National MATHEMATICS Textbook

Grade 6

'FREE ISSUE
NOT FOR SALE'

Papua New Guinea
Department of Education

From
the People of Japan

Issued free to schools by the Department of Education

First Edition

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Acknowledgements

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The Mathematics curriculum officers, textbook writers, pilot teachers from NCD and Central Provinces and the Subject Curriculum Group (SCG) are acknowledged for their contribution in writing, piloting and validating this textbook.

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National Mathematics Textbook

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Minister's Message

Dear Grade 6 Students,

I am honoured to give my message in this National Mathematics Textbook.

The Government of Papua New Guinea through The Department of Education has been working to improve students' learning of Mathematics. This textbook was developed by our dedicated Curriculum Officers, Textbook Writers and Pilot Teachers, who have worked collaboratively with Japanese Math specialists for three years. This is the best textbook for grade 6 students in Papua New Guinea and is comparable to international standards. In its development I would like to thank the Government of Japan for its support in improving the quality of learning for the children of Papua New Guinea.

I am excited about this textbook because it covers all topics necessary for learning in grade 6. You will find many photographs, illustrations, charts and diagrams that are interesting and exciting for learning. I hope they will motivate you to explore more about Mathematics.

Students, Mathematics is a very important subject. It is also very interesting and enjoyable to learn. Do you know why? Because mathematics is everywhere in our lives. You will use your knowledge and skills of Mathematics to calculate cost, to find time, distance, weight, area and many more. In addition, Mathematics will help you to develop your thinking skills, such as how to solve problems using a step-by-step process.

I encourage you to be committed, enjoy and love mathematics, because one day in the future you will be a very important person, participating in developing and looking after this very beautiful country of ours and improving the quality of living.

I wish you a happy and fun learning experience with Mathematics.

Hon. Joseph Yopyyopy, MP

Minister of Education

Message from the Amassador of Japan

Greetings to Grade 6 Students of Papua New Guinea!

It is a great pleasure that the Department of Education of Papua New Guinea and the Government of Japan worked together to publish national textbooks on mathematics for the first time.

The officers of the Curriculum Development Division of the Department of Education made full efforts to publish this textbook with Japanese math experts. To be good at mathematics, you need to keep studying with this textbook. In this textbook, you will learn many things about mathematics with a lot of fun and interest and you will find it useful in your daily life. This textbook is made not only for you but also for the future students.

You will be able to think much better and smarter if you gain more knowledge on numbers and diagrams through learning mathematics. I hope that this textbook will enable you to enjoy learning mathematics and enrich your life from now on. Papua New Guinea has a big national land with plenty of natural resources and a great chance for a better life and progress. I hope that each of you will make full use of knowledge you obtained and play an important role in realising such potential.

I am honoured that, through the publication of this textbook, Japan helped your country develop mathematics education and improve your ability, which is essential for the future of Papua New Guinea. I sincerely hope that, through the teamwork between your country and Japan, our friendship will last forever.

Satoshi Nakajima

Ambassador of Japan to Papua New Guinea

Mathematics

Share ideas with your friend!

Let's learn Mathematics, it's fun!

Secretary's Message

Dear students,

This is your Mathematics Textbook that you will use in Grade 6. It contains very interesting and enjoyable activities that you will be learning in your daily Mathematics lessons.

In our everyday lives, we come across many Mathematical related situations such as buying and selling, making and comparing shapes and their sizes, travelling distances with time and cost and many more. These situations require mathematical thinking processes and strategies to be used.

This textbook provides you with a variety of mathematical activities and ideas that are interactive that will allow you to learn with your teacher or on your own as an independent learner. The key concepts for each topic are highlighted in the summary notes at the end of each chapter. The mathematical skills and processes are expected to be used as learning tools to understand the concepts given in each unit or topic and apply these in solving problems.

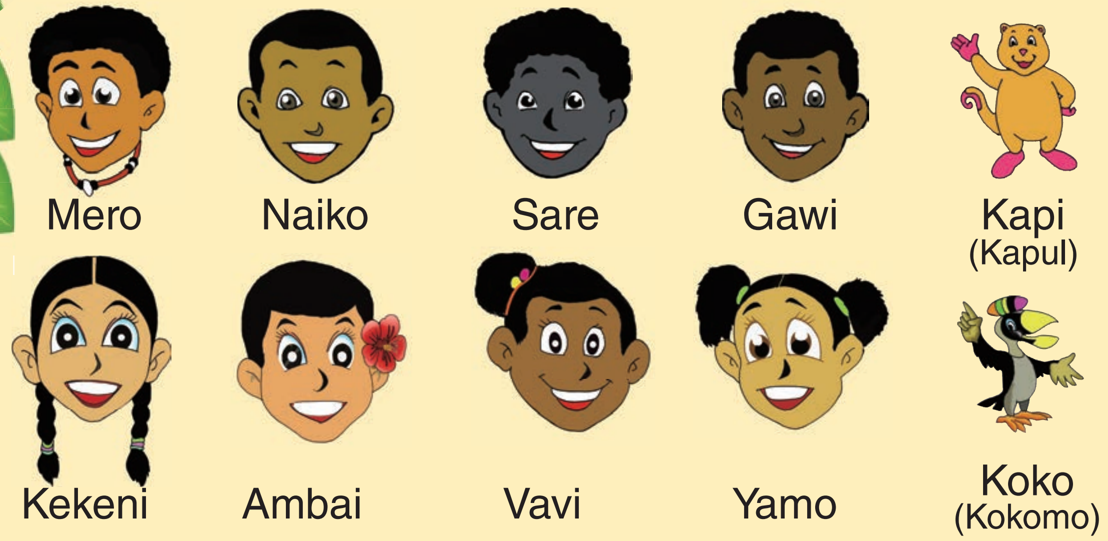
You are encouraged to be like a young Mathematician who learns and is competent in solving problems and issues that are happening in the world today. You are also encouraged to practice what you learn everyday both in school and at home with your family and friends.

I commend this Grade 6 National Mathematics Textbook as the official textbook for all Grade 6 students for their Mathematics lessons throughout Papua New Guinea.

I wish you all the best in studying Mathematics using this textbook.

Dr. Uke Kombra, PhD
Secretary for Education

Friends learning together in this textbook



Symbols in this textbook

- Ice breaking activity as the lead up activity for chapter.
- Discovered important ideas.
- Important definitions or terms.
- What we will do in the next activity?
- When you lose your way, refer to the page number given.
- You can use your calculator here.
- Practice by yourself. Fill in your copy.
- New knowledge to apply in daily life.
- Revision activities

Exercise
- Let's do the exercise.

Activity
- Let's do mathematical activities by students.

$6 = \square \times \square$
- Let's fill numbers in and complete the expression to get the page number.

What We Learned in Grade 5

Division of Decimal Numbers

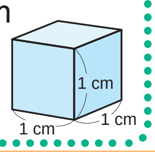
How to Divide Decimal Numbers in Vertical Form

(1) Multiply the divisor by 10, 100, or more to make it a whole number and move the decimal point to the right accordingly.
(2) Multiply the dividend by the same amount as the divisor and move the decimal point to the right accordingly.
(3) The decimal point of the answer comes at the same place as where the decimal point of the dividend has been moved to.
(4) Then, calculate as if this is the division of whole numbers.

```
         1.8
3.2 ) 5.7.6
      3 2
      2 5 6
      2 5 6
          0
```

Volume

The volume of a cube with 1 cm sides is called **1 cubic centimetre** and is written as 1 cm^3. cm^3 is a unit of volume.



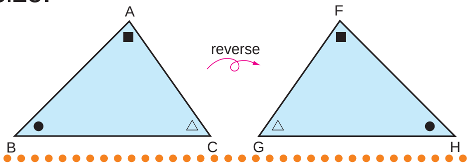
The volume of a rectangular prism is expressed in the following formula,using length, width and height.

Volume of rectangular prism = length × width × height

Congruent Figures

Two figures are also congruent if they match by reverse.
In congruent figures, the matching points, the matching sides and the matching angles are called; **corresponding vertices, corresponding sides and corresponding angles** respectively.

In congruent figures, the corresponding sides are equal in length and the corresponding angles are also equal in size.



Proportions

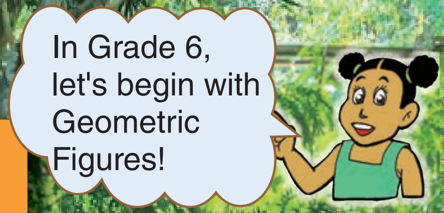
4 times
3 times
2 times

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

□ times
□ times
□ times

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 □.

Table of Contents

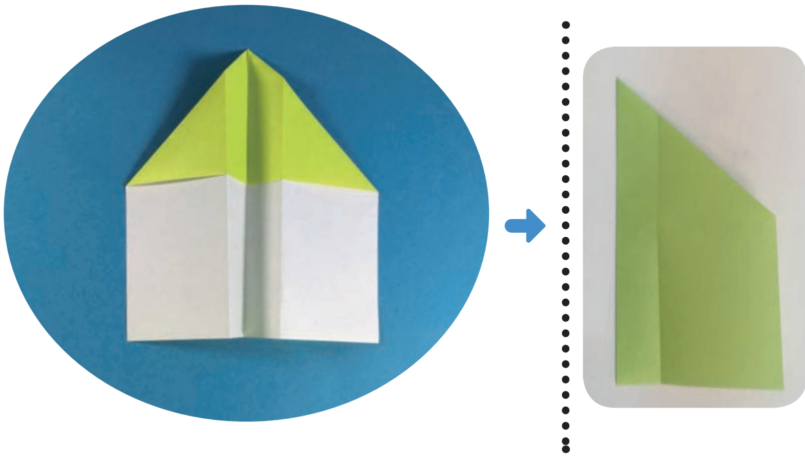


Geometric Figures

Data and Mathematical Relations

1 Symmetry

▶▶ John and his friends made and collected some toys and papercrafts. They made many different shapes and noticed that some of them had balanced and beautiful shapes.

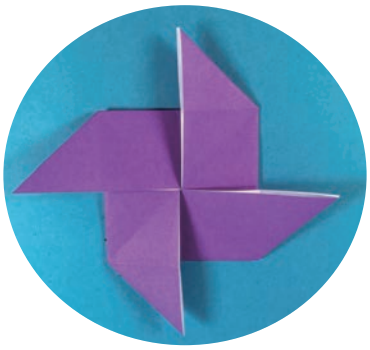


We can fold the paper and make a paper plane, by making one side of the shape fit exactly on top of the other, so it will belong to one of the groups on page 3.

Mero

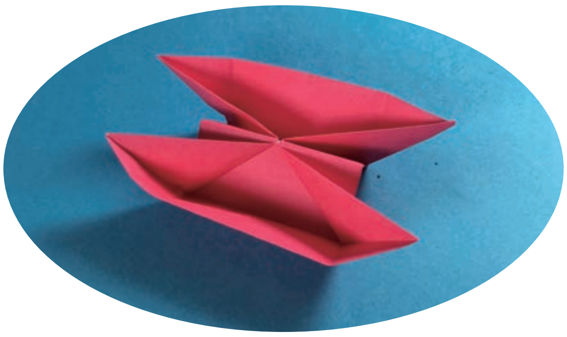
Let's explore the shapes that are balanced and beautiful.

ⓐ Paper craft windmill (Origami)



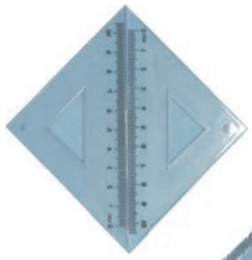
ⓑ Paper star

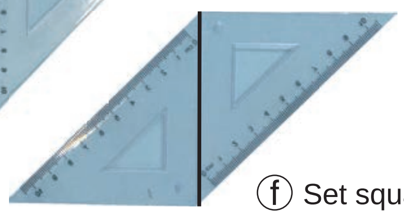
ⓒ Paper boat (Origami)



ⓓ Jigsaw puzzles

ⓔ Set square 1





ⓕ Set square 2

Let's group the shapes above ⓐ, ⓑ, ⓒ, ⓓ, ⓔ and ⓕ into the following:

Ⓐ One side of this shape fits exactly on top of the other if folded in half.

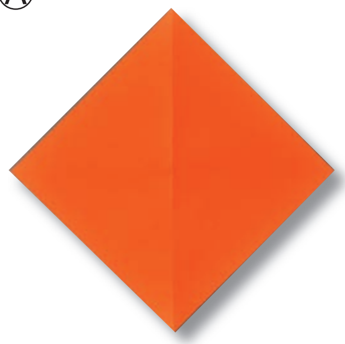
Ⓑ The shape looks exactly like the original shape when it is rotated.

Ⓒ None of the above.

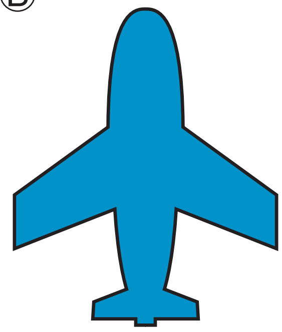
1 Shapes and Figures with Line Symmetry

1 One side of these figures should fit exactly on top of the other if folded in half.

Ⓐ



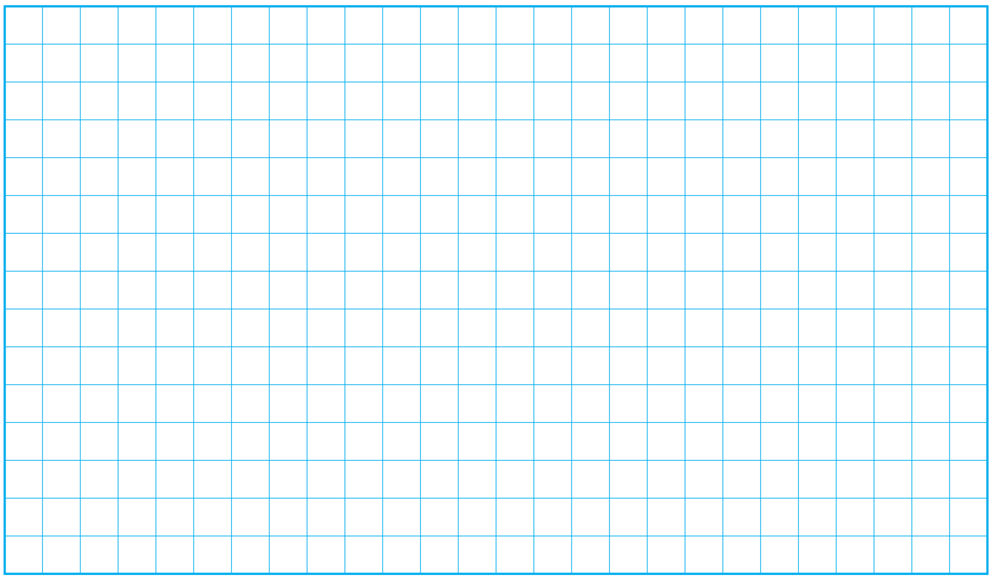
Ⓑ



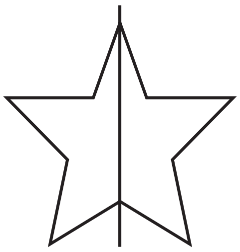
Ⓒ

① How do you fold these figures exactly in half?
Draw a folding line on each diagram above.

② Let's use the grid below and draw other shapes that can fit by folding into half.

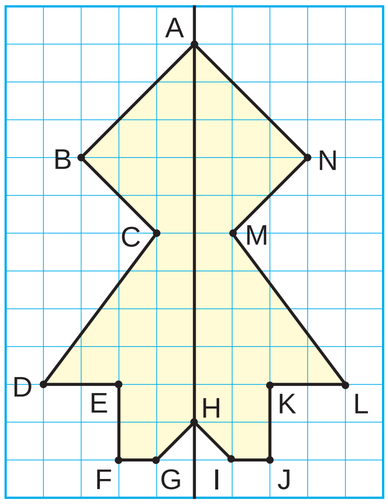


A figure with **line symmetry** can be folded along a straight line and the two halves of the shape fit exactly on top of each other.
The folding line is called the **line of symmetry** or the **axis of symmetry**.



Properties of Figures with Line Symmetry

2 The figure on the right has a line symmetry. Let's explore the points, sides and angles when it is folded along its line of symmetry.



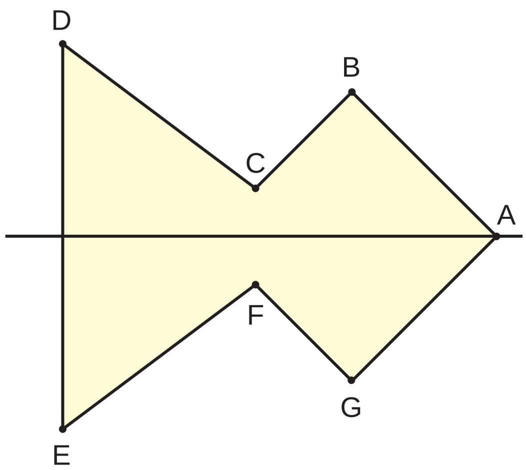
axis of symmetry

1. Which points lie on point B and point K respectively when the figure is folded along its symmetric axis?
2. Which side lies on top of side AB and DE, respectively?
3. Which angles lie on top of angle D and J, respectively?

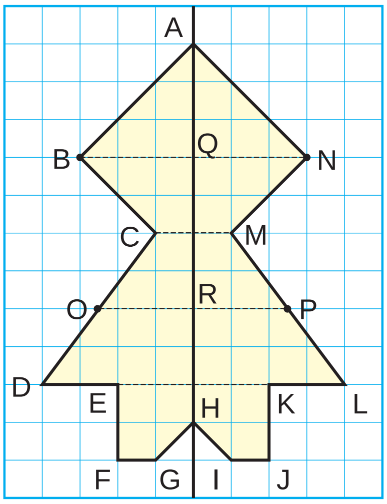
When the figure with line symmetry is folded along its axis of symmetry, the matching points are called **corresponding points** and the matching sides are called **corresponding sides** and the matching angles are called **corresponding angles**.
In line symmetric figures, the sizes of corresponding sides and angles are respectively equal.

Exercise

The figure on the right has a line symmetry.
Let's write the corresponding points, sides and angles.



3 Let's explore the figure with line symmetry on the right.



1. The points B and N are corresponding. Consider how the line BN intersects with the line of symmetry.
2. The points O and P are corresponding. Consider how the line OP intersects with the line of symmetry.
3. Compare the lengths of lines QB and QN, RP and RO.

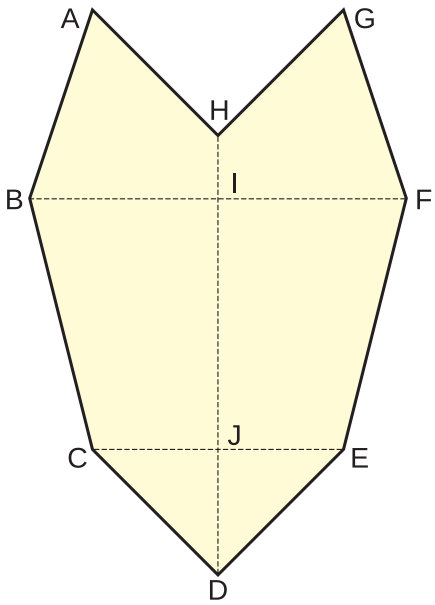
For figures with line symmetry, a line that connects two corresponding points always intersects in perpendicular with the line of symmetry.
The length from the line of symmetry to the corresponding points are equal.

Exercise

The figure on the right has a line symmetry.

① How does the line CE intersect with the line of symmetry?

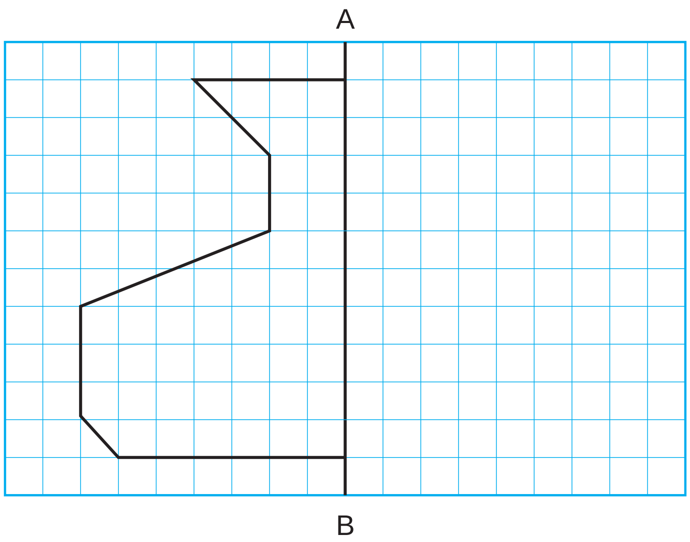
② If the length of the line BI is 25 mm, what is the length of line IF?



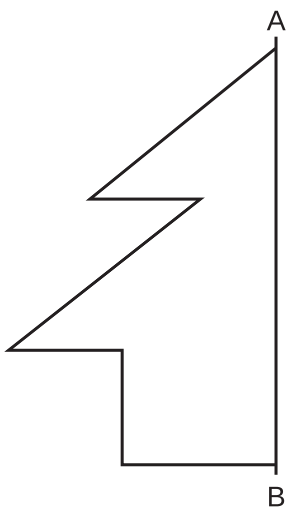
How to Draw Figures with Line Symmetry

4 The figure below shows half of the figure with AB as the line symmetry.

1. Let's draw the other half to complete the figure.
   Discuss with your friends how you will draw the other half to complete the figure.



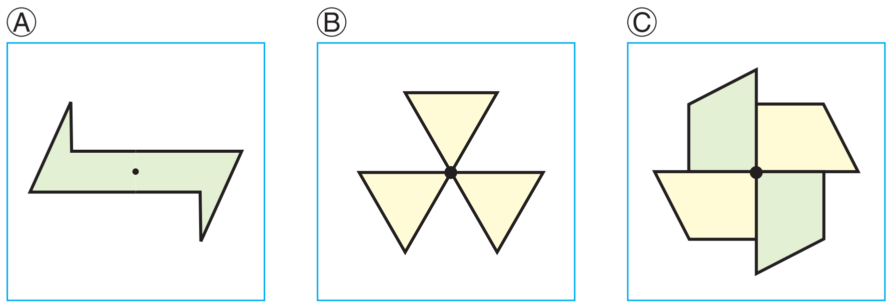
2. Let's draw the other half to complete the figure.



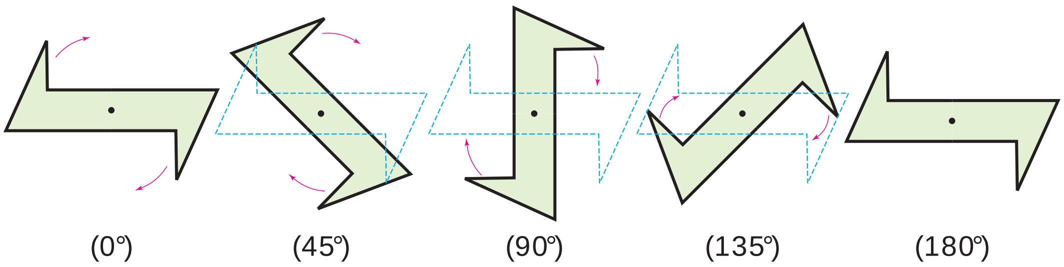
3. Let's explain the properties of line symmetry that you used to draw the complete figure.

2 Shapes and Figures with Point Symmetry

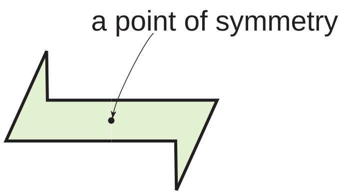
1 Which of the following figures match the original figure when rotated for 180° at a fixed point '•'?

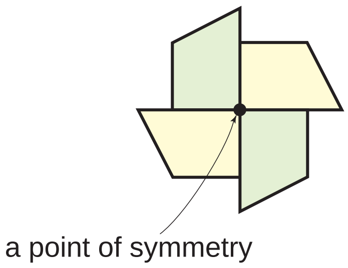


Trace each figure above and rotate it 180° at a fixed point. Confirm if the figure matches the original figure or not.



