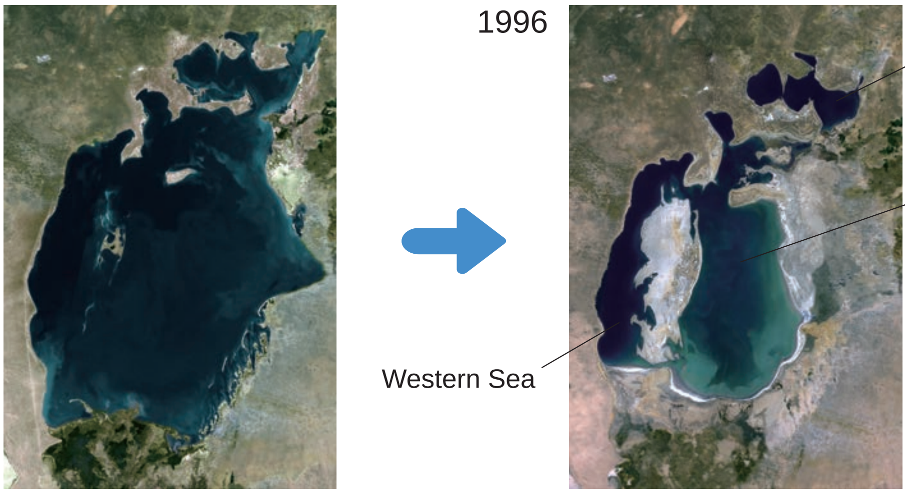
Let's go to the next place to find the fragments of the key!

10 Disappearing Lake from Map

The Aral Sea is a salt lake that lies between Kazakhstan and Uzbekistan.

An abandoned ship that was once at the bottom of the lake.

This lake used to have a water volume of 1090 km^3 containing 10 g salt per litre in 1960. However, the water volume has been reducing because of the constructions of canals for agricultural water supply.
Consequently, the amount of salt per litre has been increasing. In short, the salt water is more concentrated. In 1989, the lake separated into the South Aral Sea and the North Aral Sea and in 2003, the total volume of water in the two lakes decreased to 109 km^3. Even at the locations of low salt concentration in the South Aral Sea it contains 80 g of salt per litre.



What is the percentage of the volume of water in 2003 compared to the volume of water in 1960?

You can apply the knowledge of proportion to find the answer.

The chart below shows how the salt concentration has increased since 1987. Study when (from what year to what year) the salt concentration became equal to that of the sea and you can find the key fragment.

How many grams of salt does the sea water contain?

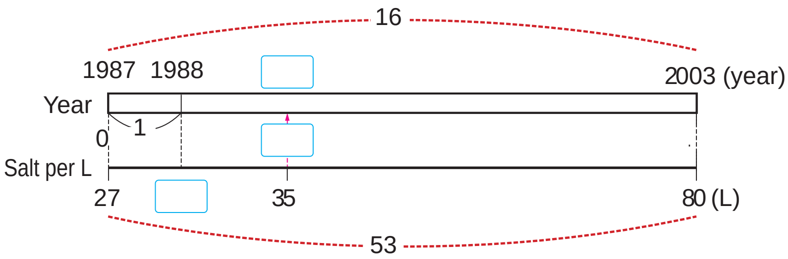
It is 35 g per litre in average.

The Change in the Concentration of Salt in Aral Sea

Year	1987	1988	1989		2003
The salt per litre (g)	27	?	?		80

Suppose that the concentration of salt increases at the constant rate every year from 1987 to 2003…

The amount of salt per litre in 1987 is 27 g per 1 L and the salt per 1 L in 2003 is 80 g per 1 L. So, there is an increase of 53 g in 16 years.



There are four jars with the key fragment inside. The final key fragment is in the jar made in the same year as the salt concentration was 35 g per litre.

