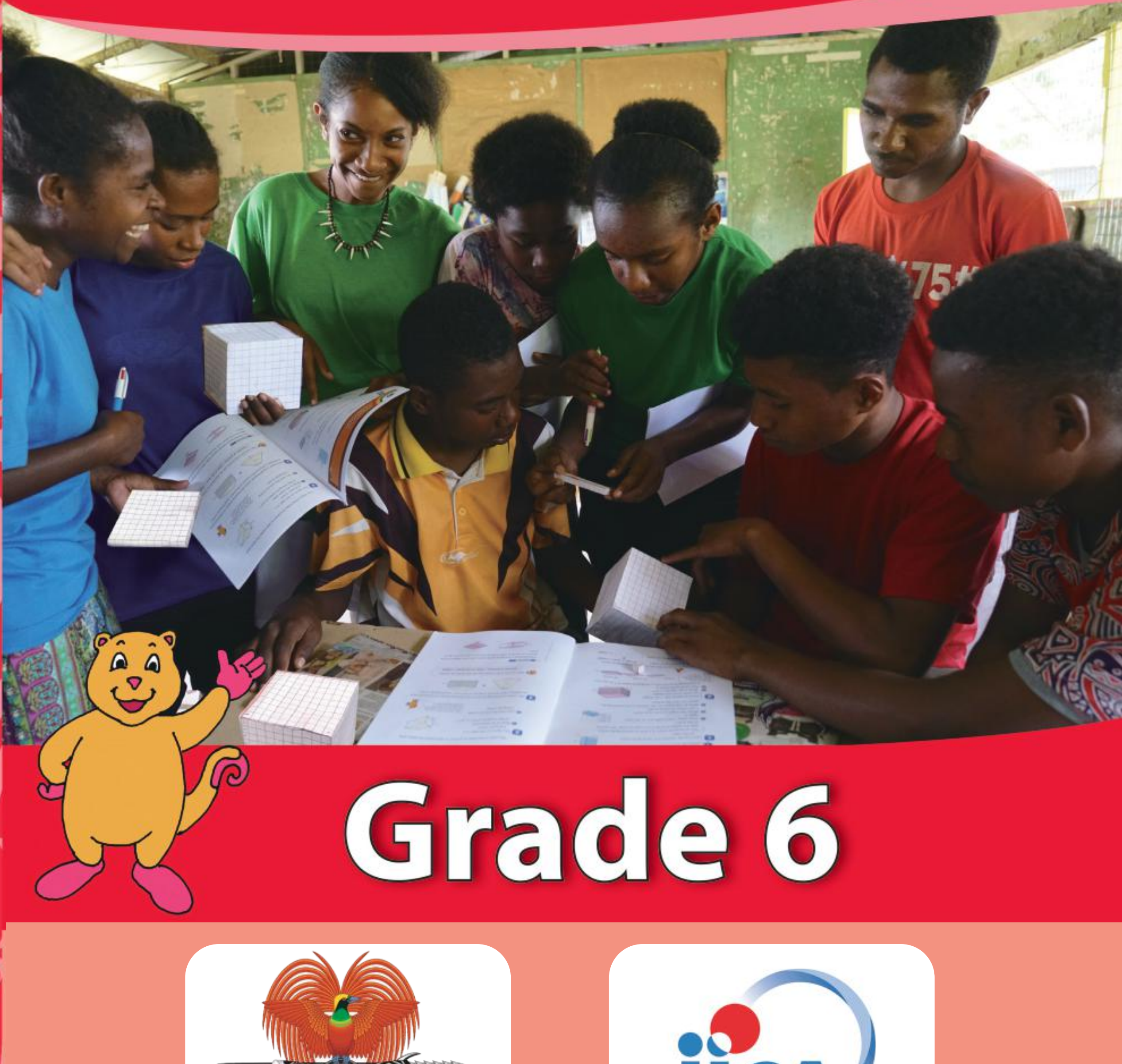
National MATHEMATICS Textbook



Grade 6

Papua New Guinea
Department of Education

JICA

Issued free to schools by the Department of Education

First Edition

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Acknowledgements

The Grade 6 National Mathematics Textbook was developed by the Curriculum Development Division in partnership with the Mathematics specialists from Japan through the **Project for Improving the Quality of Mathematics and Science Education** known as **QUIS-ME Project**.

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.

The Curriculum Panel (CP) members, members of the Subject Advisory Committee (SAC) and the Basic Education Board of Studies (BEBoS) are also acknowledged for their advice, recommendation and endorsement of this Textbook.

A special acknowledgement is given to the People and the Government of Japan for the partnership and support in funding and expertise through Japan International Cooperation Agency (JICA) - QUIS-ME Project with Curriculum Development Division (CDD).

National
Mathematics Textbook

Grade 6

Papua New Guinea
Department of Education

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


Mero


Naiko


Sare


Gawi


Kapi
(Kapul)


Kekeni


Ambai


Vavi


Yamo


Koko
(Kokomo)

Symbols in this textbook

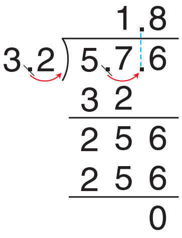
▶▶	• Ice breaking activity as the lead up activity for chapter.
	• Discovered important ideas.
	• Important definitions or terms.
	• What we will do in the next activity?
	• When you lose your way, refer to the page number given.
	• You can use your calculator here.
	• Practice by yourself. Fill in your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

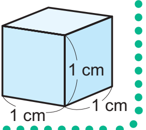
How to Divide Decimal Numbers in Vertical Form

(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.



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.



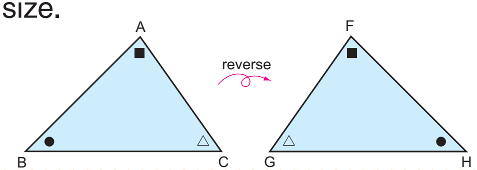
The volume of a rectangular prism is expressed in the following formula,using length, width and height.

Volume of rectangular prism = length × width × height

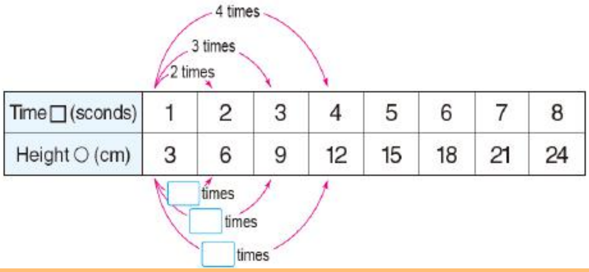
Congruent Figures

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.



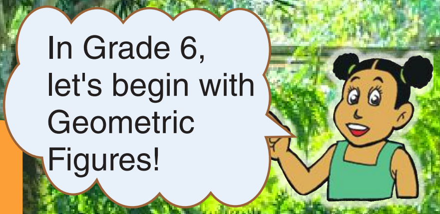
Proportions

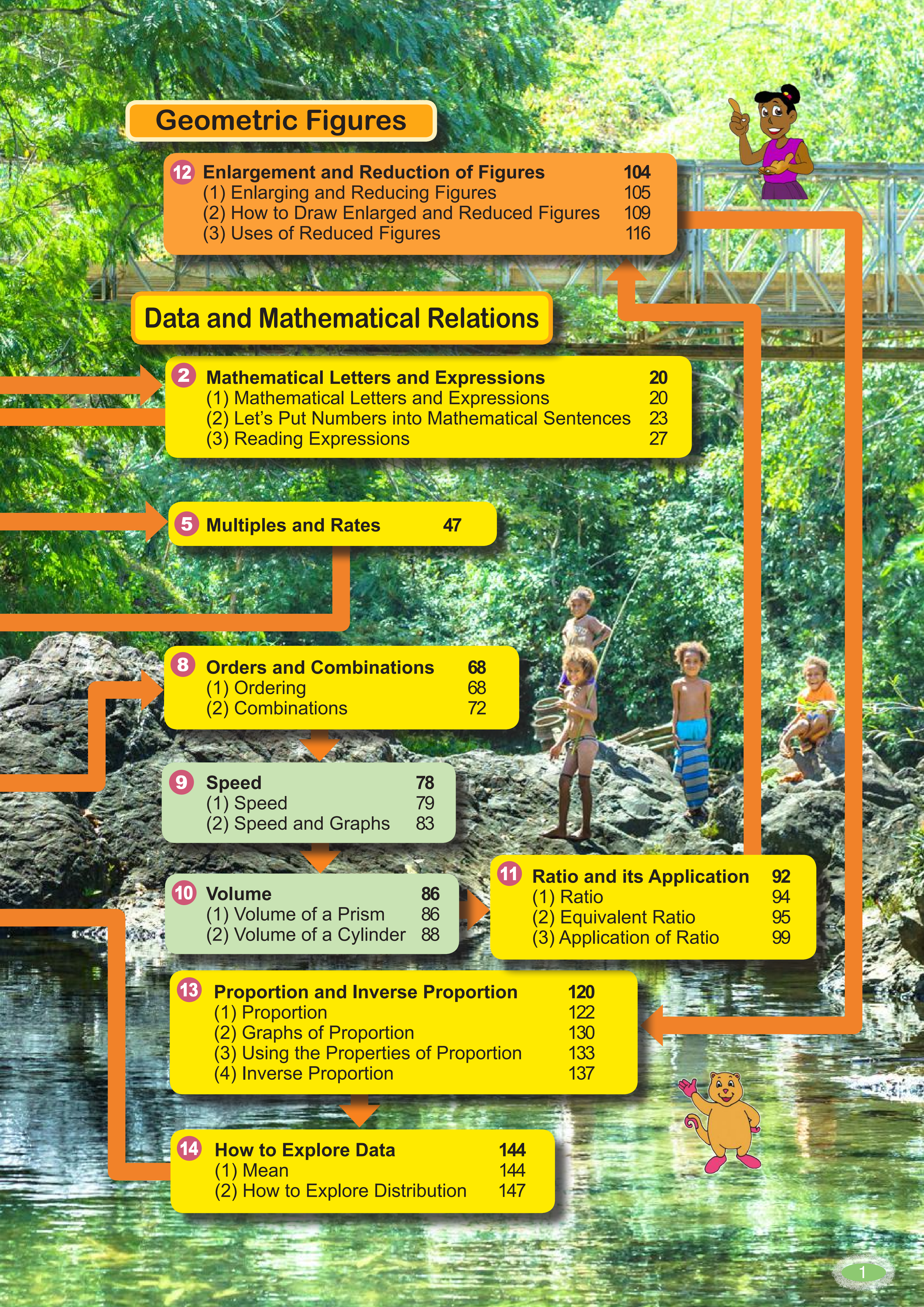


Time ☐ (sconds)	1	2	3	4	5	6	7	8
Height ○ (cm)	3	6	9	12	15	18	21	24

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

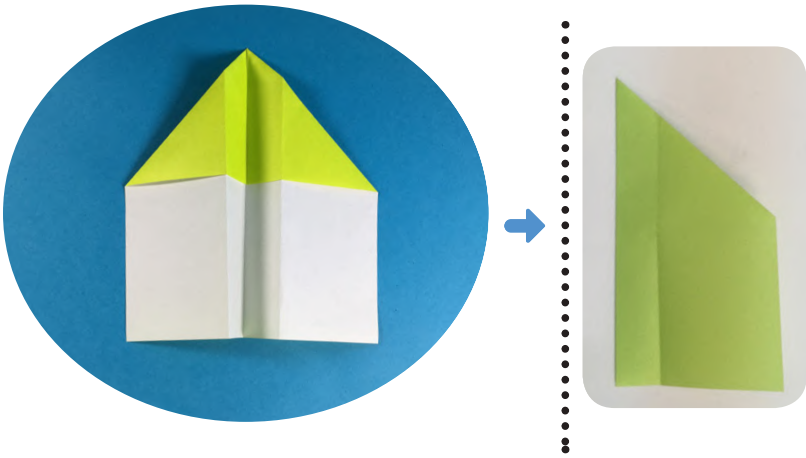




1

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.

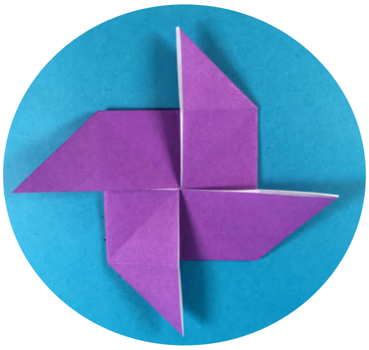


We can fold the paper and make a paper plane, by making one side of the shape fit exactly on top of the other, so it will belong to one of the groups on page 3.

Mero

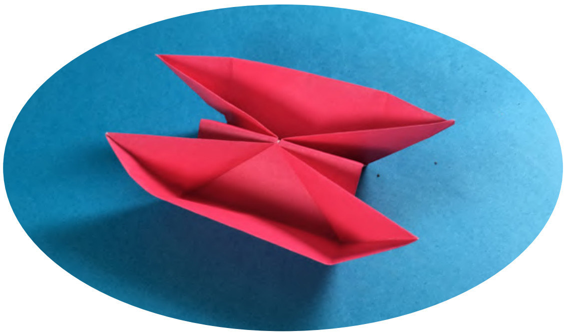
Let's explore the shapes that are balanced and beautiful.

ⓐ Paper craft windmill (Origami)



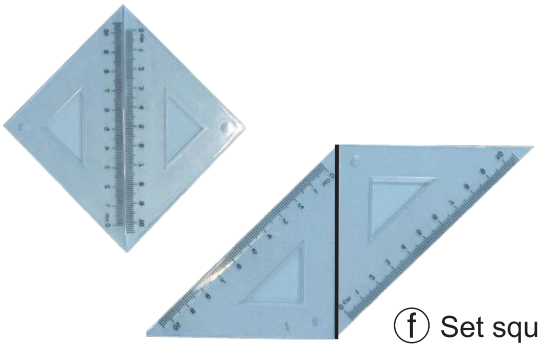
ⓑ Paper star

ⓒ 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.

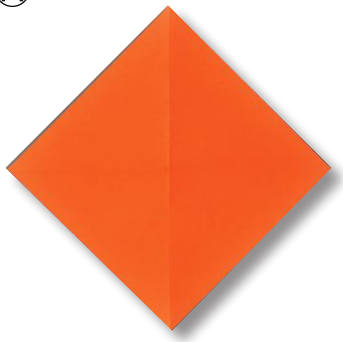
Ⓑ The shape looks exactly like the original shape when it is rotated.

Ⓒ 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.

Ⓐ



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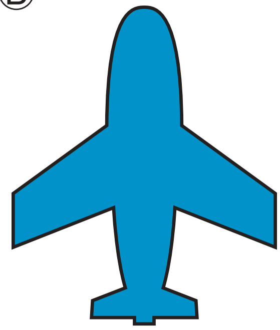
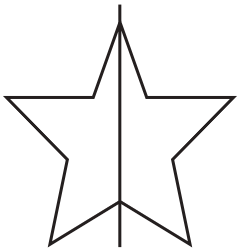


Ⓒ

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**.



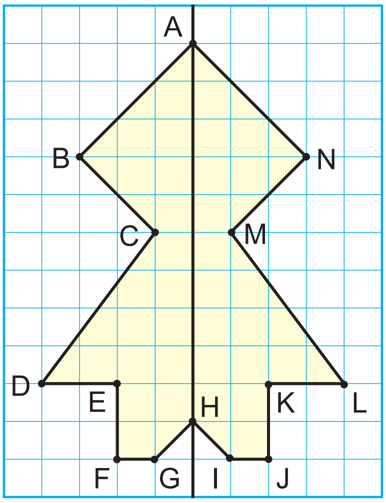
Properties of Figures with Line Symmetry

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.

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?



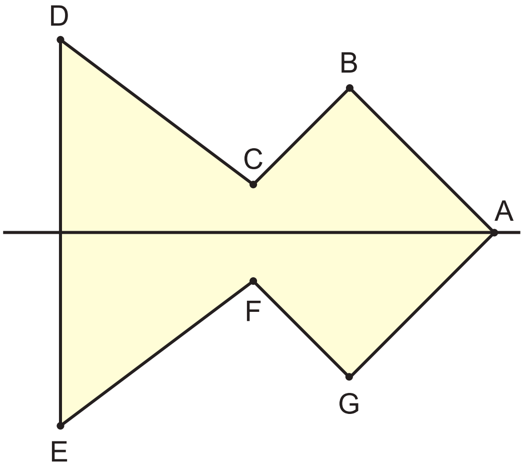
When the figure with line symmetry is folded along its axis of symmetry, the matching points are called **corresponding points** and the matching sides are called **corresponding sides** and the matching angles are called **corresponding angles**.

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.

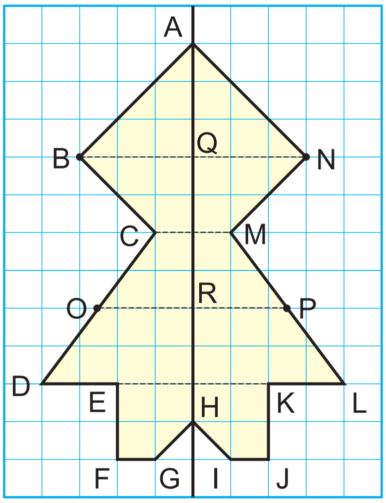


3 Let's explore the figure with line symmetry on the right.

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.



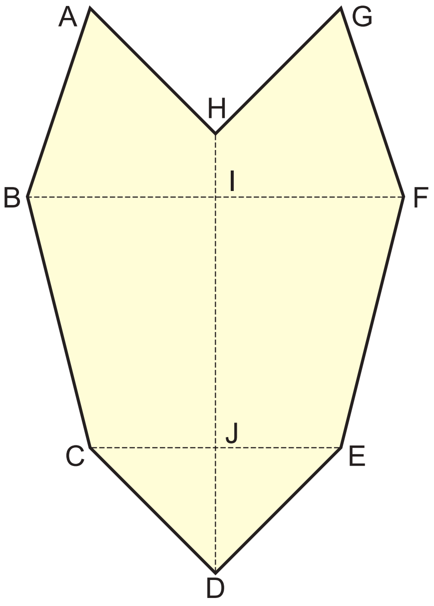
For figures with line symmetry, a line that connects two corresponding points always intersects in perpendicular with the line of symmetry.
The length from the line of symmetry to the corresponding points are equal.

Exercise

The figure on the right has a line symmetry.

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

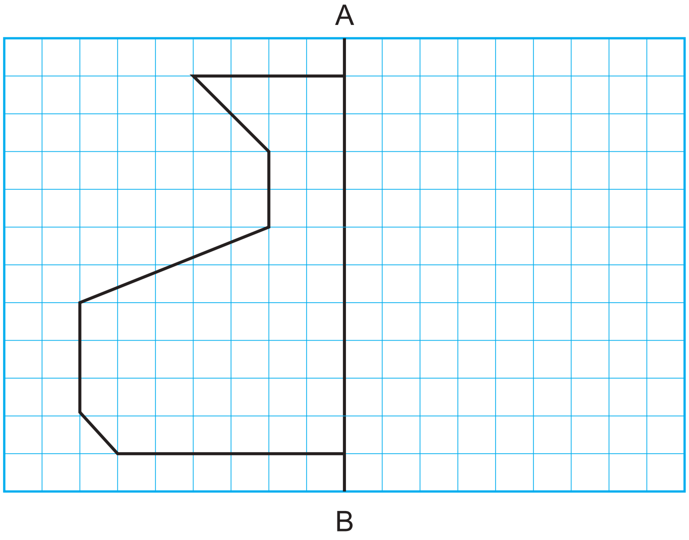
② If the length of the line BI is 25 mm, what is the length of line IF?



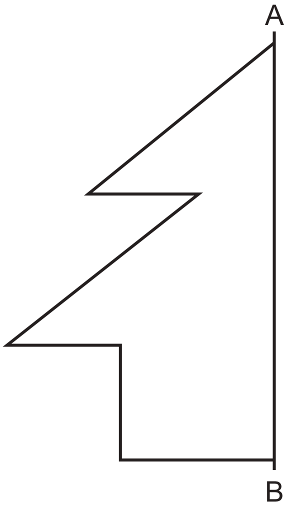
How to Draw Figures with Line Symmetry

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.

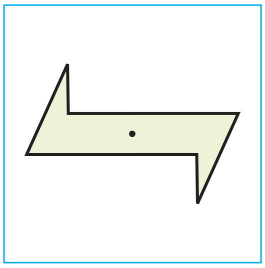


③ Let’s explain the properties of line symmetry that you used to draw the complete figure.

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 ‘ • ’?

Ⓐ



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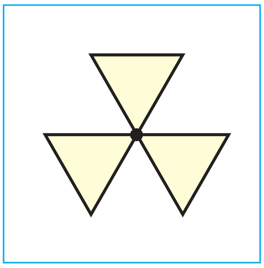

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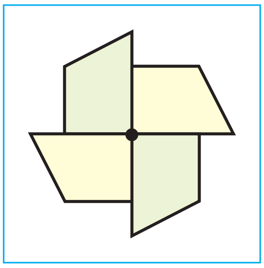
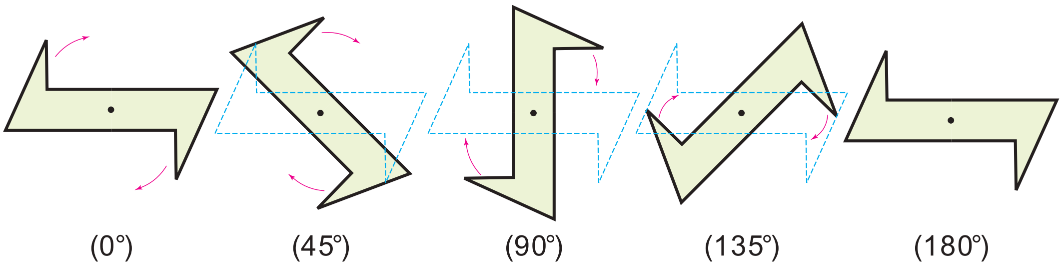
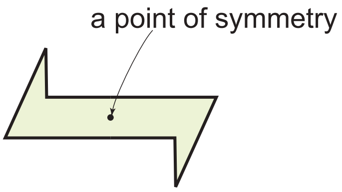
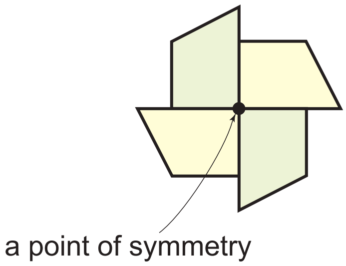


Trace each figure above and rotate it 180° at a fixed point. Confirm if the figure matches the original figure or not.



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

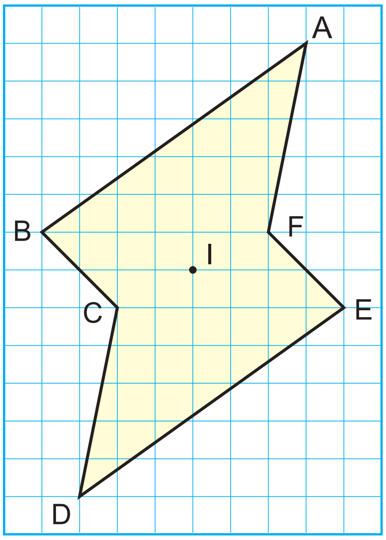
2 The figure below has a point of symmetry. Trace the figure and rotate it for 180° with respect to its point of symmetry.

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?

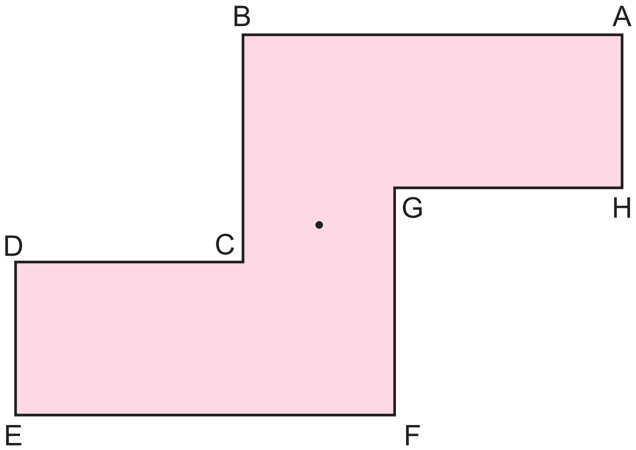
③ Which angles lie on top of angle B and D respectively after rotation?



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.

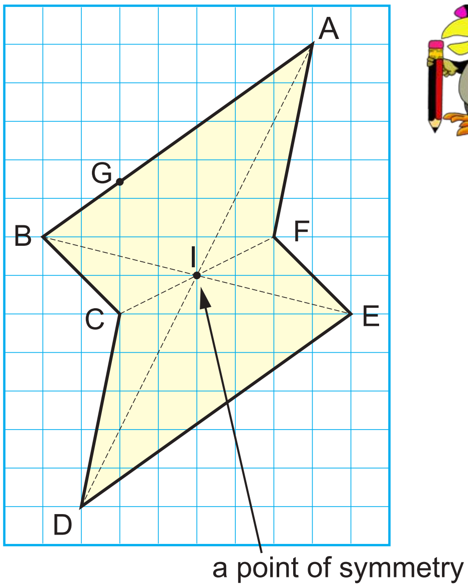


3 Let’s explore the figure with point symmetry below.

① Where do these lines intersect?
AD, BE and CF.