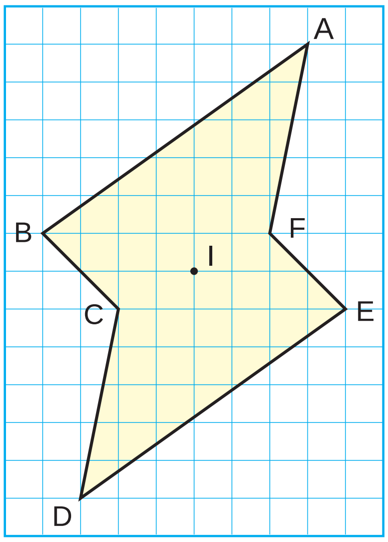
A figure with **point symmetry** can be rotated for 180° with respect to a point and the rotated shape matches the original exactly.
The centred point is called the **point of symmetry**.





Properties of Figures with Point Symmetry

2 The figure below has a point of symmetry. Trace the figure and rotate it for 180° with respect to its point of symmetry.



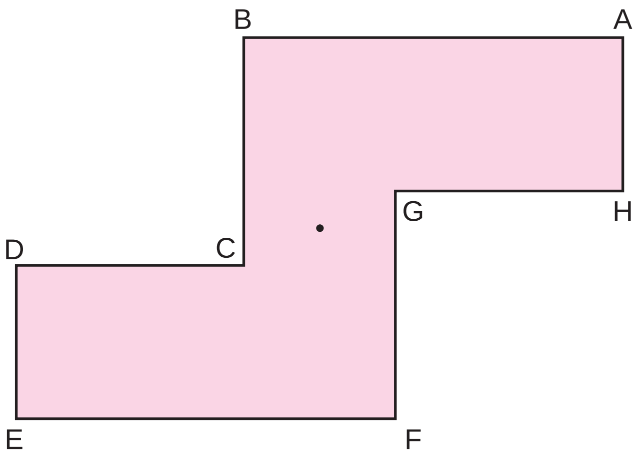
Let's explore the points, sides and angles.

1. Which points lie on point B and C respectively after rotation?
2. Which sides lie on side AB and BC respectively after rotation?
3. Which angles lie on top of angle B and D respectively after rotation?

When a figure with point symmetry is rotated 180° on the point of symmetry, the matching points are called **corresponding points**, the matching sides are called **corresponding sides** and the matching angles are called **corresponding angles**.
For any figure with point symmetry, the sizes of corresponding sides and angles are equal respectively.

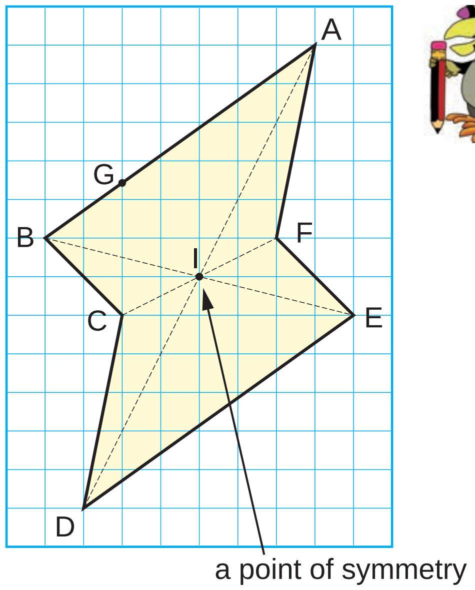
Exercise

The figure on the right has a point of symmetry.
Let's find the corresponding points, sides and angles.



3 Let's explore the figure with point symmetry below.

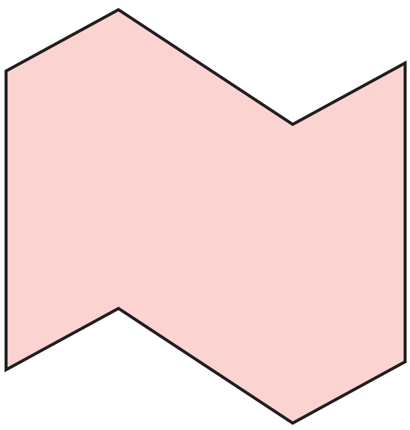
1. Where do these lines intersect? AD, BE and CF.
2. Draw point H corresponding to point G on side AB.
3. Compare the lengths of lines IG and IH.



For figures with point symmetry, a line that connects two corresponding points always passes through the point of symmetry.
The segments between a point of symmetry and each of the corresponding points are equal.

Exercise

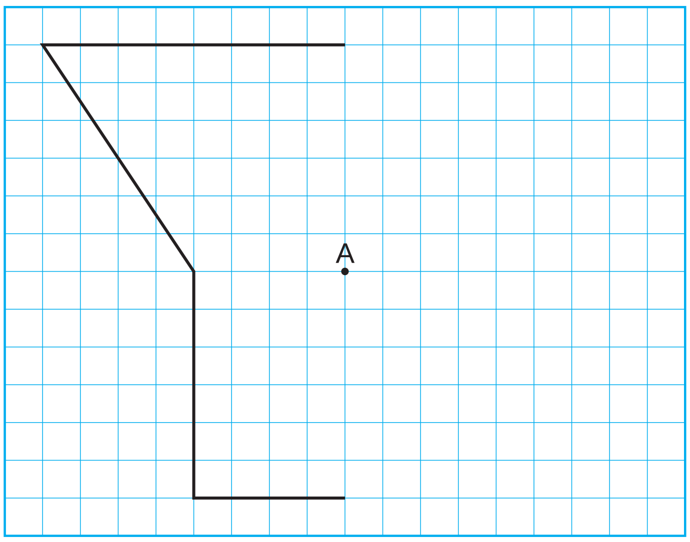
The figure on the right has point symmetry.
Let's locate the point of symmetry.
Then, explain how you locate it.



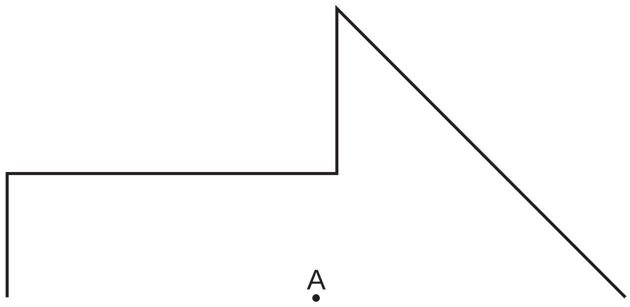
How to Draw Figures with Point Symmetry

4 The figure below is half of the shape with A as the point of symmetry.

① Let's draw the other half to complete the figure.
Discuss with your friends how you will draw the other half to complete the figure.



② Let's draw the other half to complete the figure.



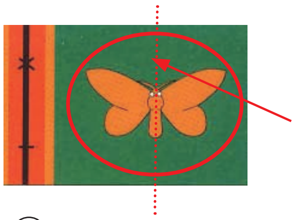
③ Let's explain the properties of point symmetry that you used to complete the figure above in your exercise book.

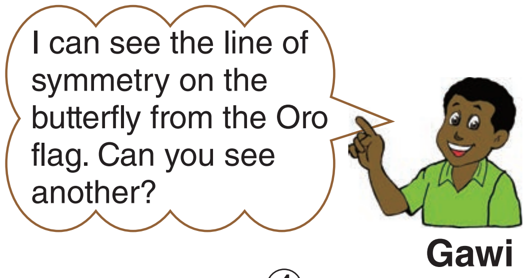
Let's Find Symmetric Figures Around Us

5 There are provincial flags and signs as shown below.

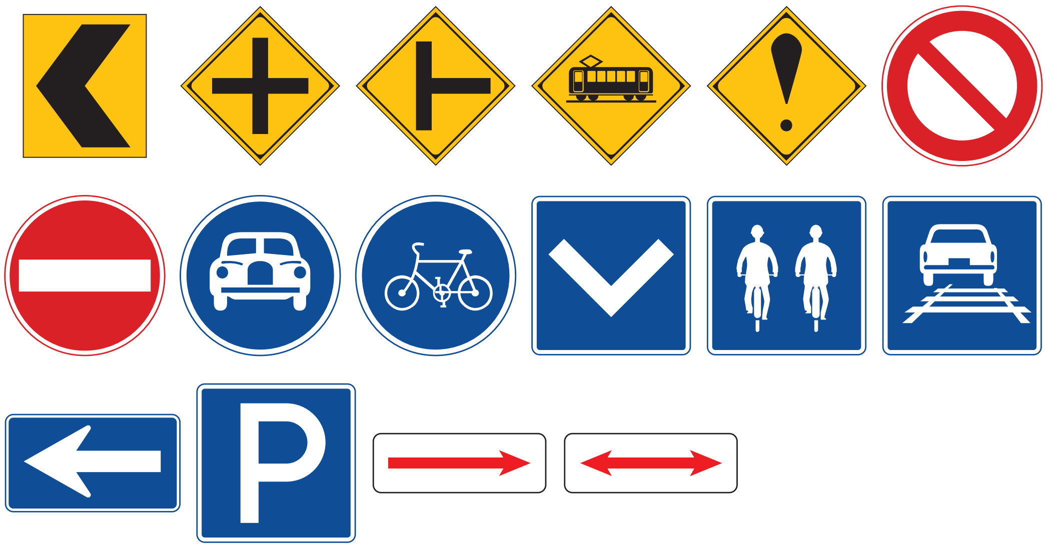
1 Can you find symmetrical figures in the Symbols of Provincial flags?

Example, Oro Provincial flag.





2 Let's find the line symmetries in the figures below of traffic and road signs in PNG and other countries.



Activity

6 There are institutions and company logos and emblems (figures) around us as shown below.

1 Let's find the characteristics of point symmetry in these figures.

ⓐ PAPUA NEW GUINEA EDUCATION INSTITUTE

ⓑ TISA TEACHERS SAVINGS AND LOAN SOCIETY LIMITED

ⓒ

ⓓ

ⓔ TOYOTA

ⓕ mazda

ⓖ MITSUBISHI MOTORS

ⓗ HONDA

Sports team logos around us.

Ambai

Which part of the figures have point symmetry?

ⓘ PAPUA NEW GUINEA ORCHIDS

ⓙ PAPUA NEW GUINEA PNG RFL

ⓚ CRICKET PNG

ⓛ PAPUA NEW GUINEA SPORTS FOUNDATION

ⓜ COWBOYS

ⓝ WARRIORS

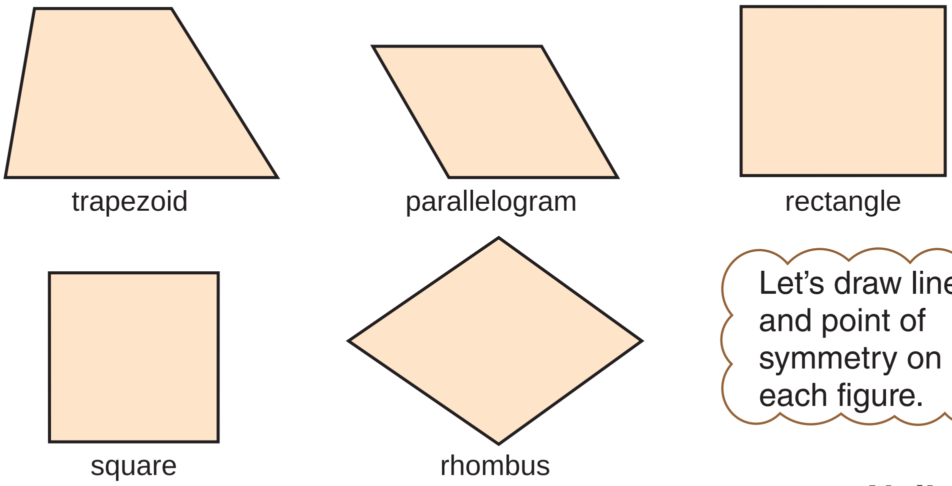
ⓞ WESTS TIGERS

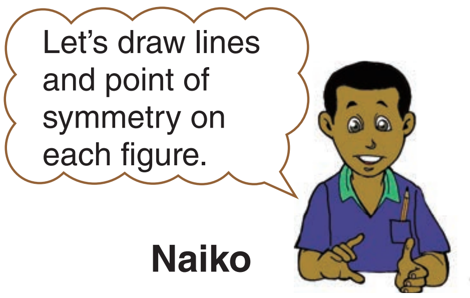
ⓟ GOLD COAST TITANS

Activity

3 Polygons and Symmetry

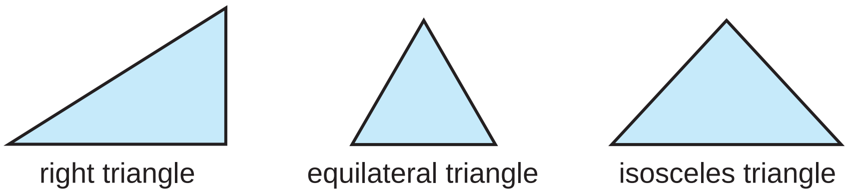
1 Let's explore the following quadrilaterals.





1. Which quadrilaterals have line symmetry and how many lines of symmetry does each have?
2. Which quadrilaterals have point symmetry?
   Indicate the point of symmetry in each figure.
3. Which quadrilaterals have line symmetry and point symmetry, respectively?
4. Which quadrilaterals have two diagonals that are also lines of symmetry?

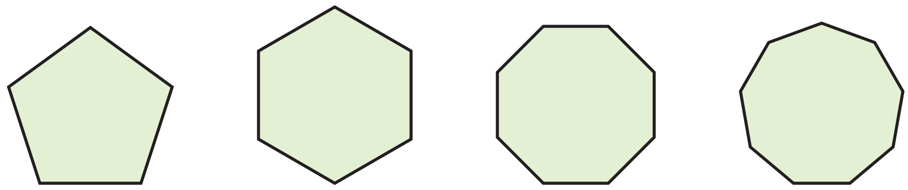
2 Let's explore the following triangles.



1. Which triangles have line symmetry and how many lines of symmetry can you draw in each figure?
2. Which triangles have point symmetry?

Regular Polygons and Symmetry

3 Let's explore regular polygons.



regular pentagon | regular hexagon | regular octagon | regular nonagon

① Let's group the figures above into the figures with line symmetry and point symmetry.

Line symmetry	
Point symmetry	

② How many lines of symmetry does each figure have?
Let's fill in the table below.

Name	regular pentagon	regular hexagon	regular octagon	regular nonagon
Number of lines				

③ Let's draw a point of symmetry in each of the point symmetrical figures.

④ Let's reflect on what you explored. Please write what you observed in your exercise book and discuss with your friends. Let's classify heptagon and decagon in the above table.

Sare

I found that there are figures with both line and point symmetries.

How many lines of symmetry does each figure have?

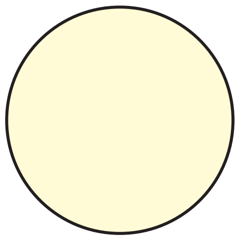
Yamo

Exercise

Let's explore a circle.

① Does a circle have line symmetry?
How many lines of symmetry can you find?

② Does a circle have point symmetry?
Place the point of symmetry on the circle.



Let's Make Some Paper Crafts

4 Using what you learned about symmetry, make household items out of flat papers.

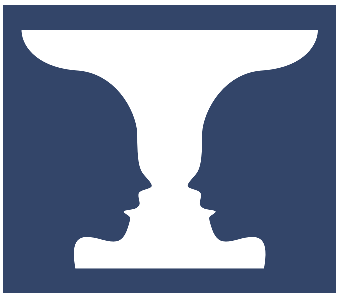

floral decoration


toothpick

nameplate

Rubin's Vase

The picture on the right is symmetrically designed. Take a closer look into it. What do you see?



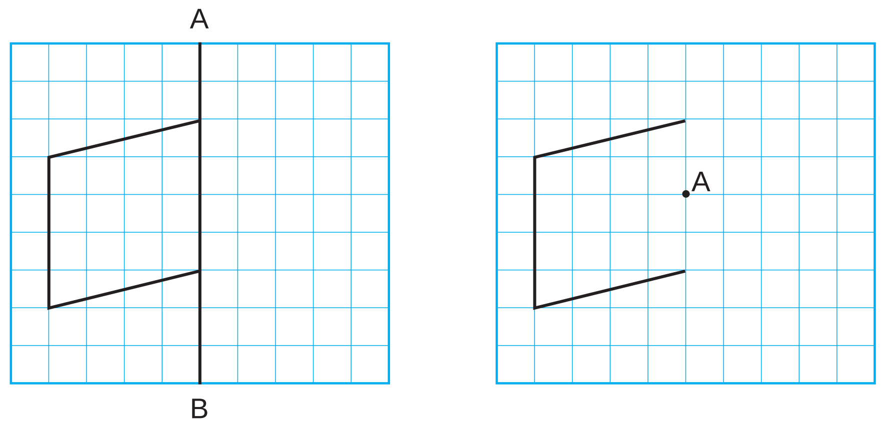
EXERCISE

1 Draw the other half to complete the symmetrical figure.

Pages 4 to 9

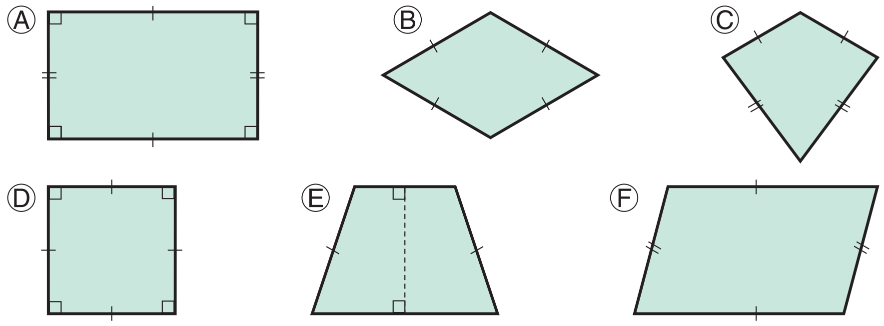
① Line AB is the line of symmetry.

② Point A is the point of symmetry.



2 Fill in the table below using the properties of the following quadrilaterals.

Pages 14 and 15



	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓕ
Figures with line symmetry	○					
Number of line	2					
Figures with point symmetry	○					

Grade 4 and 5

Do you remember?

Let's calculate.

① 1.2×43　② 3.6×35　③ 7.2×4.9　④ 8.6×7.5

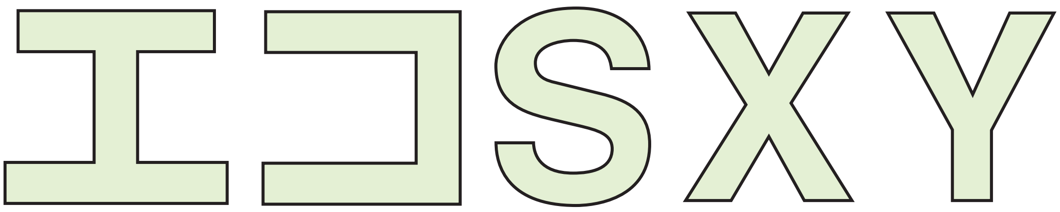
⑤ 448÷8　⑥ 379÷4　⑦ 60÷25　⑧ 9.1÷0.7

PROBLEMS 1

1 Which figures have line symmetry, point symmetry or both?

● Distinguishing symmetric figers.

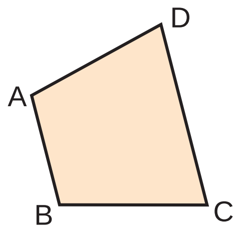
① ② ③ ④ ⑤



2 The figure on the right has line symmetry.

Draw the line of symmetry.

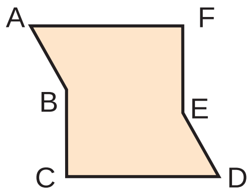
● Finding the axis of symmetry.



3 The figure on the right has point symmetry.

Draw the point of symmetry.

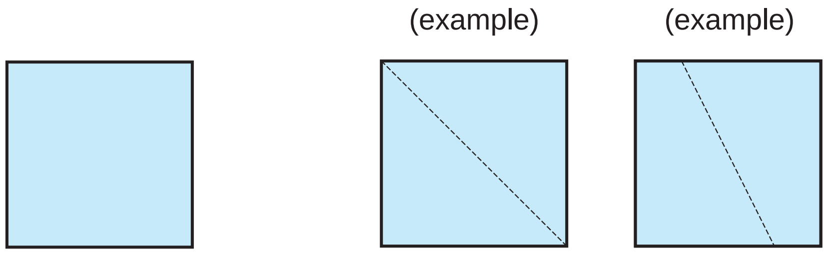
● Finding a point of symmetry.



4 A square has both line and point symmetry.

● Dividing a square into two congruent shapes.

① Divide a square into two congruent shapes by a line.

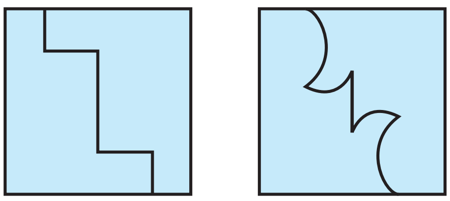


② You will find that any line drawn in ① passes the same point.

What do you call the point?

③ Use lines and curves to divide a square into two congruent shapes.

The figures on the right are examples.

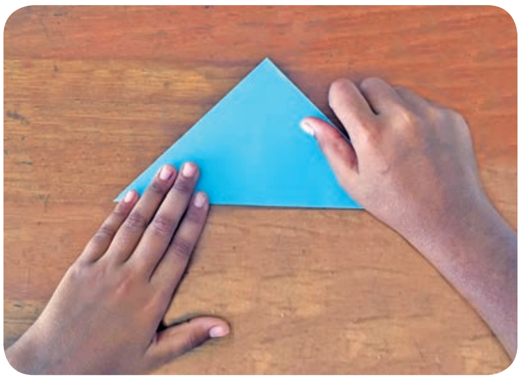


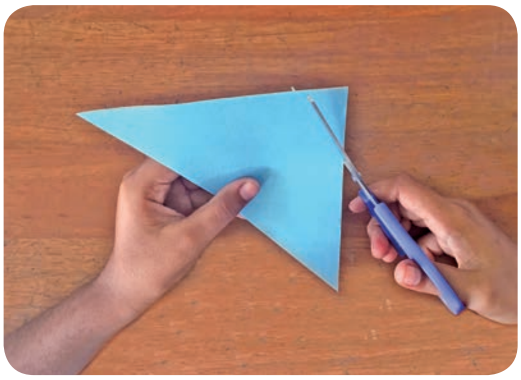
PROBLEMS 2

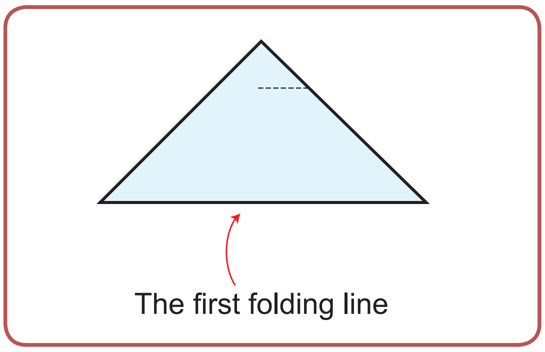
1 We are going to make symmetrical shapes with coloured papers.

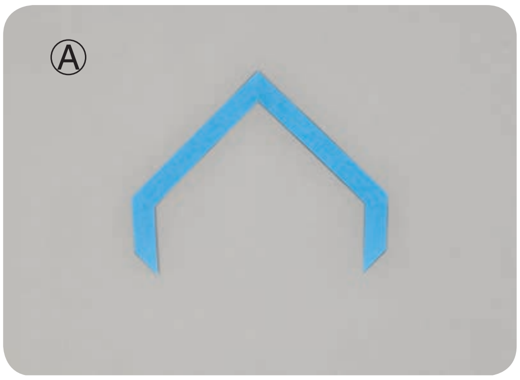
● Imagining the figure after folding by using the axis of symmetry.

① Fold the coloured paper. How can you cut to make shape Ⓐ? Draw cutting lines in the diagram.