A 1989

B 1992

C 1995

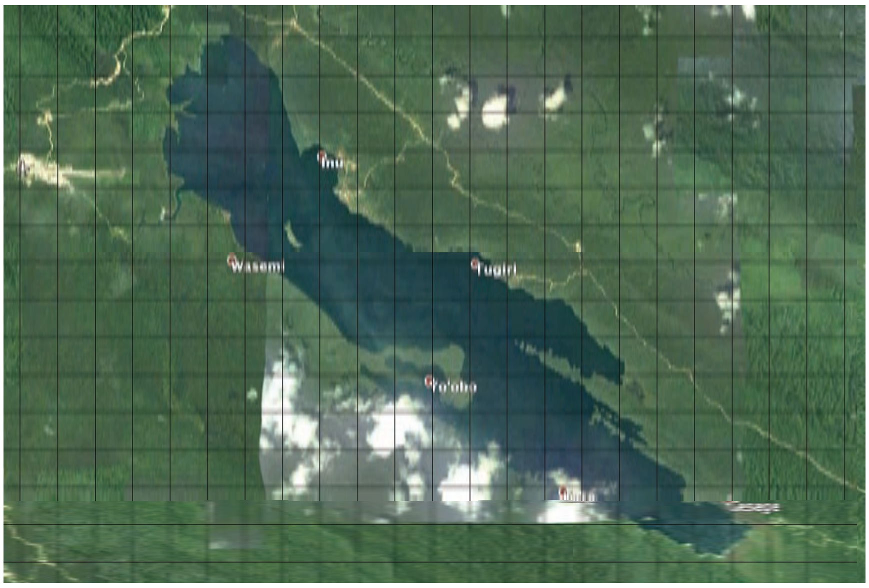
D 1997

- Let's cut out a fragment on page 245 and paste on the last page and make the key completed.

Area of Lake Kutubu

Papua New Guinea has many lakes. The two largest lakes are Lake Murray and Lake Kutubu. Lake Kutubu is famous because of its location which is near to the Kutubu Oil Project, in the Southern Highlands Province. The water is clear and the lake reaches a depth of 70 m (230 feet) and is about 800 m above sea level.

The picture shows the map of Lake Kutubu. For each square grid, the area is 10 km^2. Find the total area of the Lake using the method of calculating the approximate area learned in this grade.



Answers

Chapter 1 **Excercise: Page 8**

1. ① 10, 1, 0.1 ② 0.001, 0.0001
2. ① 10, 10 ② ten
3. 10 times of 36.05 is 360.5
   100 time of 35.05 is 3605
   $\frac{1}{10}$ of 36.05 is 3.605
   $\frac{1}{100}$ of 36.05 is 0.3605

Chapter 1 **Problems: Page 9**

1. ① 8.695 kg ② 0.32 L ③ 3670 m ④ 6720 cm
2. ① 8.25 ② 567 ③ 7.23 ④ 0.452
3. ① 0.3074 ② 2.05 ③ 175
❶ ① 132 ② See teacher ③ See teacher

Chapter 2 **Excercise: Page 22**

1. ① 6.8 cans per day
2. Ⓑ is more crowded.
3. White paint 4. 2.4 kg

Do you remember?: Page 22

① 1404 ② 5762 ③ 2730 ④ 7392 ⑤ 36160
⑥ 29664 ⑦ 21.6 ⑧ 55.8 ⑨ 20

Chapter 2 **Problems: Page 23**

1. 780 people
2. ① 120 kina ② 600 kina ③ 12 m
3. ① 70 sheets of papers
   ② 560 sheets of papers ③ 30 min
4. 37 pages 5. 5.6 second

Chapter 3 **Excercise: Page 35**

1. ① 215 ② 10.8 ③ 83.2 ④ 4.2
   ⑤ 161.2 ⑥ 43.4 ⑦ 0.48 ⑧ 3.15
   ⑨ 5.1 ⑩ 0.075 ⑪ 2.898 ⑫ 6.54
2. 1.02 m² 3. 38.7g, 3.6g
4. ① > ② < ③ < ④ =
   See teacher