② Draw point H corresponding to point G on side AB.

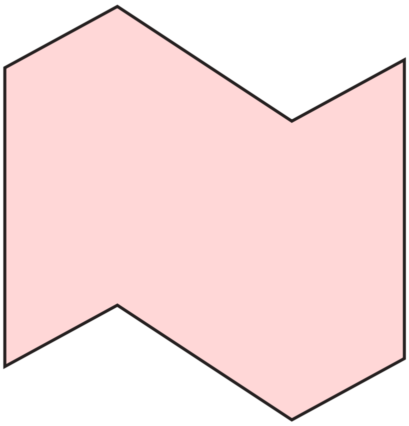
③ Compare the lengths of lines IG and IH.



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

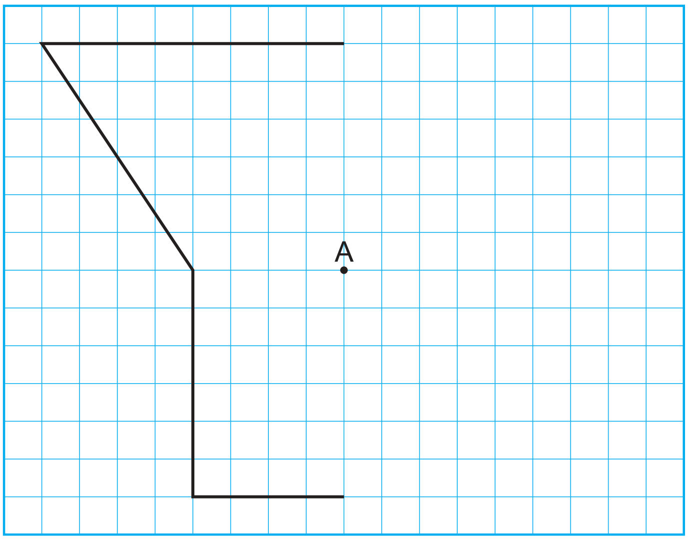
The figure on the right has point symmetry.
Let’s locate the point of symmetry.
Then, explain how you locate it.



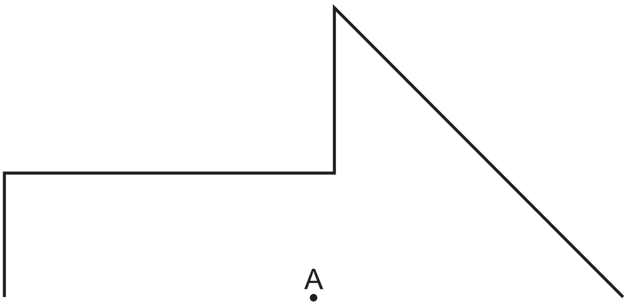
How to Draw Figures with Point Symmetry

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.



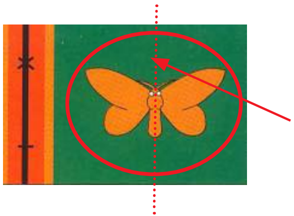
③ Let's explain the properties of point symmetry that you used to complete the figure above in your exercise book.

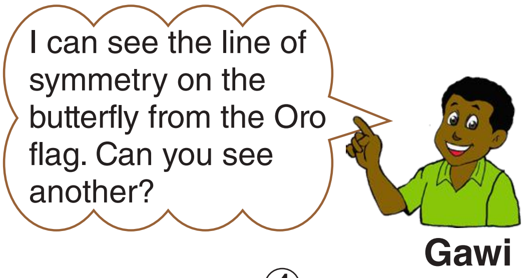
Let's Find Symmetric Figures Around Us

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.





①

②

③

④

⑤

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⑦

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⑩

⑪

⑫


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

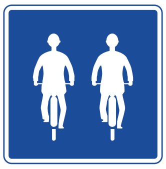















6 There are institutions and company logos and emblems (figures) around us as shown below.

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

ⓐ PAPUA NEW GUINEA EDUCATION INSTITUTE

ⓑ TISA TEACHERS SAVINGS AND LOAN SOCIETY LIMITED

ⓒ

ⓓ

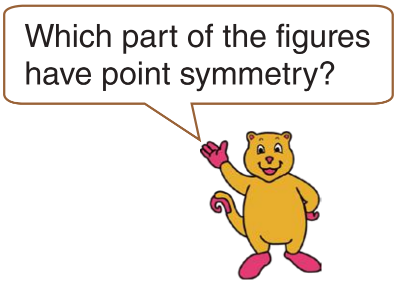
ⓔ TOYOTA

ⓕ mazda

ⓖ MITSUBISHI MOTORS

ⓗ HONDA

Ambai



ⓘ PAPUA NEW GUINEA ORCHIDS

ⓙ PAPUA NEW GUINEA PNG RFL

ⓚ CRICKET PNG

ⓛ PAPUA NEW GUINEA SPORTS FOUNDATION

ⓜ COWBOYS

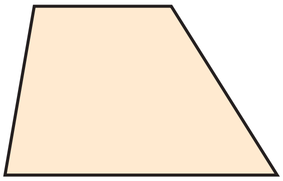
ⓝ WARRIORS

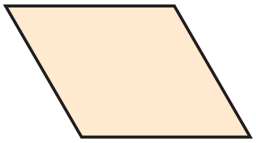
ⓞ WESTS TIGERS

ⓟ GOLD COAST TITANS

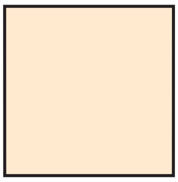
3 Polygons and Symmetry

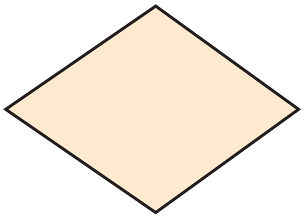
1 Let's explore the following quadrilaterals.

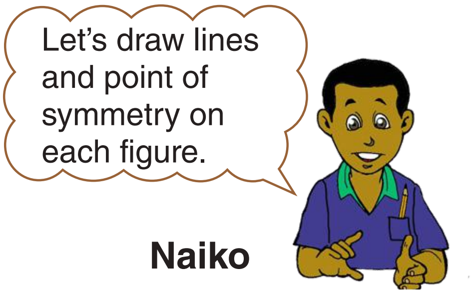

trapezoid


parallelogram


rectangle


square


rhombus



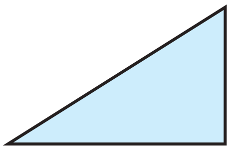
① Which quadrilaterals have line symmetry and how many lines of symmetry does each have?

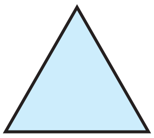
② Which quadrilaterals have point symmetry?
Indicate the point of symmetry in each figure.

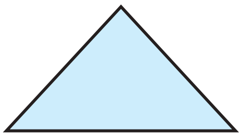
③ Which quadrilaterals have line symmetry and point symmetry, respectively?

④ Which quadrilaterals have two diagonals that are also lines of symmetry?

2 Let's explore the following triangles.


right triangle


equilateral triangle

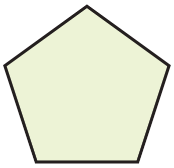

isosceles triangle

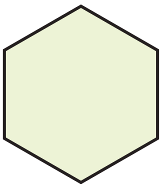
① Which triangles have line symmetry and how many lines of symmetry can you draw in each figure?

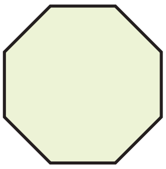
② Which triangles have point symmetry?

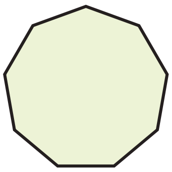
Regular Polygons and Symmetry

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.

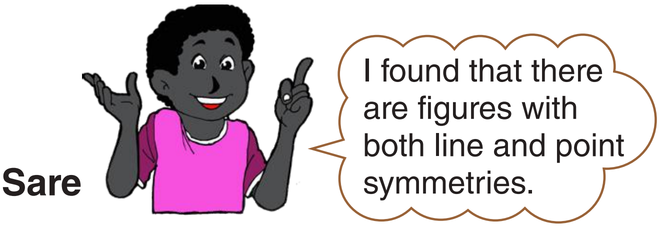
Line symmetry	
Point symmetry	

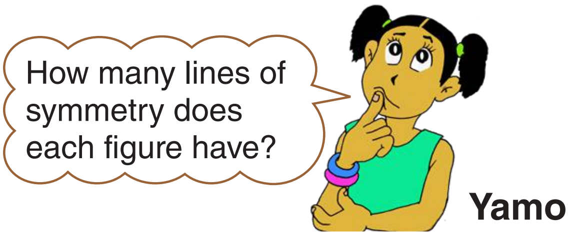
② How many lines of symmetry does each figure have?
Let’s fill in the table below.

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.



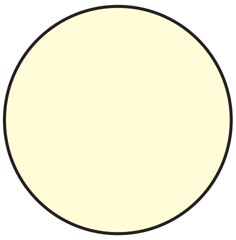


Exercise

Let’s explore a circle.

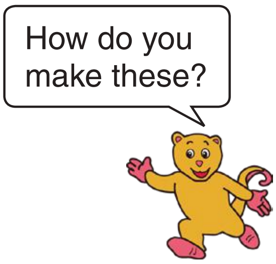
① Does a circle have line symmetry?
How many lines of symmetry can you find?

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.



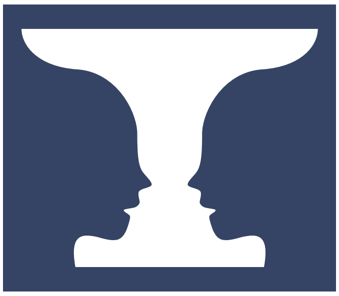
floral decoration

toothpick

nameplate

Rubin's Vase

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



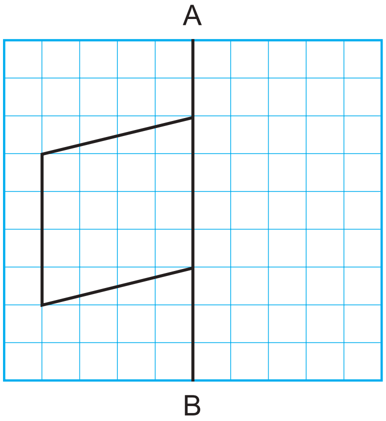
EXERCISE

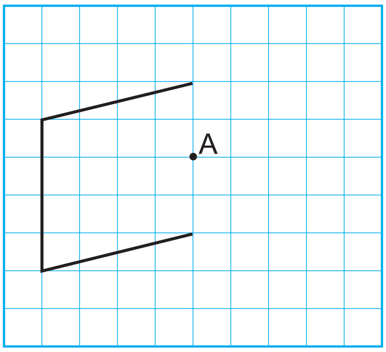
1 Draw the other half to complete the symmetrical figure.

Pages 4 to 9

① Line AB is the line of symmetry.

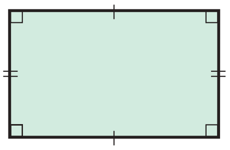
② Point A is the point of symmetry.

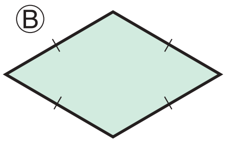


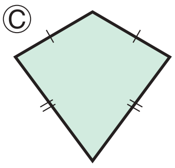


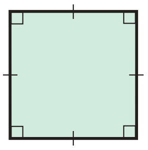
2 Fill in the table below using the properties of the following quadrilaterals.

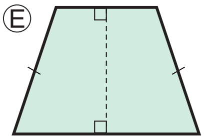
Pages 14 and 15

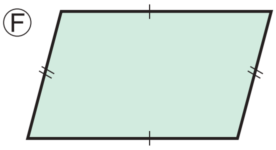
Ⓐ


Ⓑ


Ⓒ


Ⓓ


Ⓔ


Ⓕ


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

Grade 4 and 5
Do you remember?

Let’s calculate.

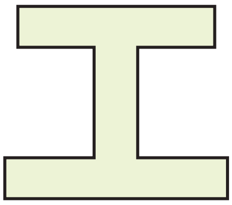
① 1.2×43 ② 3.6×35 ③ 7.2×4.9 ④ 8.6×7.5
⑤ 448÷8 ⑥ 379÷4 ⑦ 60÷25 ⑧ 9.1÷0.7

PROBLEMS 1

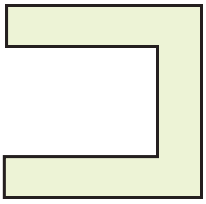
1 Which figures have line symmetry, point symmetry or both?

● Distinguishing symmetric figers.

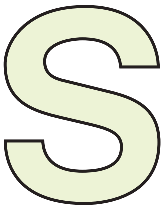
①



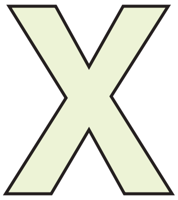
②



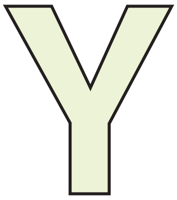
③



④



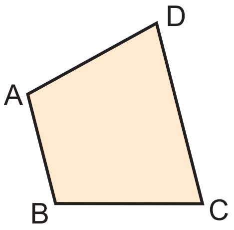
⑤



2 The figure on the right has line symmetry.

Draw the line of symmetry.

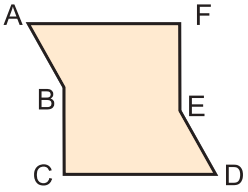
● Finding the axis of symmetry.



3 The figure on the right has point symmetry.

Draw the point of symmetry.

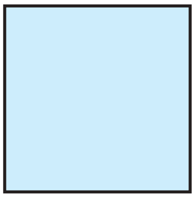
● Finding a point of symmetry.



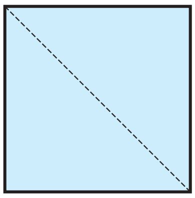
4 A square has both line and point symmetry.

● Dividing a square into two congruent shapes.

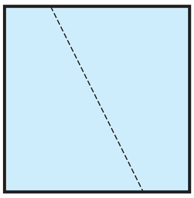
① Divide a square into two congruent shapes by a line.



(example)



(example)



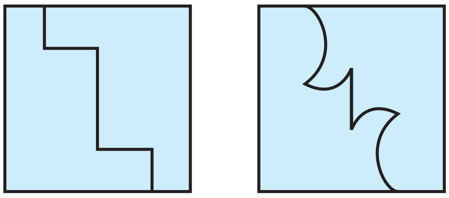
② You will find that any line drawn in ① passes the same point.

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.

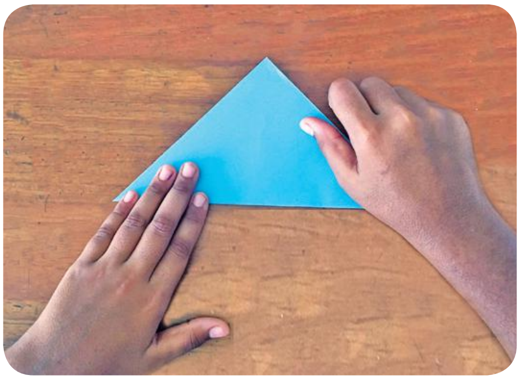


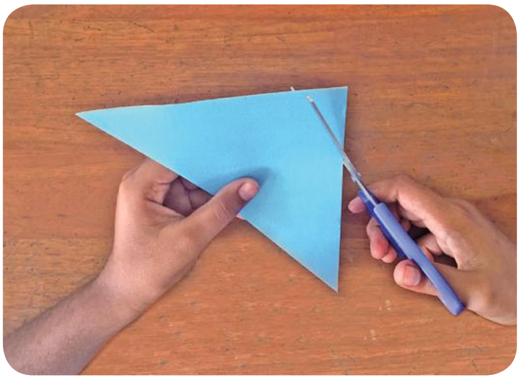
PROBLEMS 2

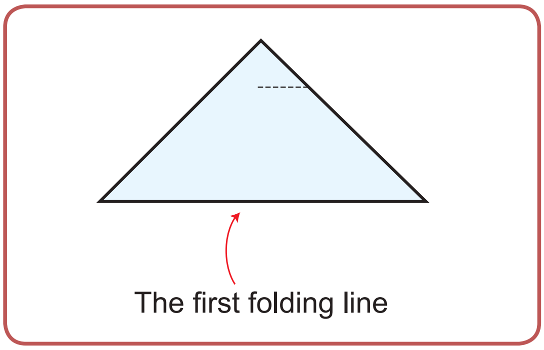
1 We are going to make symmetrical shapes with coloured papers.

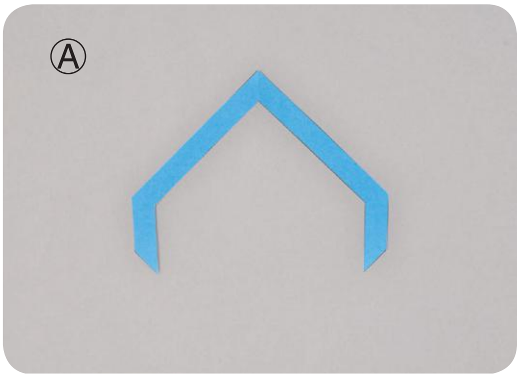
● Imagining the figure after folding by using the axis of symmetry.

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

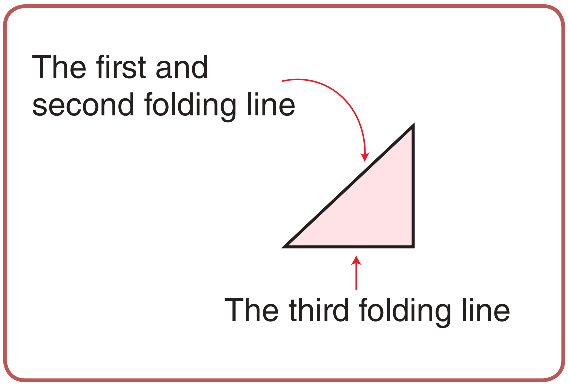


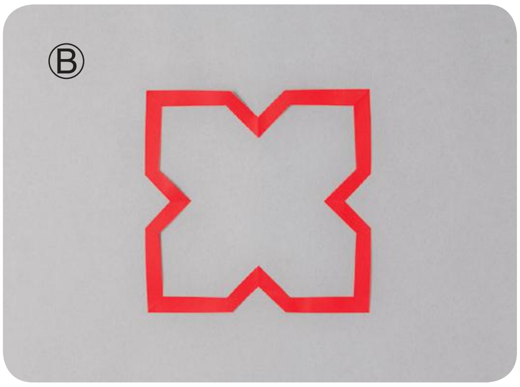






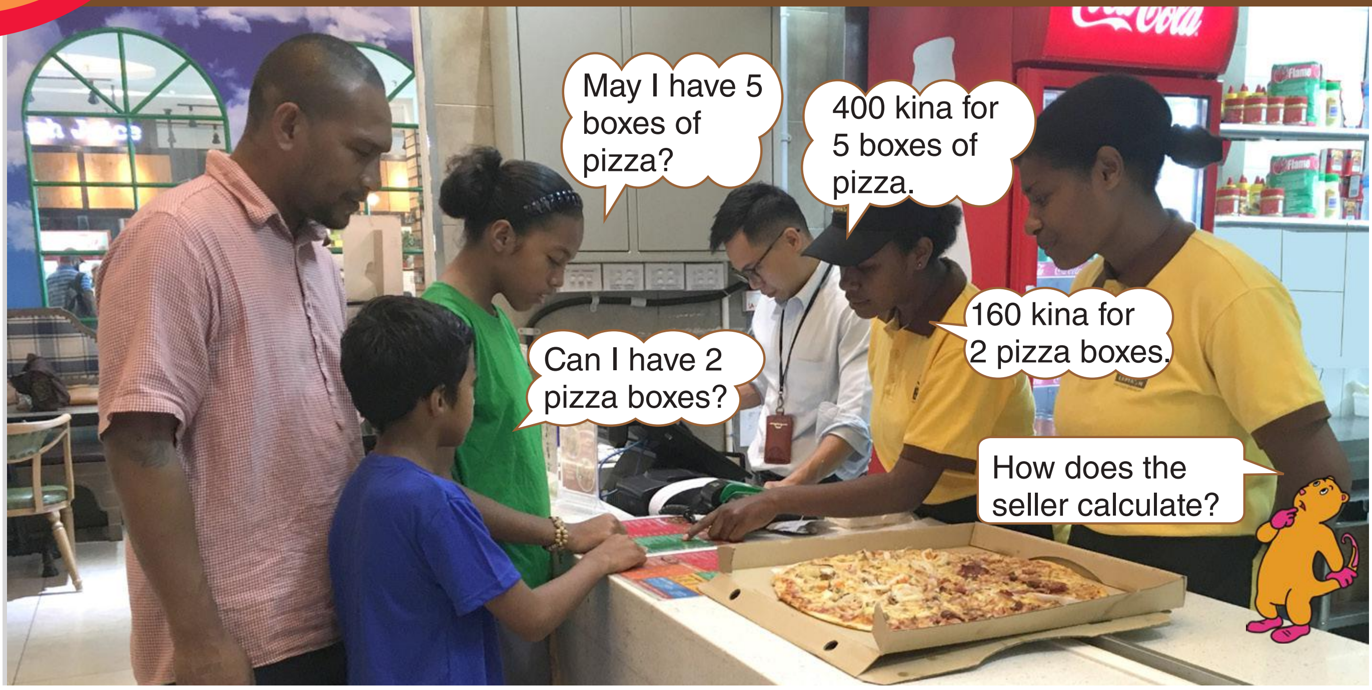
② Fold the coloured paper three times. How can you cut to make shape Ⓑ? Draw cutting lines in the diagram.





Let’s make these by exploring.

2 Mathematical Letters and Expressions



1 Mathematical Letters and Expressions

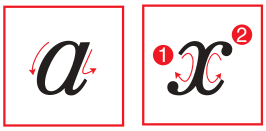
1 Rupa's family are buying pizzas which costs 80 kina each for a birthday party.

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 ○.

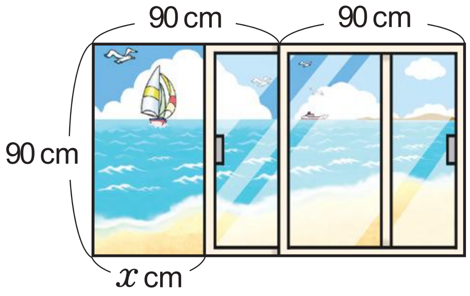
In mathematics, numbers and quantities can be represented using letters such as a or x other than □ and ○.



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	×	□	=	□
Opened 12.5 cm……	90	×	□	=	□
Opened 90 cm………	90	×	□	=	□

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 × □ = □
- Regular pentagon …… 6 × □ = □
- Regular octagon……… 6 × □ = □
- Regular dodecagon … □ × □ = □

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

- Regular polygon with a sides…… □ × □

Exercise

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

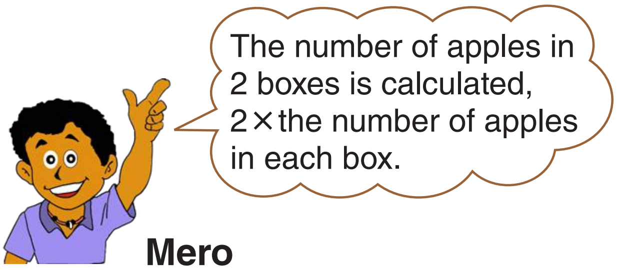
Write an expression to represent the perimeter of a circle with a cm radius.

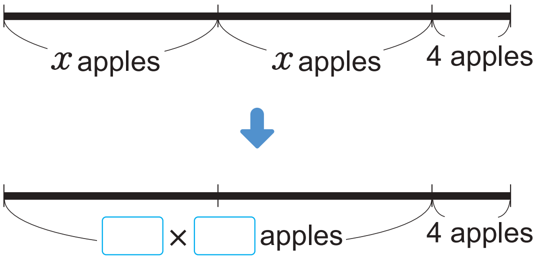
Let's Calculate Total

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?

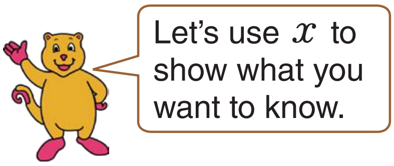
Exercise

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.

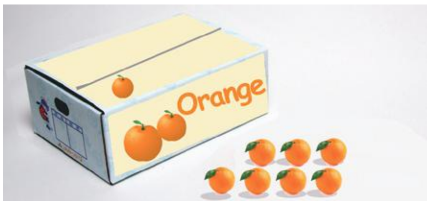
There are 3 bottles and 2 decilitre (dL) of juice.

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?

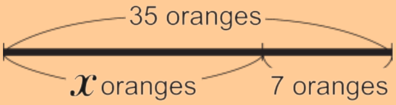
Mero's Idea

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.