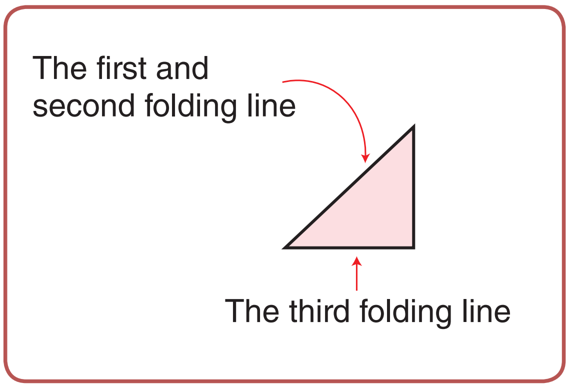


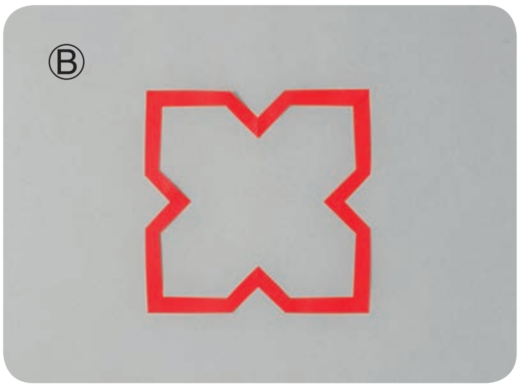






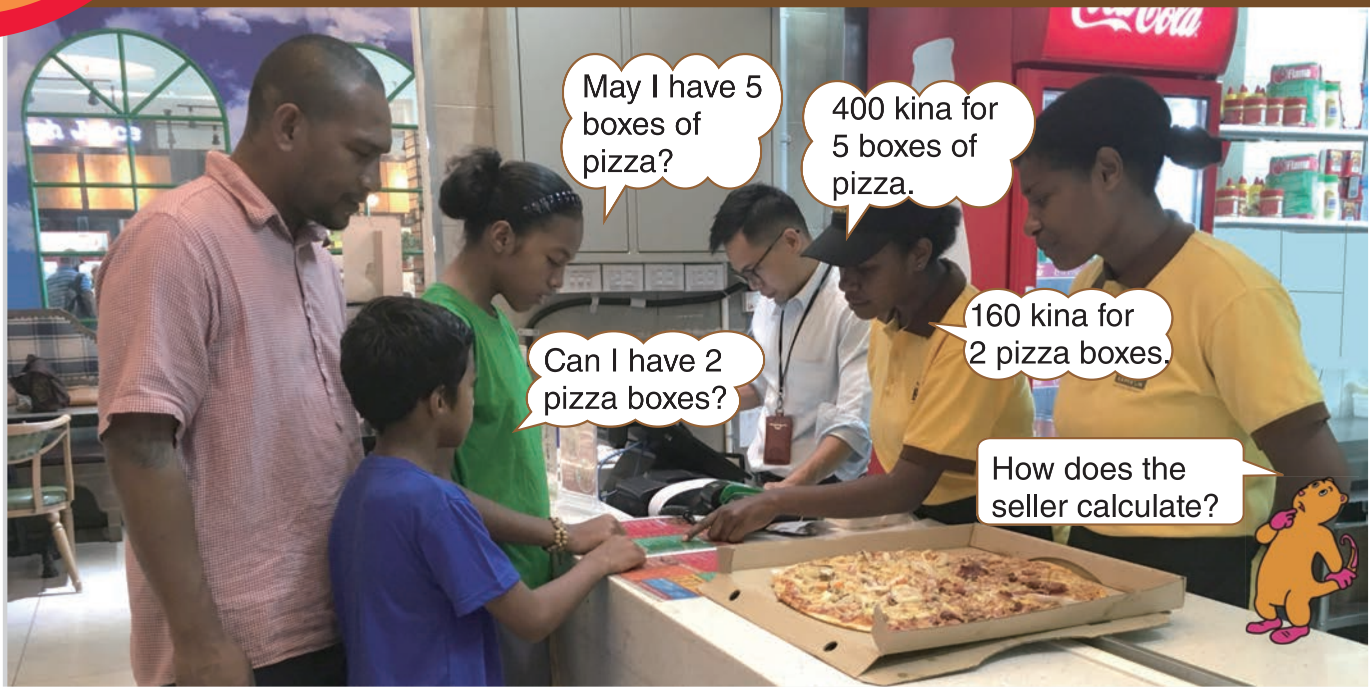
② Fold the coloured paper three times. How can you cut to make shape Ⓑ? Draw cutting lines in the diagram.





Let's make these by exploring.

2 Mathematical Letters and Expressions



1 Mathematical Letters and Expressions

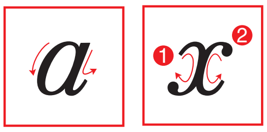
1 Rupa's family are buying pizzas which costs 80 kina each for a birthday party.

① Let's fill in each □ with a number and make expressions to find the total.

- Bought 1 box of pizza .... 80 × 1 = □
- Bought 2 boxes of pizza ...... □ × □ = □
- Bought 5 boxes of pizza ...... □ × □ = □

② Represent the number of pizzas with ○ and the total price with □. Make an expression to represent the relationship of □ and ○.

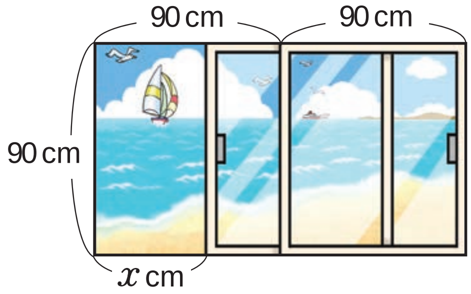
In mathematics, numbers and quantities can be represented using letters such as a or x other than □ and ○.



The price of x pizzas, which cost 80 kina each, can be written as $80 \times x$ or $x \times 80$.

2 A sliding window has a height of 90 centimetre (cm).

1 Write an expression to find the area of the window when opened.



	Height		Opened length		Area of opened window
• Opened 5 cm ………	90	×	5	=	450
• Opened 10 cm………	90	×	$\square$	=	$\square$
• Opened 12.5 cm……	90	×	$\square$	=	$\square$
• Opened 90 cm………	90	×	$\square$	=	$\square$

2 Write an expression to find the area if the opened length is x cm.

3 Make different types of regular polygons using 6 cm broom sticks.

1 Write an expression to find the perimeter (the length around the polygon).

• Regular triangle………	6	×	$\square$	=	$\square$
• Regular pentagon ……	6	×	$\square$	=	$\square$
• Regular octagon………	6	×	$\square$	=	$\square$
• Regular dodecagon …	$\square$	×	$\square$	=	$\square$

2 Write an expression to find the perimeter of a regular polygon with a sides.

• Regular polygon with a sides…… $\square \times \square$

Exercise

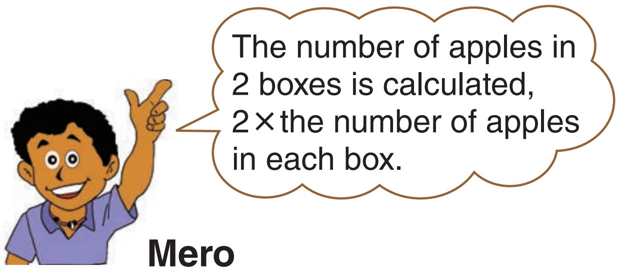
The perimeter (the length of circumference) of a circle is expressed as diameter × 3.14

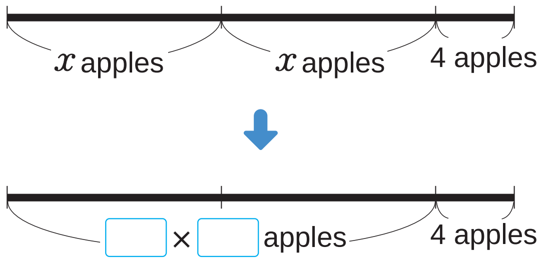
Write an expression to represent the perimeter of a circle with a cm radius.

Let's Calculate Total

4 Anda filled in boxes with apples. There are 2 boxes of apples and 4 single apples.

1. If there are 10 apples in each box, how many apples are there altogether?
2. Use x to show the number of apples in each box and write an expression to find the total number of apples.





3. If the number of apples in each box is 15, how many apples are there altogether?

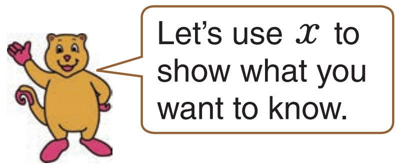
Exercise

Use x to show the number of bubble gums in each box. Write an expression to find the total number of bubble gums using x.

There are 3 bottles and 2 decilitre (dL) of juice.

① Use x dL to show the amount of juice in each bottle. Write an expression to find the total amount of juice using x.

② If the amount of juice in each bottle is 5 dL, how much do we have?



2 Let's Put Numbers into Mathematical Sentences

1 Farmers filled the box with oranges.
There is one box and 7 oranges.

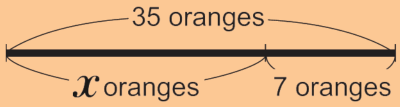
1. Use x to show the number of oranges in the box and write an expression to find the total number of oranges.
2. If we have 35 oranges at the beginning, how many oranges are in the box?

Mero's Idea

If x was 30, total number is $30+7=37$. However, it is 2 greater than 35, so x is 2 less than 30.
Therefore, $x=28$

Vavi's Idea

I used a diagram.

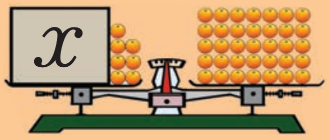


Therefore, $x=35-7=28$

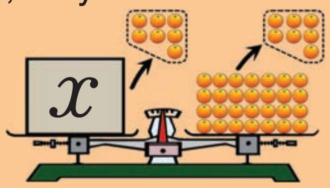
2 Yamo's idea for solving **1** is shown below. Explain her idea.

Yamo's Idea

Think of a mathematical sentence as a balance model.
$x+7$ and $\square$ is balanced.



If you take $\square$ away from both sides, they are still balanced.



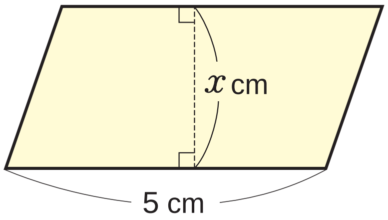
Therefore $x=28$

To find x, if a mathematical sentence is an addition such as $x+7=35$, you use subtraction on both sides to find x.

$$
\begin{aligned}
x+7&=35\\
x+7-7&=35-7\\
x&=28
\end{aligned}
$$

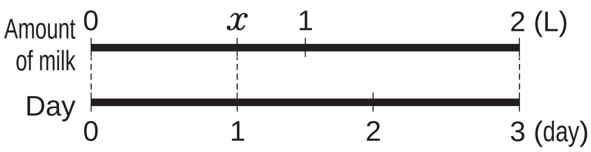
It is easy to read if you align the equal signs.

3 There is a parallelogram like the figure on the right.



1. If the area is 18 square centimetres (cm^2) and height is x cm, write a mathematical sentence to find the area.
2. Based on the expression in 1, find the height of the parallelogram.

4 Rodney drinks the same amount of milk everyday. He drank 2 litres (L) in 3 days.



1. If he drank x L per day, write a mathematical sentence to find the total amount of milk he drank in 3 days.
2. Based on the mathematical sentence of 1, solve to find the amount of milk he drank per day.

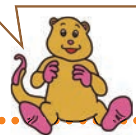
	×3 →	
Milk (L)	x	2
Day (day)	1	3
	×3 →	

To find x, if a mathematical sentence is in multiplication such as $5 \times x = 18$, or $x \times 3 = 2$, you use division on both sides to find x.

$$5 \times x = 18$$
$$5 \times x \div 5 = 18 \div 5$$
$$x = 3.6$$

$$x \times 3 = 2$$
$$x \times 3 \div 3 = 2 \div 3$$
$$x = \frac{2}{3}$$

Not only does x represent whole numbers (integers) but also decimals and fractions.



5 You used a or x to show various quantities. Write in your exercise book about why letters are useful and discuss it with your friends.

It is useful because we can represent quantities that changes in one letter.

Gawi

Make a mathematical sentence which you think is easier to solve.

Kekeni

Exercise

Find the number for x .

① $x+4=22$ ② $38+x=54$ ③ $x-6=15$

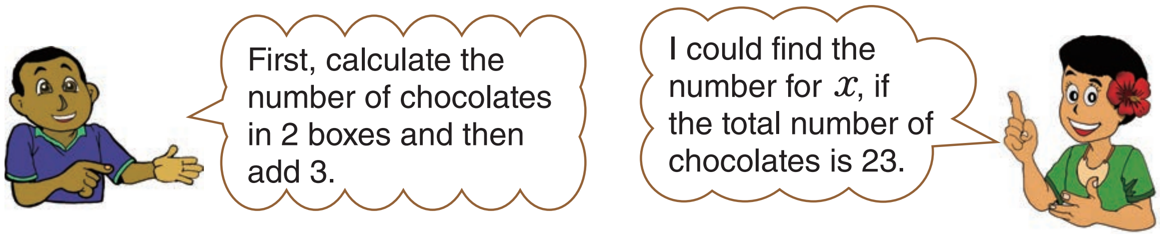
④ $x-27=18$ ⑤ $7\times x=5$ ⑥ $x\times4=14$

6 There are 2 boxes of chocolates which contain the same amount and 3 more pieces of chocolates. When you count the total, it is 23 chocolates. How many chocolates does each box have?

1 If the number of chocolates per box is x, write a mathematical sentence for the total number.

2 By using the following table below, let's find the total number of chocolates in the case of 7, 8, 9, … for x.

x	7	8	9				
$x\times2$	14						
$x\times2+3$	17						



7 There are 8 stacks of coloured papers and 3 sheets.

1 If 1 stack is x sheets, write a mathematical expression to find the total.

2 If the total is 107 sheets, how many sheets are in one stack? Try numbers 10, 11, 12 and so on for x.

Exercise

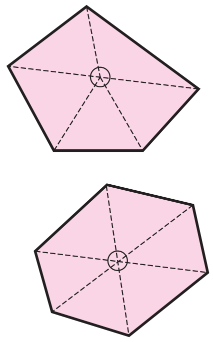
Find the number that applies for x by replacing it with 8, 9, 10, ... and so on.

① $x\times3+4=37$ ② $x\times8+5=77$

The Sum of Angles in Polygons

8 Let's reflect on the sum of angles in polygons.

- The sum of angles in a triangle .... 180°
- The sum of angles in a quadrilateral...... 360°
- The sum of angles in a pentagon .... □
- The sum of angles in a hexagon .... □



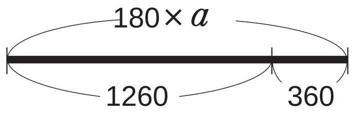
1 Based on the figures above, Phillip thought of an expression for calculating the sum of the angles of regular polygons.
Fill in the □ below and explain his thinking.

$\square \times a - \square$

2 Use the expression in **1** to find the sum of angles of a decagon.

3 If the sum of angles is 1260°, how many sides does this polygon have?

$180 \times a - 360 = 1260$

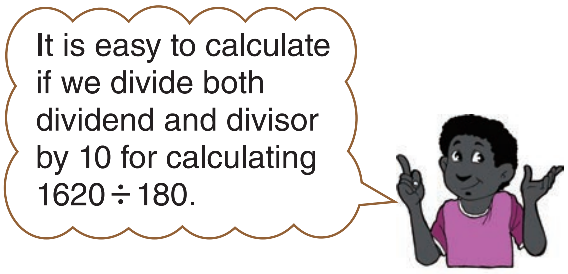


$180 \times a - 360 + 360 = 1260 + \square$

$180 \times a = \square$

$180 \times a \div 180 = \square \div 180$

$a = \square$

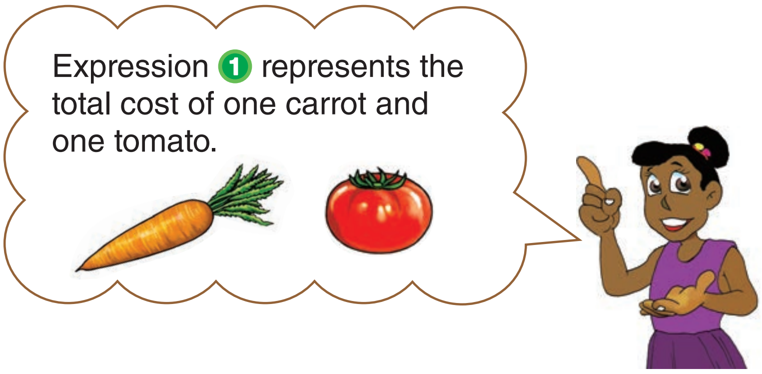


4 Brenda wrote the expression $180 \times (a - 2)$ to find the sum of angles in a-sided polygon. Explain her idea with figures.
Using the expression, calculate how many sides a polygon has if the sum of its angles is 1620°.

3 Reading Expressions

1 David went to a local market.
Carrots were x toea each, tomatoes were 50 toea each and eggplants were 90 toea each.
What does each expression for ① to ④ represent?

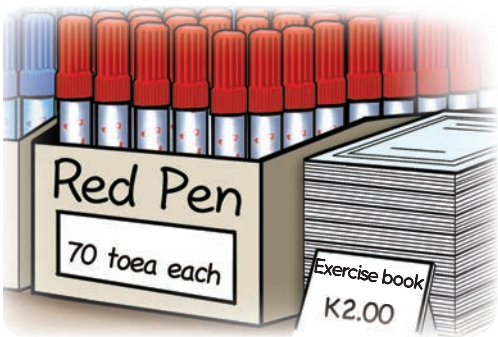
① $x+50$
② $x \times 7$
③ $x \times 5+90$
④ $x \times 4+50 \times 4$

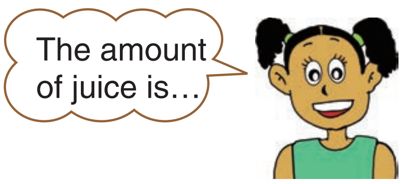


2 Look at the pictures and write what each expression represents.

① $70 \times x$

② $x \times 5+930$





EXERCISE

1 Write a mathematical expression using x and solve for x.

Pages 23 to 25

① A set of weekly diaries costs x kina. 6 sets cost 720 kina.

② The cost of one textbook is x kina and 5 textbooks books is 650 kina.

③ Mary has 20 marbles. She got x more so the total became 52.

④ There is a ribbon which is x cm long.
Lolo used 50 cm so there is 60 cm left.

2 Let's find the number for x.

Page 27

① $x+8=22$　　② $x\times6=48$

③ $x-3.5=7$　　④ $x\times3=4.5$

PROBLEMS

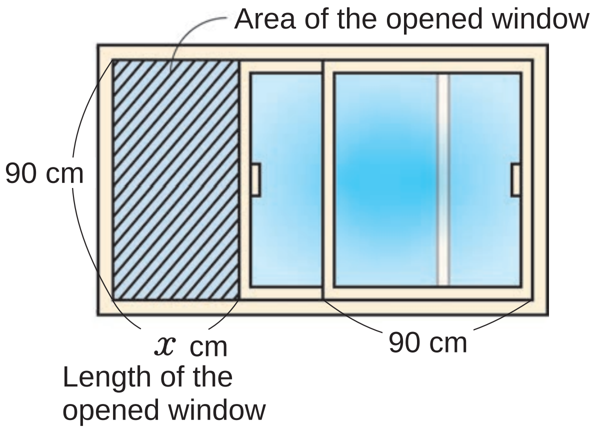
1 There is a window with the height of 90 cm.
Think about the area of the opened window.

● Understanding variables.

① If the length of the opened window is x, write an expression to calculate the area of opened window.

② If the area is 4500 cm², what is the length of the opened window?

③ The length of the window is 90 cm.
Is it possible to make the area of the opened window to 8550 cm²?
Explain your reasoning.



REVIEW

1 Let's fill in the $\square$ with numbers.

① $8.27 = \square \times 8 + \square \times 2 + \square \times 7$

② $0.206 = 0.1 \times \square + \square \times 6$

2 When 7.26 is the original number, find the answer when it is:

① 10 times the original number.

② 100 times the original number.

③ $\frac{1}{10}$ of the original number.

④ $\frac{1}{100}$ of the original number.

3 The cost of 5 mattresses is 1400 kina.

① How much is the cost for 1 mattress?

② How much will 7 mattresses cost?

4 The table shows the area of pools and the number of persons in them. Which pool is more crowded?

The Area of Pools and Number of Persons

	Area (m^2)	Number of person
Indoor	400	80
Outdoor	500	120

5 Let's multiply in vertical form.

① 4×1.6 ② 8×0.5 ③ 9×1.9

④ 5.4×1.2 ⑤ 2.6×0.4 ⑥ 2.8×1.5

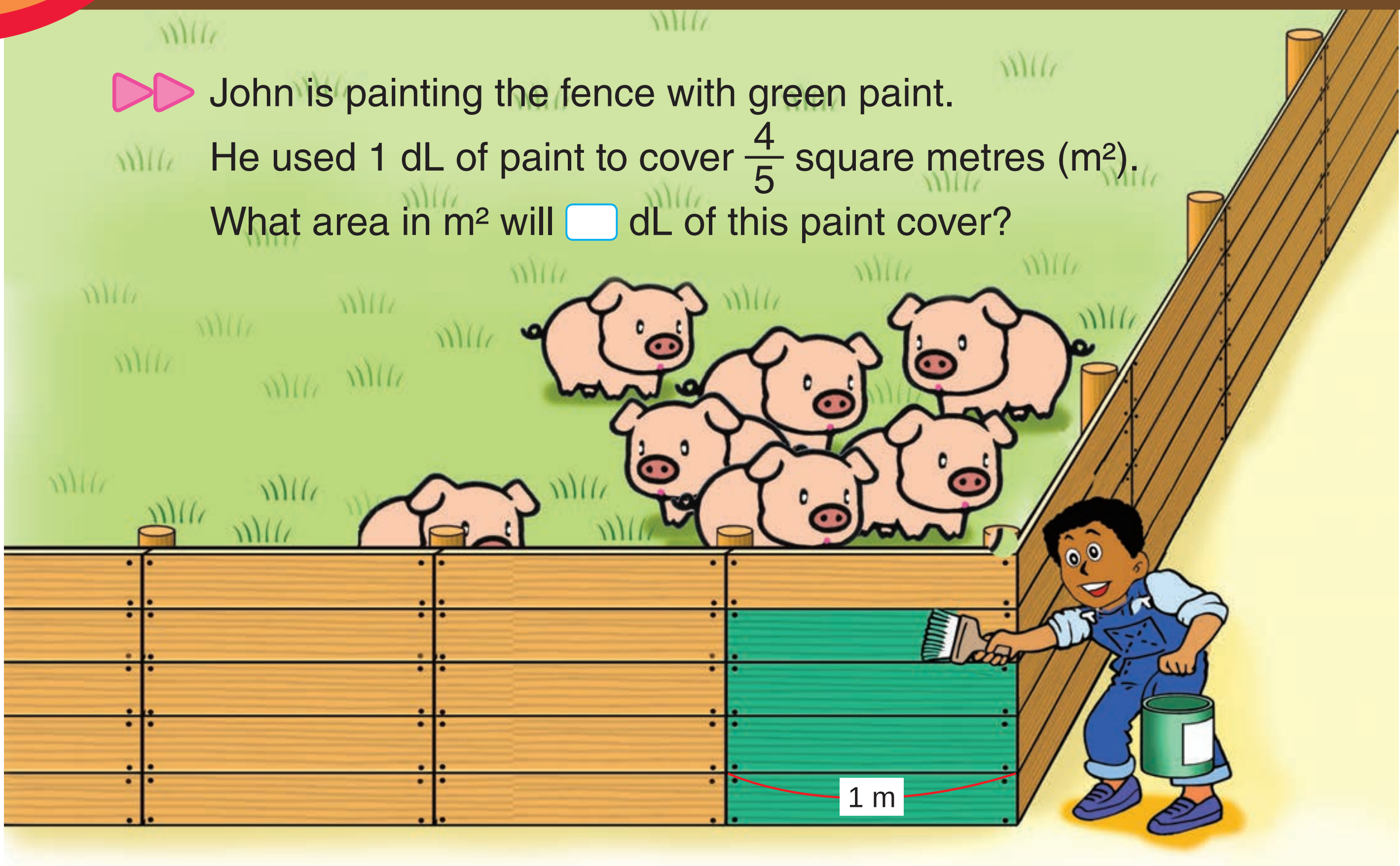
⑦ 0.5×0.6 ⑧ 2.5×0.8 ⑨ 3.4×1.8

⑩ 1.6×7.3 ⑪ 6.32×6.8 ⑫ 8.25×2.4

6 1 m of iron pipe weighs 3.6 kg.
What would be its weight when its length is 7.5 m and 0.8 m respectively?

3 Multiplication of Fractions

▷▷ John is painting the fence with green paint.
He used 1 dL of paint to cover $\frac{4}{5}$ square metres (m^2).
What area in m^2 will ☐ dL of this paint cover?