Do you remember?: Page 35

Ⓐ 120° Ⓑ 60° Ⓒ 40° Ⓓ 140°

Chapter 3 **Problems: Page 36**

1. 10, 10, 23, 16, $\frac{1}{100}$
2. ① 36.4 ② 22.8 ③ 5.76 ④ 0.24 ⑤ 2.45
   ⑥ 3.8 ⑦ 12.341 ⑧ 2.268 ⑨ 0.056
3. ① 288 kina ② 54 kina
4. ① 20.8 ② 42 5. ① 0.42 ② 15.432

Chapter 4 **Excercise: Page 47**

1. ①, ②, ③ and ④ See teacher
2. See teacher

Do you remember?: Page 47

① 180 ② 272 ③ 739 ④ 777 ⑤ 842 ⑥ 1221
⑦ 110 ⑧ 336 ⑨ 674 ⑩ 131 ⑪ 438 ⑫ 188

Chapter 4 **Excercise: Page 56**

1. ① 70 ② 25 ③ 110 ④ 95 ⑤ 120

Do you remember?: Page 56

① 12 ② 23 ③ 24 ④ 4 ⑤ 6 ⑥ 4
⑦ 56 ⑧ 75 ⑨ 58 ⑩ 6 ⑪ 9 ⑫ 57

Chapter 4 **Problems: Page 57**

1. See teacher
2. ① 80 ② 65 ③ 130 ④ 80 ⑤ 125

Chapter 5 **Excercise: Page 70**

1. ① 8 ② 20 ③ 25 ④ 3 ⑤ 7
   ⑥ 3 ⑦ 8 ⑧ 14 ⑨ 0.375 ⑩ 2.6
   ⑪ 4.5 ⑫ 0.4 ⑬ 1.45 ⑭ 9.25 ⑮ 0.25
2. ① 16 remainder 0.2 ② 27 remainder 0.02
   ③ 6 remainder 0.12
3. 4 cups of 0.8L and 0.2 L is left
4. ① 0.47, 0.467 ② 2.16, 2.158 ③ 8.41, 8.406
5. 8.3g, 8.29g

Do you remember?: Page 70

① 144 cm² ② 351 cm² ③ 24 m²

Chapter 5 **Problems: Page 71**

1. ① 23 ② 2.5 ③ 98 ④ 2.35 ⑤ 0.825 ⑥ 1.875
2. 4.5m 3. 16 cups and 0.12L left
4. ① Amount of paint per 1 kg
   ② Weight of red paint per 1 L
5. ① > ② <
6. See teacher

Chapter 6 **Excercise: Page 86**

1. ① 504 cm³ ② 729 cm³
2. 10800000 cm³, 10.8 m³
3. 400000 cm³, 0.4 m³ 4. 216 cm³

Do you remember?: Page 86

① 36 ② 6.48 ③ 11.502 ④ 0.06
⑤ 6 ⑥ 1.8 ⑦ 0.85 ⑧ 2.3

Chapter 6 **Problems: Page 87**

1. ① 540 cm³ ② 125 m³
2. ① 225 cm³ ② 48 m³
3. 68.448 cm³ 4. 4 times

Chapter 7 **Excercise: Page 103**

1. ① 3, 6, 9, 12, 15, 18, 21, 24, 27,
   30, 33, 36, 39, 42, 45, 48
   ② 7, 14, 21, 28, 35, 42, 49
   ③ 21, 42 ④ 1, 2, 4, 7, 14, 28
   ⑤ 1, 2, 4, 8, 16, 32 ⑥ 1, 2, 4
2. ① 6, 12, 18 LCM: 6 ② 40, 80 120 LCM: 40
   ③ 15, 30, 45 LCM: 15

3 ① 1, 2, 3, 6 GCD: 6 ② 1, 2 GCD: 2
③ 1, 2 GCD: 2

Do you remember?: Page 103

① $2\frac{2}{3}$, $\frac{8}{3}$ ② $1\frac{2}{5}$, $\frac{7}{5}$

Chapter 7 **Problems: Page 104**

1 ① 16, 32, 48 Divisors: 1, 2, 4, 8, 16
② 13, 26, 39 Divisors: 1, 13
③ 24, 48, 72 Divisors: 1, 2, 3, 4, 6, 8, 12, 24