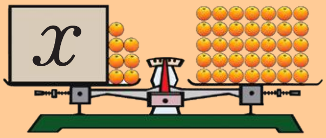


Therefore, $x=35-7=28$

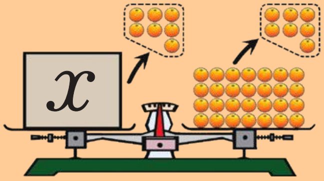
2 Yamo's idea for solving **1** is shown below. Explain her idea.

Yamo's Idea

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



If you take $\boxed{}$ away from both sides, they are still balanced.

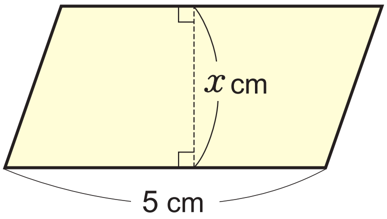


Therefore $x=28$

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

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

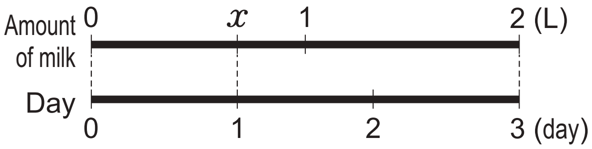
3 There is a parallelogram like the figure on the right.



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

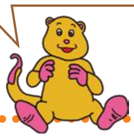
× 3

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.

$$\begin{aligned} 5\times x &= 18 \\ 5\times x\div 5 &= 18\div 5 \\ x &= 3.6 \end{aligned}$$

$$\begin{aligned} x\times 3 &= 2 \\ x\times 3\div 3 &= 2\div 3 \\ x &= \frac{2}{3} \end{aligned}$$

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.

Exercise

Find the number for x.

① $x+4=22$ ② $38+x=54$ ③ $x-6=15$

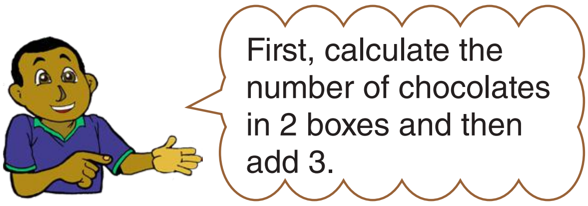
④ $x-27=18$ ⑤ $7\times x=5$ ⑥ $x\times 4=14$

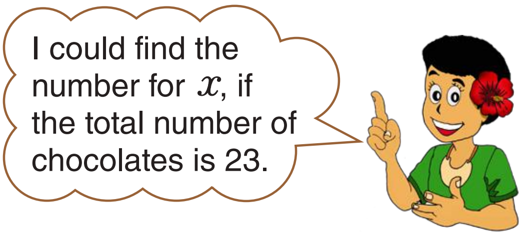
6 There are 2 boxes of chocolates which contain the same amount and 3 more pieces of chocolates. When you count the total, it is 23 chocolates. How many chocolates does each box have?

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				
$x\times 2$	14						
$x\times 2+3$	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

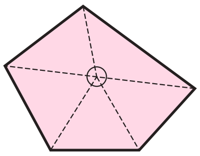
Find the number that applies for x by replacing it with 8, 9, 10, ... and so on.

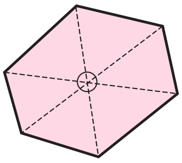
① $x\times 3+4=37$ ② $x\times 8+5=77$

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 .... ☐





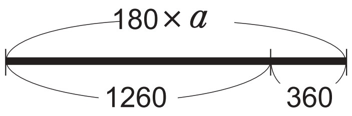
① Based on the figures above, Phillip thought of an expression for calculating the sum of the angles of regular polygons.
Fill in the ☐ below and explain his thinking.

$$\square \times a - \square$$

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?

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

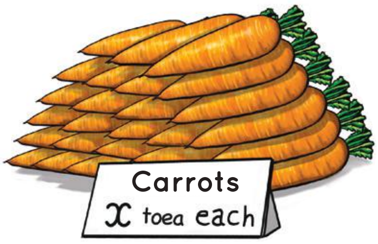


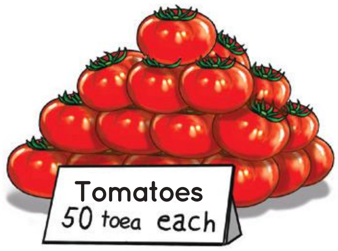
$$\begin{aligned} 180 \times a - 360 + 360 &= 1260 + \square \\ 180 \times a &= \square \\ 180 \times a \div 180 &= \square \div 180 \\ a &= \square \end{aligned}$$

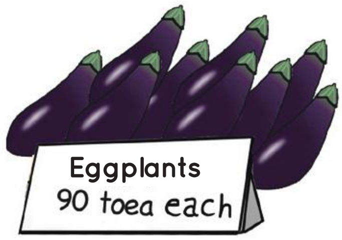
It is easy to calculate if we divide both dividend and divisor by 10 for calculating 1620 ÷ 180.

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





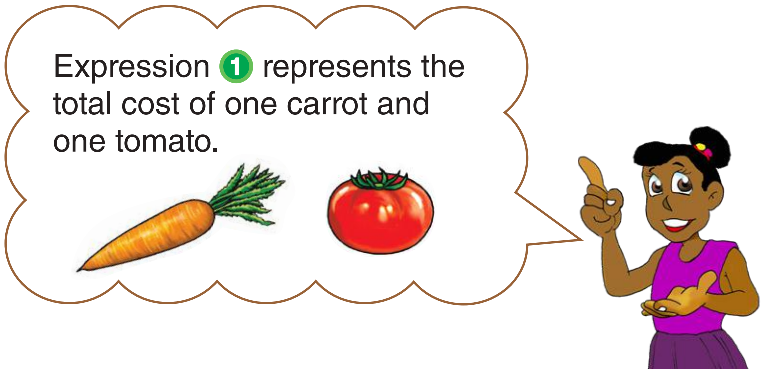


1 David went to a local market.

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?

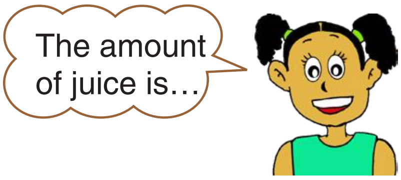
① $x+50$
② $x\times 7$
③ $x\times 5+90$
④ $x\times 4+50\times 4$



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

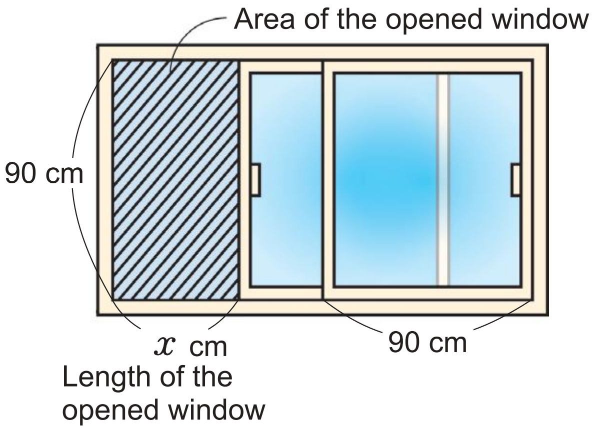
1 There is a window with the height of 90 cm.
Think about the area of the opened window.

● 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 □ with numbers.

① 8.27 = □ × 8 + □ × 2 + □ × 7

② 0.206 = 0.1 × □ + □ × 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 (m²)	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

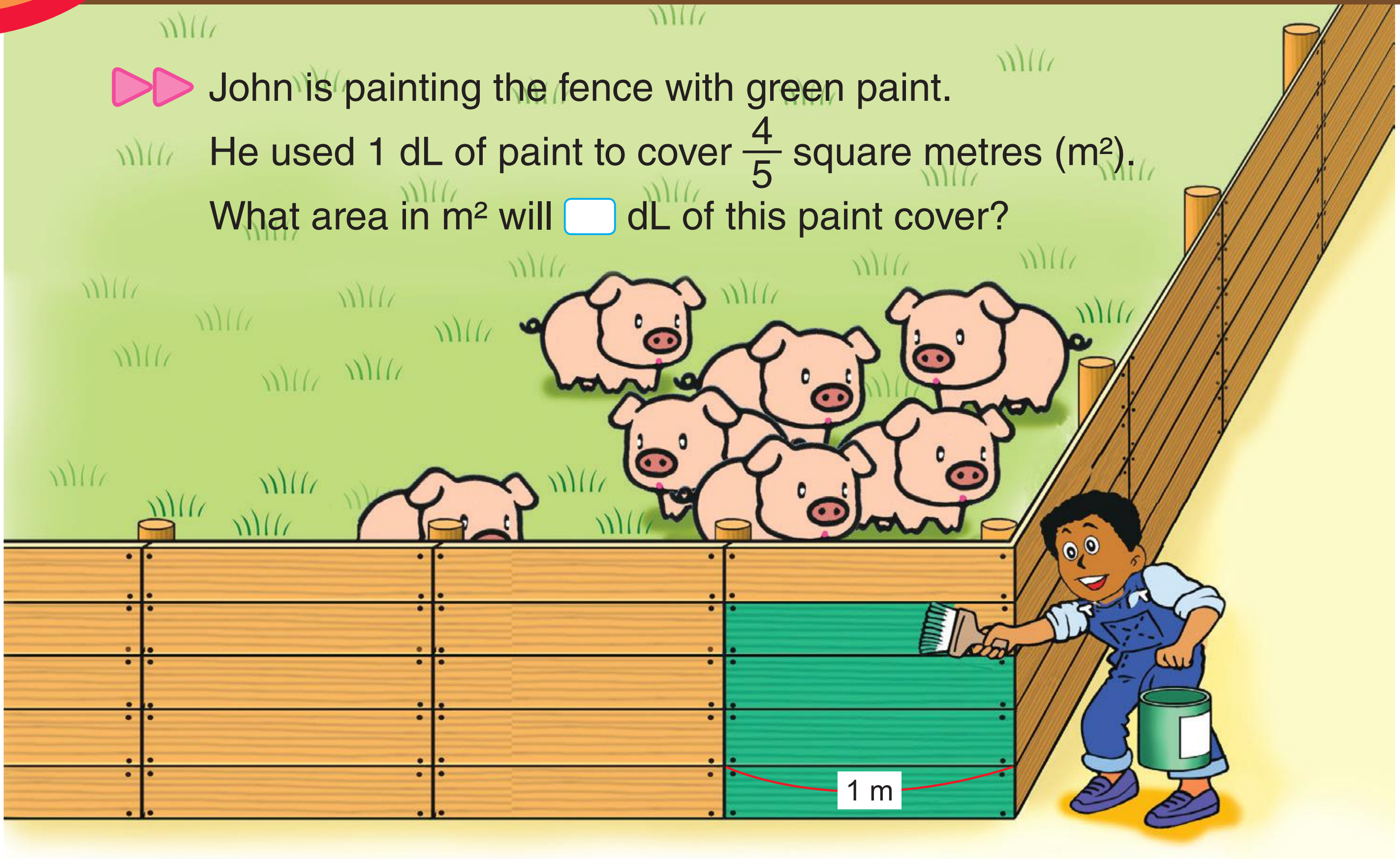
⑦ 0.5 × 0.6 ⑧ 2.5 × 0.8 ⑨ 3.4 × 1.8

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 (m²).
What area in m² will □ dL of this paint cover?



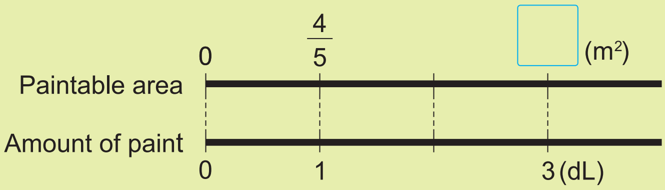
If John uses 3 dL of green paint, what area in m² will the paint cover?

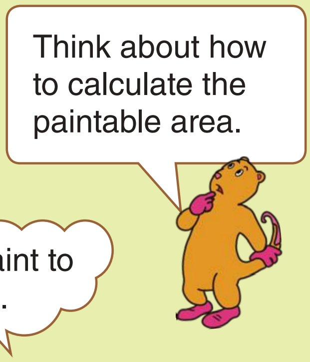
$$\underset{\text{Paintable area using 1 dL}}{\boxed{}} \times \underset{\text{Amount of paint}}{\boxed{}} = \underset{\text{Paintable area}}{\boxed{}}$$

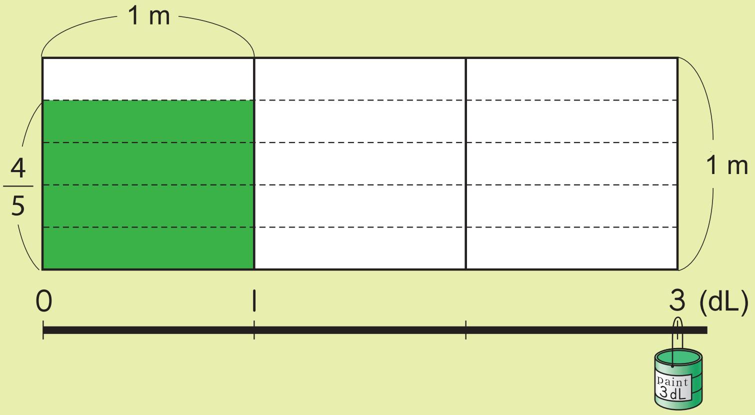
×3

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

×3







1 Operation of Fractions × Fractions

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

× $\frac{1}{3}$

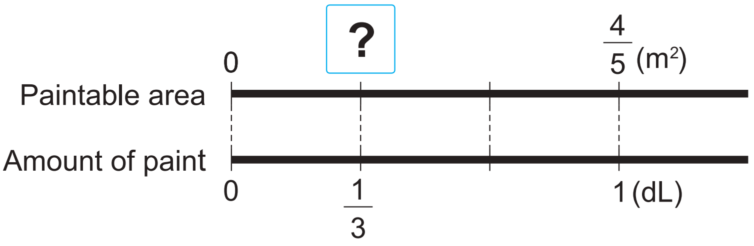
Paintable area (m²)	$\frac{4}{5}$	?
Amount of paint (dL)	1	$\frac{1}{3}$

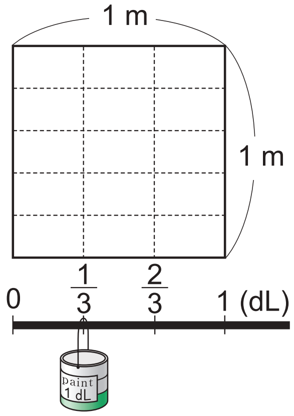
× $\frac{1}{3}$

① Write a mathematical expression.

$\boxed{} \times \boxed{}$

Paintable area using 1 dL — Amount of paint



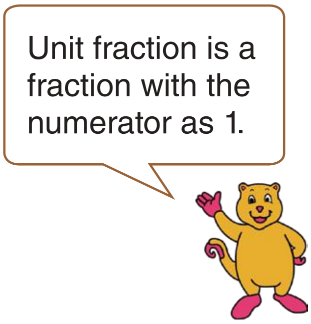


② Shade the paintable area in the picture on the right.

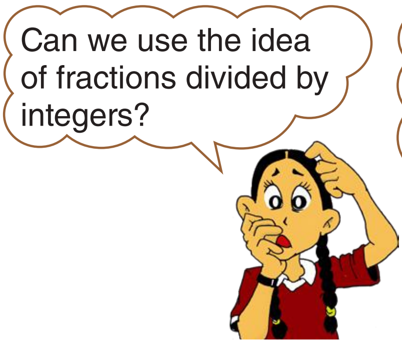
③ How about using $\frac{2}{3}$ dL of paint? What area in m² will it cover?

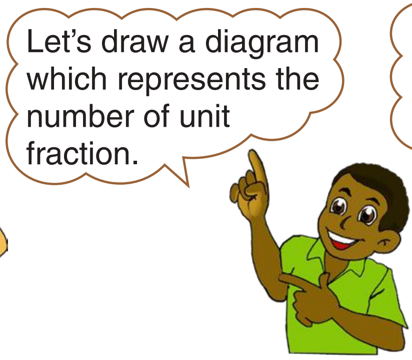
Write a mathematical expression.

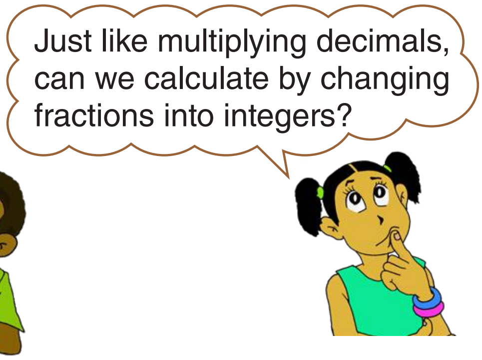
$\boxed{}$



④ Think about how to calculate the expression in ③.







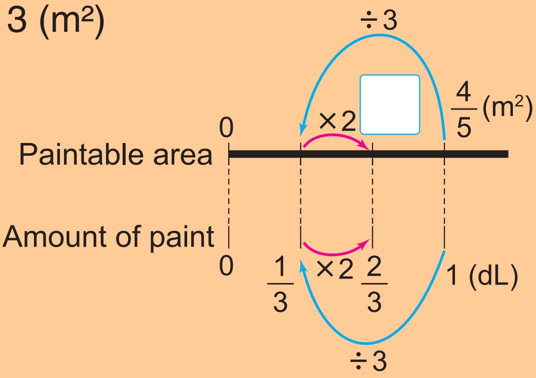
Let's think about the situation where you use multiplication of fractions and how to calculate the answers.

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.

$$\begin{aligned} \frac{4}{5} \div 3 \times 2 &= \frac{4}{5 \times 3} \times 2 \\ &= \frac{4 \times 2}{5 \times 3} \\ &= \square \end{aligned}$$



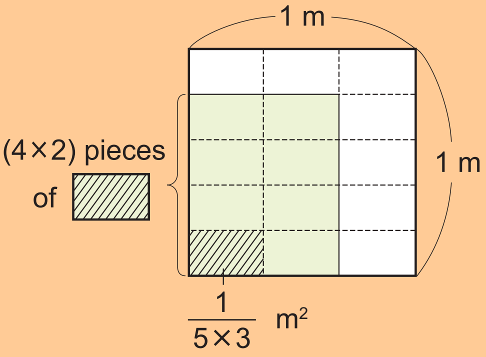
Mero's Idea

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.

$$\begin{aligned} \frac{4}{5} \times \frac{2}{3} &= \frac{4 \times 2}{5 \times 3} \\ &= \square \end{aligned}$$



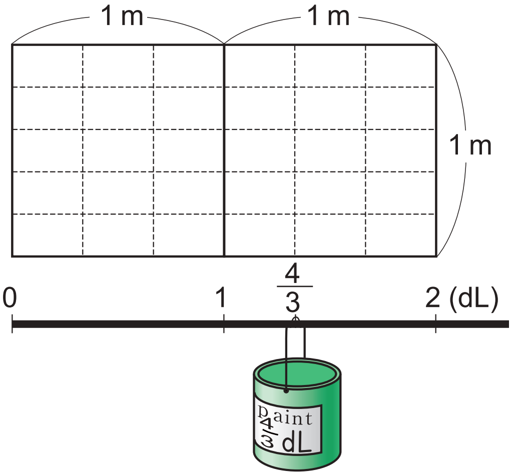
Yamo's Idea

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

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

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.

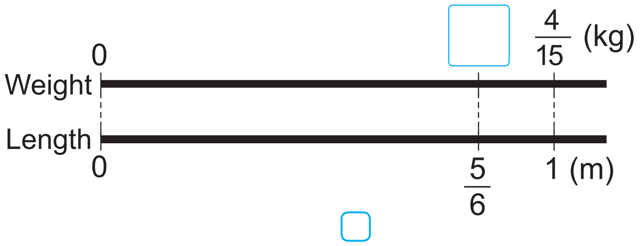


When multiplying a fraction by another fraction, multiply the two numerators and two denominators respectively.

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

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	$\frac{5}{6}$

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

$$\frac{4}{15}\times\frac{5}{6}=\frac{4\times\overset{\square}{\cancel{5}}}{\underset{\square}{\cancel{15}}\times6}$$

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

$$=\square$$

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

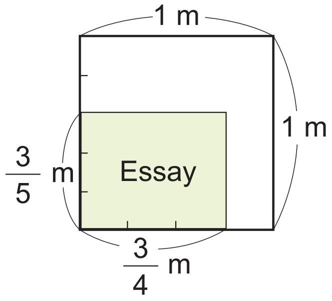
$=\square$

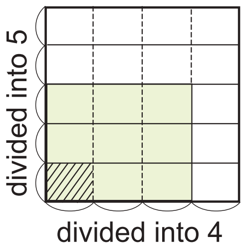
② $\frac{4}{5}\times3=\frac{4}{5}\times\frac{3}{\square}$

$=\square$

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 m^2 is covered by the essay section?





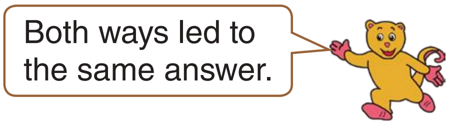
① Mane finds out as shown below.

Fill in the $\square$.

The area of ▨ is $\frac{1}{5\times4}$ of the square and it is $\square$ m^2.

The area for the essay section is (3×3) pieces which is $\square$ m^2.

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



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 $\frac{5}{8}\times2$

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.

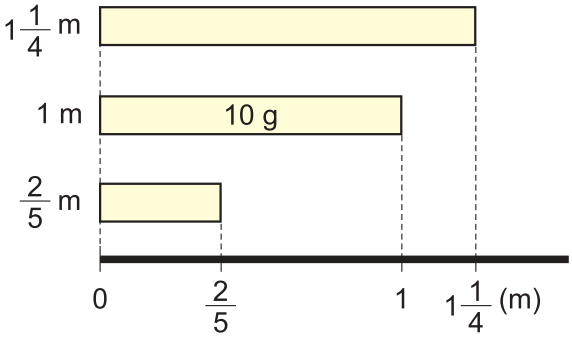
5 Let's think about how to calculate $3\frac{1}{7}\times2\frac{1}{10}$.

$$\begin{aligned}3\frac{1}{7}\times2\frac{1}{10}&=\frac{22}{7}\times\frac{21}{10}\\&=\frac{22\times21}{7\times10}\\&=\boxed{}\end{aligned}$$

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?



$10\times1\frac{1}{4}=\boxed{}$

$10\times\ 1\ =10$

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

② $10\times1\frac{1}{4}$ 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 $3\frac{1}{2}\times1\frac{5}{9}$ ② $2\frac{5}{8}\times2\frac{2}{9}$ ③ $9\frac{1}{3}\times\frac{3}{8}$ ④ $\frac{6}{7}\times4\frac{2}{3}$

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.

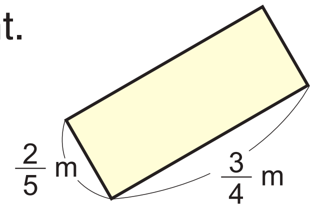
ⓐ $A\times B=B\times A$

ⓑ $(A\times B)\times C=A\times(B\times C)$

ⓒ $(A+B)\times C=A\times C+B\times C$

ⓓ $(A-B)\times C=A\times C-B\times C$

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

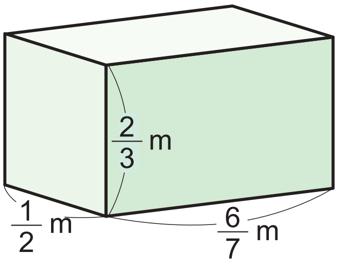


$$\frac{2}{5}\times\frac{3}{4}=\frac{\overset{1}{\cancel{2}}\times 3}{5\times\underset{2}{\cancel{4}}}$$
$$=\frac{3}{10}$$

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

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 1 to 9 and there are two cards for each number.

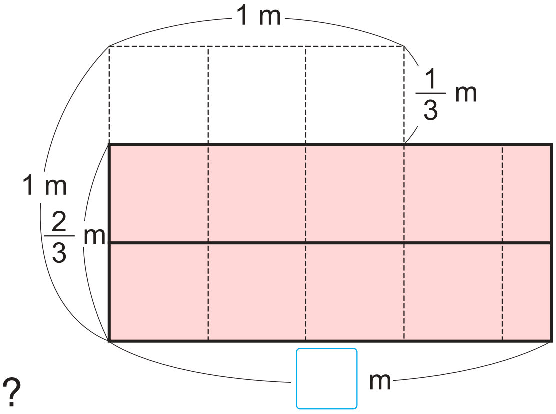
Use those cards and complete the expression below.

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

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

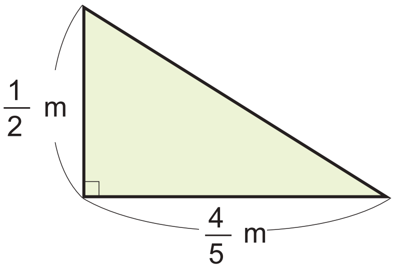
PROBLEMS

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.

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

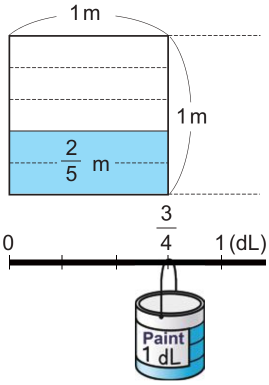
① Make various multiplication expression of fractions and calculate.