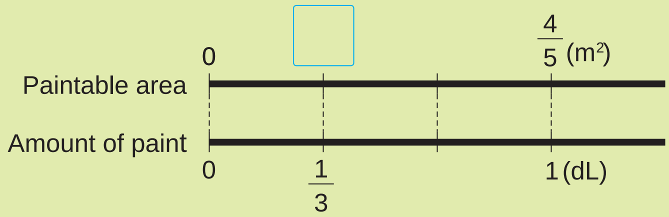
If John uses 3 dL of green paint, what area in m^2 will the paint cover?

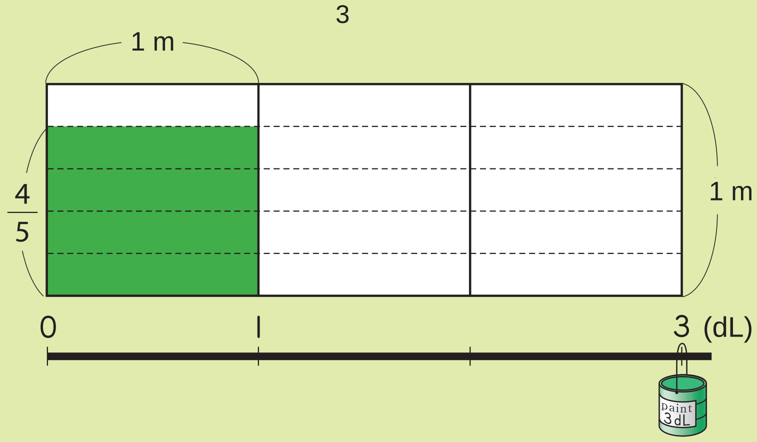
☐ × ☐ = ☐

Paintable area using 1 dL | Amount of paint | Paintable area

Paintable area (m^2)	$\frac{4}{5}$	?
Amount of paint (dL)	1	3

×3 ×3





Think about how to calculate the paintable area.

Let's paint to confirm.

1 Operation of Fractions × Fractions

1 How much area in m² can John paint using $\frac{1}{3}$ dL of green paint?

$\times \frac{1}{3}$

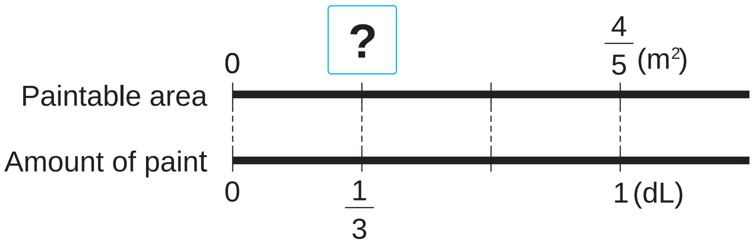
Paintable area (m²)	$\frac{4}{5}$	?
Amount of paint (dL)	1	$\frac{1}{3}$

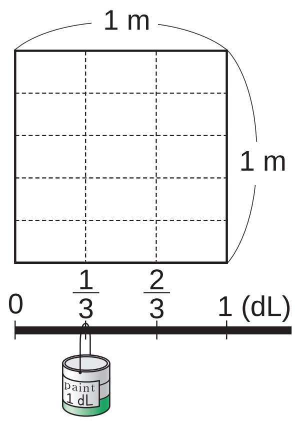
$\times \frac{1}{3}$

1. Write a mathematical expression.

$\square \times \square$

Paintable area using 1 dL — Amount of paint





2. Shade the paintable area in the picture on the right.

3. How about using $\frac{2}{3}$ dL of paint? What area in m² will it cover?
   Write a mathematical expression.

$\square$

Unit fraction is a fraction with the numerator as 1.

4. Think about how to calculate the expression in 3.

Can we use the idea of fractions divided by integers?

Let's draw a diagram which represents the number of unit fraction.

Just like multiplying decimals, can we calculate by changing fractions into integers?

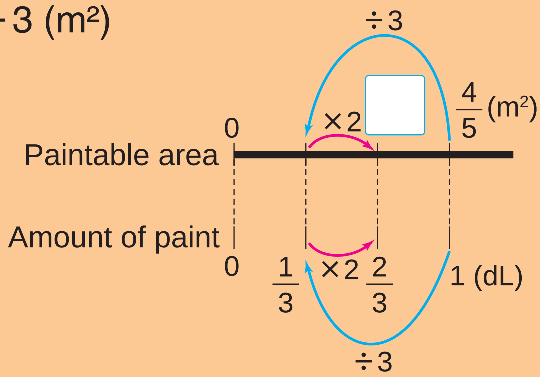
Let's think about the situation where you use multiplication of fractions and how to calculate the answers.

Kekeni's Idea

Paintable area with $\frac{1}{3}$ dL is $\frac{4}{5} \div 3$ (m²)

$\frac{2}{3}$ dL is twice of $\frac{1}{3}$ dL.

$$\frac{4}{5} \div 3 \times 2 = \frac{4}{5 \times 3} \times 2$$
$$= \frac{4 \times 2}{5 \times 3}$$
$$= \square$$



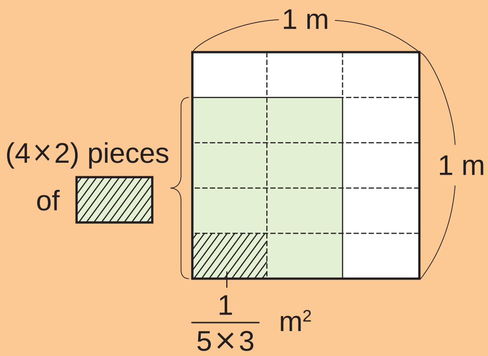
Mero's Idea

Divide 1 m² equally into 5 horizontal strips and 3 vertical strips.

Area of ▨ is $\frac{1}{5 \times 3}$ m².

Paintable area is (4×2) strips of $\frac{1}{5 \times 3}$ m², therefore $\frac{4 \times 2}{5 \times 3}$ m².

$$\frac{4}{5} \times \frac{2}{3} = \frac{4 \times 2}{5 \times 3}$$
$$= \square$$



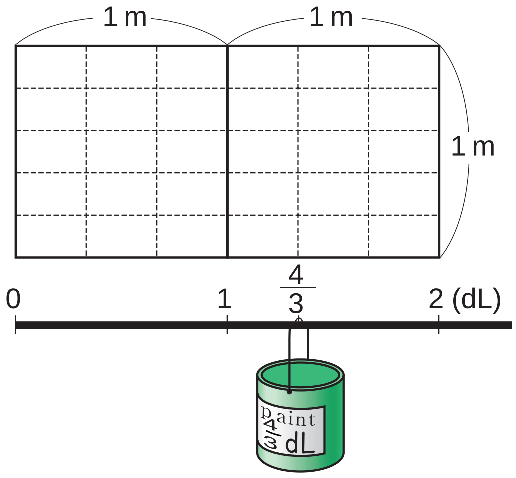
Yamo's Idea

Calculate by changing fractions into integers, just as we did with decimals.

$$\begin{array}{ccccccc} \frac{4}{5} & \times & \frac{2}{3} & = & \square \\ \downarrow \times 5 & & \downarrow \times 3 & & \uparrow \div 15 \\ 4 & \times & 2 & = & 8 \end{array}$$

5 How much area in m² will the $\frac{4}{3}$ dL of paint cover in **1**?

- Write an expression.
- Colour the diagram.
- Calculate the answer.

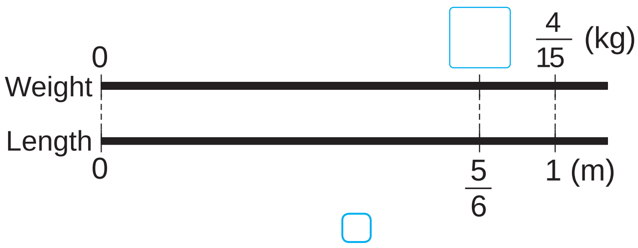


When multiplying a fraction by another fraction, multiply the two numerators and two denominators respectively.

$$\frac{B}{A}\times\frac{D}{C}=\frac{B\times D}{A\times C}$$

2 There is an iron pole, which weighs $\frac{4}{15}$ kilograms per metre (kg/m).

How much does it weigh if the pole is $\frac{5}{6}$ m in length?



$\times\frac{5}{6}$

Weight (kg)	$\frac{4}{15}$	?
Length (m)	1	$\frac{5}{6}$

$\times\frac{5}{6}$

$$\frac{4}{15}\times\frac{5}{6}=\frac{\overset{\square}{4\times\cancel{5}}}{\underset{\square}{\cancel{15}\times 6}}$$

$$=\frac{\overset{\square\ \ \square}{\cancel{4}\times\cancel{5}}}{\underset{\square\ \ \square}{\cancel{15}\times\cancel{6}}}$$

$$=\boxed{}$$

It is easy to calculate if you simplify the fraction during the calculation.

Exercise

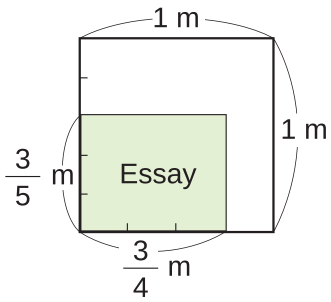
① $\frac{3}{4}\times\frac{1}{2}$ ② $\frac{3}{5}\times\frac{3}{8}$ ③ $\frac{5}{4}\times\frac{5}{3}$ ④ $\frac{3}{2}\times\frac{14}{9}$

3 Let's think about how to calculate.

① $2 \times \frac{3}{5} = \frac{2}{\square} \times \frac{3}{5} = \square$ ② $\frac{4}{5} \times 3 = \frac{4}{5} \times \frac{3}{\square} = \square$

By changing integers to fractions, the calculation becomes multiplication of fractions.

4 The diagram on the right shows the area for the essay section on the bulletin board. What area in m² is covered by the essay section?

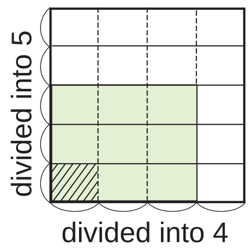


① Mane finds out as shown below.

Fill in the $\square$.

The area of ▨ is $\frac{1}{5 \times 4}$ of the square and it is $\square$ m².

The area for the essay section is (3×3) pieces which is $\square$ m².



② Use the area formula for rectangle $\frac{3}{5} \times \frac{3}{4}$.

Both ways led to the same answer.

Even when the measurements of the sides are given in fractions, we can use area formulas.

Exercise

1 Let's calculate.

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

2

① Find the area of a square with each side as $\frac{2}{3}$ metre (m).

② Find the area of rectangle with the length of $\frac{3}{4}$ cm and the width of $\frac{1}{4}$ cm.

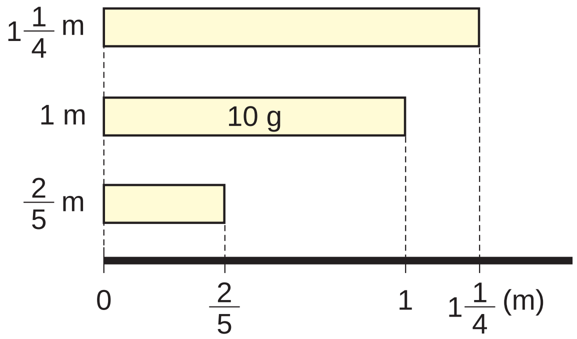
5 Let's think about how to calculate $3\frac{1}{7} \times 2\frac{1}{10}$.

$$3\frac{1}{7} \times 2\frac{1}{10} = \frac{22}{7} \times \frac{21}{10}$$
$$= \frac{22 \times 21}{7 \times 10}$$
$$= \square$$

When multiplying fractions, change mixed numbers into improper fractions.

6 1 m of wire weighs 10 grams (g).

① How much does each wire weigh in grams (g) if it is $1\frac{1}{4}$ m and $\frac{2}{5}$ m long?



$10 \times 1\frac{1}{4} = \square$

$10 \times 1 = 10$

$10 \times \frac{2}{5} = \square$

② $10 \times 1\frac{1}{4}$ or $10 \times \frac{2}{5}$, which expression has the product that is less than 10?

If you multiply a fraction that is less than 1, the product will be less than the multiplicand.

Exercise

1 Let's calculate.

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

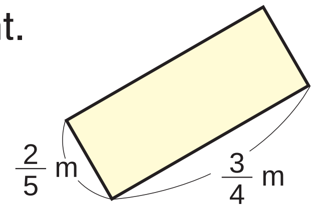
2 1 L of sand weighs $1\frac{3}{5}$ kg.
How much does it weigh in kg, if there is $3\frac{3}{4}$ L of sand?

Rules of Calculations

7 You learned the rules of calculation in grade 5.
Confirm that those rules can be used in calculation of fractions.

ⓐ $A\times B=B\times A$
ⓑ $(A\times B)\times C=A\times(B\times C)$
ⓒ $(A+B)\times C=A\times C+B\times C$
ⓓ $(A-B)\times C=A\times C-B\times C$

1 Let's calculate the area of a rectangle on the right.

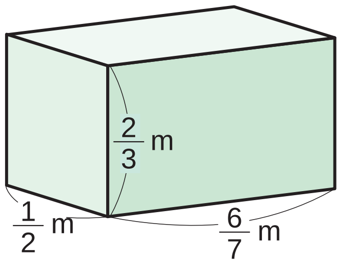


$$\frac{2}{5}\times\frac{3}{4}=\frac{\overset{1}{\cancel{2}}\times 3}{5\times\underset{2}{\cancel{4}}}=\frac{3}{10}$$

$$\frac{3}{4}\times\frac{2}{5}=\frac{3\times\overset{1}{\cancel{2}}}{\underset{2}{\cancel{4}}\times 5}=\frac{3}{10}$$

Which rule is applied to this calculation?

2 Let's find the volume of a quadrangular prism on the right.



$$\left(\frac{1}{2}\times\frac{6}{7}\right)\times\frac{2}{3}=\frac{1\times\overset{3}{\cancel{6}}}{\underset{1}{\cancel{2}}\times 7}\times\frac{2}{3}=\frac{3}{7}\times\frac{2}{3}=\frac{\overset{1}{\cancel{3}}\times 2}{7\times\underset{1}{\cancel{3}}}=\frac{2}{7}$$

$$\frac{1}{2}\times\left(\frac{6}{7}\times\frac{2}{3}\right)=\frac{1}{2}\times\frac{\overset{2}{\cancel{6}}\times 2}{7\times\underset{1}{\cancel{3}}}=\frac{1}{2}\times\frac{4}{7}=\frac{1\times\overset{2}{\cancel{4}}}{\underset{1}{\cancel{2}}\times 7}=\frac{2}{7}$$

Which rule is applied to this calculation?

3 If $A=\frac{2}{3}$, $B=\frac{1}{2}$ and $C=\frac{6}{7}$, confirm if calculation rules ⓒ and ⓓ work with these fractions.

2 Inverse of a Number

1 Let's answer the following questions.

① There are 18 cards with numbers $\boxed{1}$ to $\boxed{9}$ and there are two cards for each number.

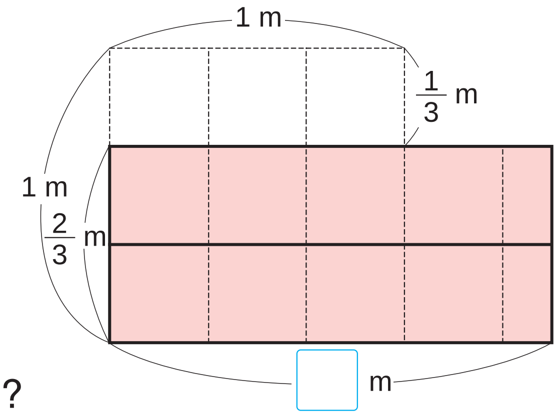
Use those cards and complete the expression below.

$$\frac{\square}{\square} \times \frac{\square}{\square} = 1$$

② What rule is there between the multiplicand and the multiplier to make the product 1?

③ There is a square whose side is 1 m each.

If you change the shape into a rectangle without changing its area of 1 m², and if the width of the rectangle is $\frac{2}{3}$ m what is the length?



When the product of two fractions is 1, one fraction is called **inverse** of the other fraction.
The inverse of $\frac{2}{3}$ is $\frac{3}{2}$ and the inverse of $\frac{3}{2}$ is $\frac{2}{3}$.

2 Let's find the inverse numbers of 6 and of 0.4.

To find an inverse number of integers or decimals, change them into fractions first.

Exercise

Let's find the inverse numbers.

① $\frac{4}{5}$ ② $\frac{10}{3}$ ③ $\frac{1}{8}$ ④ $1\frac{5}{6}$ ⑤ 0.6

EXERCISE

1 Let's calculate.

Pages 31 to 36

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

⑤ $\frac{5}{6}\times\frac{2}{3}$ ⑥ $\frac{2}{3}\times\frac{1}{4}$ ⑦ $\frac{9}{14}\times\frac{7}{18}$ ⑧ $\frac{7}{15}\times\frac{20}{21}$

⑨ $\frac{15}{4}\times\frac{6}{5}$ ⑩ $\frac{25}{18}\times\frac{27}{10}$ ⑪ $2\frac{5}{6}\times\frac{2}{17}$ ⑫ $1\frac{2}{3}\times1\frac{1}{5}$

⑬ $7\times\frac{4}{5}$ ⑭ $8\times\frac{3}{4}$ ⑮ $6\times\frac{9}{8}$ ⑯ $22\times1\frac{2}{11}$

2 Which multiplication has the product that is less than 5?

Page 35

$5\times1\frac{1}{12}$ $5\times\frac{5}{6}$ $5\times\frac{4}{3}$ $5\times\frac{9}{10}$

3 Let's find the inverse of these numbers.

Page 37

① $\frac{1}{3}$ ② $\frac{7}{2}$ ③ $\frac{5}{6}$ ④ $1\frac{1}{2}$ ⑤ 6 ⑥ 0.7

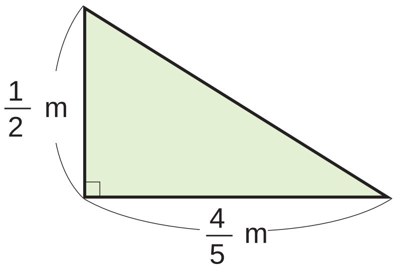
PROBLEMS

1 There is a rice field that produces $\frac{4}{7}$ kg of rice in 1 m². How much rice can we get if the field is $\frac{5}{8}$ m²?

● Understanding the calculation of fractions.

2 There is a right triangle shaped flowerbed on the right.
What is the area of this flowerbed?

● Calculating the area with fractions.



3 Fill in the □ with numbers 2 to 9 and calculate.

● Making multiplication of fractions.

① Make various multiplication expression of fractions and calculate.

$$\frac{\square}{\square}\times\frac{\square}{\square}$$

② Make multiplication expressions where the answer becomes 1.

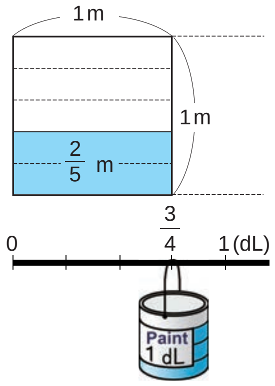
③ Make multiplication expressions where the answer becomes 2.

4 Division of Fractions

1 Operation of Fractions ÷ Fractions

1 We used $\frac{3}{4}$ dL of blue paint for a $\frac{2}{5}$ m² fence.

How many m² can be covered with 1 dL of paint?



① Let's write a mathematical expression.

If 1 dL of paint is used to paint x m², we can show that using a multiplication expression.

$$x \times \frac{3}{4} = \frac{2}{5}$$

Therefore,

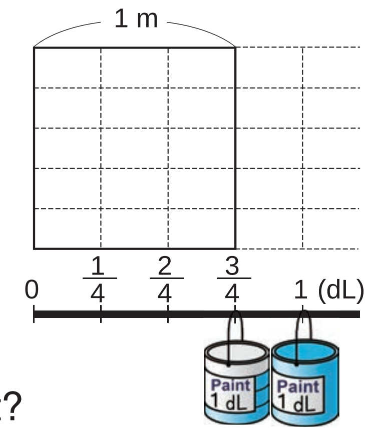
$$x = \frac{2}{5} \div \frac{3}{4}$$

Paintable area (m²)	x	$\frac{2}{5}$
Amount of paint (dL)	1	$\frac{3}{4}$

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

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

Paintable area (m²)	?	$\frac{2}{5}$
Amount of paint (dL)	1	$\frac{3}{4}$



② How many m² can be covered by 1 dL of paint?

Check this by colouring the sections of the figure above.

③ Let's think about how to calculate.

First, let's see how many m² can be painted by using $\frac{1}{4}$ dL. Then, we can multiply that number by 4.

I calculated the answer by using the rules of division and changing the fractions to whole numbers.

I think about how many unit fractions are used by looking at the figure.

Let's think about the situation to use division of fraction by fraction and how to calculate.

Kekeni's Idea

The area that can be painted with $\frac{1}{4}$ dL of paint is

$\frac{2}{5} \div 3$ (m²).

The area that can be painted with 1 dL of paint is

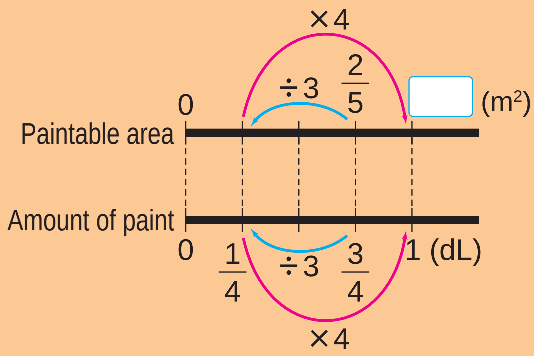
$\frac{2}{5} \div 3 \times 4$ (m²).

$$\frac{2}{5} \div \frac{3}{4} = \frac{2}{5} \div 3 \times 4$$

$$= \frac{2}{5 \times 3} \times 4$$

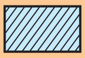
$$= \frac{2 \times 4}{5 \times 3}$$

$$= \square$$



Ambai's Idea

I divide 1 m² horizontally into 5 equal parts and vertically into 3 equal parts.

Then the area of 

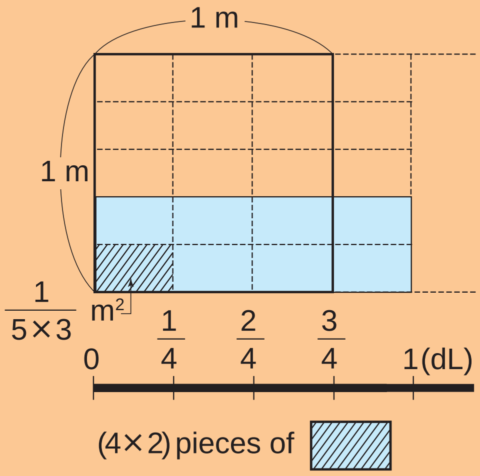
becomes $\frac{1}{5 \times 3}$ m².

Since there are (2×4) sets of $\frac{1}{5 \times 3}$ m², the area that can be painted with 1dL is

$$\frac{2}{5} \div \frac{3}{4} = \frac{1}{5 \times 3} \times (2 \times 4)$$

$$= \frac{2 \times 4}{5 \times 3}$$

$$= \square$$



Sare's Idea

The answer to a division problem is the same even if we multiply the divisor and dividend by the same number.

$$\frac{2}{5} \div \frac{3}{4} = \left(\frac{2}{5} \times \frac{4}{3}\right) \div \left(\frac{3}{4} \times \frac{4}{3}\right)$$
$$= \frac{2}{5} \times \frac{3}{4} \div 1$$
$$= \frac{2}{5} \times \frac{3}{4} = \frac{2 \times 4}{5 \times 3} = \square$$

Kekeni and Ambai calculated $\frac{2 \times 4}{5 \times 3}$ with the answer $\square$. It is the same as $\frac{2}{5} \times \frac{4}{3}$.

To divide a fraction by another fraction, you can calculate the answer by multiplying the inverse number of the divisor fraction.

$$\frac{B}{A} \div \frac{D}{C} = \frac{B}{A} \times \frac{C}{D}$$

2 Let's think about how to calculate.

① $\frac{8}{3} \div \frac{12}{5} = \frac{8}{3} \times \frac{\square}{\square}$

$= \square$

It is easy to calculate if you reduce a fraction.