2 ① 21, 42, 63 LCM: 21 ② 36, 72, 108 LCM: 36
③ 20, 40, 60 LCM: 20

3 ① 1, 3 GCD: 3 ② 1 GCD: 1
③ 1, 2, 3, 4, 6, 12 GCD: 12

4 9 : 24 am **5** 10 sets of 6 cm squares **6** 53

Chapter 8 **Excercise: Page 121**

1 ① > ② > ③ < ④ >

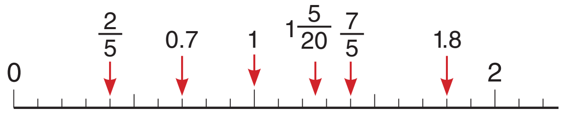
2 ① $\frac{1}{2}$ ② $\frac{2}{3}$ ③ $\frac{3}{4}$ ④ $\frac{2}{3}$ ⑤ $\frac{3}{4}$

3 ① $\frac{1}{7}$ ② $\frac{5}{9}$ ③ $\frac{11}{3}$ $(3\frac{2}{3})$

4 ① 0.5 ② 0.31 ③ 3 ④ 1.25

5 ① $\frac{3}{10}$ ② $\frac{19}{10}$ $(1\frac{9}{10})$ ③ $\frac{61}{100}$ ④ $\frac{111}{100}$ $(1\frac{11}{100})$

6



Do you remember?: Page 121

① $\frac{2}{5}$ ② 1 ③ $\frac{9}{4}$ $(2\frac{1}{4})$ ④ $\frac{6}{7}$ ⑤ $\frac{4}{5}$ ⑥ $\frac{11}{8}$ $(1\frac{3}{8})$

Chapter 9 **Excercise: Page 129**

1 ① $\frac{15}{28}$ ② $1\frac{6}{35}$ ③ $1\frac{1}{12}$ ④ $1\frac{1}{2}$ ⑤ $2\frac{7}{8}$ ⑥ $7\frac{10}{21}$
⑦ $\frac{11}{18}$ ⑧ $\frac{1}{24}$ ⑨ $\frac{11}{28}$ ⑩ $1\frac{1}{12}$ ⑪ $4\frac{11}{35}$ ⑫ $1\frac{11}{12}$

2 ① $\frac{4}{5}$ m rope with $\frac{1}{20}$ m longer ② $1\frac{11}{20}$ m

3 ① Wrong, not calculated making same dinominator.

Do you remember?: Page 129

① 6.37 ② 2.38 ③ 0.28 ④ 12.642
⑤ 20 ⑥ 0.6 ⑦ 3.5 ⑧ 2.5

Chapter 10 **Excercise: Page 147**

1 ① 32 cm² ② 10 cm² **2** ① 6 cm² ② 40.5 cm²

3 ① 16 cm² ② 20 cm²

Do you remember?: Page 147

① 16 ② 12 ③ 4 ④ 4
⑤ 86 ⑥ 156 ⑦ 18 ⑧ 27

Chapter 10 **Problems: Page 148**

1 ① 18 cm² ② 20 cm² ③ 12 cm² ④ 18 cm²

2 See teacher **3** 18 cm

4 ① 40 cm² ② 14 cm² ③ 20 cm²

Chapter 11 **Excercise: Page 159**

1 ① $\frac{2\times3}{7}$, $\frac{6}{7}$ ② $\frac{5}{7\times3}$ $\frac{5}{21}$

2 ① 2 ② $4\frac{2}{3}$ ③ $9\frac{1}{3}$ ④ 33 ⑤ $1\frac{1}{4}$ ⑥ 12
⑦ $4\frac{1}{2}$ ⑧ 99

3 $2\frac{1}{2}$ L

4 ① $\frac{5}{24}$ ② $\frac{2}{7}$ ③ $\frac{1}{20}$ ④ $\frac{2}{35}$
⑤ $\frac{3}{4}$ ⑥ $\frac{1}{7}$ ⑦ $\frac{11}{24}$ ⑧ $\frac{7}{8}$