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,

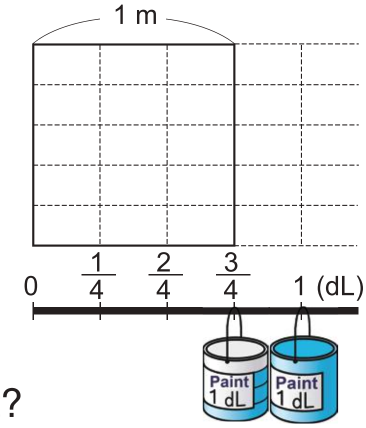
$$x = \frac{2}{5} \div \frac{3}{4}$$

× $\frac{3}{4}$

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

× $\frac{3}{4}$

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

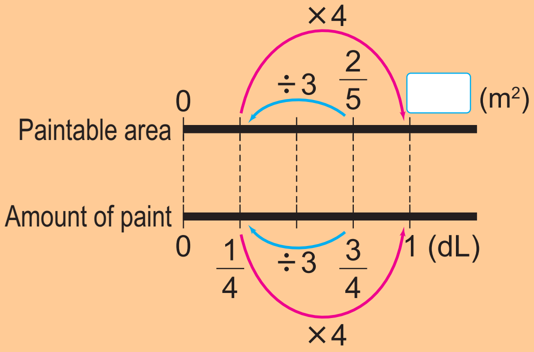
The area that can be painted with $\frac{1}{4}$ dL of paint is

$\frac{2}{5} \div 3$ (m²).

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

$\frac{2}{5} \div 3 \times 4$ (m²).

$$\begin{aligned}\frac{2}{5} \div \frac{3}{4} &= \frac{2}{5} \div 3 \times 4 \\ &= \frac{2}{5 \times 3} \times 4 \\ &= \frac{2 \times 4}{5 \times 3} \\ &= \boxed{}\end{aligned}$$



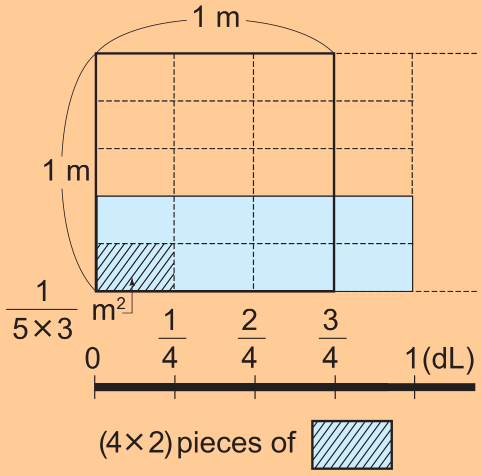
Ambai's Idea

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

$$\begin{aligned}\frac{2}{5} \div \frac{3}{4} &= \frac{1}{5 \times 3} \times (2 \times 4) \\ &= \frac{2 \times 4}{5 \times 3} \\ &= \boxed{}\end{aligned}$$



Sare's Idea

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

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

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

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

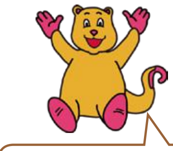
To divide a fraction by another fraction, you can calculate the answer by multiplying the inverse number of the divisor fraction.

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

2 Let's think about how to calculate.

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

$= \square$



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

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

$= \square$

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

$= \square$

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?

$\div 1\frac{1}{4}$

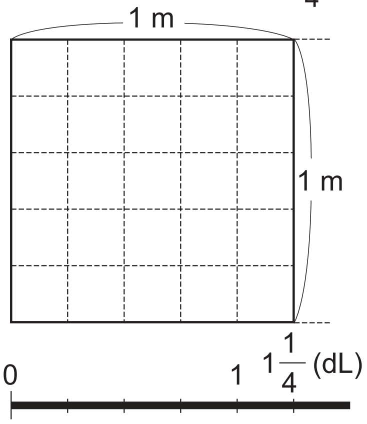
Paintable area (m²)	?	$\frac{2}{5}$
Amount of paint (dL)	1	$1\frac{1}{4}$

$\div 1\frac{1}{4}$

① Let's write an expression.

$\square$

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



③ Let's think about how to calculate.

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

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

$$= \square$$

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

④ Let's compare the dividend and quotient.

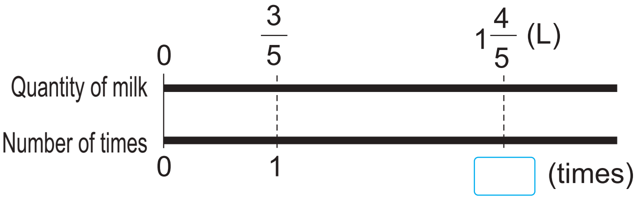
Dividing by a fraction is just like we divided by a decimal.
If the divisor is smaller than 1, the quotient becomes larger than the dividend. If the divisor is larger than 1, the quotient becomes smaller than the dividend.

Exercise

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

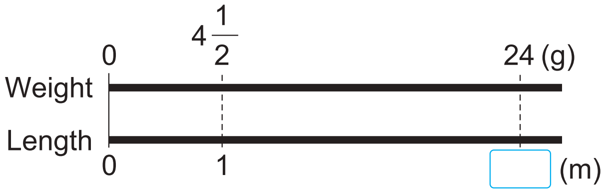
$7 \div \frac{3}{4}$ $\quad$ $7 \div 1\frac{2}{3}$ $\quad$ $7 \div \frac{3}{2}$ $\quad$ $7 \div 7\frac{7}{8}$

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?



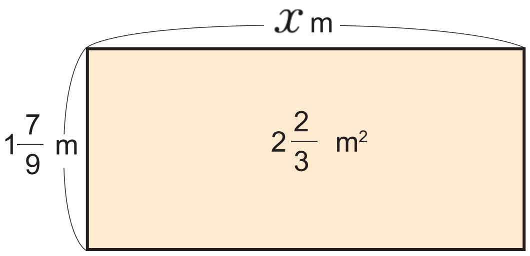
Amount of milk (L)	$\frac{3}{5}$	$\div\frac{3}{5}$	$1\frac{4}{5}$	$\div\frac{3}{5}$
Number of times	1		?	

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

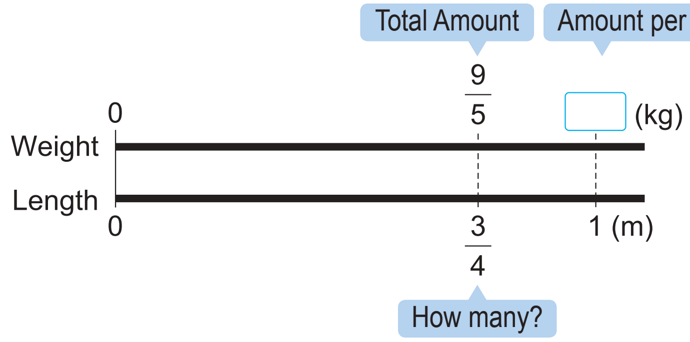
① $\frac{3}{5}\div\frac{9}{10}$ ② $\frac{5}{8}\div\frac{5}{6}$ ③ $\frac{7}{8}\div\frac{7}{12}$ ④ $\frac{5}{6}\div\frac{10}{21}$

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?

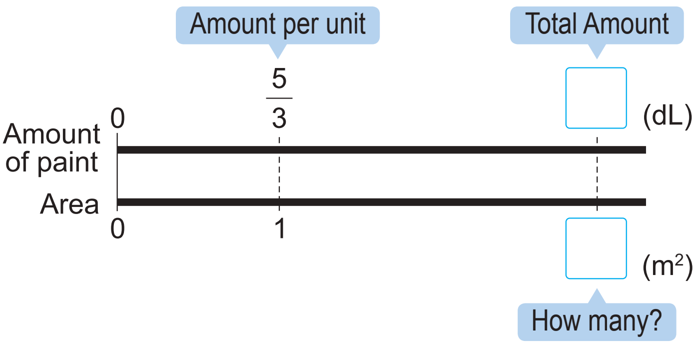


$\div\frac{3}{4}$

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 m² of the wall.
How many dL of paint do we need for $\frac{5}{2}$ m²?



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

Amount of paint (dL)	$\frac{5}{3}$	?
Area (m²)	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 m² field, we need □ L of water for a $\frac{2}{3}$ m² 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 $\square$.

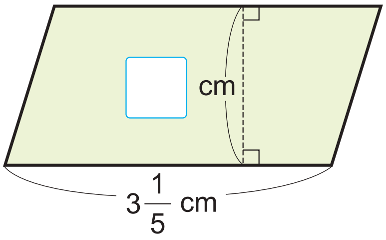
Page 42

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.

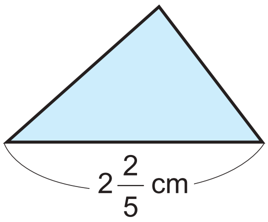
● Understanding the relationship between multiplication and division.

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?

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

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,

× x

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

× x

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

For getting x,

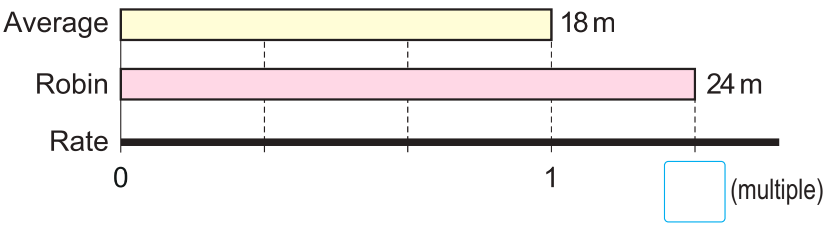
$$\begin{aligned} x &= 50 \div 20 \\ &= \frac{5}{2} \end{aligned}$$

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.

① 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,

× x

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

× x

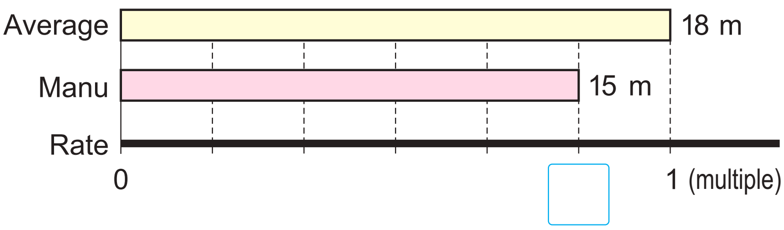
$18 \times x = 24$

$x = 24 \div 18$

Rate is sometimes expressed as fractions.

② 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,

× x

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

× 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?

$\boxed{} \times \boxed{} = \boxed{}$

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.

$x \times \boxed{} = 56$

$x = 56 \div \boxed{}$

Exercise

Let's fill in the □.

① $\frac{7}{5}$ times of 5 kg is □ kg.

② $\frac{5}{6}$ times of □ kg is 50 kg.

6

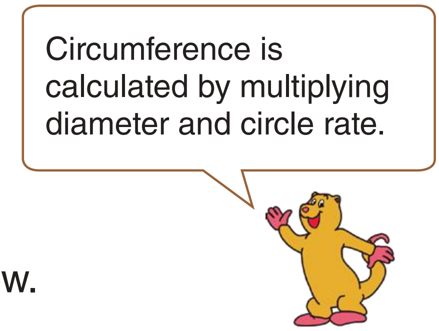
Operation of Decimals and Fractions

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?

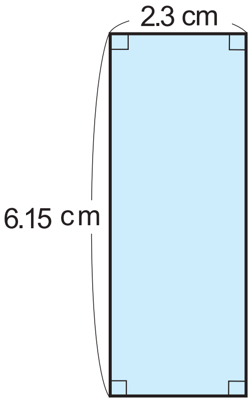
2 James ran 850 m in the 2 km fun run course. How many more kilometres does he have to run?

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

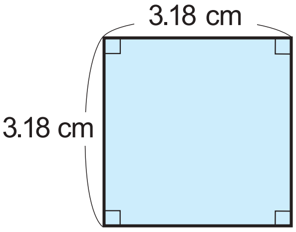


4 Let's find the area of these figures below.

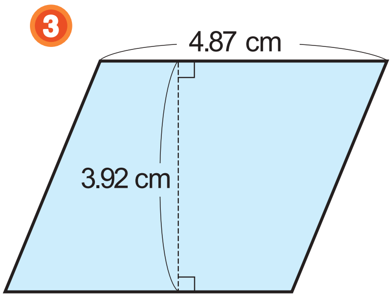
①



②



③



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?

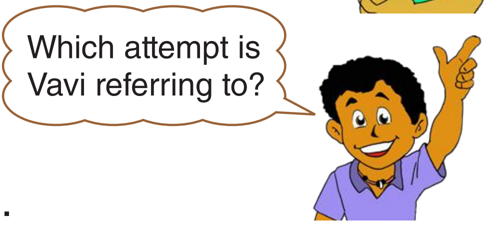
③ What is the difference between the best and worst records for Jack after 3 attempts?

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.

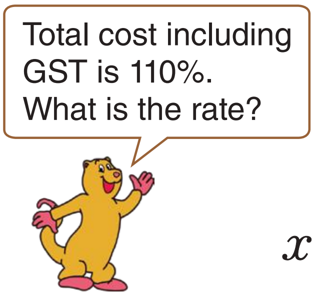
6 There are three sets of cards for each of the numbers $\boxed{1}$ to $\boxed{9}$. Let's develop division problems and calculate. If the number is not divisible, round off the quotient to one decimal place.

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

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.



×1.1

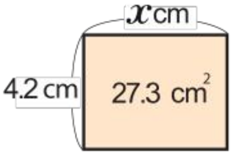
Price (kina)	x	840
Rate	1	1.1

×1.1

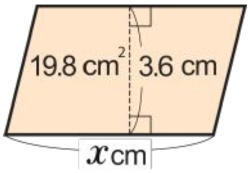
$$x \times 1.1 = 840$$

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

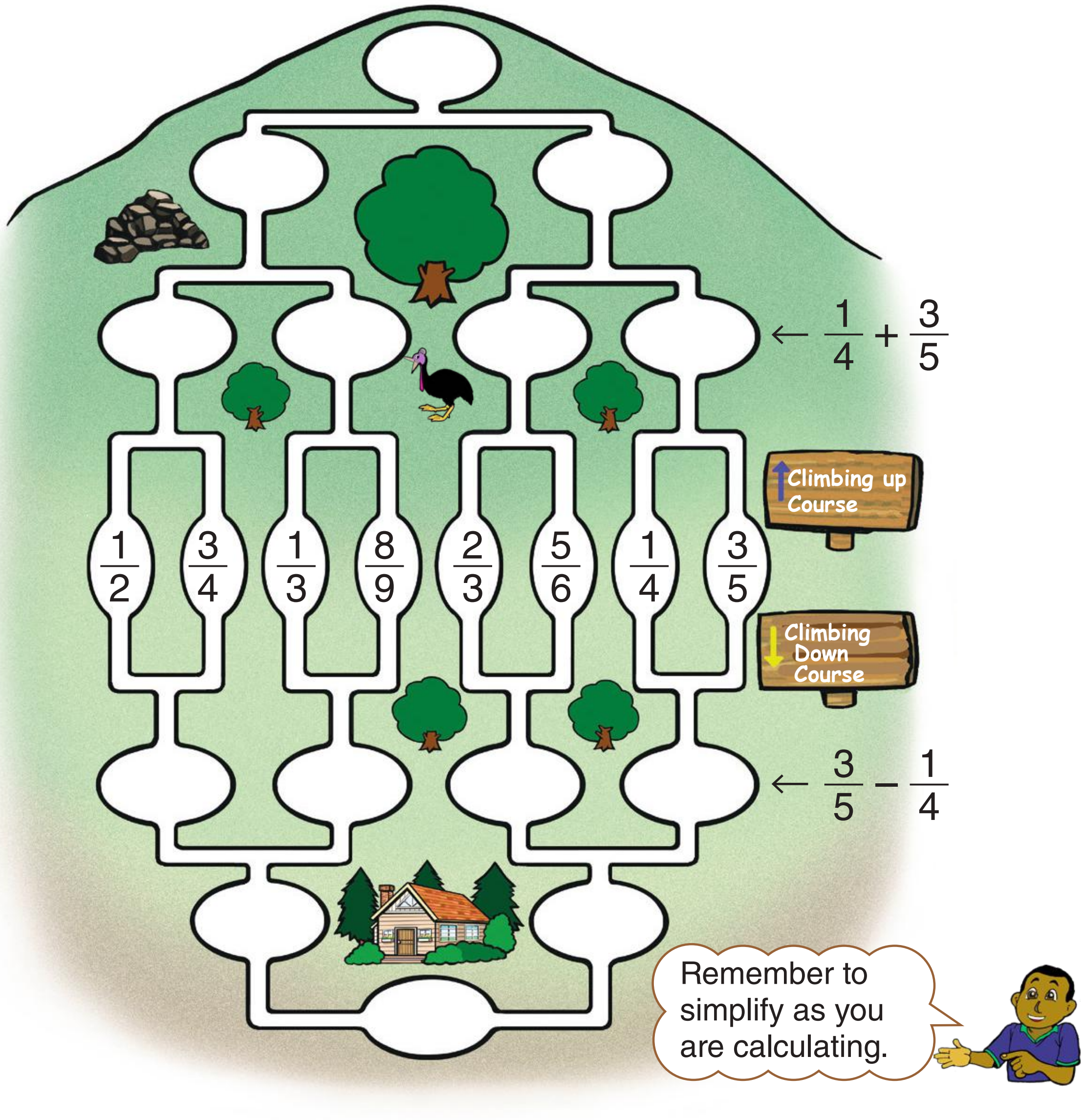
Let's calculate.

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

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 $1\frac{2}{9}-\frac{4}{5}$

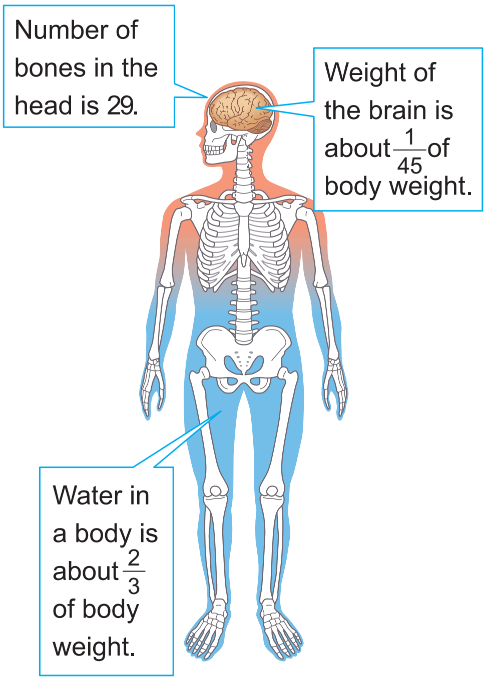
Our Body and Food

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

Nutritional information used here are rough estimates!

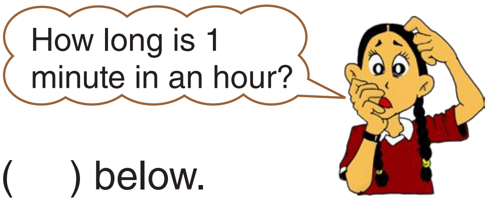
Calculation of Time

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?

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

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.

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

② Let's convert fractions to decimals and calculate.

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

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

① Let's convert decimals to fractions and calculate.

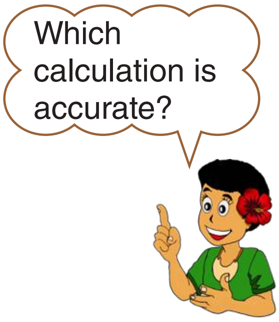
$$0.2=\frac{1}{5} \qquad \frac{1}{5}-\frac{1}{6}=\boxed{}$$

② Let's convert fractions to decimals and calculate.

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

$$\downarrow$$

$$0.167$$



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.

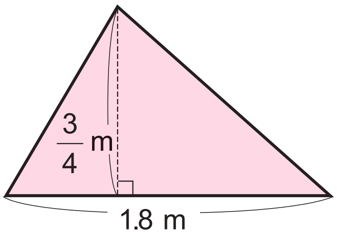
② Calculate it.

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

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

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

$$= \square$$



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

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

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?

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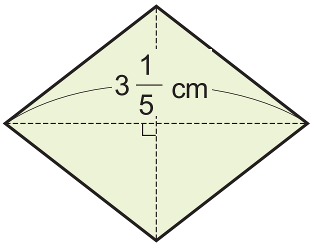
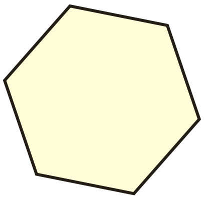


Grade 6

Do you remember?

The figure on the right has lines of symmetry.

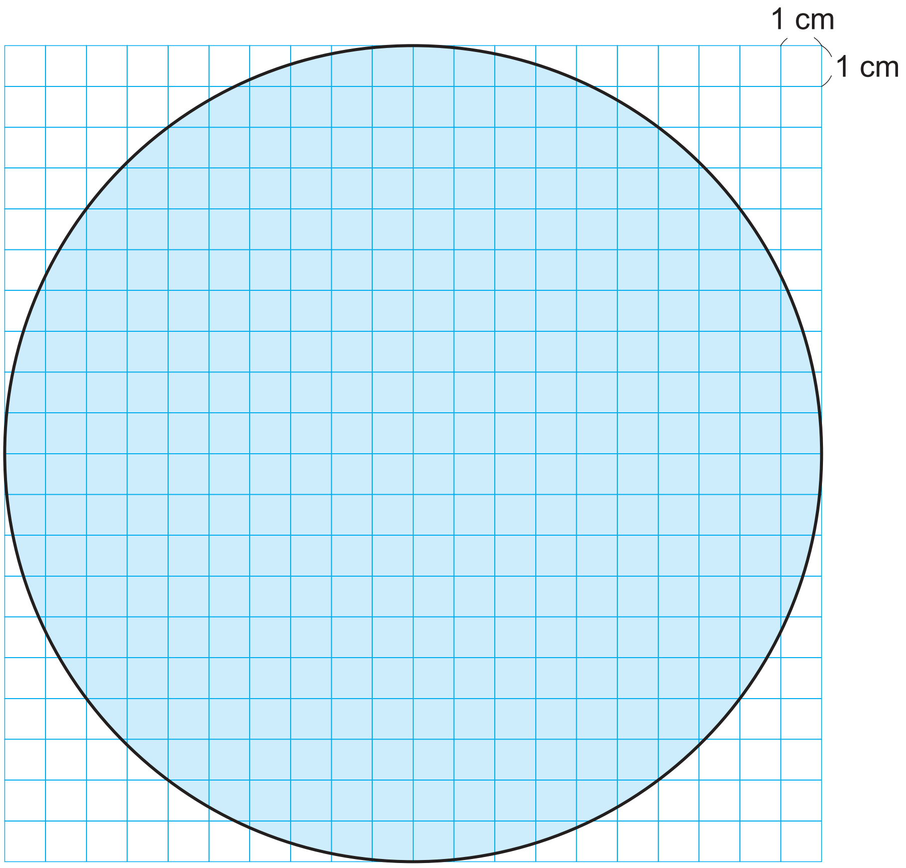
Draw the lines of symmetry.



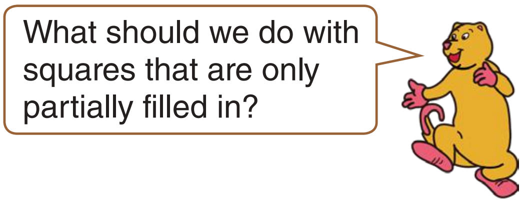
7 Calculating the Area of Various Figures

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?

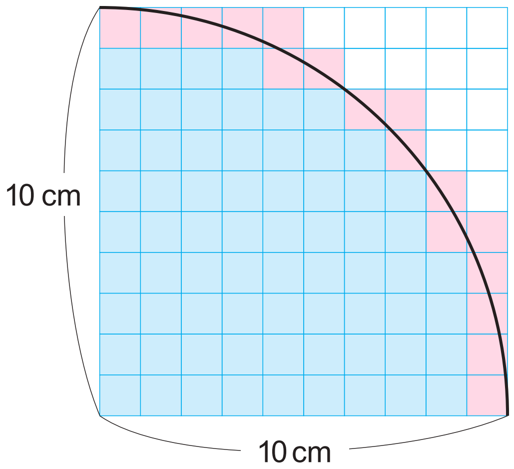


Let's think about how to find the area of the circle and the area formula for a circle.

② 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 cm^2 each, approximately how many cm^2 is the area of this quarter of a circle?



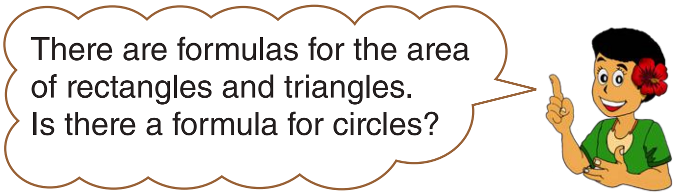
Blue squares............ 1 × □ (cm^2)

Red squares ....0.5× □ (cm^2)

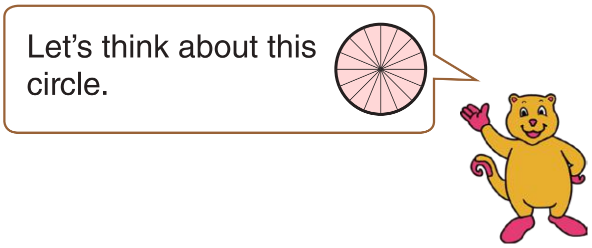
③ How many cm^2 is the area of the entire circle?