② $3 \div \frac{2}{5} = \frac{3}{1} \div \frac{2}{5}$

$= \frac{3}{1} \times \frac{\square}{\square}$

$= \square$

③ $\frac{2}{3} \div 5 = \frac{2}{3} \times \frac{1}{\square}$

$= \square$

Change an integer (whole number) to a fraction, then use the method of fraction ÷ fraction.

Exercise

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

⑤ $\frac{16}{7} \div \frac{4}{9}$ ⑥ $\frac{4}{3} \div \frac{2}{3}$ ⑦ $4 \div \frac{3}{5}$ ⑧ $8 \div \frac{2}{3}$

3 We use $1\frac{1}{4}$ dL of red paint to paint $\frac{2}{5}$ m² of the fence.
How much can we paint in m² using 1 dL of paint?

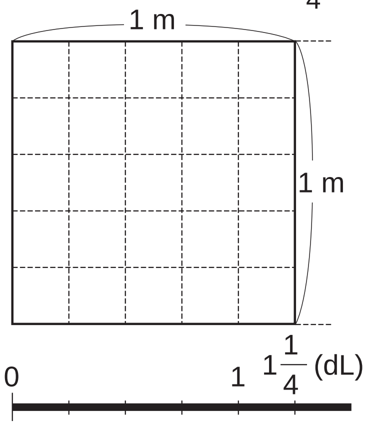
Paintable area (m²)	?	$\frac{2}{5}$
Amount of paint (dL)	1	$1\frac{1}{4}$

$\div 1\frac{1}{4}$ (above and below the table, from the right column to the middle column)

1. Let's write an expression.

$\boxed{}$

2. Check this by colouring the sections of the figure on the right.



3. Let's think about how to calculate.

$$\frac{2}{5} \div 1\frac{1}{4} = \frac{2}{5} \div \frac{\boxed{}}{\boxed{}}$$

$$= \frac{2}{5} \times \frac{\boxed{}}{\boxed{}}$$

$$= \boxed{}$$

We can calculate by changing a mixed number into an improper fraction.

When we calculate division of fractions, change a mixed number into an improper fraction.

4. Let's compare the dividend and quotient.

1 is that the divisor is smaller than 1.
3 is that the divisor is larger than 1.

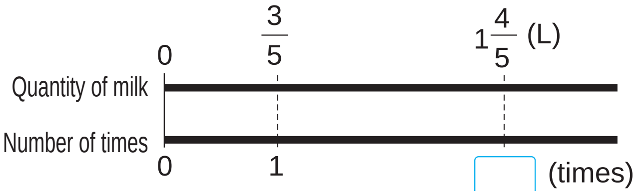
Dividing by a fraction is just like we divided by a decimal.
If the divisor is smaller than 1, the quotient becomes larger than the dividend. If the divisor is larger than 1, the quotient becomes smaller than the dividend.

Exercise

Which one has a quotient that is larger than 7? Explain.

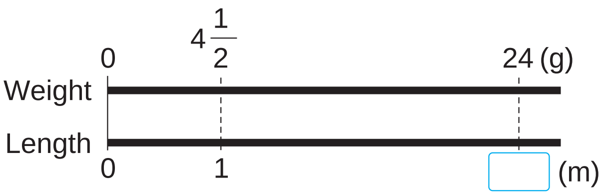
$7 \div \frac{3}{4}$ $\quad$ $7 \div 1\frac{2}{3}$ $\quad$ $7 \div \frac{3}{2}$ $\quad$ $7 \div 7\frac{7}{8}$

4 There is $1\frac{4}{5}$ L of milk. If you drink $\frac{3}{5}$ L each time with your family meals, how many meals will it take to finish the milk?



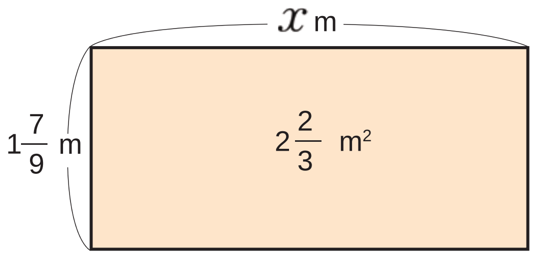
Amount of milk (L)	$\frac{3}{5}$	$\div\frac{3}{5}$	$1\frac{4}{5}$	$\div\frac{3}{5}$
Number of times	1		?	

5 There is a wire which weighs $4\frac{1}{2}$ g per metre (g/m).
If it weighs 24 g in total, what is its length in m?



Weight (g)	$4\frac{1}{2}$	$\div4\frac{1}{2}$	24	$\div4\frac{1}{2}$
Length (m)	1		?	

6 There is a rectangular cloth with an area of $2\frac{2}{3}$ m².
If its length is $1\frac{7}{9}$ m, what is its width in m?



The area formula of a rectangle is **length × width**.

Exercise

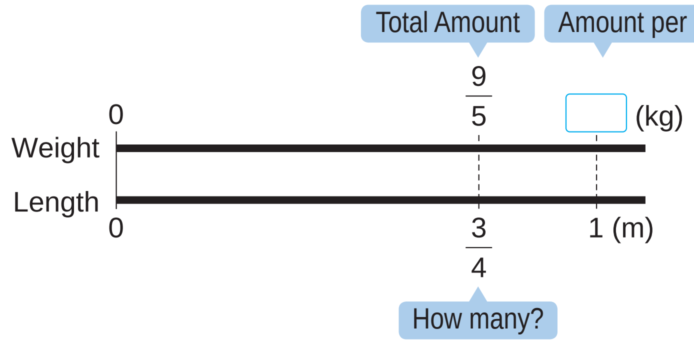
① $\frac{3}{5}\div\frac{9}{10}$ ② $\frac{5}{8}\div\frac{5}{6}$ ③ $\frac{7}{8}\div\frac{7}{12}$ ④ $\frac{5}{6}\div\frac{10}{21}$

⑤ $\frac{2}{3}\div\frac{2}{9}$ ⑥ $\frac{6}{7}\div\frac{13}{14}$ ⑦ $\frac{9}{10}\div\frac{3}{20}$ ⑧ $\frac{1}{4}\div\frac{1}{12}$

⑨ $1\frac{3}{5}\div\frac{2}{7}$ ⑩ $1\frac{1}{4}\div\frac{5}{8}$ ⑪ $4\frac{2}{3}\div1\frac{1}{5}$ ⑫ $2\frac{1}{3}\div1\frac{5}{9}$

② What Kind of Expression will It Become?

1 An iron bar with the length of $\frac{3}{4}$ m weighs $\frac{9}{5}$ kg.
How many kg is 1 m of this bar?

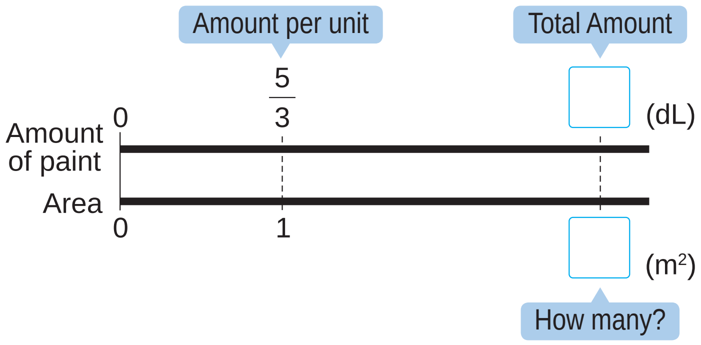


$\div \frac{3}{4}$

Weight (kg)	?	$\frac{9}{5}$
Length (m)	1	$\frac{3}{4}$

$\div \frac{3}{4}$

2 We painted the wall of a corridor. We used $\frac{5}{3}$ dL of paint to cover 1 m^2 of the wall.
How many dL of paint do we need for $\frac{5}{2}$ m^2?



$\times \frac{5}{2}$

Amount of paint (dL)	$\frac{5}{3}$	?
Area (m^2)	1	$\frac{5}{2}$

$\times \frac{5}{2}$

3 Mary made the following problem.

> If we use $\frac{6}{7}$ L of water for a 1 m^2 field, we need ☐ L of water for a $\frac{2}{3}$ m^2 field. Let's fill in the ☐.

① Let's solve Mary's problem.

② Change the words and numbers in the ▭ and make a new multiplication or division problem.

EXERCISE

1 Let's calculate.

Pages 39 to 41

① $\frac{2}{5} \div \frac{3}{7}$ ② $\frac{1}{5} \div \frac{9}{10}$ ③ $\frac{4}{9} \div \frac{2}{3}$ ④ $\frac{3}{4} \div \frac{15}{16}$

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

⑨ $\frac{2}{5} \div 1\frac{3}{5}$ ⑩ $\frac{3}{8} \div 5\frac{1}{4}$ ⑪ $2\frac{2}{9} \div \frac{2}{7}$ ⑫ $3\frac{1}{6} \div 1\frac{1}{18}$

2 Which one has a quotient that is larger than 5?

Pages 39 to 43

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

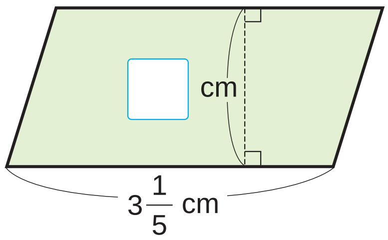
3 Let's fill in the $\square$.

Page 42

① $\frac{7}{12} \div \frac{3}{5} = \frac{7}{12} \times \square$ ② $3 \div \frac{4}{7} = 3 \times \square$

Page 43

4 There is a parallelogram with an area of 6 m² on the right. What is its height in cm?



Page 43

5 You cut $1\frac{4}{5}$ m of tape into pieces that are $\frac{3}{10}$ m long. How many pieces of tape can you make?

Grade 6

Do you remember?

Let's calculate.

① $\frac{1}{3} \times \frac{1}{2}$ ② $\frac{2}{5} \times \frac{1}{4}$ ③ $\frac{3}{8} \times \frac{4}{9}$ ④ $\frac{8}{15} \times \frac{3}{4}$

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

PROBLEMS

1 Let's calculate.

● Calculating division of fraction.

① $\frac{3}{7} \div \frac{1}{3}$ ② $\frac{1}{4} \div \frac{7}{8}$ ③ $\frac{4}{5} \div \frac{8}{9}$ ④ $\frac{3}{4} \div \frac{15}{16}$

⑤ $7 \div \frac{2}{5}$ ⑥ $14 \div \frac{8}{11}$ ⑦ $3\frac{1}{3} \div \frac{5}{7}$ ⑧ $4\frac{1}{6} \div \frac{5}{2}$

2 Find the number for x.

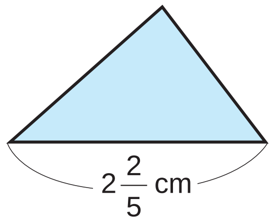
● Understanding the relationship between multiplication and division.

① $x \times \frac{5}{6} = \frac{10}{21}$ ② $x \div 1\frac{2}{3} = \frac{3}{5}$

3 There is $\frac{2}{3}$ L of paint and its weight is $\frac{3}{4}$ kg.
How much does it weigh in kilogram per 1 L?

● Understanding the situation for calculating fractions.

4 The area of the triangle shown on the right is $1\frac{3}{5}$ cm².
Let's find it's height.



● Calculating the height of triangle with fraction.

5 Skylar, Philomina and Keneto share $\frac{3}{5}$ of a cake.
What fraction of the cake does each person get?

● Understanding the situation for calculating fractions.

6 A $2\frac{1}{2}$ m of string is used to make shell necklaces. How many necklaces can be made if each one requires $\frac{1}{4}$ m?

● Understanding the situation for calculating fractions.

7 Wena's family is preparing a mumu. It takes 6 hours to cook for $\frac{3}{4}$ of the total time needed. How many hours will it take for the mumu to be cooked?

● Understanding the situation for calculating fractions.

5 Multiples and Rates

1 Sebi is in the school basketball team. He was able to score more baskets in grade 6.
He scored 20 baskets in grade 5 and scored 50 baskets in grade 6.

① How many times more did he score in grade 6 compared to grade 5?

$$\underbrace{50}_{\text{Compared quantity}} \div \underbrace{20}_{\text{Base quantity}} = \underbrace{\square}_{\text{Multiple}}$$

When comparing two quantities while considering the basic quantity as 1, the relationship between the two quantities is called **rate**. In the example above, a rate is sometimes shown as a multiple of the base quantity (to show the other quantity).

Suppose the number of baskets he scored in grade 6 is x times more than grade 5,

Baskets (shots)	20	50
Rate (multiple)	1	x

$\times x$

$\times x$

$$\underbrace{20}_{\text{Base quantity}} \times \underbrace{x}_{\text{Multiple}} = \underbrace{50}_{\text{Compared quantity}}$$

For getting x,

$$x = 50 \div 20$$
$$= \frac{5}{2}$$

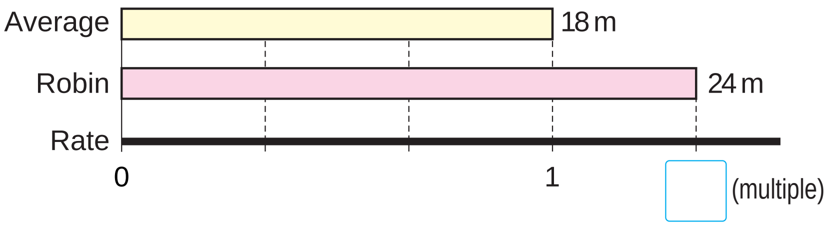
Rate Represented by a Fraction

2 Robin and his friends played a game by comparing how far they could throw a ball.

The average was 18 m.

❶ Robin's record is 24 m. How many times the average is his record?

Show it by a fraction.



24 ÷ 18 = ☐

Compared quantity · Base quantity · Multiple

Suppose his record is x times the average,

Distance (m)	18	24
Rate (multiple)	1	x

$\times x$

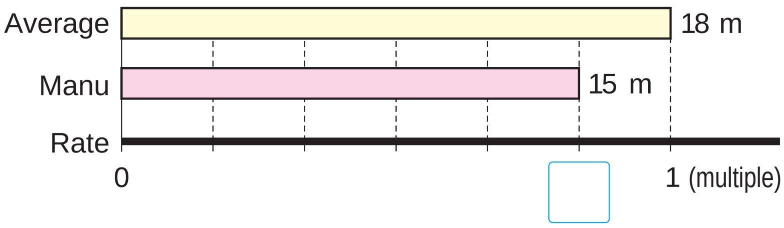
$18 \times x = 24$

$x = 24 \div 18$

Rate is sometimes expressed as fractions.

❷ Manu's record was 15 m.

How many times the average is his record?



15 ÷ 18 = ☐

Compared quantity · Base quantity · Multiple

Suppose his record is x times the average,

Distance (m)	18	15
Rate (multiple)	1	x

$\times x$

$18 \times x = 15$

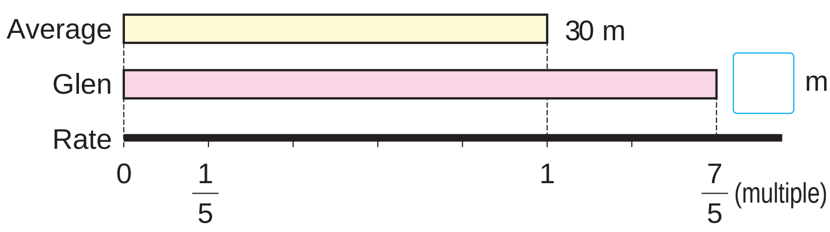
$x = 15 \div 18$

Exercise

Let's fill in the ☐ with fractions.

① 15 m is ☐ times of 9 m. ② 35 kg is ☐ times of 42 kg.

3 Glen and his friends played a game by comparing how far they could throw a ball and the average distance was 30 m.
Glen's record was $\frac{7}{5}$ times the average.
How far did he throw in m?



$\square \times \square = \square$

Base quantity　Value of rate　Compared quantity

Suppose his record is x m.

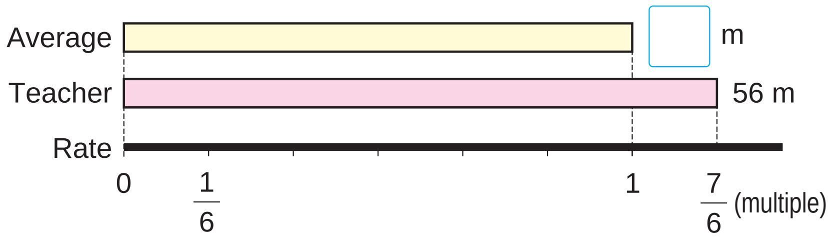
$\times \frac{7}{5}$

Distance (m)	30	x
Rate (multiple)	1	$\frac{7}{5}$

$\times \frac{7}{5}$

$30 \times \frac{7}{5} = x$

4 A teacher threw a softball 56 m.
The record was $\frac{7}{6}$ times the teacher's average.
What was the teacher's average in m?



$\times \frac{7}{6}$

Distance (m)	x	56
Rate (multiple)	1	$\frac{7}{6}$

$\times \frac{7}{6}$

Suppose the average is x m, write its mathematical sentence.

$x \times \square = 56$

$x = 56 \div \square$

Exercise

Let's fill in the $\square$.

① $\frac{7}{5}$ times of 5 kg is $\square$ kg.　② $\frac{5}{6}$ times of $\square$ kg is 50 kg.

6 Operation of Decimals and Fractions

1 Operation of Decimals

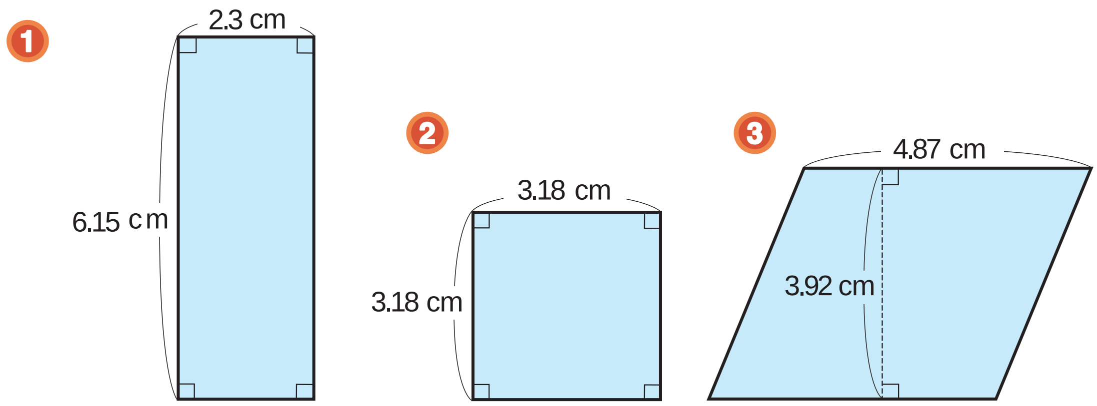
1 There are two watermelons, one weighs 3.2 kg and another 1.63 kg. What is their total weight in kilograms?

2 James ran 850 m in the 2 km fun run course.
How many more kilometres does he have to run?

3 Adam drew a circle with a 7 m radius on the ground. Find the circumference of this circle. The rate of the circumference is 3.14

Circumference is calculated by multiplying diameter and circle rate.

4 Let's find the area of these figures below.



parallelogram

Exercise

Let's calculate.

① 1.24+2.45 ② 5.57+3.61 ③ 2.66+4.54 ④ 6.8+2.36

⑤ 8.75−3.52 ⑥ 9.36−6.54 ⑦ 7.24−4.35 ⑧ 8.5−1.72

⑨ 2.3×1.2 ⑩ 7.43×8.2 ⑪ 3.8×2.94 ⑫ 3.12×1.23

Organise the Records

5 Vanua and 3 of his friends made 3 attempts for long jumps.
The table on the right shows their records in metres.

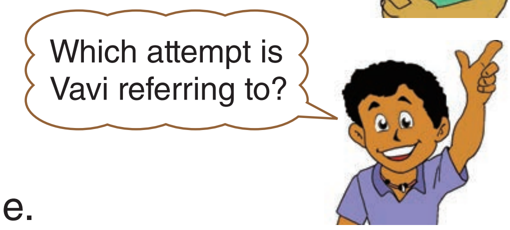
Attempt / Name	1st (m)	2nd (m)	3rd (m)
Vanua	2.56	2.43	2.54
Jack	2.53	2.51	2.61
Dona	2.62	2.52	2.51
Nobin	2.51	2.49	2.53

1. What is the total length that Vanua jumped in 3 attempts?
2. On the first attempt, how much further did Dona jump than Jack?
3. What is the difference between the best and worst records for Jack after 3 attempts?
4. Look at the table and discuss who jumped the furthest. Explain your reasons.

Ⓐ Mero says that Dona jumped the best.

Ⓑ Vavi says that Jack jumped the best.

Ⓒ Yamo says that the achievement of both Jack and Dona is the same.



Phrase

"Probably,"

You use the word "probably," when you predict or suppose something based on data or ideas.

Let's imagine each reasoning of Mero, Vavi, and Yamo.

6 There are three sets of cards for each of the numbers $\boxed{1}$ to $\boxed{9}$.
Let's develop division problems and calculate. If the number is not divisible, round off the quotient to one decimal place.

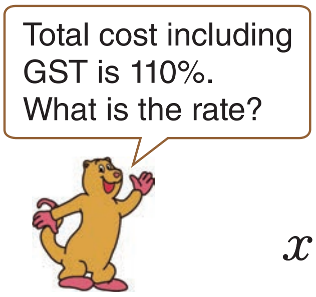
$$\square\ \square . \square \div \square . \square$$

$\boxed{1}$ $\boxed{2}$ $\boxed{3}$ $\boxed{4}$ $\boxed{5}$ $\boxed{6}$ $\boxed{7}$ $\boxed{8}$ $\boxed{9}$

7 Kila bought a bolt of laplap which cost 840 kina and 10 % of GST included to the price.
How much is the price without GST rounded to 1 decimal place?


Laplap (Material)

Suppose the price without GST is x.



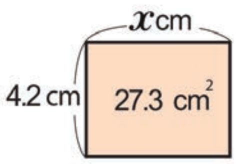
Price (kina)	x	840
Rate	1	1.1

×1.1 ×1.1

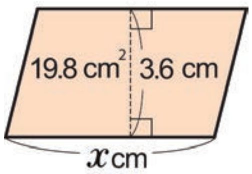
$x \times 1.1 = 840$

8 Answer the questions.

① Suppose the width of a rectangle is x cm and its length is 4.2 cm and the area is 27.3 cm².
Find the width.



② Suppose the width of a parallelogram is x cm and its height is 3.6 cm and the area is 19.8 cm².
Find the base.