5 $\frac{7}{18}$ L

Do you remember?: Page 159

① 48 cm³ ② 15.625 cm³ ③ 150 m³

Chapter 11 **Problems: Page 160**

1 ① 4 ② $\frac{7}{32}$

2 ① $\frac{5}{6}$ ② $3\frac{3}{4}$ ③ 14 ④ $\frac{4}{27}$ ⑤ $\frac{3}{13}$ ⑥ $\frac{5}{27}$

3 $\frac{7}{50}$ m **4** $5\frac{1}{2}$ cm²

❶ ① $\frac{1}{3}$ hours ② $\frac{1}{3}$ days ③ $\frac{1}{16}$ minutes

Chapter 12 **Problems: Page 169**

1 ① Not proportional ② Not proportional
③ Proportional ○=30×□

2 ① 20, 40, 60, 80, 100, 120
② Length is directly proportional to weight.
③ 20 ④ ○=20×□ ⑤ 48 g

Chapter 13 **Excercise: Page 181**

1 See teacher

2 ① 18.84 cm ② 31.4 cm

3 ① 2 cm ② 4 cm

4 6.28 cm

Do you remember?: Page 181

① 8 ② 98 ③ 13.26 ④ 2.76 ⑤ 32.68 ⑥ 19.716

Chapter 14 **Excercise: Page 190**

1 ① Triangular Prism ② 5 faces and 9 edges
③ Parallel face DEF, Perpendicular faces ACFD, BCFE and ABED
④ AD, BE and CF

2 Number of vertices 14, 16, 18, 20
Number of edges 21, 24, 27, 30
Number of faces 9, 10, 11, 12

3 ① Cylinder ② 12.6 cm ③ See teacher

Do you remember?: Page 190

① 16 ② 4 ③ 35 ④ 8 ⑤ 2.6 ⑥ 9

Chapter 14 **Problems: Page 191**

1 ① Pentagonal prism ② Cylinder

2 See teacher **3** 10.2 cm

Chapter 15 **Excercise: Page 207**

1 ① 0.7 ② 1

2 ① 0.8 ② 1.25

3 105% **4** 12 eggs

Do you remember?: Page 207

① $\frac{9}{10}$ ② $1\frac{1}{18}$ ③ $3\frac{3}{4}$ ④ $3\frac{19}{24}$
⑤ $\frac{1}{4}$ ⑥ $\frac{3}{20}$ ⑦ $\frac{1}{2}$ ⑧ $2\frac{12}{35}$

Glossary

Addition is the process of calculating the total of two or more numbers or amounts. · · · · · · · · · · · · · 5 & 32

Approximately is when a number or measure obtained from given numbers which is closer to the actual number or measure · · · · · · · · · · · · · · · · 25

Averaging is the process of making different sized measurements to the new measure evenly or equally. · · · · · · · · · · · · · · · · 13

Band Graph is a graph that expresses the total as a rectangle-like band. · · · · · · · · · · · · · · · 203

Circumference is the surrounding length of a circle. · · · · · · · · · · · · · · · 175

Congruent is a figure which is identical in shape, size and angles. · · 38 & 42

Corresponding is the side, vertex or angle of a figure which is simmilar or identical to another congruent figure. · · · · · · · · · · · · · · · · 42

Denominator is the number below the line in a fraction. · · · · · · · 109 & 110

Diameter is a straight line that passes through the centre of a circle that halves the circle into two equal parts. · · · · · · · · · · · · · · · 175

Division is the process of sharing or dividing a number or a quantity by another. · · · · · · · · · · · · · · · · 58

Divisors are whole numbers by which a number can be divided with no remainder. · · · · · · · · · · · · 59 & 61

Estimate is a measure or number obtained by guessing from given numbers which is almost the same as the actual answer. · · · · · · · · · · · · · · · · 11

Even numbers are whole numbers divided by 2 without a remainder. · · 102

Improper fraction is a fraction expressed that has a numerator larger than its denominator. · · · · · · · · · · · · · · · 103