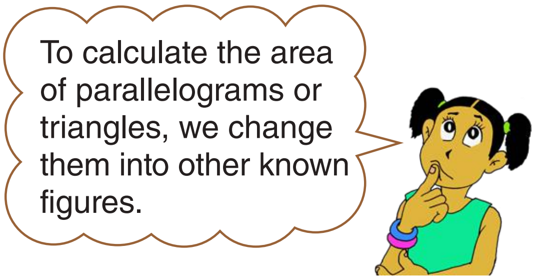
Formula to Calculate the Area of a Circle

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



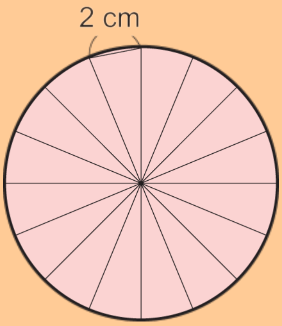
① Let's think about the formula by using figures that divide the circle into many equal sections from the radius.





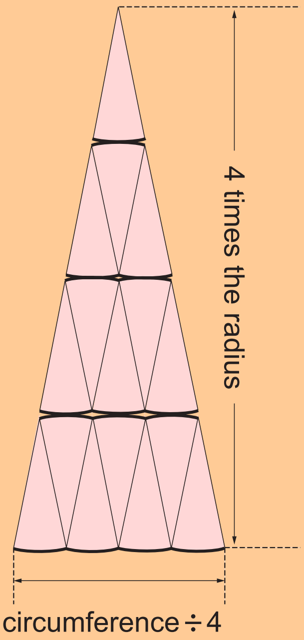
② Tell the class your ideas about finding the area of a circle. Explain that to 3 other students.

Mero's Idea



I divide a circle into a lot of small triangles.

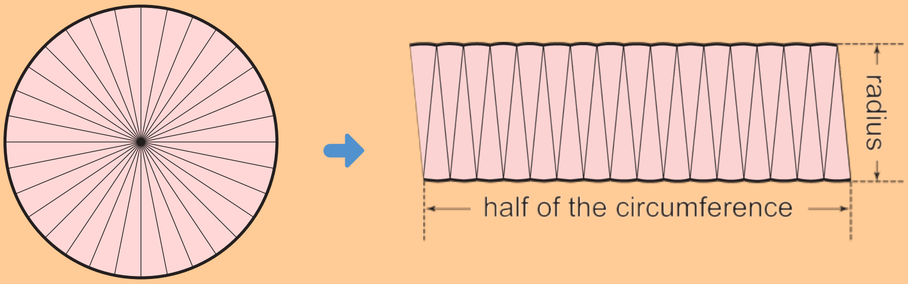
Yamo's Idea



I changed the circle into a triangle.

Ambai's Idea

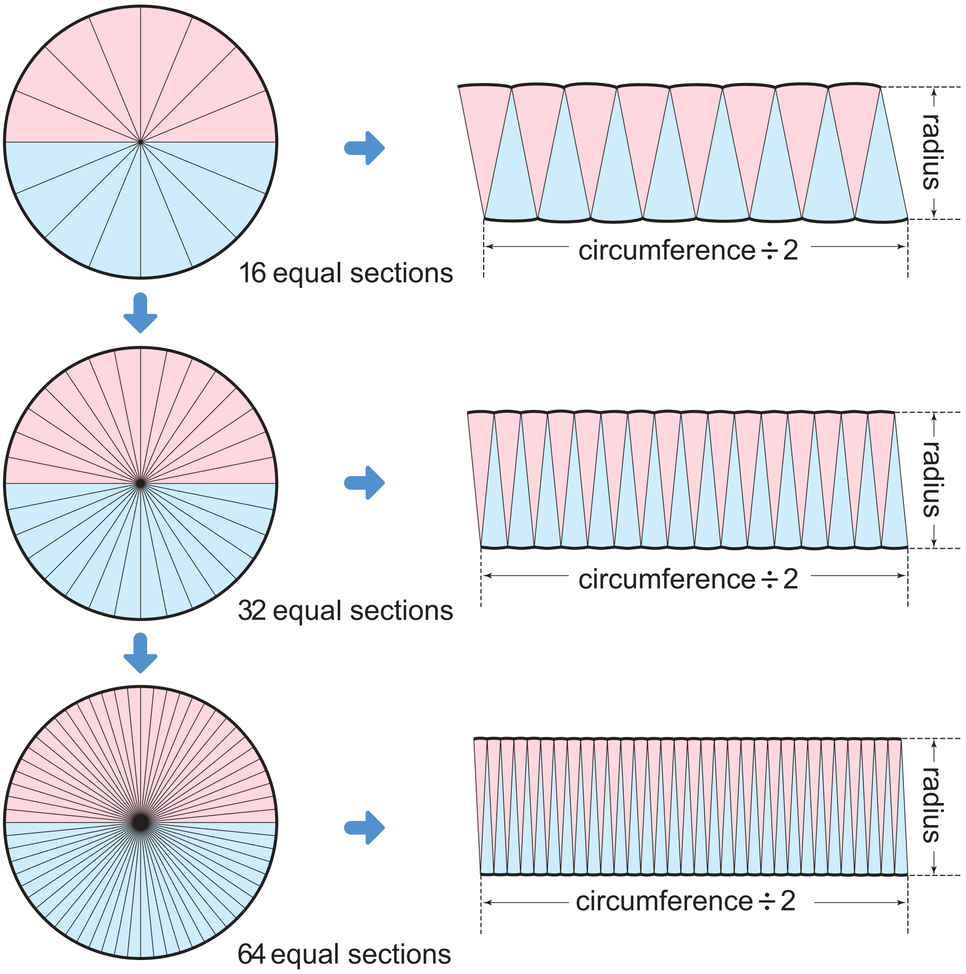
I rearranged the circle to make a parallelogram.



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

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

$\downarrow$ $\downarrow$ $\downarrow$

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

$\downarrow$

= radius × diameter × 3.14 ÷ 2

$\downarrow$

= radius × diameter ÷ 2 × 3.14

$\downarrow$

= radius × $\boxed{\quad}$ × 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.

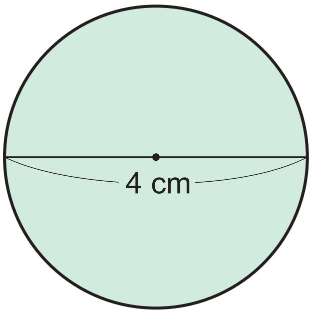
① A circle with 8 cm radius.
② A circle with 12 cm diameter.

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

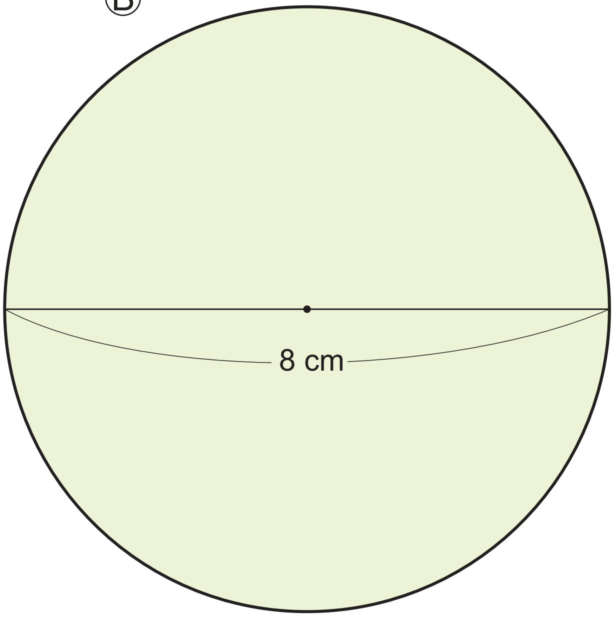
① Find the circumference and area of each circle.

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

Ⓐ



Ⓑ

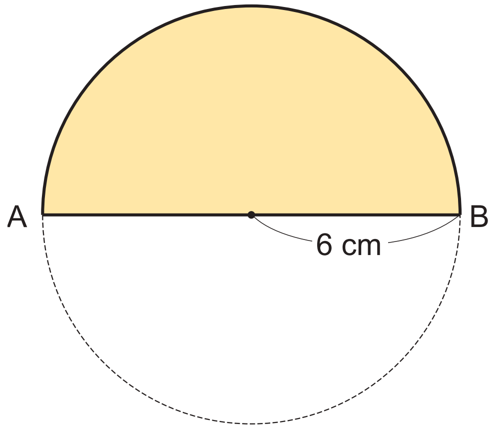


Exercise

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.

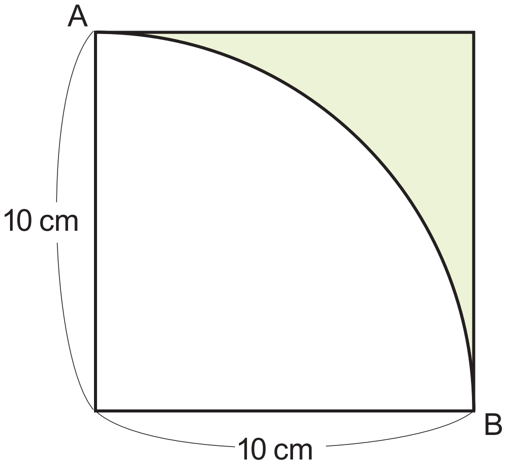


① The length of the arc from A to B.

② The circumference and area of this half circle.

What fraction of the circle is it?

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

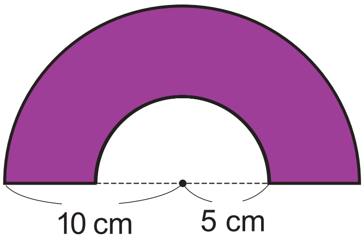


① The length of the arc from A to B.

② The area of the coloured section.

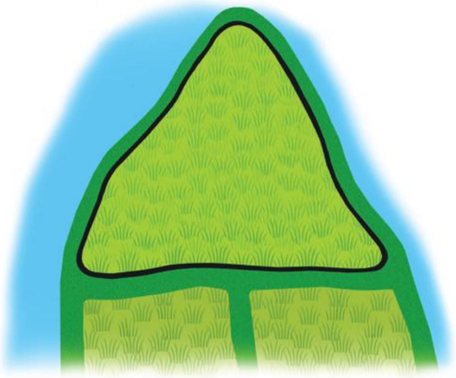
Exercise

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

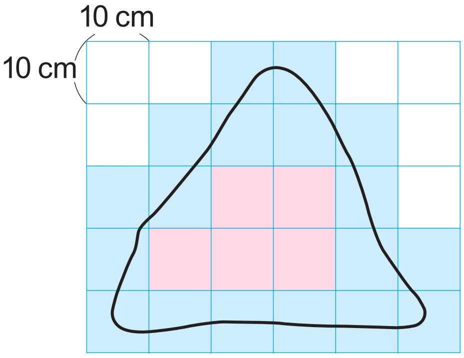


2 Approximate Area

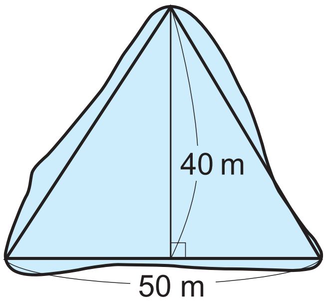
1 What is the area of the field bordered by 2 rivers as shown on the right?



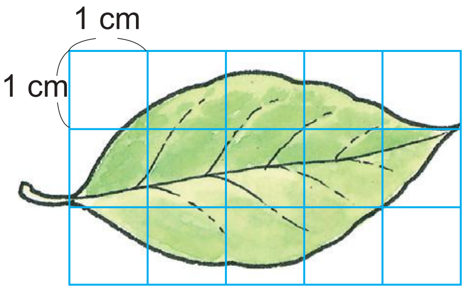
① How many squares are there inside the curved area? Calculate the area of the field by considering the area of any 2 squares that the line passes through as 100 m².



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.

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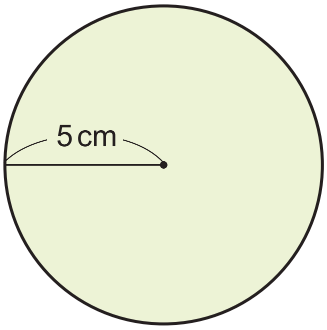
①



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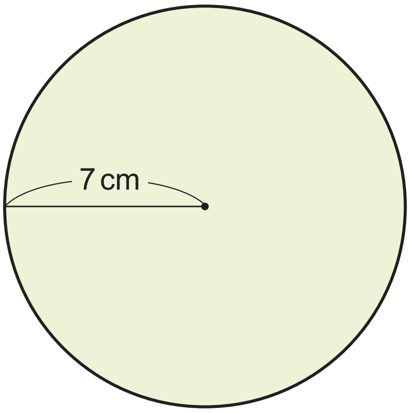

2 There are 2 circles with radii 9 cm and 10 cm on the right. Let's find the difference in their areas.

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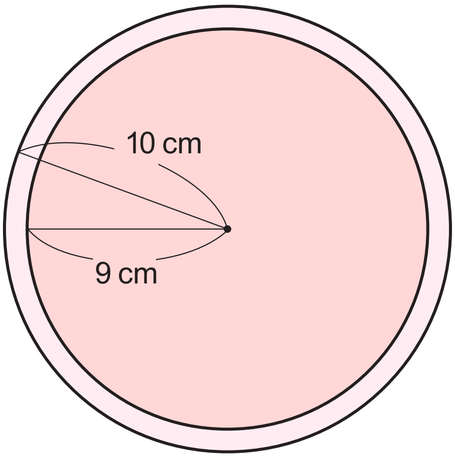


Grade 4

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

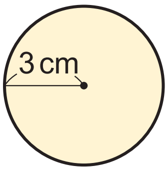
⑤ $\frac{4}{5}-\frac{1}{3}$ ⑥ $1\frac{3}{4}-\frac{4}{5}$ ⑦ $2\frac{1}{5}-1\frac{6}{7}$ ⑧ $3\frac{2}{3}-2\frac{5}{8}$

PROBLEMS

1 Calculate the circumference and the area of these circles.

● Calculating the circumference and area from the radius.

①



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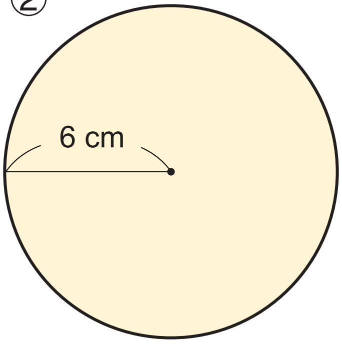


2 Calculate the diameter and the area of these circles.

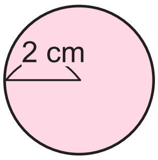
● Usng a circumference to calculate the diameter and area of a circle.

① A circle with 6.28 cm circumference.
② A circle with 12.56 cm circumference.

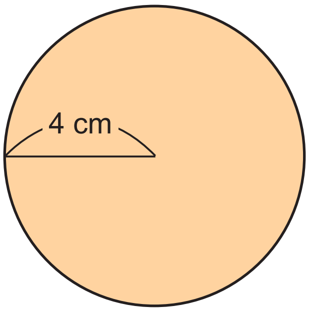
3 Find the circumference and area of the following.

● Finding area and circumference using formula.

①



②



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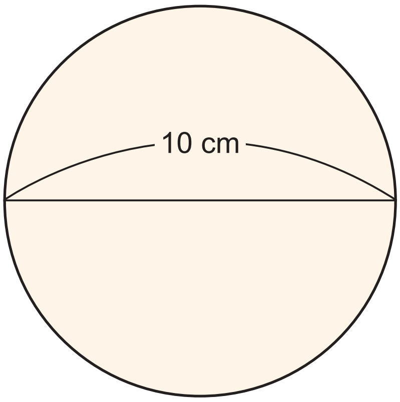

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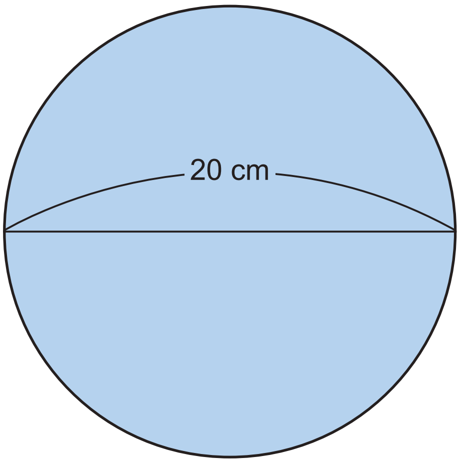
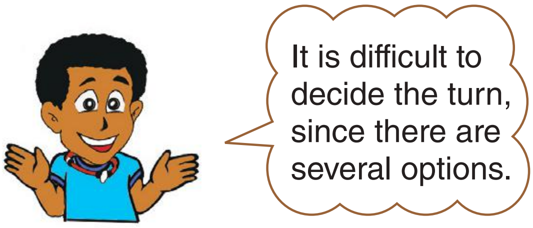


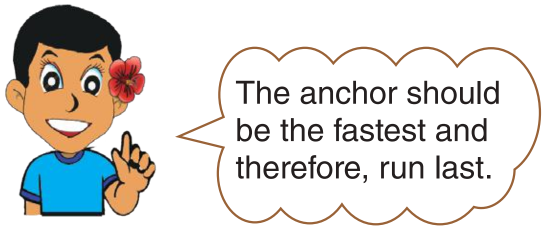
8

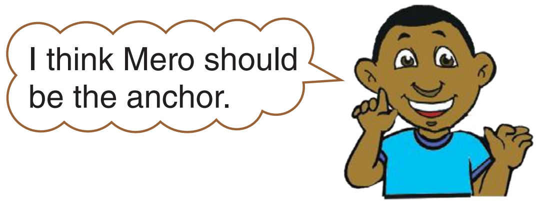
Orders and Combinations

1 Ordering

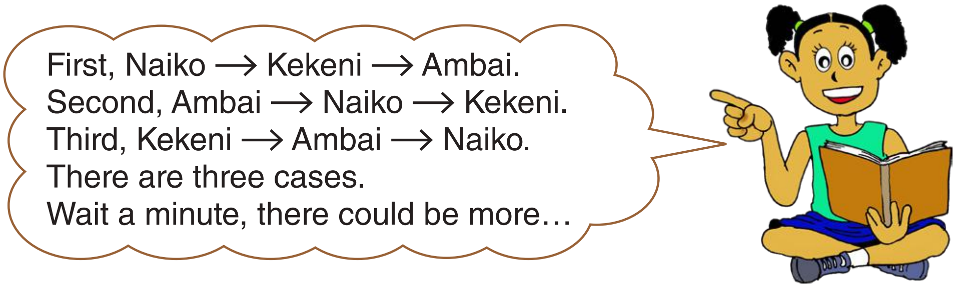
1 Naiko, Ambai, Kekeni and Mero are running the relay race.
Let's decide their turn to run.







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



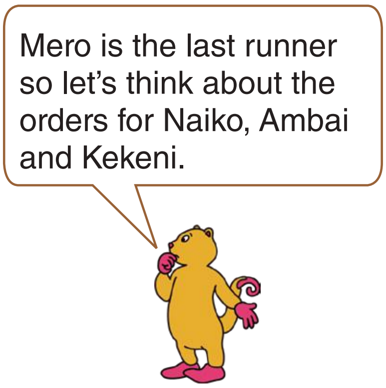
① Are there other ways of ordering, other than what Yamo found?

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

③ Let's consider the following method.

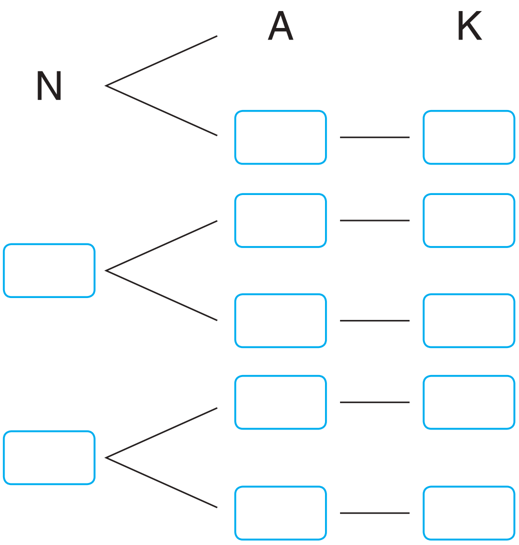
Draw a table

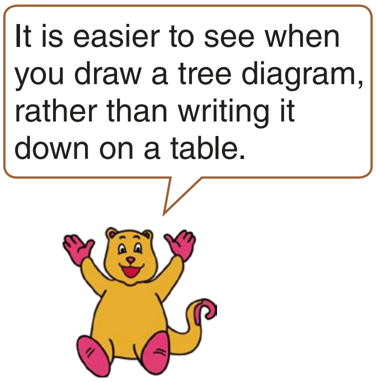
Determine the first runner and fill in the order of the next runners in the table.



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 $\boxed{4}$.

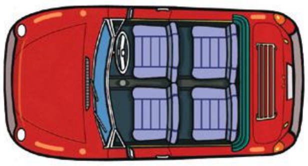
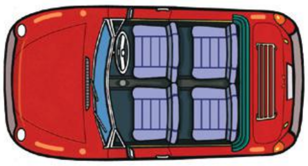
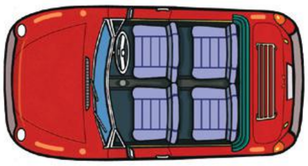
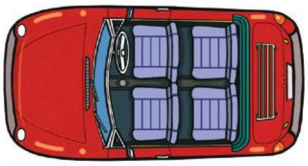
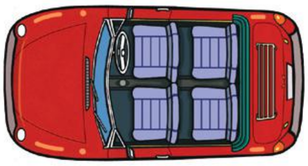
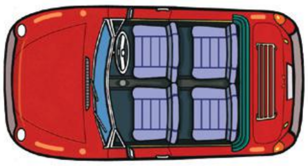
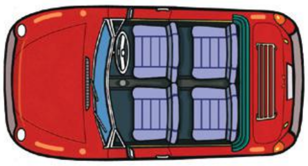
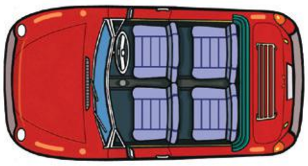
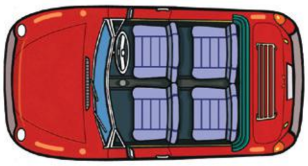
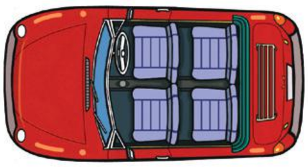
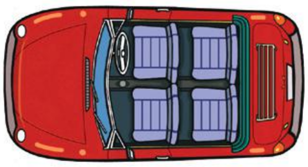
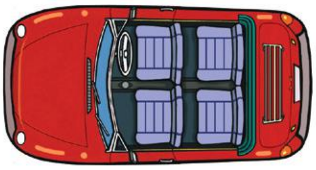
Use all the cards to make four digit numbers.

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?

Vanilla

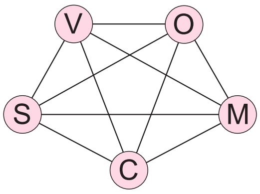
Strawberry

Chocolate

Melon

Orange

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



Combinations with vanilla………… Ⓥ–Ⓢ, Ⓥ–Ⓒ, Ⓥ–Ⓜ, ○–○
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?

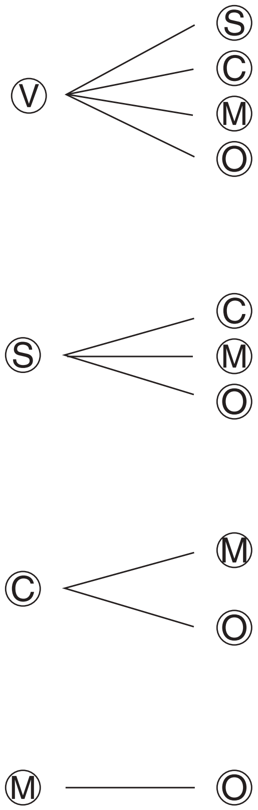
④ Yenbi drew a table below.

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	✓	✓	✓	✓	✓	

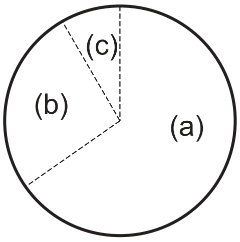
Exercise

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

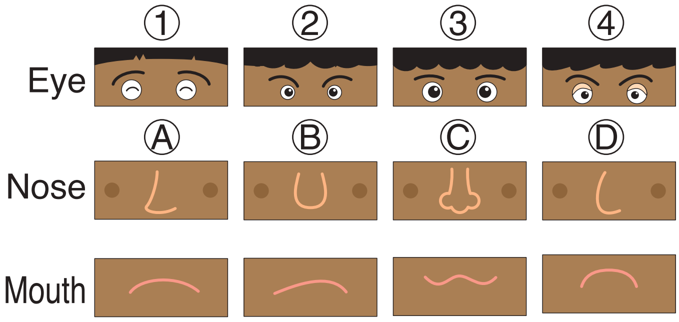
Pages 69 to 70

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?