Exercise

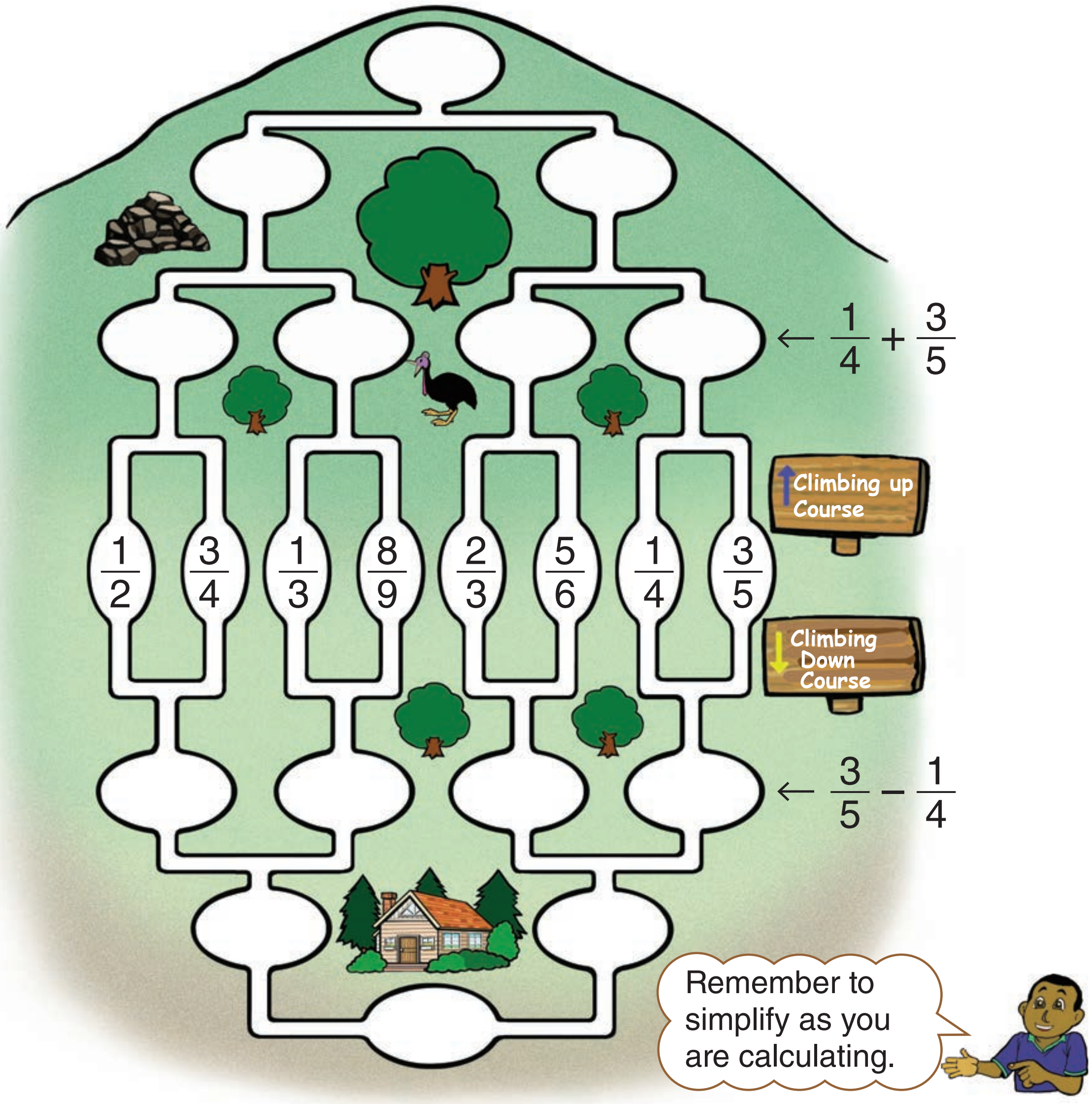
Let's calculate.

① 9÷0.6 ② 8.4÷0.7 ③ 1.2÷0.4 ④ 22.8÷0.4
⑤ 7.14÷3.4 ⑥ 6.45÷1.5 ⑦ 6.66÷3.7 ⑧ 9.24÷4.2

2 Operation of Fractions

1 Starting from the fractions in the middle of the picture, add the pairs of fractions and fill in the spaces as you go up the course. As you go down the course, subtract the smaller fractions from the larger ones and fill in the spaces.

What are the final fractions?



Exercise

Let's calculate.

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

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

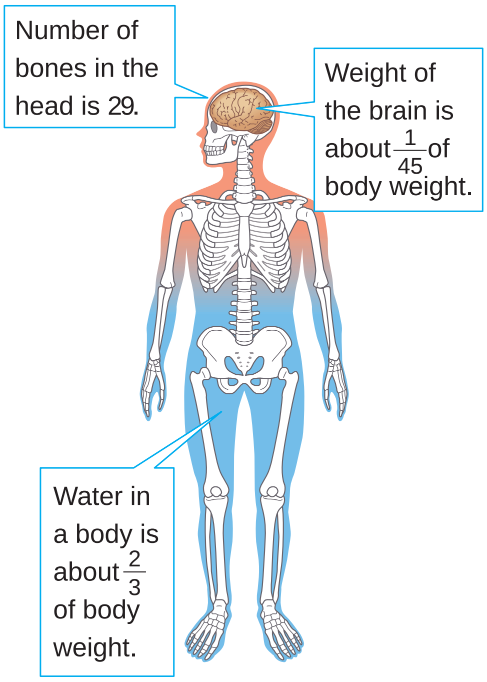
Our Body and Food

2 Look at the picture on the right and think about our body.

① How much is the weight of the brain if the person weighs 36 kg?

② About $\frac{1}{7}$ of bones are in the head. How many bones are there in a human body?

③ How much water is in the body if the person weighs 45 kg?



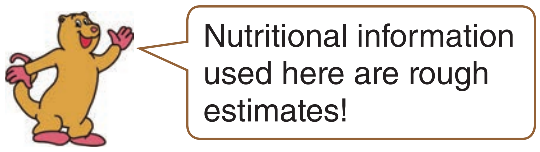
3 For the body to grow and for fitness, we need various nutrition. Carbohydrate provides the energy for exercise. Protein provides a base for the body like muscles.

① Rice contains about $\frac{2}{5}$ of carbohydrate in the total weight. How much carbohydrate is in 200 g of rice?

② A fish contains about $\frac{1}{4}$ of protein in the total weight. If you want to take 30 g of protein from a fish, how much do you have to eat in g?


Rice


Fish



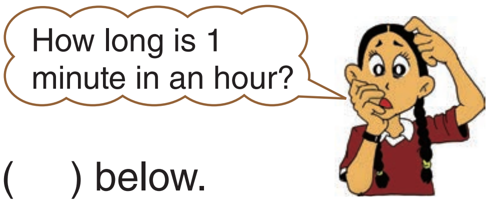
Calculation of Time

4 The relationships among different units of time are shown in the table on the right. Time units are not organised by multiples of tens. To calculate time, it is useful to use fractions.

Hour	Minutes	Second
$\frac{1}{3600}$	$\frac{1}{60}$	1
$\frac{1}{60}$	1	60
1	60	3600

1. What is 4 minutes in terms of hours?

$$\frac{1}{\square} \times 4 = \square$$



2. Let's change the given time by the unit ( ) below.

Ⓐ 35 minutes (hour) Ⓑ 20 seconds (minute)

Ⓒ $\frac{2}{3}$ hour (minute) Ⓓ $\frac{1}{4}$ minute (second)

3. How long is $7\frac{1}{3}$ minutes in minutes and seconds?

$$7\frac{1}{3} \text{ (minutes)} = 7 \text{ (minutes)} + \frac{1}{3} \text{ (minutes)}$$
$$= 7 \text{ (minutes)} + \square \times \frac{1}{3} \text{ (seconds)}$$
$$= 7 \text{ (minutes)} + \square \text{ (seconds)}$$

5 When we use the method in task **4**, we can represent the calculation of time using fractions.

Answer the following by using fractions.

1. The game played by grade 6 students is 1 hour and 40 minutes long. If they played it 3 times, how long will it take in hours?
2. Melo ran 1.5 km in 6 minutes and 15 seconds. How much time did it take him to run 1 km?
3. Loa studies for 2 hours and 40 minutes every day. Yesterday, she spent 40 minutes on each subject. How many subjects did she study?

3 Operation of Decimals and Fractions

1 Let's calculate $\frac{2}{5}+0.5$

① Let's convert decimals to fractions and calculate.

$$0.5=\frac{1}{2} \qquad \frac{2}{5}+\frac{1}{2}=\square$$

② Let's convert fractions to decimals and calculate.

$$\frac{2}{5}=0.4 \qquad 0.4+0.5=\square$$

2 Let's calculate $0.2-\frac{1}{6}$.

① Let's convert decimals to fractions and calculate.

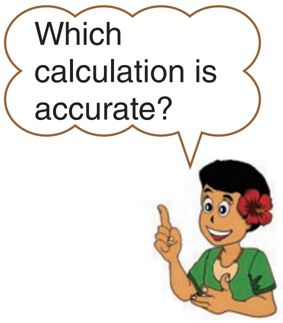
$$0.2=\frac{1}{5} \qquad \frac{1}{5}-\frac{1}{6}=\square$$

② Let's convert fractions to decimals and calculate.

$$\frac{1}{6}=0.1666\ldots \qquad 0.2-0.167=\square$$

$$\downarrow$$

$$0.167$$



If addition and subtraction include both decimal and fraction, convert the units to either decimal or fraction.
If you cannot convert a number to an accurate decimal, convert the unit to a fraction.

Exercise

Let's calculate.

① $0.6+\frac{4}{9}$ ② $0.7+\frac{4}{5}$ ③ $\frac{3}{7}+0.4$ ④ $\frac{2}{3}+0.45$

⑤ $\frac{7}{8}-0.3$ ⑥ $1\frac{4}{7}-0.4$ ⑦ $\frac{7}{8}-0.25$ ⑧ $\frac{1}{5}-0.12$

3 Let's calculate the area of the triangle as shown below.

1 Write a mathematical expression.

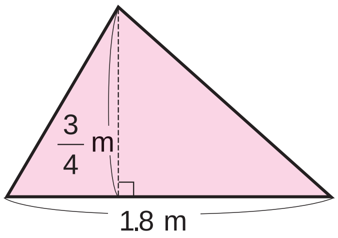
2 Calculate it.

$$\square \times \square \div 2 = \square \times \square \div \frac{2}{\square}$$

$$= \square \times \square \times \frac{\square}{2}$$

$$= \frac{\square \times \square \times \square}{\square \times \square \times 2}$$

$$= \square$$



If calculation of fraction includes both multiplication and division, change the divisor into its inverse and multiply all.

4 Let's calculate using fractions.

1 $1.6 \div 0.25 \times \frac{5}{8} = \frac{16}{\square} \div \frac{15}{\square} \times \frac{5}{8} = \frac{16}{\square} \times \frac{\square}{25} \times \frac{5}{8}$

$$= \frac{16 \times \square \times 5}{\square \times 25 \times 8} = \square$$

2 $0.3 \times 0.48 \div 0.45 = \frac{3}{\square} \times \frac{48}{\square} \div \frac{45}{\square} = \frac{3}{\square} \times \frac{48}{\square} \times \frac{\square}{45}$

$$= \frac{3 \times 48 \times \square}{\square \times \square \times 45} = \square$$

Exercise

Let's calculate using fractions.

① $\frac{1}{3} \div 0.4 \times \frac{3}{5}$ ② $27 \div 48 \times 32$ ③ $0.8 \times \frac{3}{5} \div 0.36$

④ $\frac{3}{7} \div 0.75 \div \frac{9}{14}$ ⑤ $0.7 \times 0.35 \div 0.25$ ⑥ $0.5 \div 0.21 \times 0.7$

EXERCISE

1 Let's find the sum, difference, product and quotient of decimals below. For quotient, use the number on the left as a dividend and right as a divisor, then round off the answer to one decimal place.

Pages 50 to 52

① 3.25, 2.13 ② 4.37, 8.06

③ 9.18, 6.57 ④ 0.85, 5.32

2 Let's find the sum, difference, product and quotient of fractions. For quotient, use the number on the left as a dividend and right as a divisor.

Pages 53 and 54

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

③ $1\frac{2}{3}, \frac{7}{8}$ ④ $3\frac{3}{4}, 2\frac{1}{3}$

3 Let's calculate using fractions.

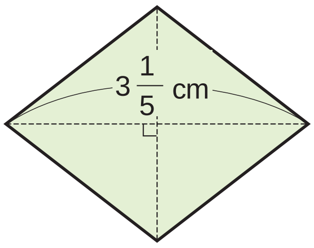
Page 57

① $\frac{1}{5} \div 0.6 \times \frac{2}{3}$ ② $36 \div 27 \times 16$ ③ $0.9 \times \frac{2}{7} \div 0.18$

④ $\frac{5}{12} \div 0.25 \div \frac{3}{10}$ ⑤ $0.2 \div 0.16 \div 0.35$ ⑥ $0.7 \div 0.35 \div 0.5$

4 The rhombus on the right has an area of 4 cm².
What is the length of the other diagonal line in cm?

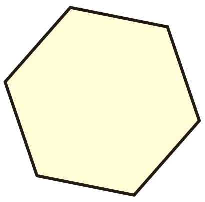
Page 57



Grade 6

Do you remember?

The figure on the right has lines of symmetry.
Draw the lines of symmetry.

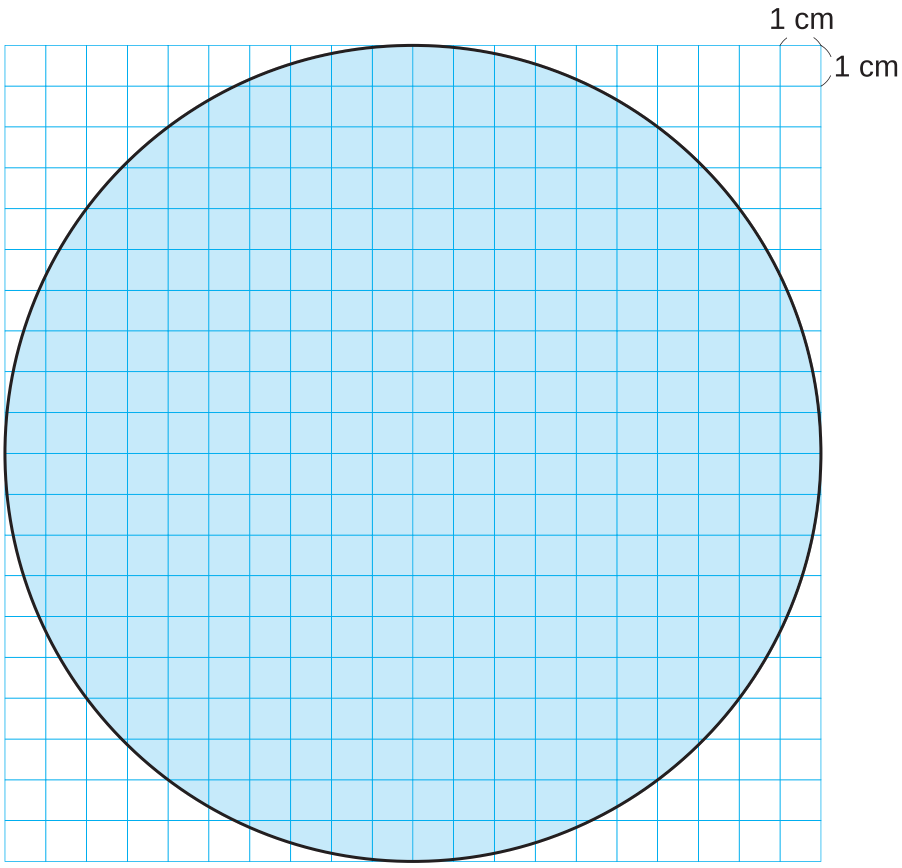


7

Calculating the Area of Various Figures

1 The Area of a Circle

1 What is the area of the circle with a radius of 10 cm?
Check the answer by drawing this circle on graph paper with a 1 cm scale.



① How can we check the answer?

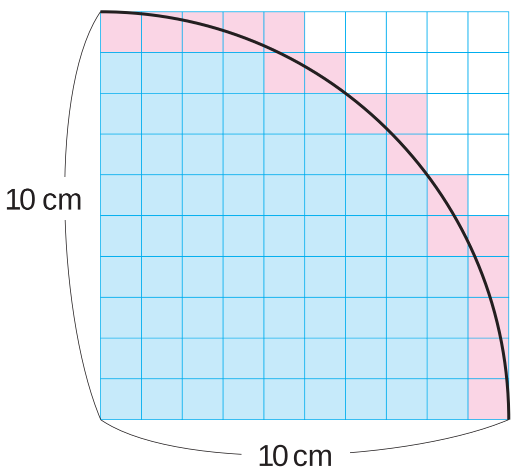
What should we do with squares that are only partially filled in?

Let's think about how to find the area of the circle and the area formula for a circle.

❷ Let's begin by dividing the circle into 4 equal parts, then look at one part.

① How many blue squares and red squares are there?

② If we think of the areas of the red squares along the circumference as 0.5 cm² each, approximately how many cm² is the area of this quarter of a circle?



Blue squares............ 1 × ☐ (cm²)

Red squares ....0.5 × ☐ (cm²)

❸ How many cm² is the area of the entire circle?

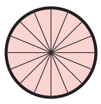
Formula to Calculate the Area of a Circle

Activity

2 Let's think about how to find the area of a circle.

There are formulas for the area of rectangles and triangles. Is there a formula for circles?

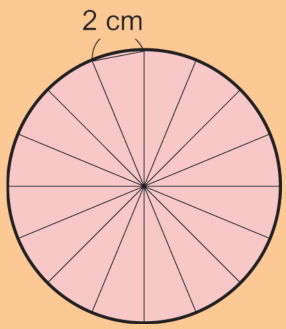
❶ Let's think about the formula by using figures that divide the circle into many equal sections from the radius.

Let's think about this circle. 

To calculate the area of parallelograms or triangles, we change them into other known figures.

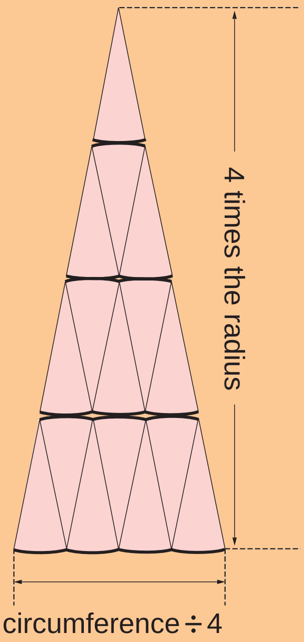
2. Tell the class your ideas about finding the area of a circle. Explain that to 3 other students.

Mero's Idea



I divide a circle into a lot of small triangles.

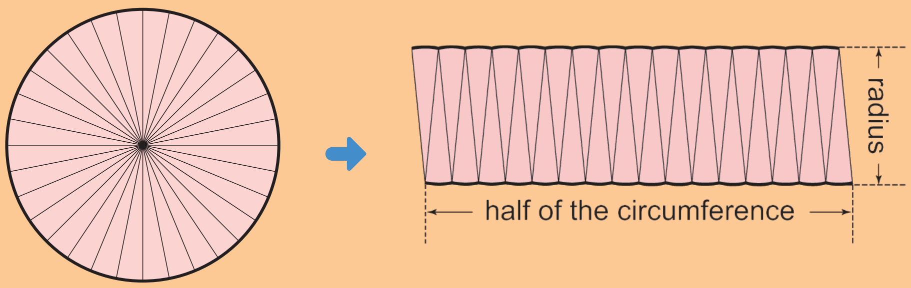
Yamo's Idea



I changed the circle into a triangle.

Ambai's Idea

I rearranged the circle to make a parallelogram.

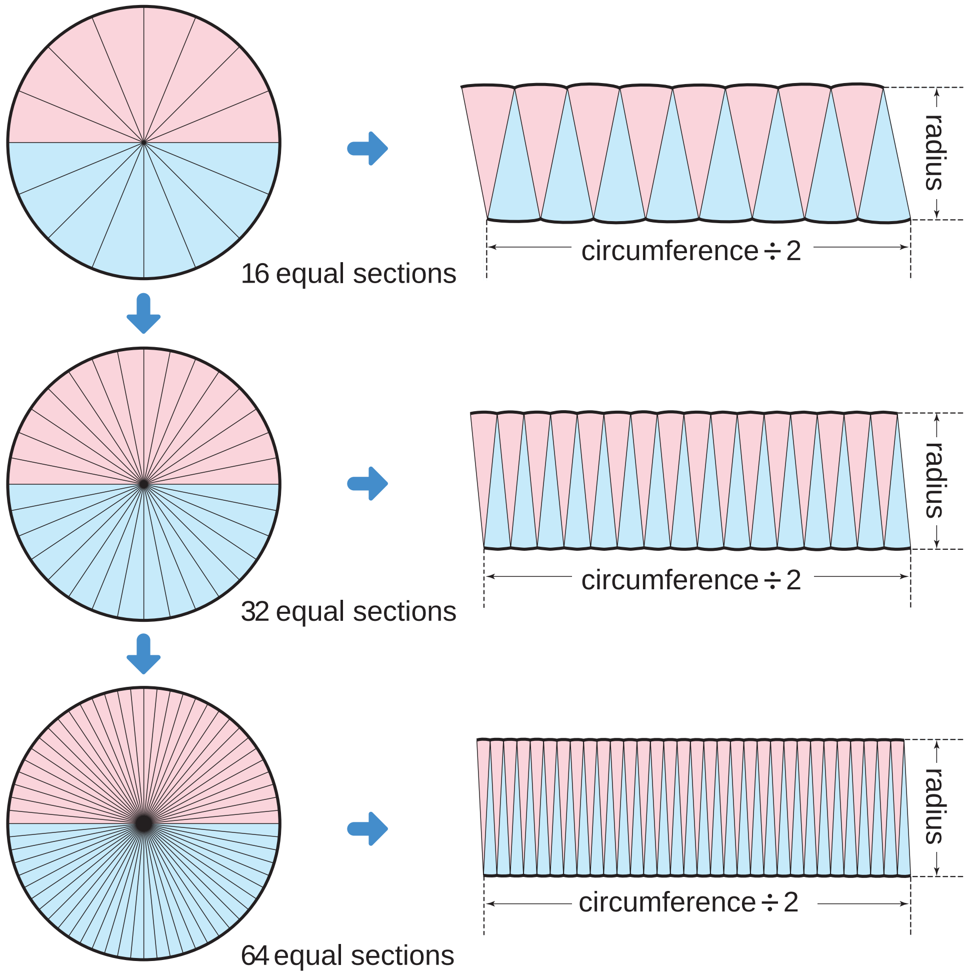


3. Think about how to make a formula to calculate the area of a circle by using the ideas above.

Activity

4 Make a formula based on Ambai's idea.

If we divide a circle into small sections of equal size, what shape does the circle become?



The area of a rectangle = width × length

The area of a circle = $\boxed{}$ × circumference ÷ 2

= radius × diameter × 3.14 ÷ 2

= radius × diameter ÷ 2 × 3.14

= radius × $\boxed{}$ × 3.14

Diameter ÷ 2 = radius, right?

The area of a circle can be calculated by using this formula:

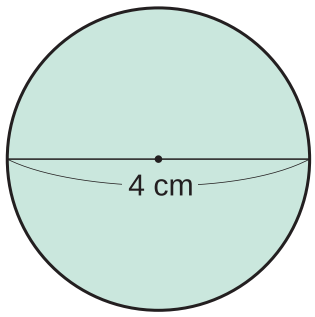
Area of a circle = radius × radius × 3.14

3 Calculate the area of these circles.

1. A circle with 8 cm radius.
2. A circle with 12 cm diameter.

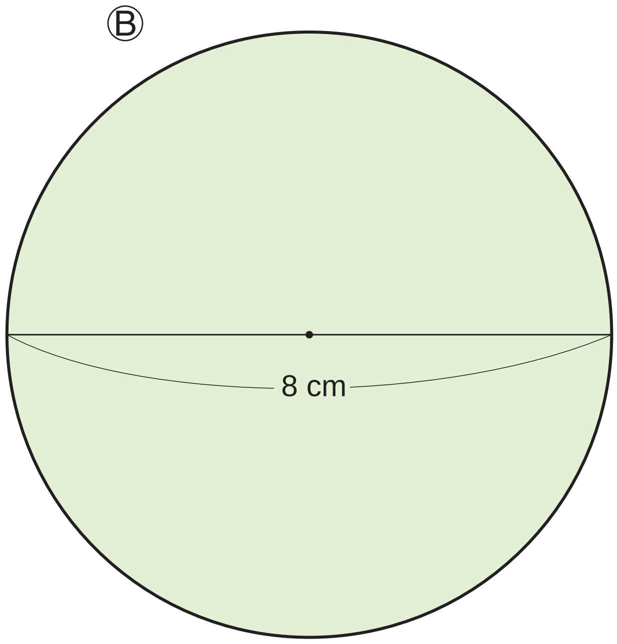
4 There are two circles, one with a 4 cm diameter and another with 8 cm diameter as shown.

Ⓐ



1. Find the circumference and area of each circle.
2. The diameter of Ⓑ is twice the diameter of Ⓐ.
   How many times are the circumference and the area of Ⓑ to Ⓐ?

Ⓑ

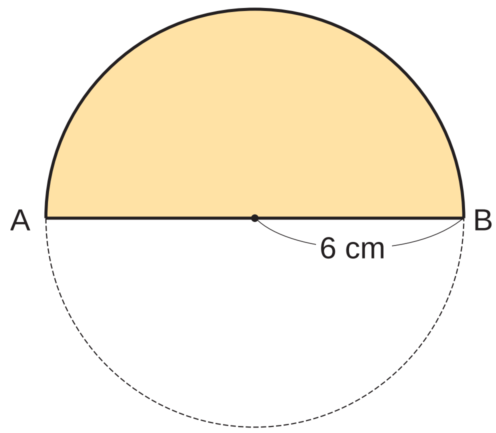


Exercise

These numbers are the circumferences of circles.
Find the radius and area of each circle.