Mean is the same number or measure which is averaged from some numbers or measures. · · · · · · · · · · · · · · · · 13

Mixed fraction is a fraction that includes both a whole number part and a fractional part. · · · · · · · · · · · · · · · 103

Multiples are whole numbers multiplied by a certain number. · · · · · · 7 & 29

Multiplication is the process of combining a number or quantity by another to obtain its product. · · · · · · · · · · · · · · · · 24

Net is the plane shape that is developed that when folded, it gives an enclosed solid. · · · · · · · · · 187 & 188

Numerator is the number above the line in a fraction. · · · · · · · · · · · · · · · 109

Odd numbers are whole numbers divided by 2 that leaves a remainder of 1. · · · · · · · · · · · · · · · 102

Percentage is the quantity obtained in expressing a ratio by making the basic quantity 100. · · · · · · · · · · · · · · · 197

Polygon is a plane figure with at least three straight sides and angles and are typically five or more. · · · · · · · · · · · · · · · · 55

Population Density is the population measured in per 1km^2. · · · · · · · · · · 18

Prime is the number of sides of base in polygons. · · · · · · · · · · · · · · · 100

Prime Number is a number than can be divided only by 1 and itself. · · · 100

Proportion is when a quantity changes and the other quantity also changes at the same amount. · · · · · · · · · 165 & 166

Quadrilateral is a shape with four sides, vertex and angles. · · · · · · 43 & 44

Quotient is the result or measure obtained by dividing one quantity by another. · · · · · · · · · · · 64 & 66

Ratio is the result or measure obtained when compared quantity is divided by a basic quantity. · · · · · · · · · · · · · · · 178

Regular Polygons are polygons that have all sides and angles equal. · · 172

Solids are the shapes that are covered by planes or curved surfaces. · · 182

Subtraction is the process of taking away one number or amount from the other. · · · · · · · · · · · · · · · 122

Volume is the size of a solid represented by a number of units. · · · · · · · 76

Attachments

Let’s paste the fragments on the last page

Cathedral from Birds’ Eyes (Page 219)

A

B

C

World Heritage Site - Comparing Height (Page 221)

A

B

C

D

Sinking Islands (Page 223)

A

B

C

Roman Empire Cities with Water Supply (Page 225)

A

B

C

D

Pentagon by Fractions (Page 227)

A

B

C

D

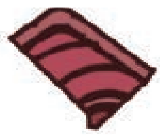
Let's paste the fragments on the last page

Ayers Rock the Centre of the Earth (Page 233)

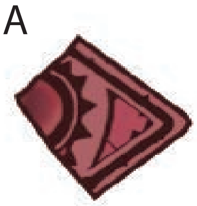
A


B


C


D


A Mysterious Circle of Stones (Page 235)

A


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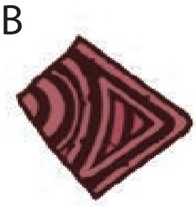

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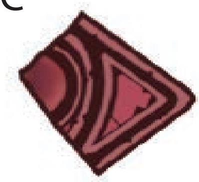

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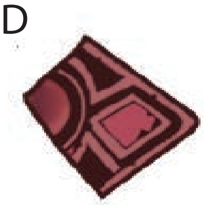
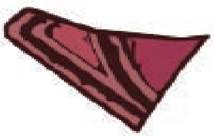


World Heritage - Comparing the Areas of the Lakes (Page 237)

A


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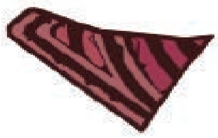

Disappearing Lake from Map (Page 239)

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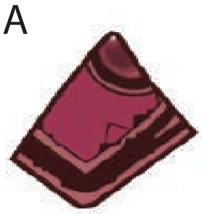

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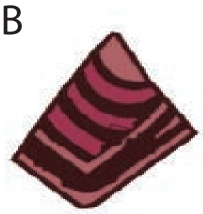