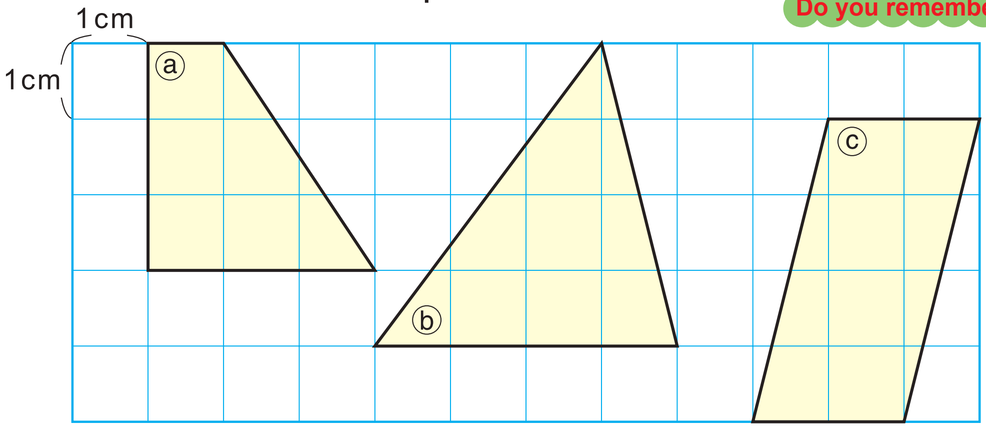
② If you make a three-digit number using all three cards, how many numbers can you make? Let's write them down.

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?

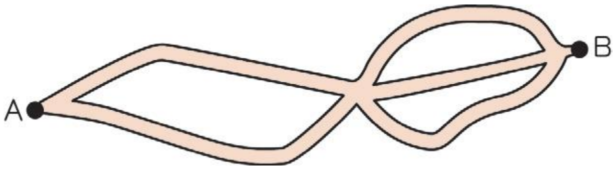
Let's find the area of the shapes below.



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.

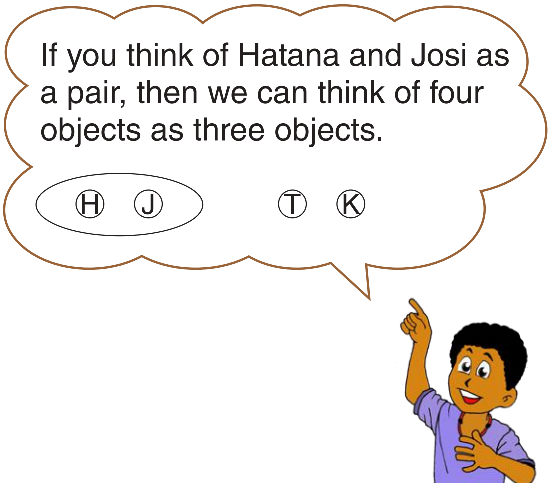
● Considering possibilities with omissions.

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.



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?

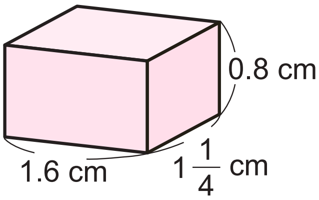
3 There is a 12 cm tape. If you cut it into $\frac{4}{5}$ cm pieces, how many pieces of tape can you make?

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

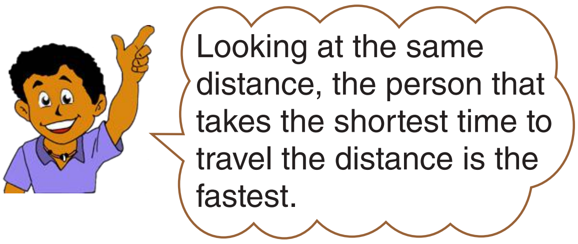
▷▷ In a Physical Education class, the teacher wants to measure the running speed of individual students.

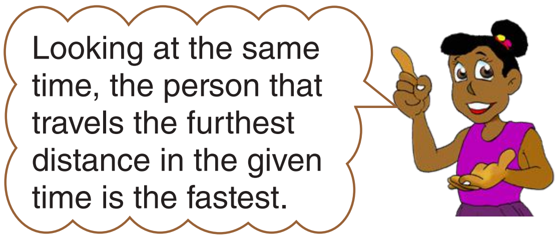
They got into two groups.

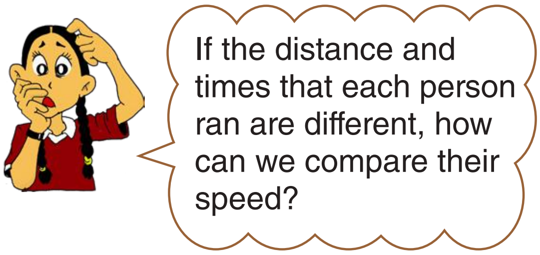
One group timed students that ran certain distances.

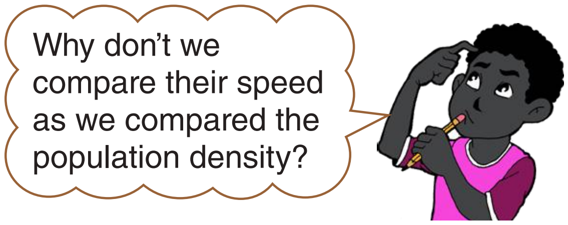
Another group measured the distance the students ran within a time period.

Who can run the fastest?









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.

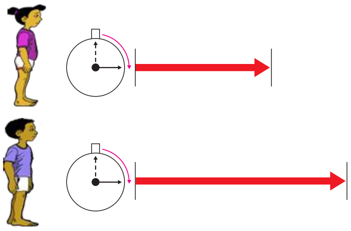
Comparing Ⓑ and Ⓒ → ☐ is faster.

Comparing Ⓐ and Ⓒ → ☐ is faster.

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

Same time

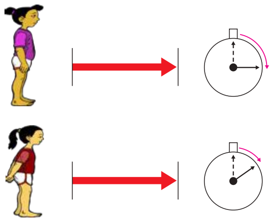
The distance that the student covered in 1 minute.



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?

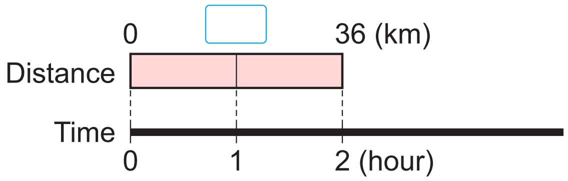
Compare their speed in seconds.

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.

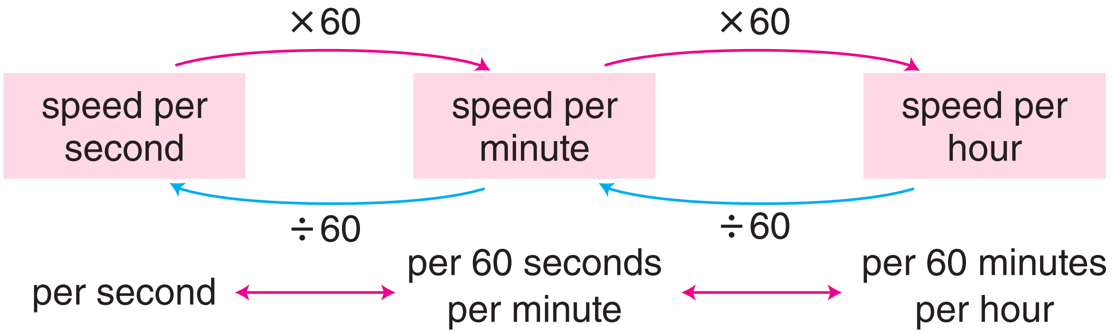
3 During a long distance race, a runner ran 36 km in 2 hours.



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)?



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

×2

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

×2

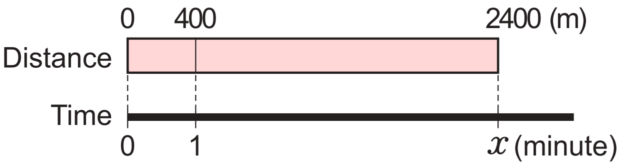
②

×3

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 × x

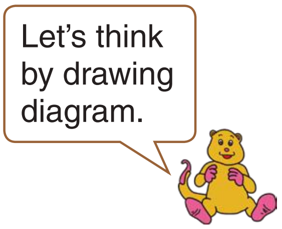
x = 2400 ÷ 400

×x

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 started walking from his house at 10 o'clock 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.

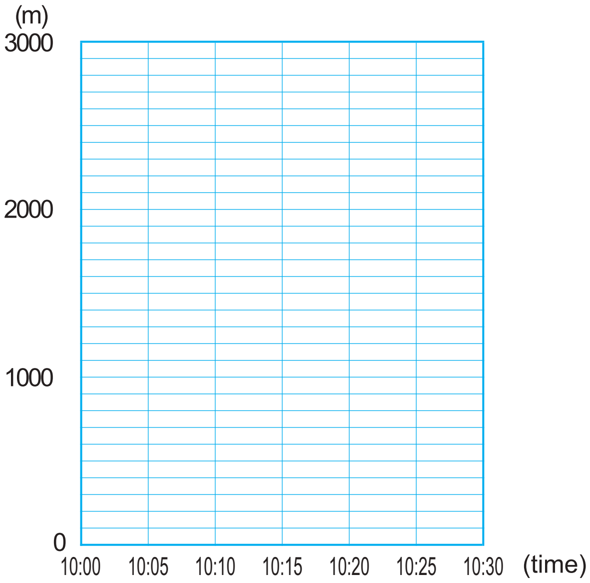
Time (minutes)	0	5	10
Distance (m)			

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.

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?

Let's calculate the area of the circles.

Grade 6

Do you remember?

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?

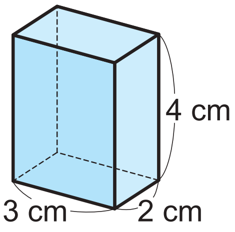
② How many kilometres per hour (km/h) can she walk?

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

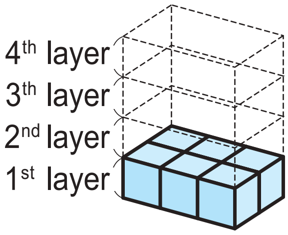
① Volume of a Prism

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.

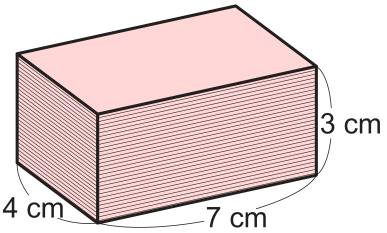


① How many 1 cm^3 cubes are on the base layer ?

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.

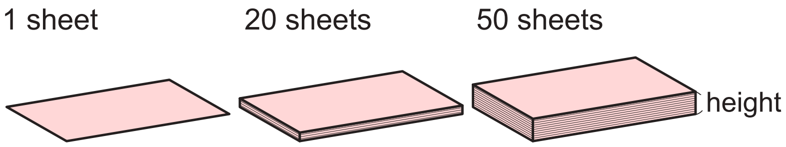
2 A stack of papers has 7 cm length, 4 cm width and 3 cm height.



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.

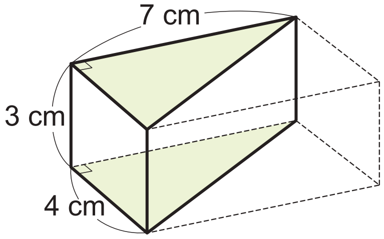
$$\text{Volume of a rectangular prism} = (\text{length} \times \text{width}) \times \text{height}$$

$$\downarrow$$

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

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

3 The figure on the right is a triangular prism.

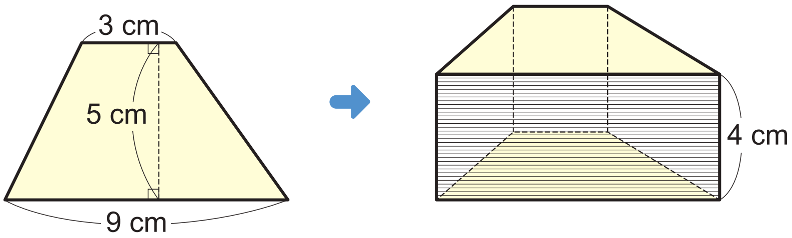


① What is the base area of the triangular prism in cm²?

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.



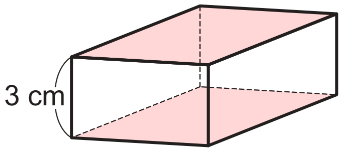
The volume of all prisms can be calculated using the formula:

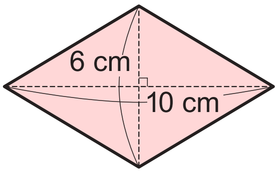
Volume of prisms = area of the base × height

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.

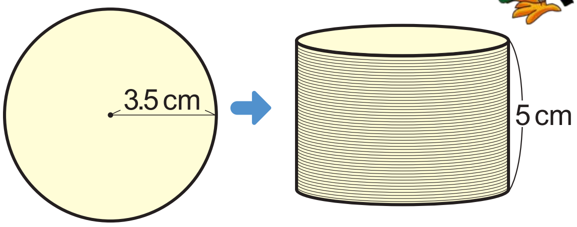




Base

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 cm²?

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.

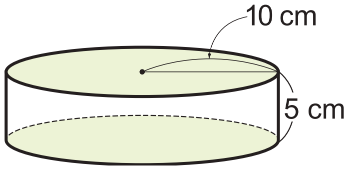
The area of the base of the cylinder is also called the base area.

The volume of cylinders can be calculated using the formula:

Volume of cylinder = area of the base × height

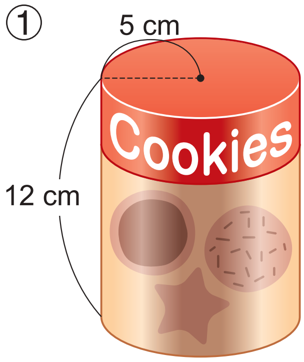
Exercise

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

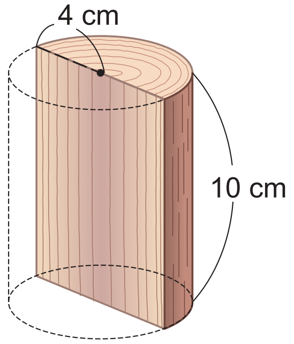


2 Let's find the volume of these solids.

①

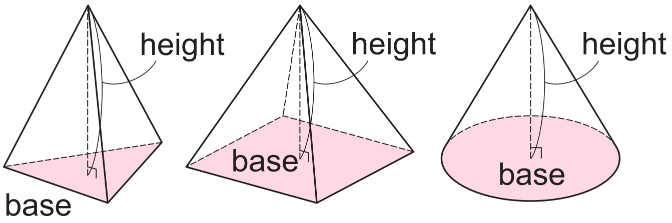


②

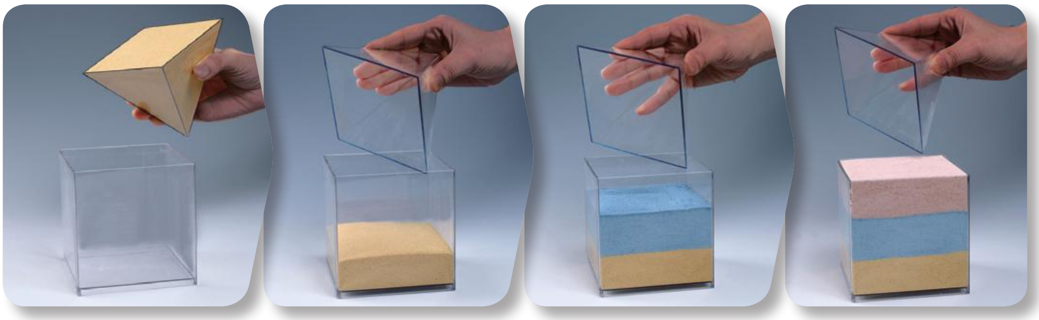


Comparing Volumes of Various Solids

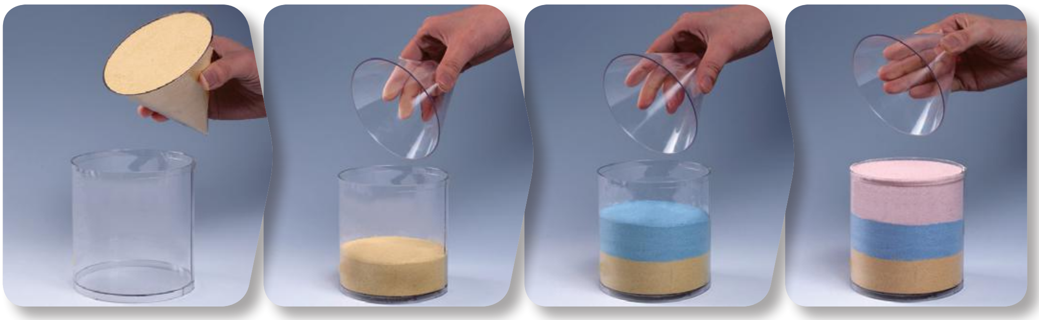
The figures below are called pyramids and cones.
The base of pyramids are polygons such as the pentagon.



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 □ with numbers and discuss what he thought.

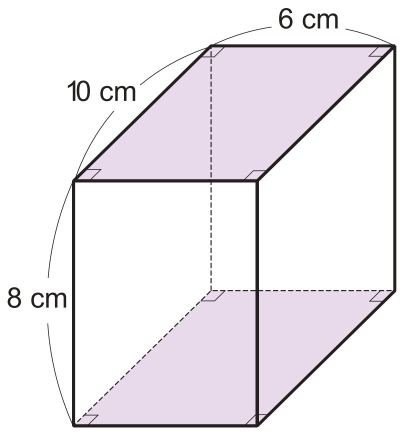
Volume of pyramid or cone = Area of the base × height × $\frac{1}{\square}$

EXERCISE

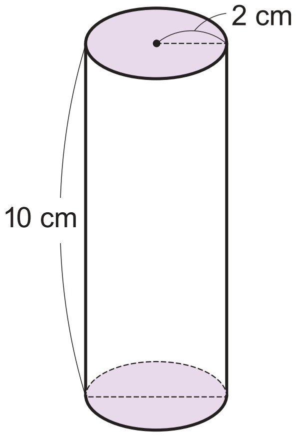
1 Let's find the volumes of the solids below.

Pages 86 to 88

①



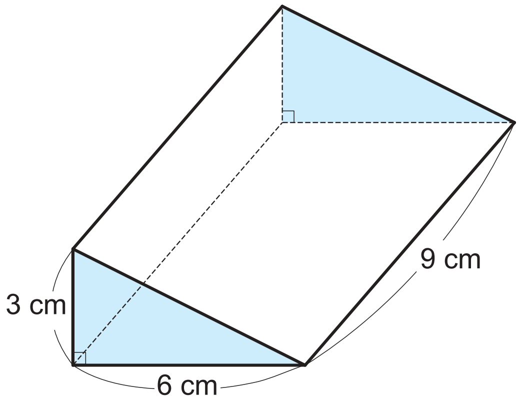
②



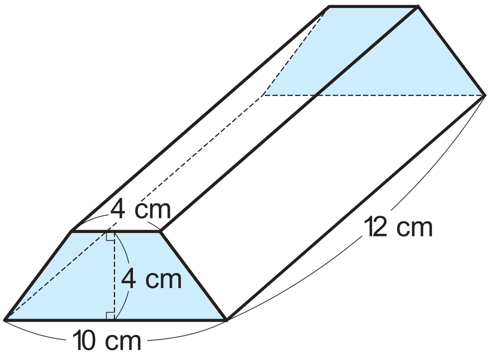
2 Let's find the volumes of the following solids.

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

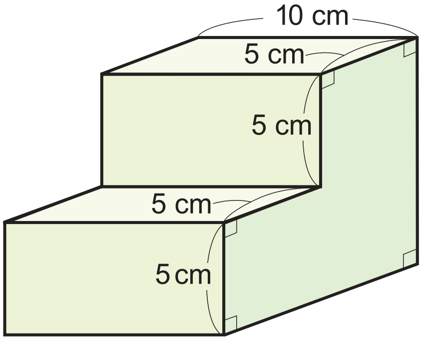
⑦ 1.87×7　⑧ 2.46×1.8　⑨ 9.72×7.3

PROBLEMS

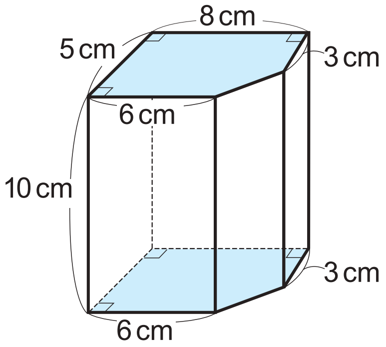
1 Let's find the volume of the solids below.

● Understanding how to find the volume of prism.

①

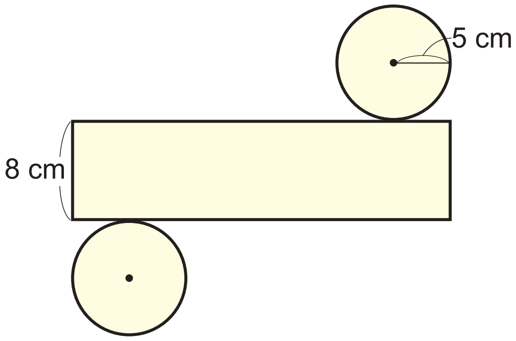


②

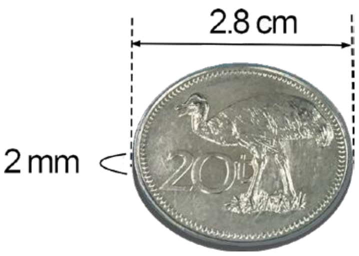


2 Let's find the volume of the solid figure constructed from the net shown.

● Understanding the volume of solid from the net.



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



11

Ratio and its Application

Mek, Lala and Vele are mixing various ingredients during their cooking lesson.

Mek is responsible for making vegetable salad. He is thinking about which international sauce will go well with the salad.

French Salad Sauce

Vinegar...... 3 teaspoons

Cooking oil...6 teaspoons

Salt......... $\frac{3}{5}$ teaspoons

Japanese Salad Sauce

Vinegar... $4\frac{1}{5}$ teaspoons

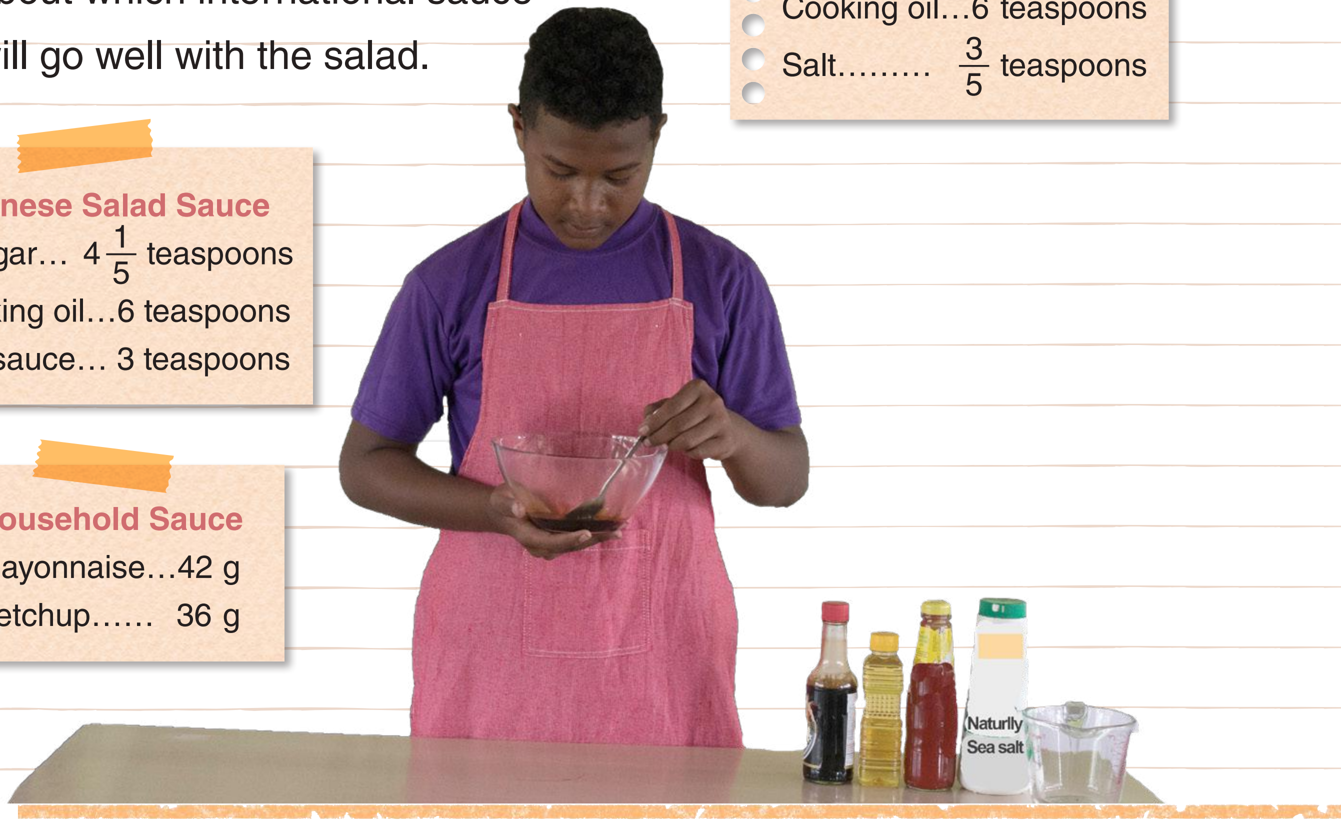
Cooking oil...6 teaspoons

Soy sauce... 3 teaspoons

Household Sauce

Mayonnaise...42 g

Ketchup...... 36 g



Let's explain the quantity of each cooking ingredient, using the representation of ratio which you have already learned.