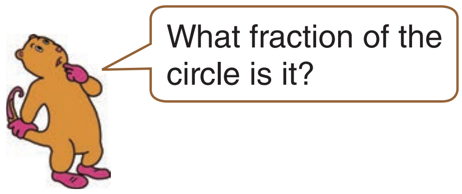
① 62.8 cm ② 18.84 cm ③ 15.7 cm

5 The figure on the right is a circle with a 6 cm radius that has been cut along its diameter.
Answer the following.

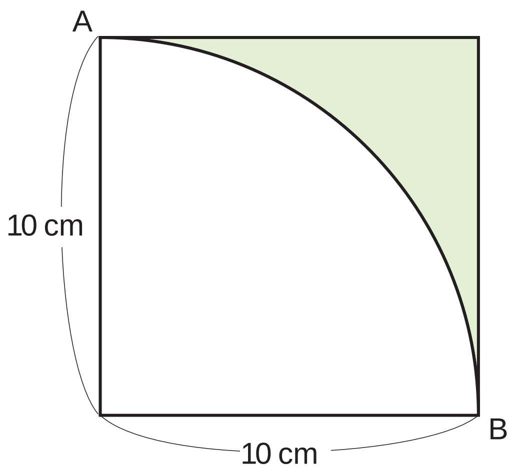


① The length of the arc from A to B.

② The circumference and area of this half circle.



6 As shown on the right, one part of a circle fits exactly inside a square with 10 cm sides.
Answer the following.

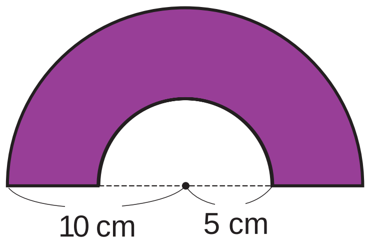


① The length of the arc from A to B.

② The area of the coloured section.

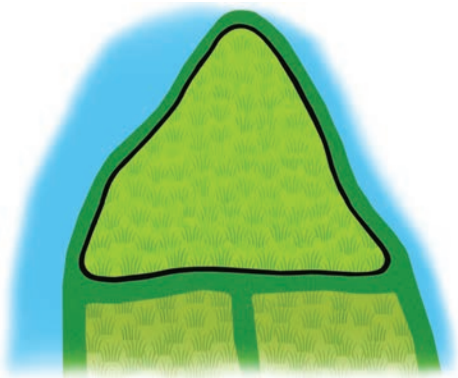
Exercise

Let's find the area of the coloured section on the right.

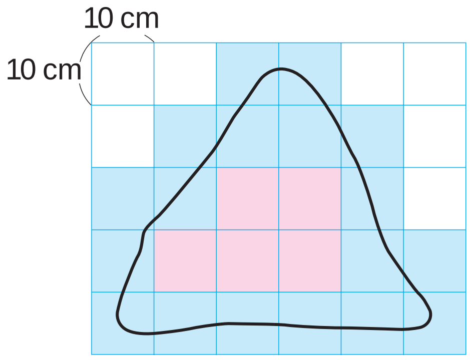


2 Approximate Area

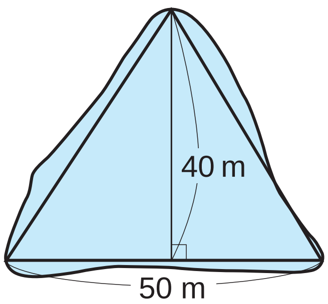
1 What is the area of the field bordered by 2 rivers as shown on the right?



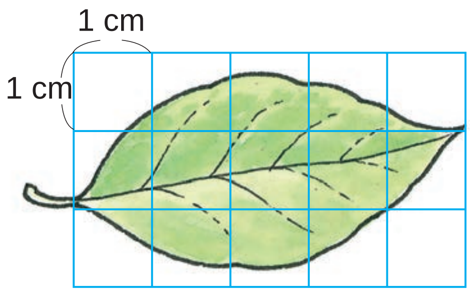
① How many squares are there inside the curved area?
Calculate the area of the field by considering the area of any 2 squares that the line passes through as 100 m^2.



② Calculate the area by considering the shape of the field as a triangle.



2 Calculate the area of various leaves by using the method in **1**.

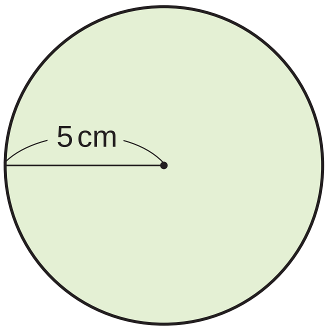


EXERCISE

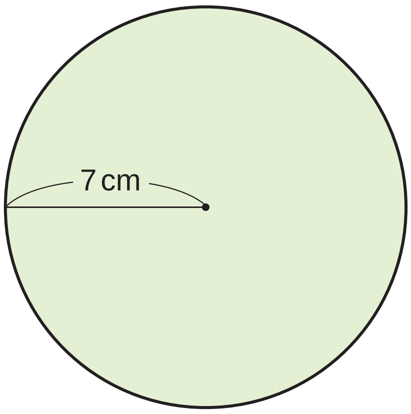
1 Let's calculate the area of each circle.

Page 61

①

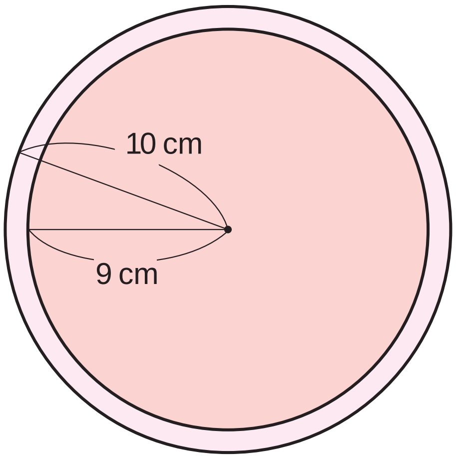


②



2 There are 2 circles with radii 9 cm and 10 cm on the right. Let's find the difference in their areas.

Page 63



Grade 4

Do you remember?

Let's calculate.

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

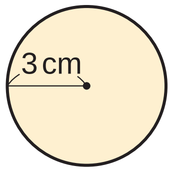
⑤ $\frac{4}{5}-\frac{1}{3}$　⑥ $1\frac{3}{4}-\frac{4}{5}$　⑦ $2\frac{1}{5}-1\frac{6}{7}$　⑧ $3\frac{2}{3}-2\frac{5}{8}$

PROBLEMS

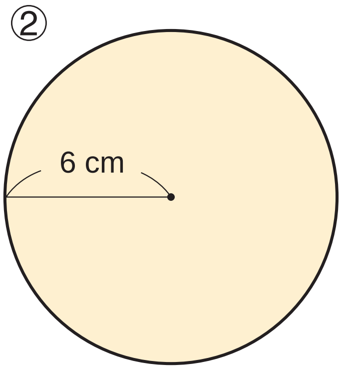
1 Calculate the circumference and the area of these circles.

● Calculating the circumference and area from the radius.

①



②



2 Calculate the diameter and the area of these circles.

● Usng a circumference to calculate the diameter and area of a circle.

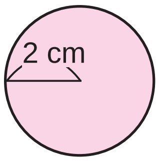
① A circle with 6.28 cm circumference.

② A circle with 12.56 cm circumference.

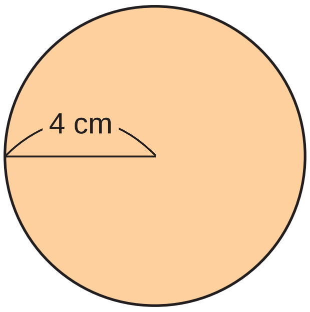
3 Find the circumference and area of the following.

● Finding area and circumference using formula.

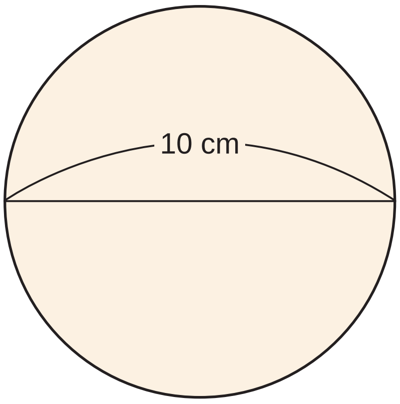
①



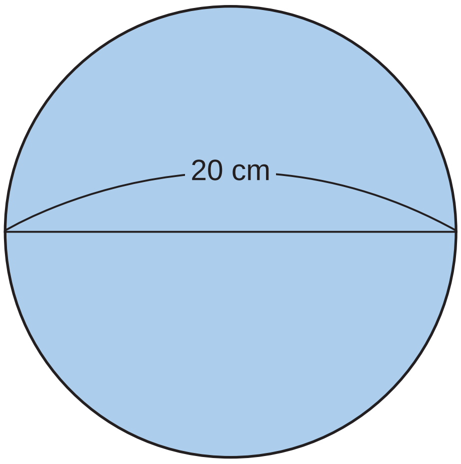
②



③



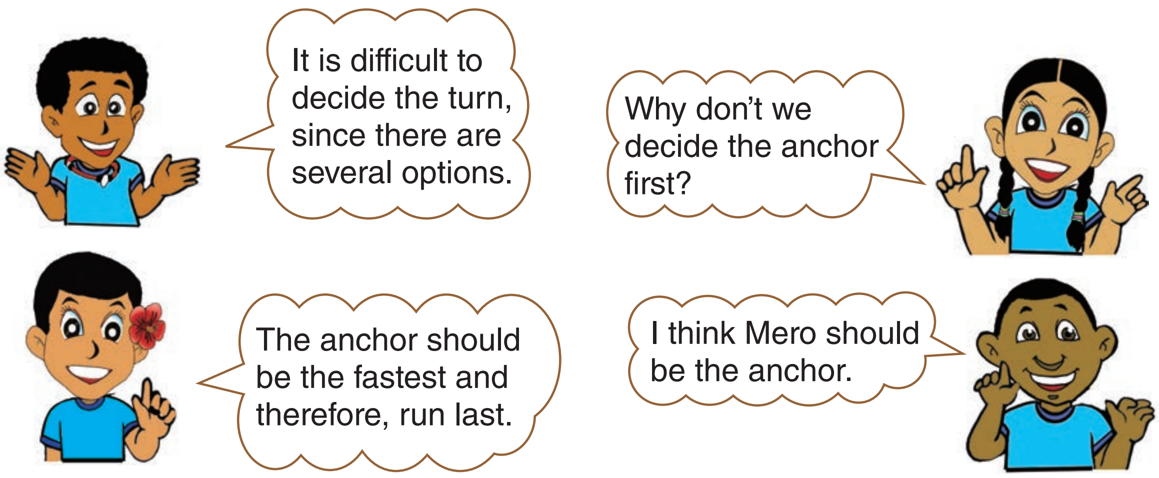
④



8 Orders and Combinations

1 Ordering

1 Naiko, Ambai, Kekeni and Mero are running the relay race.
Let's decide their turn to run.



When Mero is the anchor, how many different orders can there be for the first, second and third runners?

First, Naiko → Kekeni → Ambai.
Second, Ambai → Naiko → Kekeni.
Third, Kekeni → Ambai → Naiko.
There are three cases.
Wait a minute, there could be more…

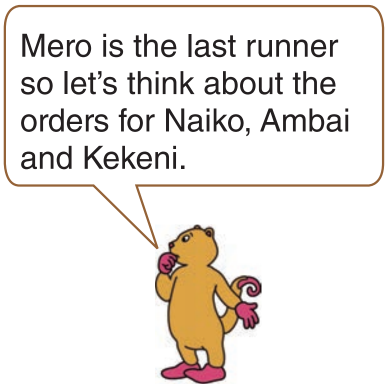
1. Are there other ways of ordering, other than what Yamo found?

2. Let's think about ways to find all the orders systematically and efficiently.

3 Let’s consider the following method.

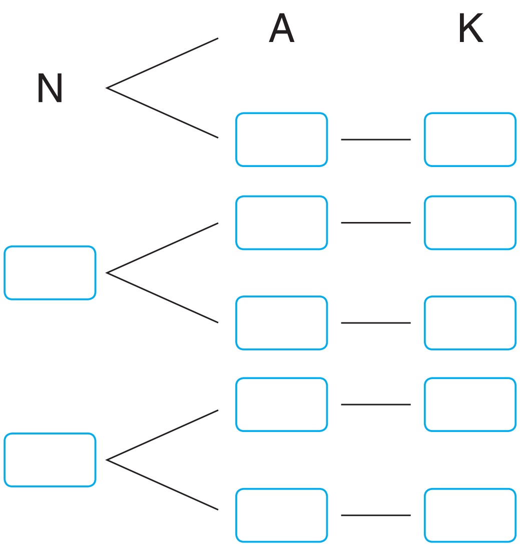
Draw a table

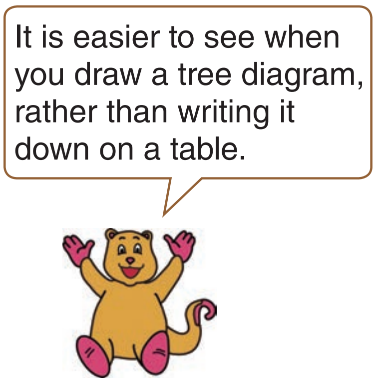
Determine the first runner and fill in the order of the next runners in the table.



First runner	Second runner	Third runner
Naiko (N)	Ambai (A)	Kekeni (K)

Draw a diagram





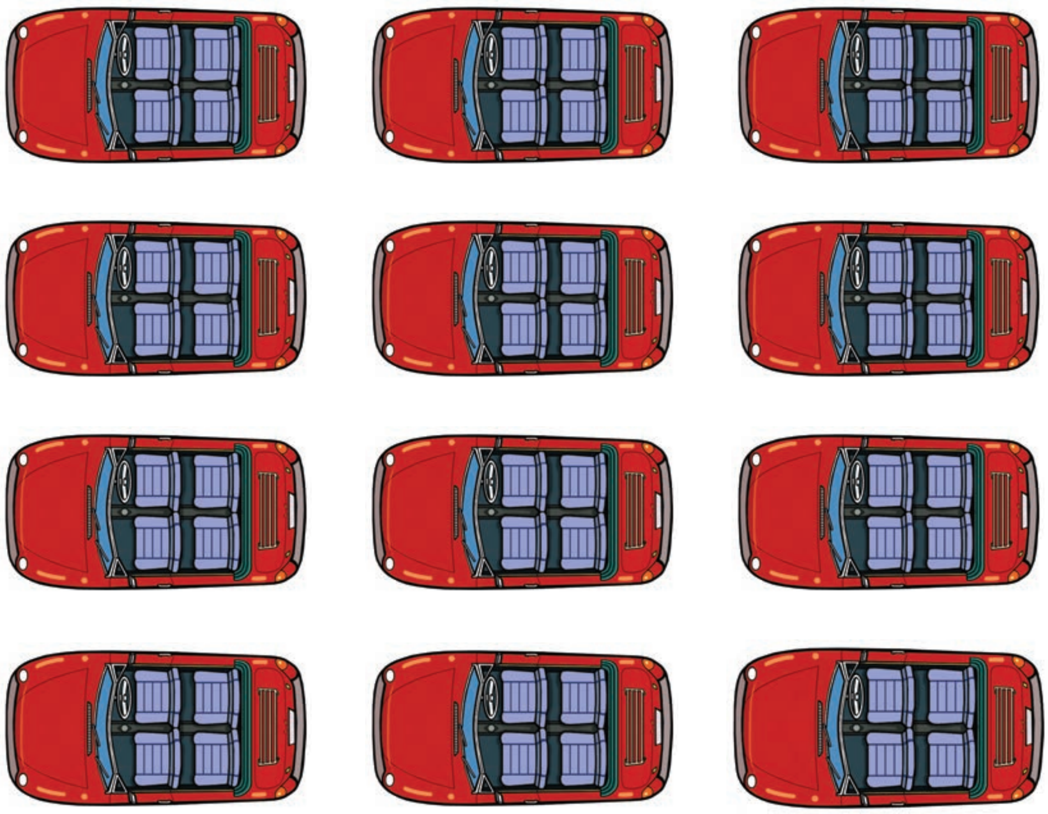
4 How many different orders are there when Naiko is the anchor?

2 There are four cards with numbers $\boxed{1}$, $\boxed{2}$, $\boxed{3}$ and $\boxed{4}$.
Use all the cards to make four digit numbers.
How many numbers can you make?

Which Seat Would You Like to Sit?

3 Meva is going for a ride with his parents and sister.
If the car has four seats, how many seating options are there?
Both his mother and father can drive.

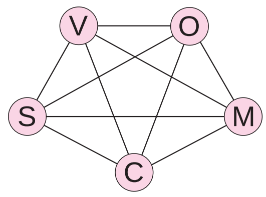
Use counters for each family member and put them in the seats.



2 Combinations

1 Nukuwe is going to buy ice cream.
She can buy two kinds from five flavours shown below.
How many combinations are there?

① Look at the figure on the right and write all the combinations.



Combinations with vanilla…………	V − S, V − C, V − M, ◯ − ◯
Combinations with strawberry……	◯ − ◯, ◯ − ◯, ◯ − ◯, ◯ − ◯
Combinations with chocolate………	◯ − ◯, ◯ − ◯, ◯ − ◯, ◯ − ◯
Combinations with melon …………	◯ − ◯, ◯ − ◯, ◯ − ◯, ◯ − ◯
Combinations with orange…………	◯ − ◯, ◯ − ◯, ◯ − ◯, ◯ − ◯

② Are there same combinations in the figure?
Erase one of the combinations which overlaps.

The order does not matter, so Ⓥ − Ⓒ and Ⓒ − Ⓥ is the same.

③ How many combinations are there, if you buy two kinds of flavours from five?

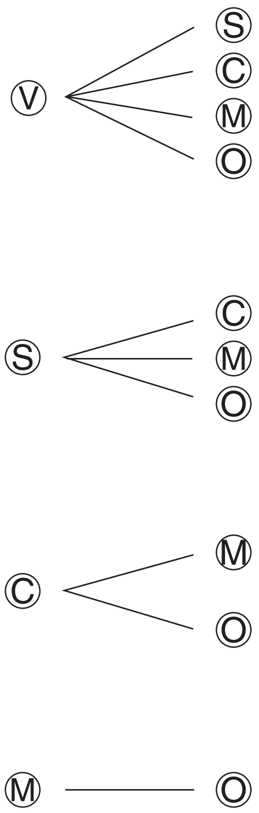
4 Yenbi drew a table below.

Continue and fill in the □ for the combinations.

Ⓥ	V−S	V−C	V−M	V−O						
Ⓢ	S−V				S−C	S−M	S−O			
Ⓒ		C−V			□			C−M	□	
Ⓜ			□			□		□		□
Ⓞ				O−V			□		□	□

5 Haro used a diagram below.

Explain his method.



Exercise

① If you are buying three flavours, how many combinations are there?

② If you are buying four flavours, how many combinations are there?

2 There are six teams participating in a basketball tournament.
Each team will play with the other five teams. In this tournament, how many games are played in total?

Ambai's Idea

I numbered the teams and found their combinations.

1 − 2, 1 − 3, 1 − 4, 1 − 5, 1 − 6
2 − 3, 2 − 4, 2 − 5, 2 − 6
: …………

Mero's Idea

I numbered the teams and made a table.

	1	2	3	4	5	6
1						
2	✓					
3	✓	✓				
4	✓	✓	✓			
5	✓	✓	✓	✓		
6	✓	✓	✓	✓	✓	

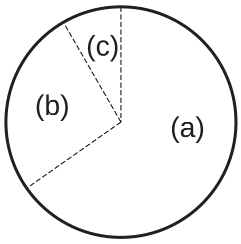
Exercise

1. There is a baseball tournament with seven teams participating. Each team plays one time with each other. In this tournament, how many games are played in total?

EXERCISE

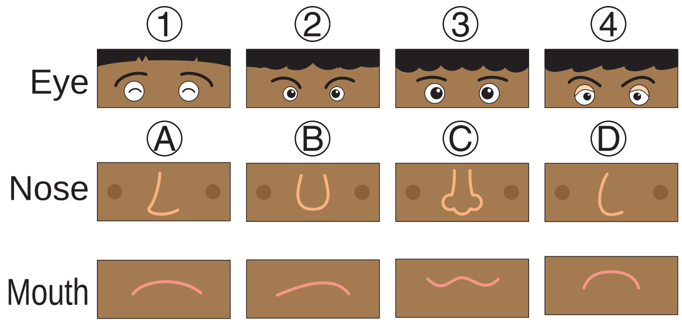
Pages 69 to 70

1 There is a circle graph on the right. Colour (a), (b) and (c) with red, yellow and blue. Show all possible colour combinations.



Pages 69 to 71

2 In making a face, choose eyes, nose and mouth from each category on the right. If you choose eyes, ① how many combinations are there to make a face by choosing different nose and mouth?



Pages 69 to 73

3 There are three cards numbered $\boxed{3}$, $\boxed{4}$ and $\boxed{5}$.

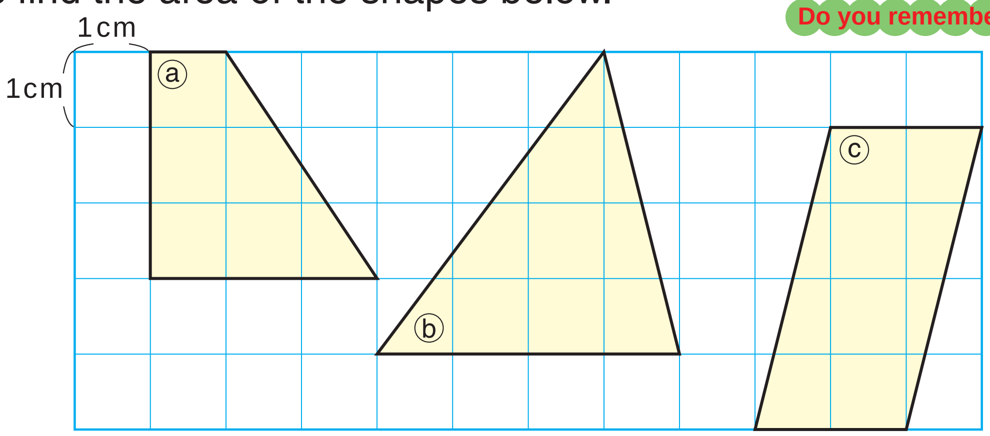
① If you make a two-digit number using two cards out of three, what is the third largest number you can make?

② If you make a three-digit number using all three cards, how many numbers can you make? Let's write them down.

③ If you choose two cards out of three, how many combinations are there? Find them all and write them.

Grade 5
Do you remember?

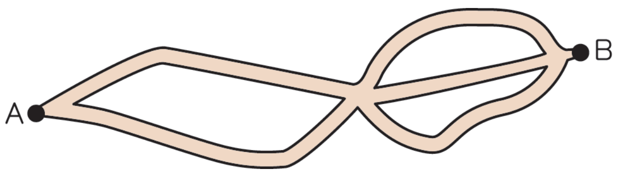
Let's find the area of the shapes below.



PROBLEMS

1 There is a road below. How many ways are there to go from A to B?

● Counting all posssibilities without repetition and ommisions.



2 There are four cards numbered $\boxed{0}$, $\boxed{1}$, $\boxed{2}$ and $\boxed{3}$.
Make a four digit number.

● Considering possibilities with omissions.

① How many numbers can you make? Write down all options.

② How many even numbers can you make?
Write them from the smallest to the largest.

3 Hatana, Tukana, Keara and Josi will sit on a bench.
How many different ways can they sit while Hatana and Josi are next to each other?

● Considering with the special case.

If you think of Hatana and Josi as a pair, then we can think of four objects as three objects.

Ⓗ Ⓙ　　Ⓣ Ⓚ

REVIEW

1 Let's calculate.

① $\frac{2}{7} \times \frac{3}{5}$ ② $\frac{8}{9} \times \frac{15}{16}$ ③ $\frac{5}{21} \times 1\frac{3}{4}$ ④ $2\frac{1}{4} \times 3\frac{5}{9}$

⑤ $\frac{5}{8} \div \frac{2}{3}$ ⑥ $\frac{6}{11} \div \frac{9}{22}$ ⑦ $\frac{5}{6} \div 2\frac{2}{9}$ ⑧ $2\frac{5}{8} \div 2\frac{1}{4}$

⑨ $\frac{1}{4} \div \frac{5}{6} \times \frac{8}{15}$ ⑩ $\frac{1}{6} \div 0.25 \div \frac{2}{3}$ ⑪ $0.75 \div 0.5 \div \frac{5}{6}$

2 The weight of 1 packet of rice was $\frac{5}{6}$ kg.
How much is the weight in kilograms, if there is $\frac{4}{5}$ of the packet of rice?
How much is the weight in kg, if there is $\frac{14}{5}$ of the same packet of rice?