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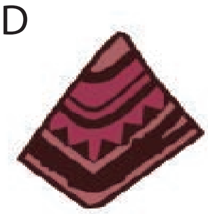
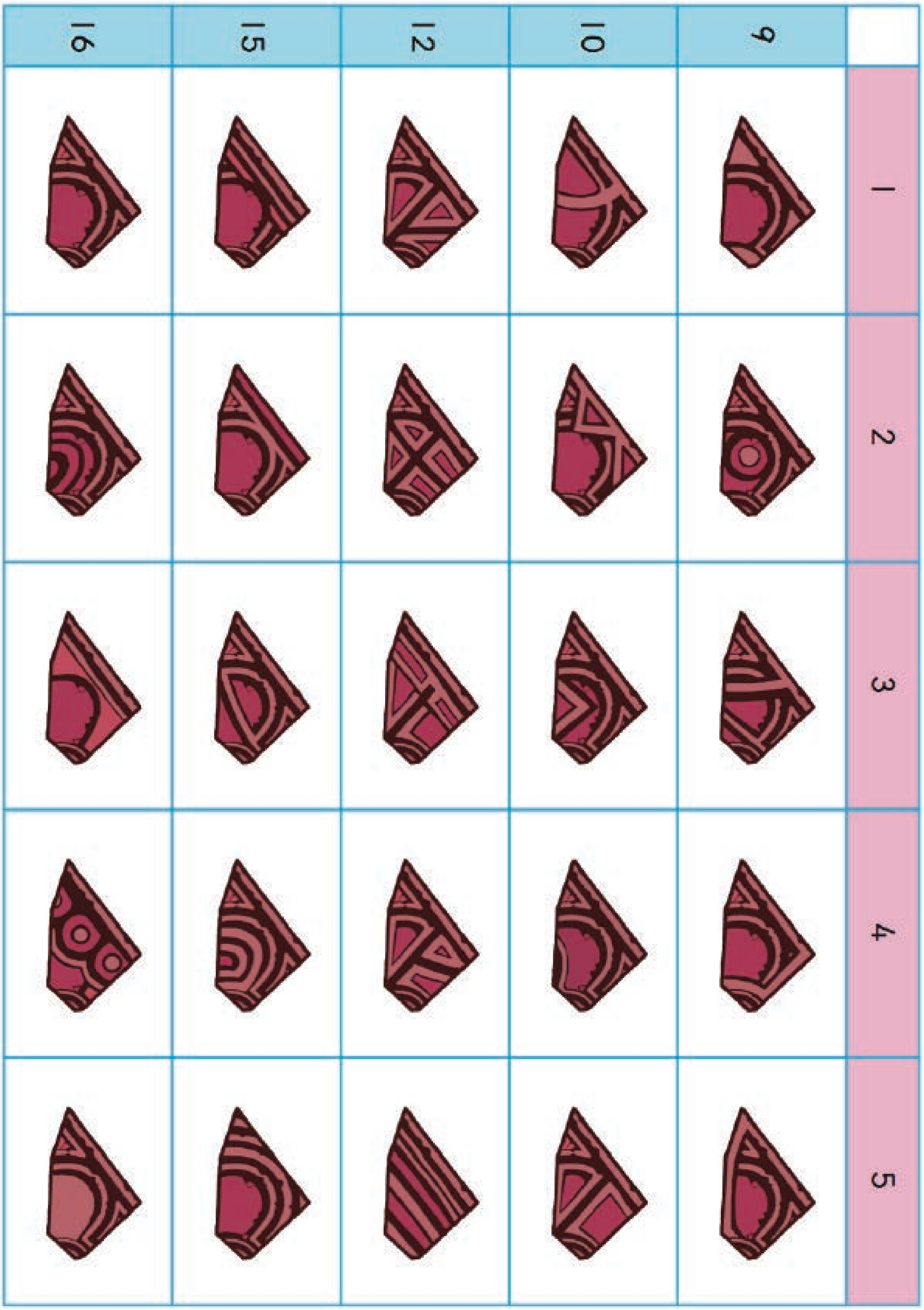


The Oldest Scroll of Mathematics (Page 231)



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