Think about a new way to represent ratio.

Lala is responsible for making seasoning salt for roasted pork.

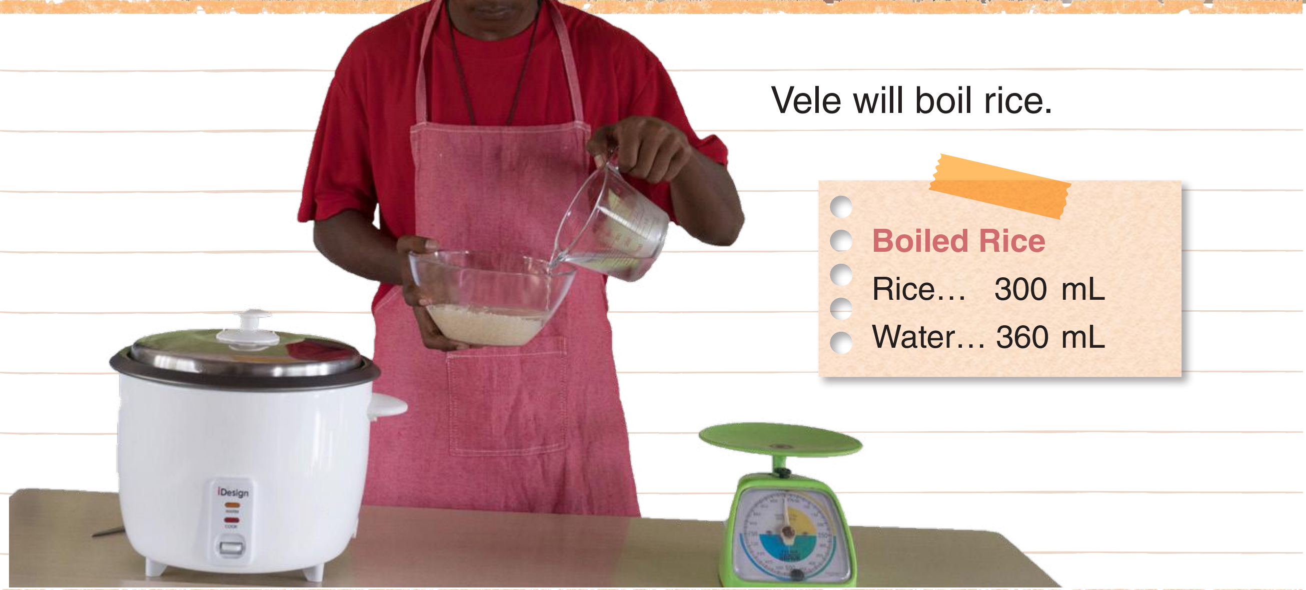
Seasoning Salt

Iodised salt…450 g
Chilli………… 50 g

Vele will boil rice.

Boiled Rice

Rice… 300 mL
Water… 360 mL

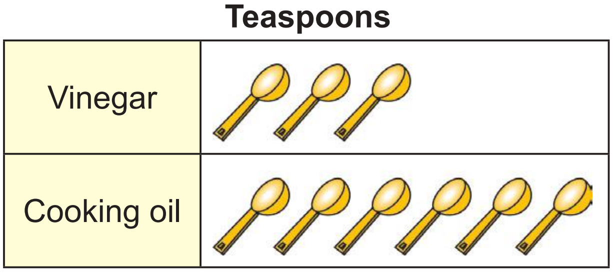


To make seasoning salt, $50 \div 450 = \frac{1}{9}$ therefore, chilli powder is $\frac{1}{9}$ of the seasoning salt.

Adding salt and chilli powder makes 500 g seasoning salt. $450 \div 500 = 0.9$, which means 90 % of iodised salt is in the seasoning salt.

① Ratio

1 Mek is trying to make a French salad sauce.



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

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

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

3 : 6 is also read **"ratio of 3 is to 6"**.

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

☐ : ☐

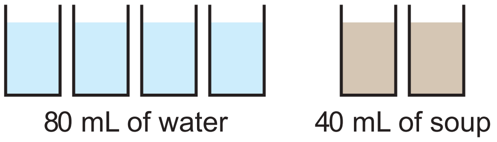
③ Represent the ratio of mayonnaise and ketchup in the household sauce.

☐ : ☐

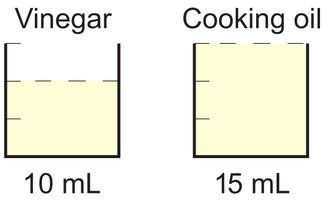
Exercise

Let's represent the ratio.

①



②



2 Equivalent Ratio

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

Rice… 300 mL
Water… 360 mL

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

☐ : ☐

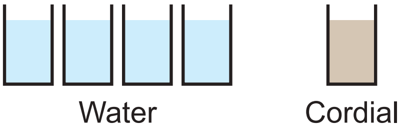
② How many times is the volume of rice compared to the volume of water? Let's represent it as a fraction.

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

2 You make cordial by mixing with water.

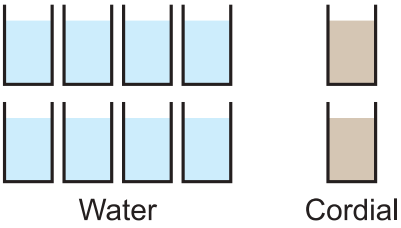
How to mix with water
Water … 4
Cordial … 1

① Ani uses small cups.



Value of ratio 4 : 1 is ☐

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



Value of ratio 8 : 2 is ☐

③ Was the concentration level of the cordial that Ani and Buru made the same?

When the values of 2 ratios are equal, we say the two ratios are equal and it is written as

$4 : 1 = 8 : 2$

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

Ⓐ
Rice… 60 mL
Water…72 mL

Ⓑ
Rice… 100 mL
Water…120 mL

Ⓒ
Rice… 300 mL
Water…360 mL

① Values of ratios in Ⓐ and Ⓒ are both $\square$,
Therefore, $60 : 72 = 300 : 360$.

$60 : 72 = (60 \times \square) : (72 \times \square)$
$= 300 : 360$

$\times \square$
$60 : 72 = 300 : 360$
$\times \square$

② Values of ratios in Ⓒ and Ⓑ are both $\square$
Therefore, $300 : 360 = 100 : 120$.

$300 : 360 = (300 \div \square) : (360 \div \square)$
$= 100 : 120$

$\div \square$
$300 : 360 = 100 : 120$
$\div \square$

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

Exercise

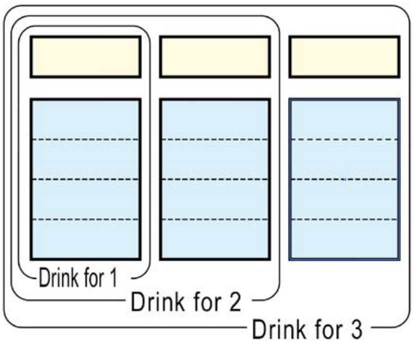
1 Which ratio is equal to 3 : 1?

① 6 : 3　② 6 : 2　③ 1 : 3　④ 13 : 10　⑤ 9 : 3

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

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

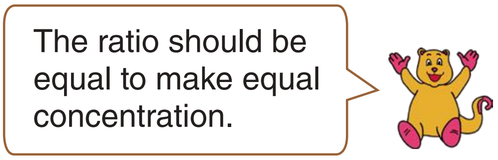
How much water and cordial do you have to mix to prepare the drink for 3 people?



$$\times\square$$

$$120 : 30 = \square : \square$$

$$\times\square$$

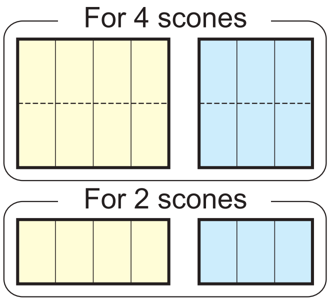


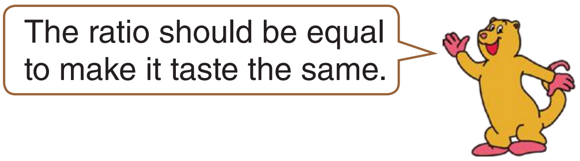
5 200 g of flour and 150 g of water is needed to make 4 scones. To make 2 scones how much flour and water is needed?

$$\div\square$$

$$200 : 150 = \square : \square$$

$$\div\square$$





Exercise

1 Find the number for x.

① $2 : 3 = x : 9$ ② $4 : 5 = 100 : x$

③ $12 : x = 3 : 5$ ④ $x : 20 = 5 : 4$

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

Simplifying the Ratio

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

Gawi's Idea

$$\begin{aligned}12 : 18 &= (12 \div 2) : (18 \div 2)\\ &= 6 : 9\\ &= (6 \div 3) : (9 \div 3)\\ &= 2 : 3\end{aligned}$$

Yamo's Idea

$$\begin{aligned}12 : 18 &= (12 \div 6) : (18 \div 6)\\ &= 2 : 3\end{aligned}$$

Both ideas use the rule of equal ratio.

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

7 Simplify the following ratios.

① $1.2 : 3.2 = (1.2 \times 10) : (3.2 \times 10)$

$$\begin{aligned}&= \square : \square\\ &= \square : \square\end{aligned}$$

② $\frac{2}{5} : \frac{3}{8} = \frac{16}{40} : \frac{15}{40}$

$$\begin{aligned}&= \left(\frac{16}{40} \times \square\right) : \left(\frac{15}{40} \times \square\right)\\ &= \square : \square\end{aligned}$$

Changing both numbers into smaller whole numbers.

Exercise

1 Simplify the following ratios.

① 25 : 35 ② 7 : 28 ③ 180 : 120 ④ 0.6 : 2.9 ⑤ $\frac{3}{4} : \frac{2}{3}$

2 Simplify the ratio of vinegar and cooking oil in the Japanese salad sauce shown on page 92.

3 Application of Ratio

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

① There is a right triangle ⓐ.

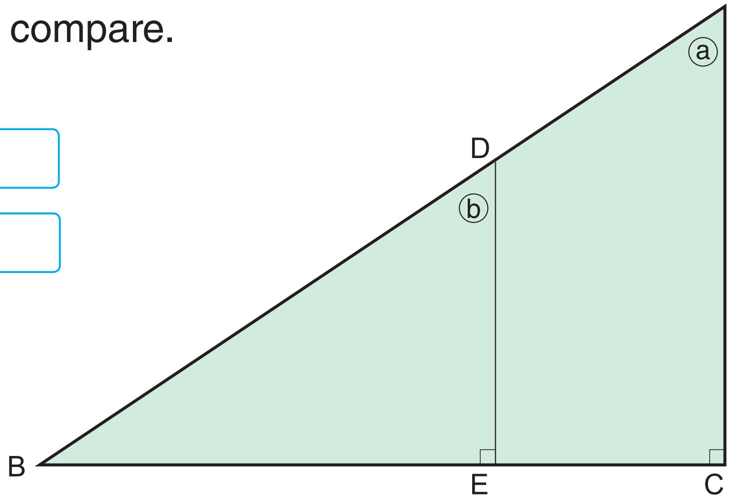
Put point E on side BC and make a right triangle ⓑ.

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

Measure the lengths to compare.

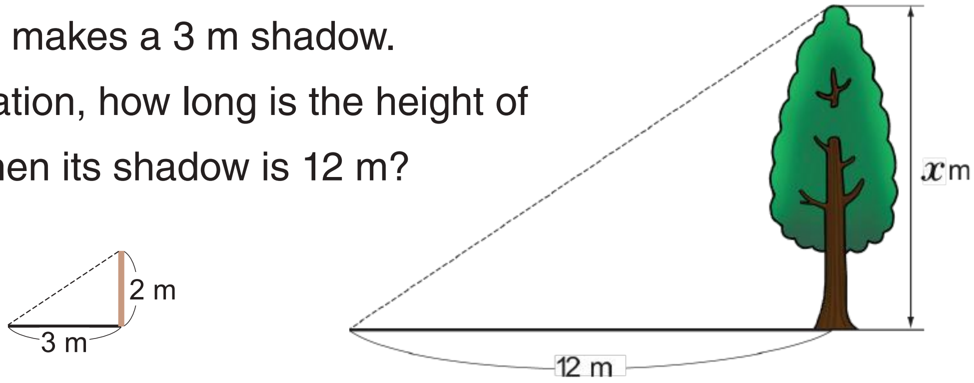
DE : EB = ☐ : ☐

AC : CB = ☐ : ☐



② A 2 m pole makes a 3 m shadow.

In this situation, how long is the height of the tree when its shadow is 12 m?



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

$\times\square$

$$2:3 = x:12$$

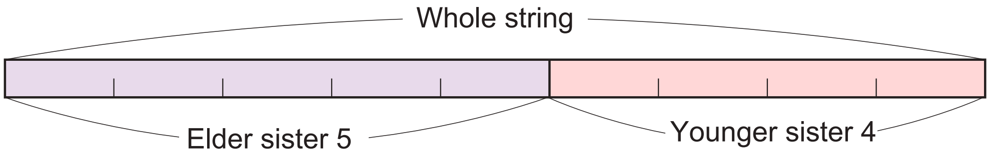
$\times 4$

Exercise

How long is the height of the tree if its shadow is 15 m in the same situation as problem ②?

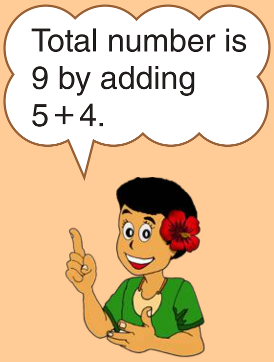
Dividing by Ratio

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



Ambai's Idea

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



Sare's Idea

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

Exercise

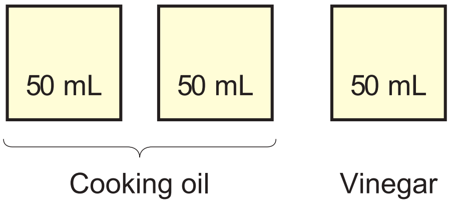
We divide 500 mL of milk for Jaydan and his father in the ratio of 2 : 3.
How much milk does Jaydan get?

EXERCISE

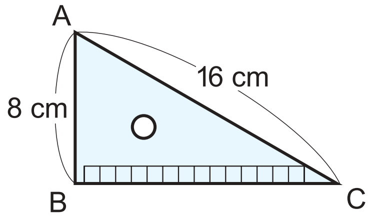
1 Let's represent the ratios for the following:

Page 94

① The quantity of cooking oil and vinegar.



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



2 Find the number for x.

Pages 96 and 97

① $3 : 5 = x : 10$

② $7 : 4 = 35 : x$

③ $80 : x = 5 : 8$

④ $x : 125 = 3 : 5$

3 Simplify the following ratios.

Page 98

① 36 : 48

② 800 : 1400

③ 1.2 : 0.8

4 You draw a rectangle, where the ratio of length to width is 2 : 3.

If the width is 18 cm, how long is the length?

Page 99

Grade 5

Do you remember?

Let's calculate.

① 3.6×1.2

② $1.5 \div 2.5$

③ 6.4×0.8

④ $4.32 \div 3.6$

⑤ 9.43×4.1

⑥ $4.08 \div 5.1$

⑦ $\frac{1}{6} + \frac{1}{2}$

⑧ $\frac{8}{15} - \frac{1}{3}$

⑨ $\frac{7}{12} + \frac{7}{8}$

⑩ $1\frac{1}{2} - \frac{2}{3}$

⑪ $2\frac{1}{6} + \frac{5}{12}$

⑫ $2\frac{3}{4} - 1\frac{3}{8}$

PROBLEMS

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

● Utilising equal ratio.

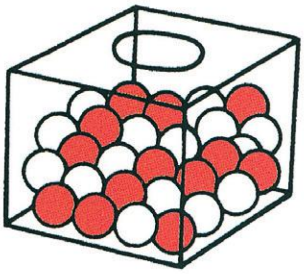
① How many g of steamed rice and curry do you need, to make curry rice for 2 people?

② How many g of steamed rice and curry do you need, to make curry rice for 8 people?

③ There is 600 g of steamed rice.
If you try to make curry rice in the same ratio as the one you made for 4 people, how many g of curry do you need?

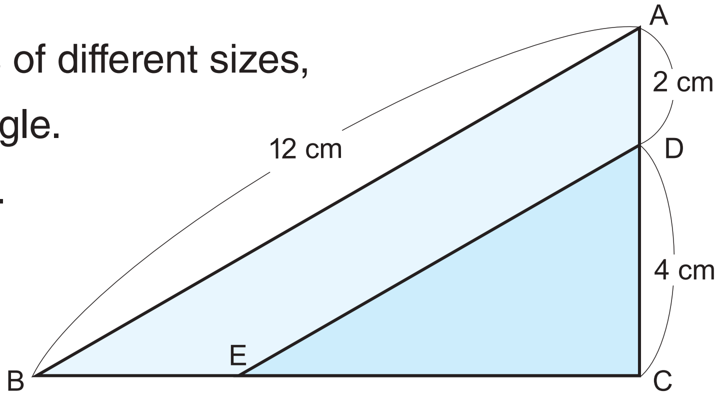
2 Ben is drawing a box which has red balls and white balls in the ratio of 3 : 4.
There are 28 white balls.
How many red balls should he draw?

● Representing ratio of two quantities.



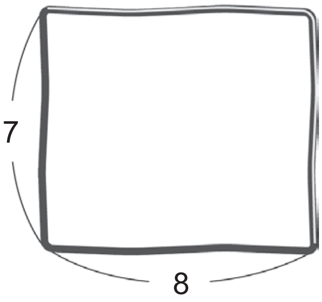
3 There are two set-squares of different sizes, overlapping at the right angle.
Find the length of side DE.

● You can use equal ratio in the diagram.



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

● You can use dividing by ratio.



Mathematics Practices in Papua New Guinea

Traditional Patterns and Symmetry

Papua New Guinea consists of diverse cultures, customs and languages and is also home to many distinctive traditional patterns, shapes and symbols that indicate the practices of mathematics in culture and tradition.

Many of these can be seen mostly as symmetrical structures or figures, demonstrated in tattoos, artefacts, bilum and basket weaving, initiations, traditional buildings, costume designs and many more.


Central Tattoos

Tattoos play significant roles in respective tribes. They can be found on different parts of the body depending on their significance.

Whole-body tattooing is common in some parts of Papua New Guinea. Some are done as an indication of maturity while others represent tribal identity. Different patterns of lines and figures are used in symmetry with bush materials to draw lines and congruent shapes.

Bilums come in different patterns with each pattern resembling certain tribes or clans.

More complex and specific patterns are made for carrying during public appearances or special ceremonial events including yam festivals, tumbuan dances, bride price payment, compensation and barter system.

These patterns are inherited from elders and carefully woven using cane or bamboos to create uniform and symmetrical patterns and shapes.


Highlands Bilum


Momase Bilum

Here are more examples of symmetrical patterns and figures in PNG.


Sepik Carving


Oro Tapa

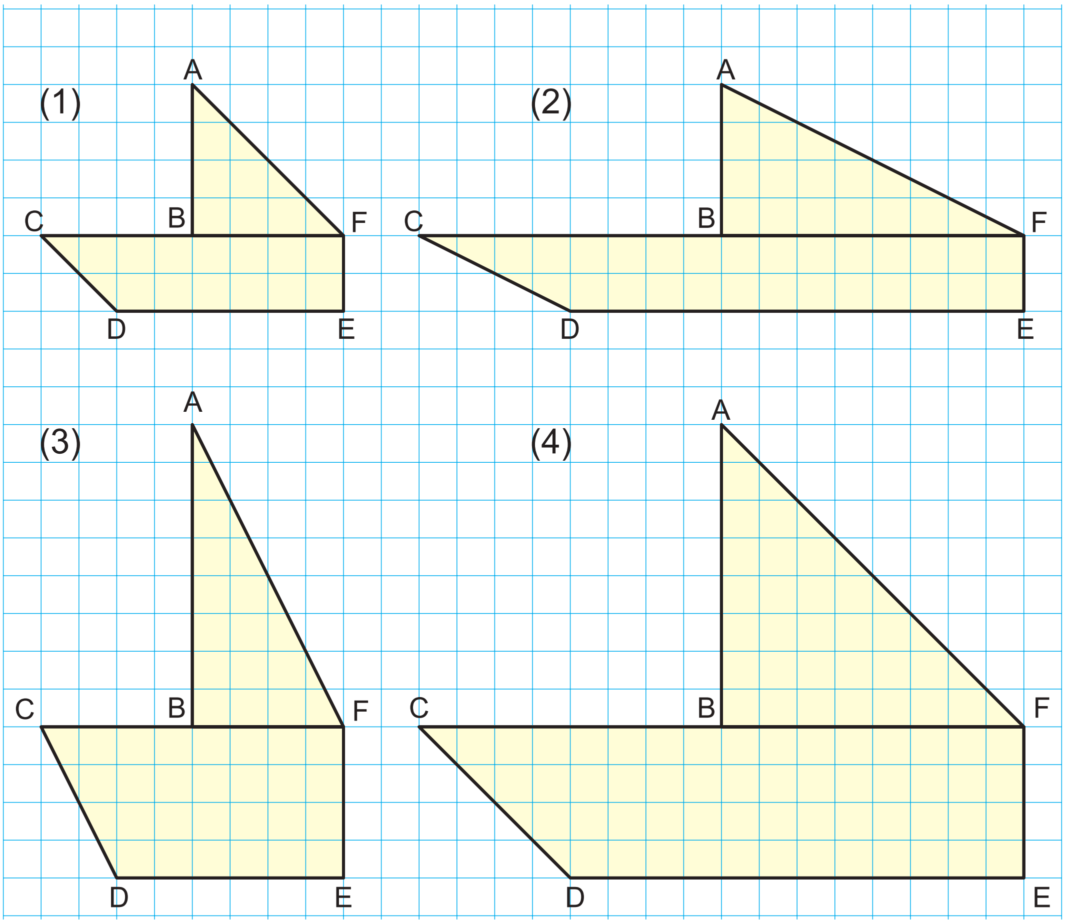

Buka Tray and Basket

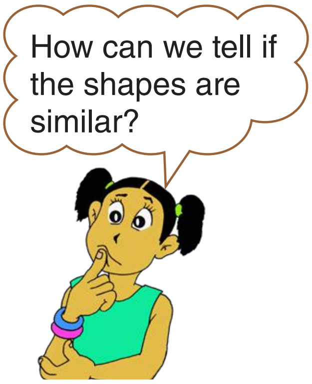

Milne Bay Yam House

12

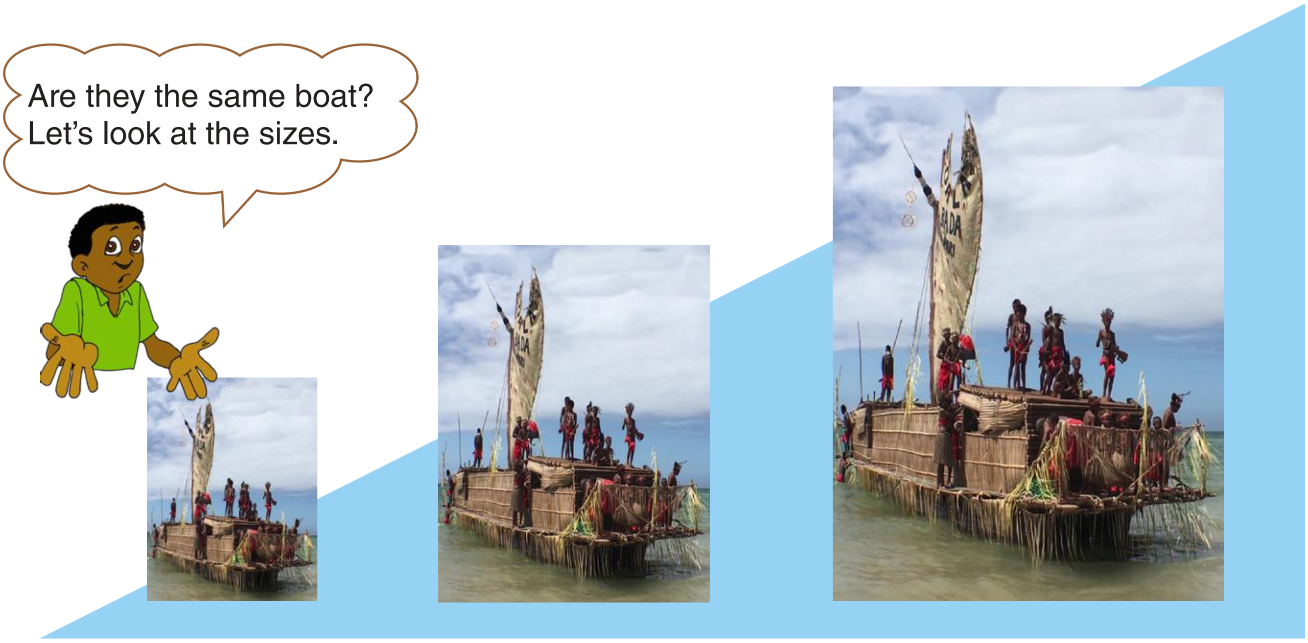
Enlargement and Reduction of Figures

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





1 Enlarging and Reducing Figures



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

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

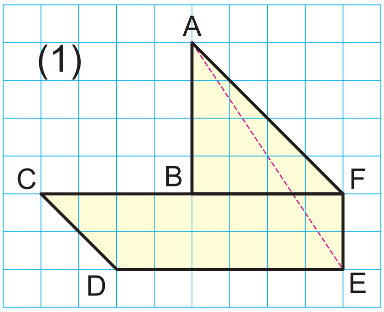
	Length of side (cm)			Angle (Degree)			
	Side AB	Side CD	Side AF	Angle A	Angle C	Angle D	Angle E
(1)	2	1.4	2.8	45	45	135	90
(2)							
(3)							
(4)							

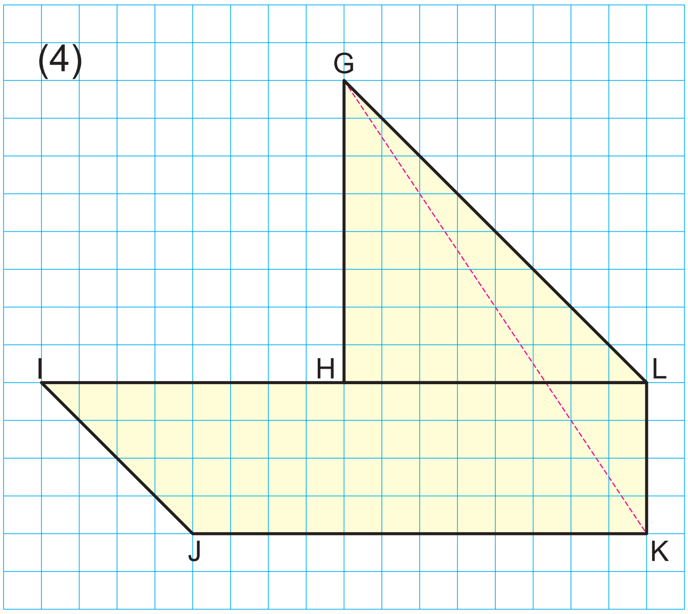
② Compare the lengths of the 3 sides. Which shape has the length 2 times the length as in (1)?