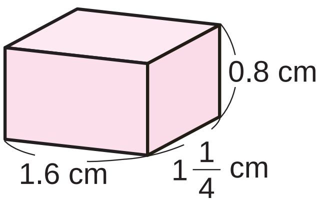
3 There is a 12 cm tape. If you cut it into $\frac{4}{5}$ cm pieces, how many pieces of tape can you make?

4 Ruwe, Peto and Karo did a long jump. Ruwe jumped 320 cm, Peto jumped 240 cm and Karo jumped $\frac{9}{8}$ times of Ruwe's distance.

① How many times more did Ruwe jump compared to Peto?

② How many m did Karo jump?

5 Find the volume of the rectangular prism on the right.



9 Speed

In a Physical Education class, the teacher wants to measure the running speed of individual students.

They got into two groups.

One group timed students that ran certain distances.

Another group measured the distance the students ran within a time period.

Who can run the fastest?

Looking at the same distance, the person that takes the shortest time to travel the distance is the fastest.

Looking at the same time, the person that travels the furthest distance in the given time is the fastest.

If the distance and times that each person ran are different, how can we compare their speed?

Why don't we compare their speed as we compared the population density?

1 Speed

How to Express "Speed"

1 The distance and time of the 3 students are shown in the table.

Distances and Times

Student	Distance (m)	Time (seconds)
Ⓐ	20	5
Ⓑ	15	5
Ⓒ	15	4

1. Which student is the fastest? Compare their speed.

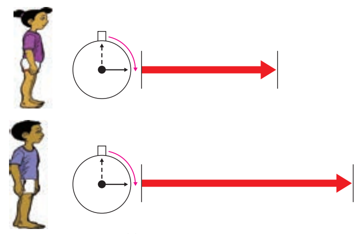
   Comparing Ⓐ and Ⓑ → □ is faster.

   Comparing Ⓑ and Ⓒ → □ is faster.

   Comparing Ⓐ and Ⓒ → □ is faster.

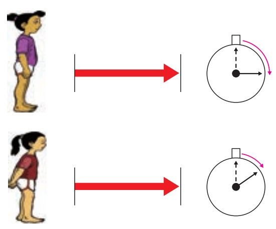
Speed can be compared if the time or the distance is the same.

Same time
The distance that the student covered in 1 minute.



Same time, different distances.

Same distance
The time needed to travel the distance.



Same distance, different times.

2. Let's compare their speed by calculating how many m travelled in one second.
3. Let's compare their speed by calculating how many seconds it took to travel in 1 m.

If you compare the speed by distance, the shorter the time the faster the student. If you compare the speed by time, the longer the distance the faster the student.

Speed is expressed as distance per unit of time.

Speed = distance ÷ time

2 A transport company truck “Horks” travels between Lae and Mt. Hagen.

It travelled a distance of 540 km in six hours.

Another transport company truck “Kasawari” travels a distance of 320 km in four hours.

1. Which company truck is the fastest?
2. What is Kasawari’s speed per hour?

Speed is expressed in various ways depending on the unit of time. Speed is a measurement per unit.

Speed in distance per hour

… Speed expressed by the distance travelled in an hour.

Speed in distance per minute

… Speed expressed by the distance travelled in a minute.

Speed in distance per second

… Speed expressed by the distance travelled in a second.

Exercise

1 Greg ran 50 m in 8 seconds and Aileen ran 60 m in 10 seconds.

Who is the fastest?

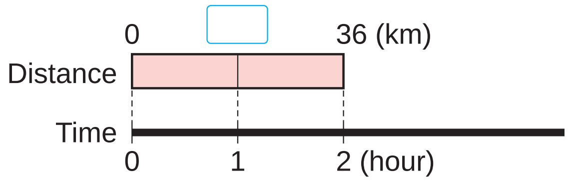
Compare their speed in seconds.

2 Kim walks 432 m in 6 minutes and Viti walks 280 m in 4 minutes.

Who is the fastest ?

Compare their speed in minutes.

3 During a long distance race, a runner ran 36 km in 2 hours.



1. What is his speed in km/hr (kilometre per hour)?
2. What is his speed in m/min (metre per minute)?
3. What is his speed in m/sec (metre per second)?

speed per second	$\xrightarrow{\times 60}$ / $\xleftarrow{\div 60}$	speed per minute	$\xrightarrow{\times 60}$ / $\xleftarrow{\div 60}$	speed per hour
per second	↔	per 60 seconds per minute	↔	per 60 minutes per hour

Exercise

Let's compare Ⓐ ~ Ⓒ in m/min to find which is the fastest?

Ⓐ A car which covers 30 km per hour.

Ⓑ A bike which runs 510 m per minute.

Ⓒ A sprinter who runs 100 m in 10 m per second.

When comparing, it is necessary to use the same unit.

Walking Speed

Measure how long it takes for you to walk 50 m and calculate your walking speed per second, per minute and per hour.

Finding Distance and Time

4 There is a car travelling at 40 km per hour.

① How many km would it travel in two hours?

② How many km would it travel in three hours?

Distance = speed × time

In ① and ②, each car has travelled x km each.

①

Distance (km)	40	x
Time (hour)	1	2

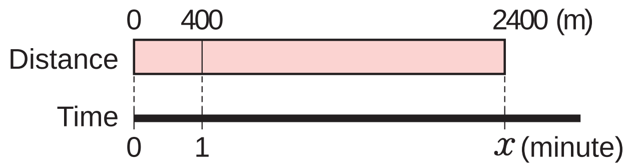
×2

②

Distance (km)	40	x
Time (hour)	1	3

×3

5 A cyclist travels 400 m per minute. How many minutes does he take to travel 2400 m?



If the time he takes is x, let's find the answer!

Distance = speed × time

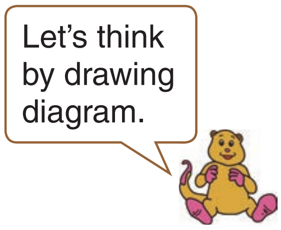
$2400 = 400 \times x$

$x = 2400 \div 400$

Distance (km)	400	2400
Time (hour)	1	x

× x

Time = Distance ÷ speed



Exercise

Priscilla walks at the speed of 80 m per minute.

① How many m will she walk in 5 minutes?

② How many minutes will it take for her to walk 2000 m ?

2 Speed and Graphs

1 Joshua's father is walking from his house to a bus stop at a speed of 100 m per min. 10 minutes after his father had gone, Joshua noticed his father's wallet in the house. He then, started to go after his father by bicycle at a speed of 300 m per minute.
The road distance between his house and the bus stop is 3 km.

1. Let's complete the following table to represent the relationship between the time in minutes and the distance in m for Joshua's father.

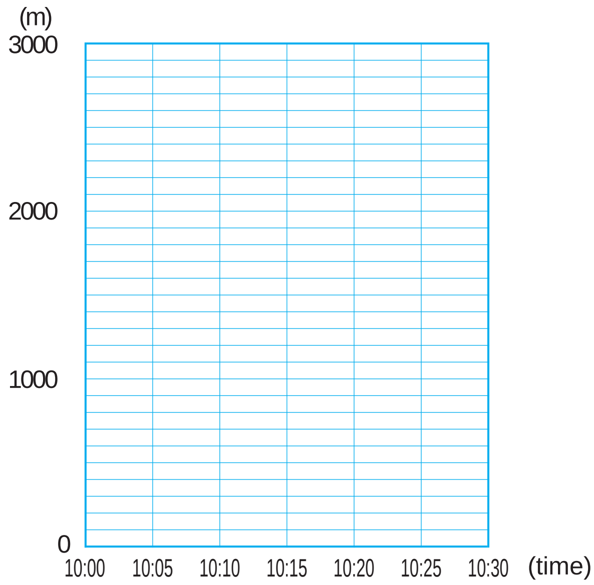
Time (minutes)	0	5	10	15	20	25	30
Distance (m)							

2. Let's draw the line graph below to represent the relationship between time in minutes and distance in m for Joshua's father.

3. Let's complete the table to represent the relationship between the time in minutes and the distance in m for Joshua's ride by bicycle.

Time (minutes)	0	5	10
Distance (m)			

4. Let's add Joshua's line graph below to represent the relationship between the time in minutes and the distance in m for his ride by bicycle.
Actually, Joshua followed his father 10 minutes after his father's departure at 10 o'clock.



5. At what time did Joshua catch up with his father?
Let's read it from the graph.

EXERCISE

1 A blue PMV truck travels the distance of 210 km in 3 hours, and a maroon PMV truck travels the distance of 160 km in 2 hours.

Page 80

① What is the speed of the blue PMV truck in km per hour?

② What is the speed of the maroon PMV truck in km per hour?

2 Let's fill in the blanks in the table below and compare their speed.

Pages 80 and 81

	The speed per hour	The speed per minute	The speed per second
Small airplane	270 km		
Racing car		4 km	
Sound			340 m

3 It takes 4 minutes for a car travelling at a speed of 48 km per hour to pass the Highway.

Page 82

① What is the speed of the car per minute?

② What is the length of the highway in m?

Grade 6

Do you remember?

Let's calculate the area of the circles.

① Radius 3 cm

② Radius 20 cm

③ Diameter 10 cm

④ Diameter 40 cm

PROBLEMS

1 It takes 3 and half hours between Port Moresby and Brisbane airports by flight. The distance between the 2 Airports is 2100 km. How many km per hour does the airplane travel?

● Calculating speed.

2 A train is travelling at 1.8 km per minute and another train travelling at 100 km per hour. Which is faster?

● Changing the denomination of speed.

3 A cyclone is moving at 25 km per hour.

● Knowng distance, speed and time.

① How many km will the cyclone travel in 12 hours?

② If the speed of the cyclone does not change, how many hours will it take to move 400 km away?

4 Kali takes 12 minutes to walk from her house to the school.
Her speed is 70 m per minute.
How far is the distance from her house to the school in km?

● Getting the distance.

5 Salomie's walking speed is 60 m per minute.

● Knowng distance, speed and time.

① How many m can she walk in 15 minutes if she maintains this speed?

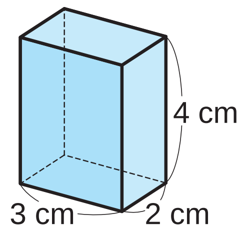
② How many kilometres per hour (km/h) can she walk?

③ The distance between Salomie and her aunty's house is 16.2 km. How many hours and minutes will it take for her to get to her aunty's house?

10 Volume

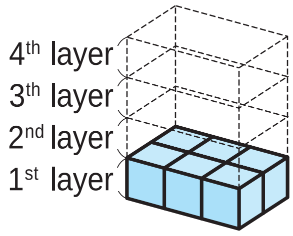
1 Volume of a Prism

1 Let's calculate the volume of the rectangular prism on the right.



This rectangular prism is a kind of quadrangular prism with the bases 3 cm by 2 cm.

Let's consider the volume of this prism.

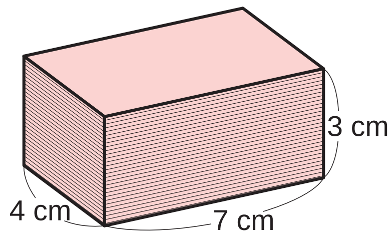


① How many 1 cm^3 cubes are on the base layer ?

② When the height is 4 cm, how many 1 cm^3 cubes are there altogether?

③ Write an expression for the volume of the quadrangular prism and calculate the answer.

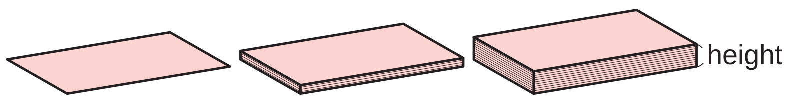
2 A stack of papers has 7 cm length, 4 cm width and 3 cm height.



① What is the volume in cm^3?

② This rectangular prism is a quadrangular prism with a rectangular base of 7 cm by 4 cm.

We think of the height as the total stack of papers and not per sheet of paper.



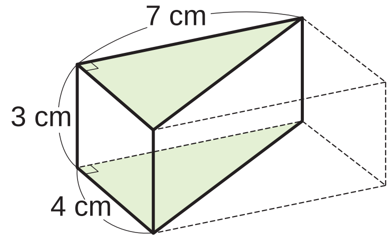
Let's find the formula for the volume of the quadrangular prism.

Volume of a rectangular prism = (length × width) × height

Volume of a quadrangular prism = $\boxed{}$ × height

The area of the base of a prism is also called the base area.

3 The figure on the right is a triangular prism.

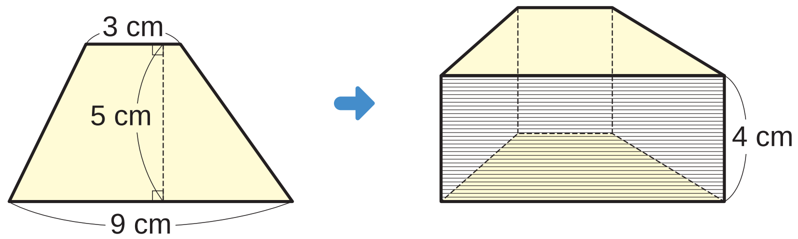


1 What is the base area of the triangular prism in cm²?

2 Let's find the volume of this triangular prism.

Can you find the volume of the prism, by relating to finding the volume of quadrangular prism?

4 We made a quadrangular prism by stacking sheets of trapezoid card as follows. Let's find the volume of the quadrangular prism.

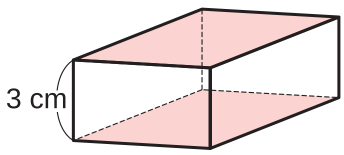


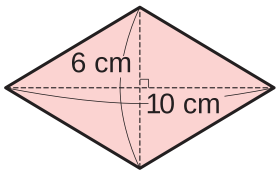
The volume of all prisms can be calculated using the formula:

Volume of prisms = area of the base × height

Exercise

Below is a quadrangular prism with 3 cm height and its base is a rhombus.
Let's find the volume of this quadrangular prism.

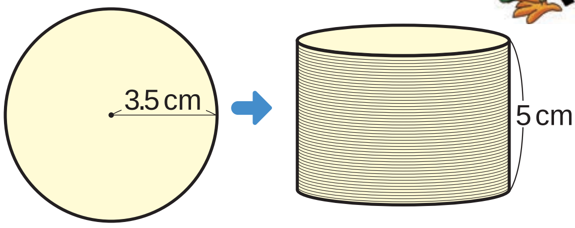




Base

2 Volume of a Cylinder

1 A stack of circular sheets of paper with the radius of 3.5 cm forms a cylinder.



① What is the area of the circular sheet of paper in cm^2?

② Stack of the circular sheets to the height of 1 cm.
The volume and the area of the base are the same.
How about if we stack the sheets to the height of 5 cm, what will be the volume of this cylinder?

③ Let's explain how to calculate the volume of the cylinder.

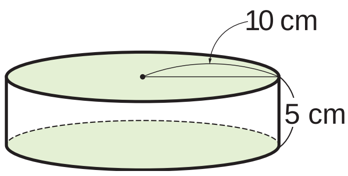
The area of the base of the cylinder is also called the base area.

The volume of cylinders can be calculated using the formula:

Volume of cylinder = area of the base × height

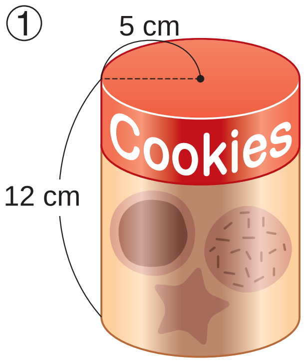
Exercise

1 Let's find the volume of the cylinder on the right.

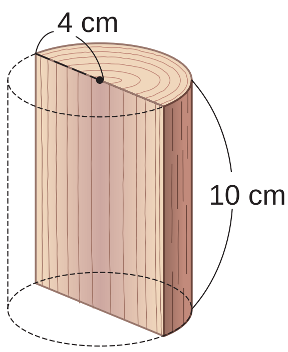


2 Let's find the volume of these solids.

①

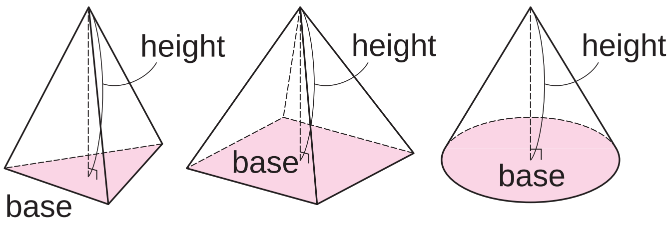


②

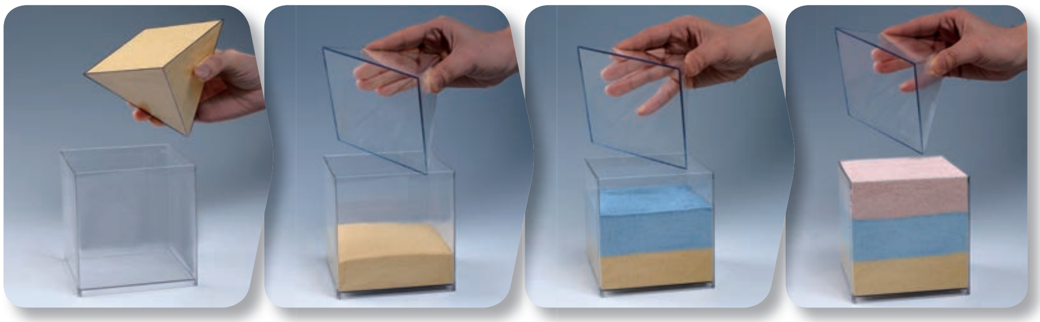


Comparing Volumes of Various Solids

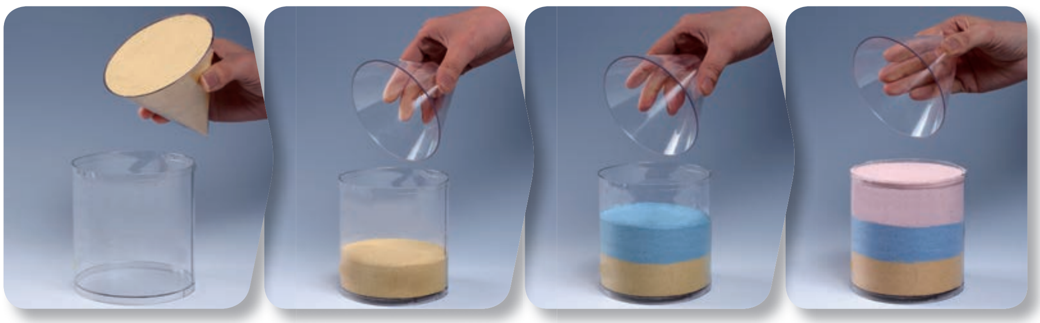
1 The figures below are called pyramids and cones.
The base of pyramids are polygons such as the pentagon.



2 Let's investigate and compare the volume of the pyramid with that of the cube when their bases and heights are the same.



3 Let's investigate and compare the volume of a cone with that of a cylinder when their bases and heights are the same.



4 From the experiment above, what did you discover?
Let's discuss.

5 Nick used the formula to calculate the volumes of pyramids and cones as shown.
Let's fill in the $\square$ with numbers and discuss what he thought.

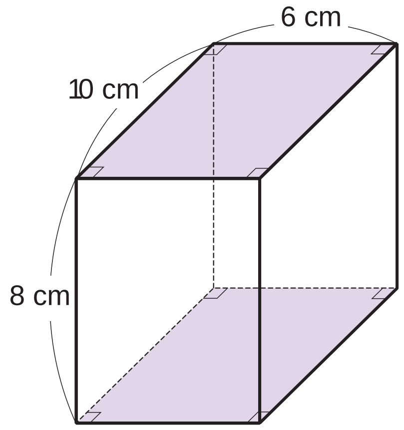
Volume of pyramid or cone $=$ Area of the base $\times$ height $\times \dfrac{1}{\square}$

EXERCISE

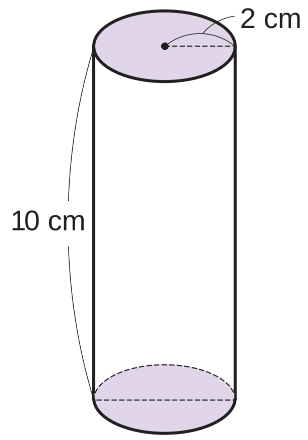
1 Let's find the volumes of the solids below.

Pages 86 to 88

①



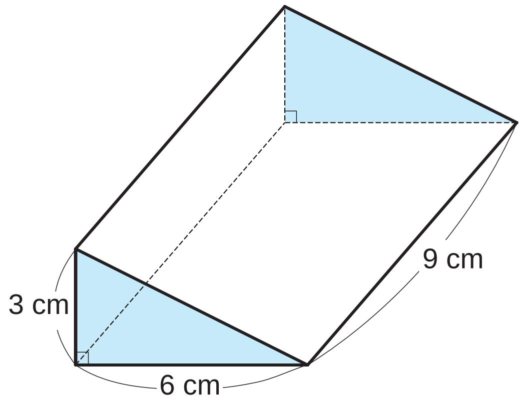
②



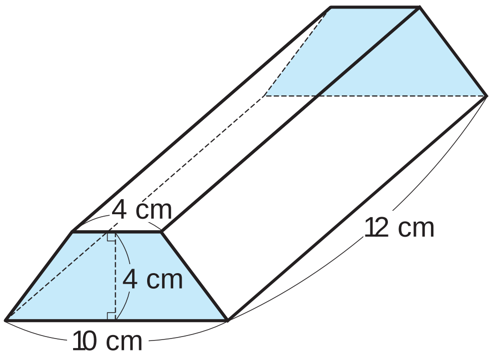
2 Let's find the volumes of the following solids.

Pages 87 to 89

①



②



Grade 5

Do you remember?

Let's calculate.

① 1.2×3 ② 3.7×3 ③ 2.5×4

④ 5.1×1.2 ⑤ 4.8×3.3 ⑥ 6.2×5.1

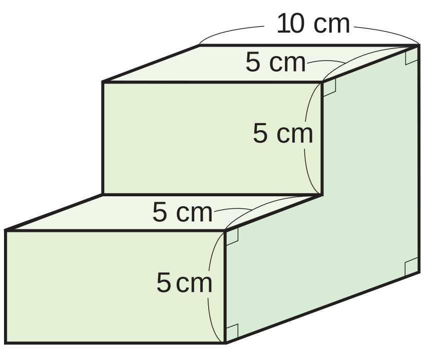
⑦ 1.87×7 ⑧ 2.46×1.8 ⑨ 9.72×7.3

PROBLEMS

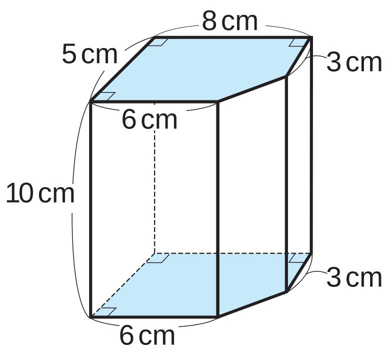
1 Let's find the volume of the solids below.

● Understanding how to find the volume of prism.

①

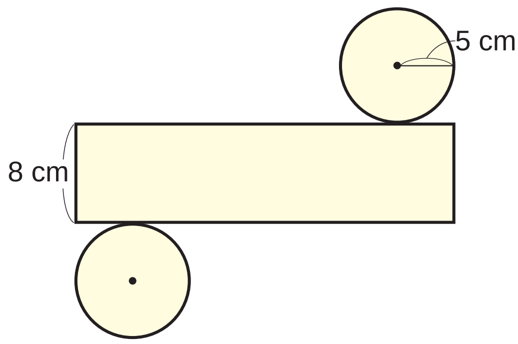


②



2 Let's find the volume of the solid figure constructed from the net shown.

● Understanding the volume of solid from the net.



2 Let's find the volume of a 20 t coin.