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

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

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





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

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

Side DE : Side JK = ☐ : ☐

Side DE ÷ Side JK = $\frac{\square}{\square} = \square$ (times more)

Let's investigate the other corresponding sides lengths.

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

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

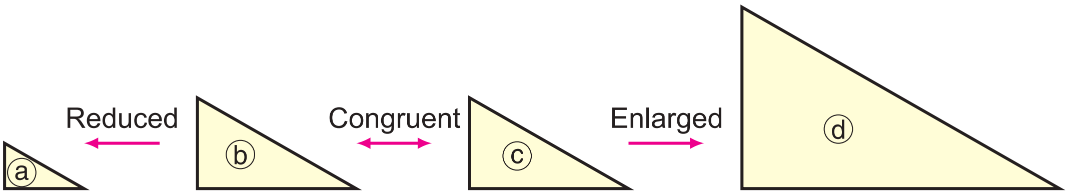
③ Let's compare the corresponding angles.

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

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

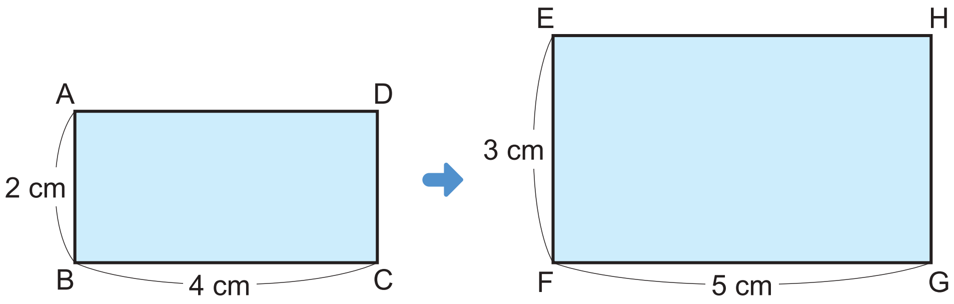
Figure (4) is two times an enlarged drawing of figure (1) and figure (1) is a $\frac{1}{2}$ reduced drawing of figure (4).

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



Exercise

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



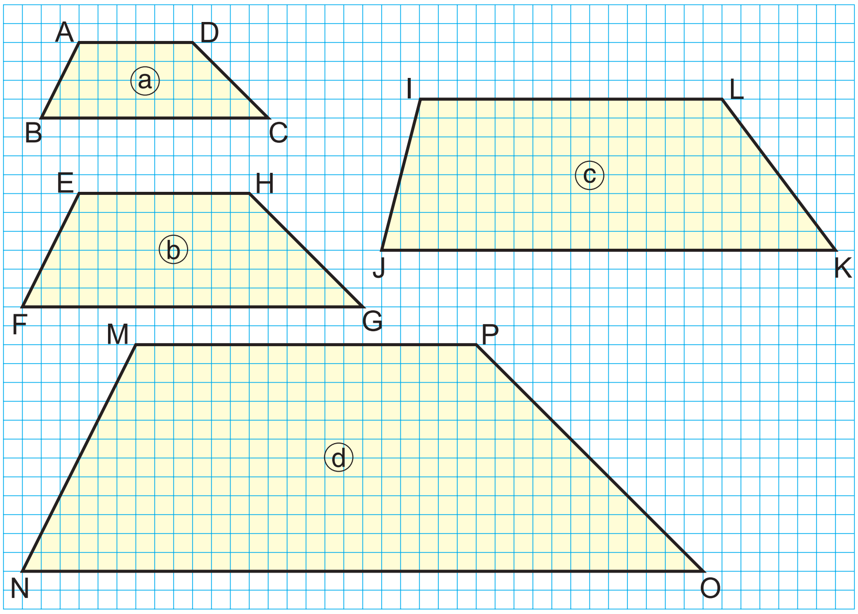
① Is rectangle EFGH an enlarged figure of rectangle ABCD?

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

3 Let's investigate the figures below.

① Which is an enlarged drawing of figure ⓐ and by how many times is it enlarged?

② Which is a reduced drawing of figure ⓓ and by how many times is it reduced?



4 Look around you and find enlarged and reduced figures.

Reduced image captured on camera.

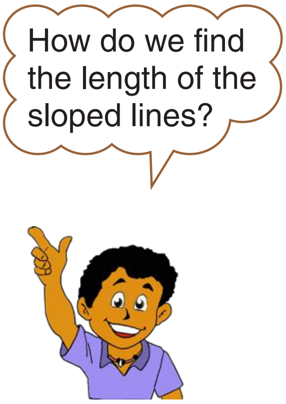
Enlarged image in a microscope.

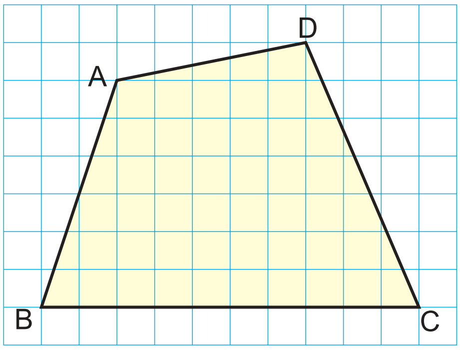
2 How to Draw Enlarged and Reduced Figures

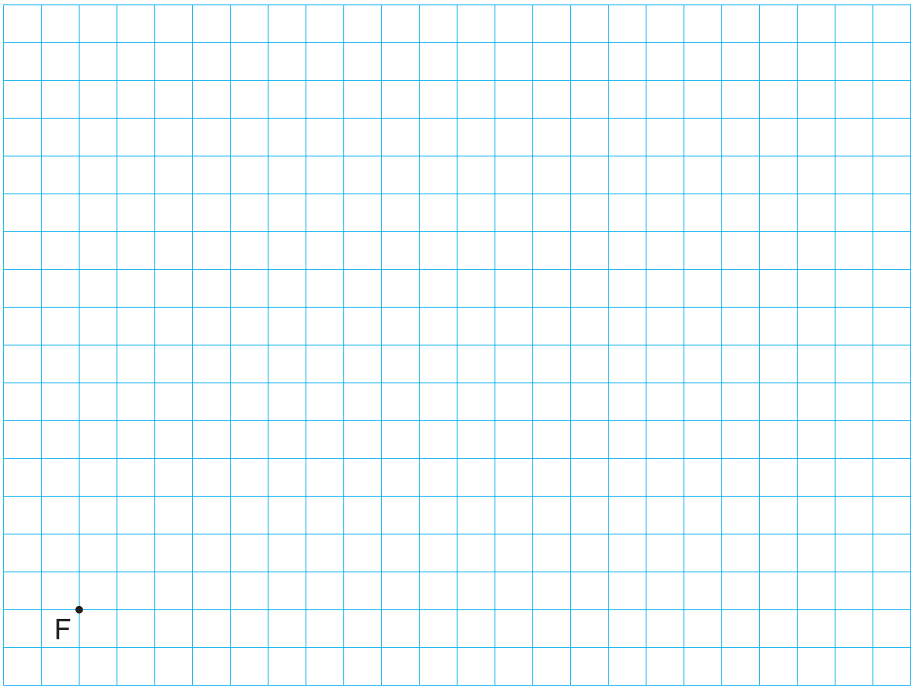
How to Draw Using Grid Paper

1 Let's think about how to draw an enlarged figure EFGH which is 2 times of the quadrilateral ABCD.

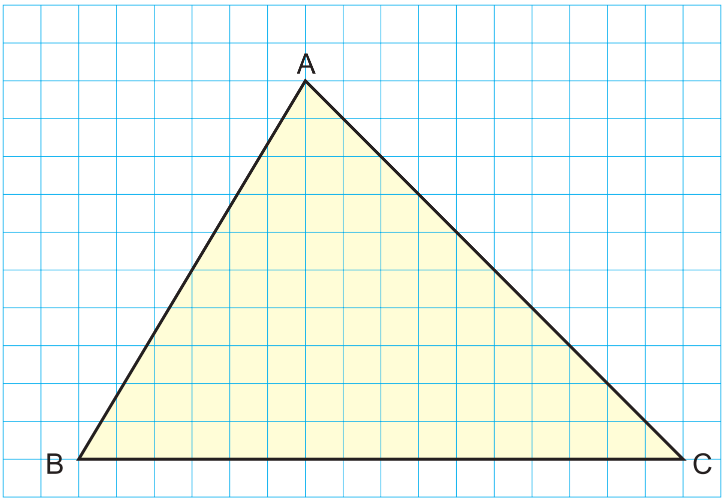
Point F is corresponding to point B and it is already drawn on the grid paper.



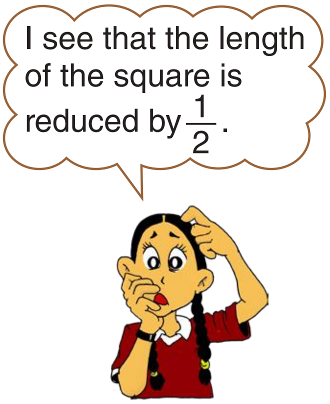




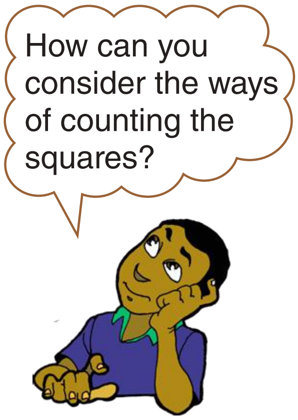
2 Draw triangle DEF which is triangle ABC reduced by $\frac{1}{2}$ on the two grid papers below.



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

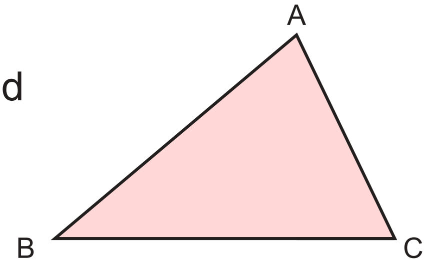


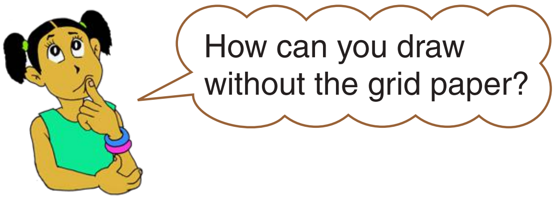
② Draw triangle DEF, in which the side length of the square is equal to the original grid above.



How to Draw Using Sides and Angles

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



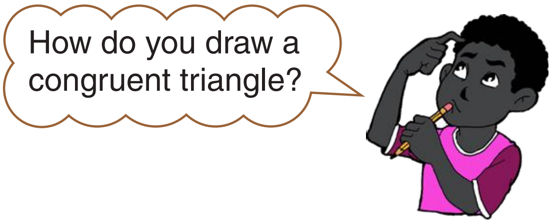


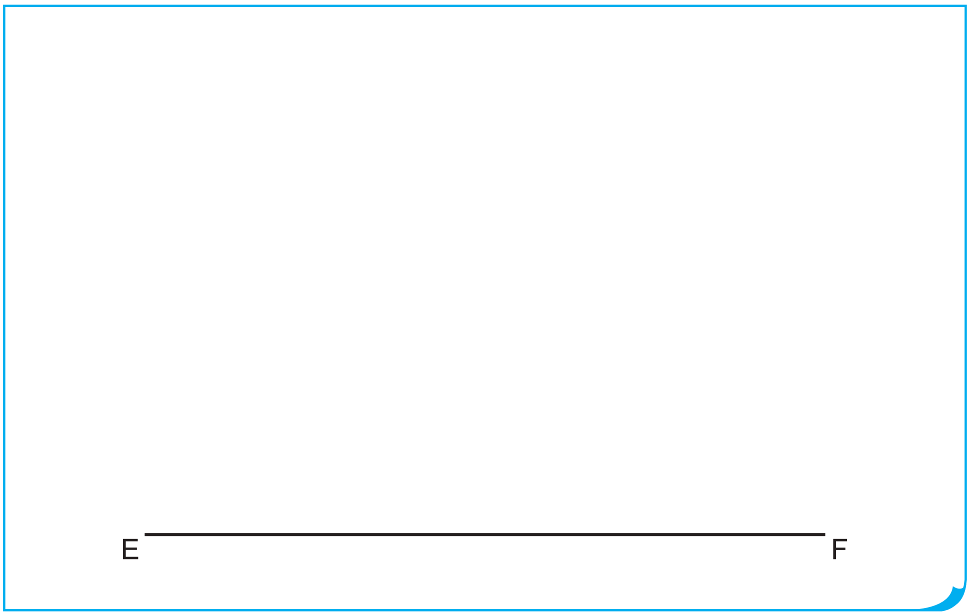
① Which sides and angles should you measure?

② Line EF, which is twice the enlarged line of line BC is already drawn.

Point D is the corresponding point of point A.

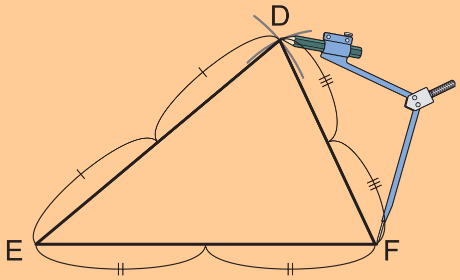
Let’s think about where point D should be placed and finish the drawing.





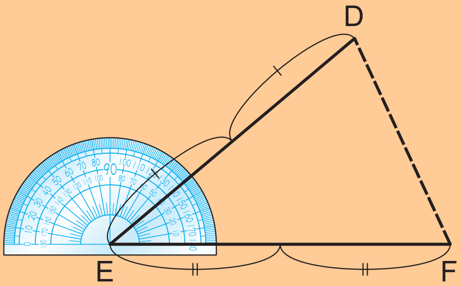
Vavi's Method to Draw

Enlarge all 3 sides to twice the lengths.



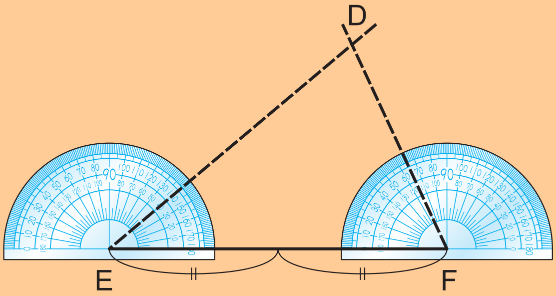
Mero's Method to Draw

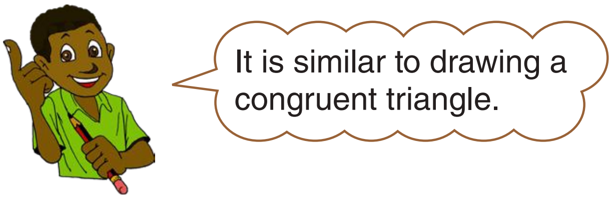
Enlarge 2 sides twice the lengths and use the angle between 2 lines.



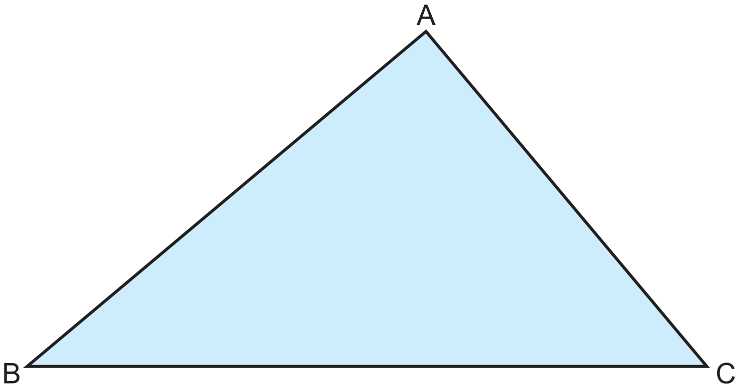
Naiko's Method to Draw

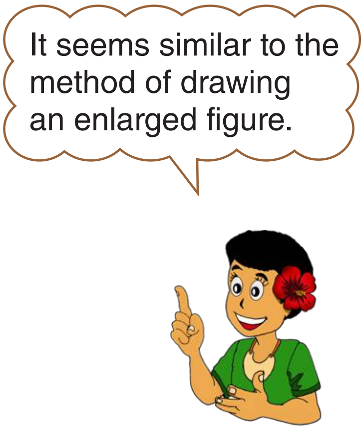
Enlarge 1 side twice the length and use 2 angles on the other line.





4 Let’s think about the way to draw triangle DEF, which is a $\frac{1}{3}$ reduced drawing of triangle ABC.



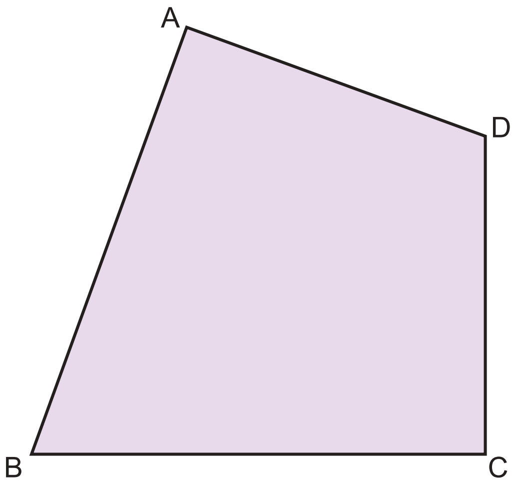


① Draw triangle DEF in your own way and explain how you drew it to your friend.

② Whose method is similar to how you drew your triangle?

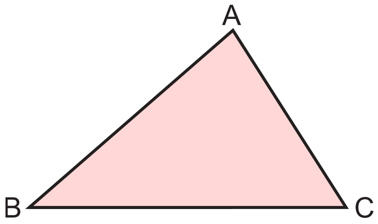
Exercise

Let’s draw a 2 times enlarged drawing and a $\frac{1}{2}$ reduced drawing of the quadrilateral on the right.

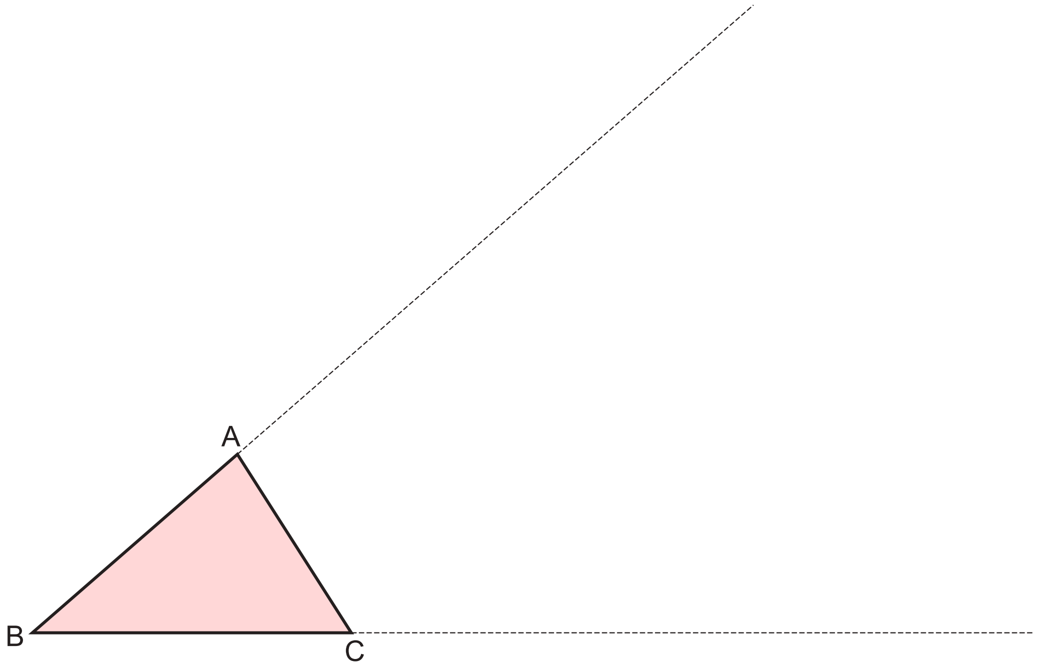


How to Draw Using Centre Point

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



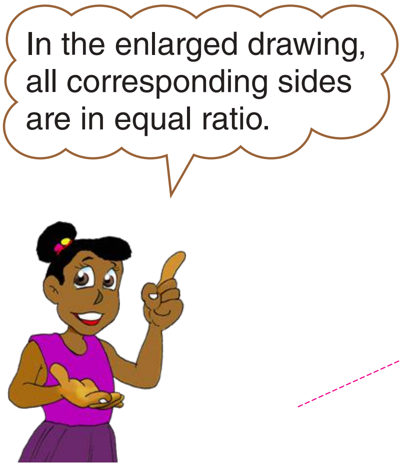
① Extend line BA and place point D, corresponding point of point A. Then extend line BC and place point E, corresponding point of point C.

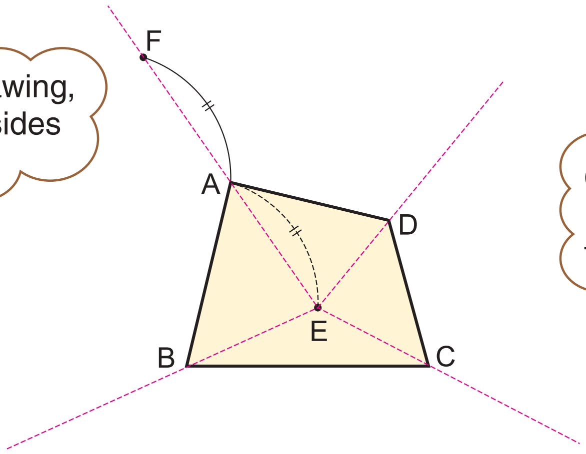


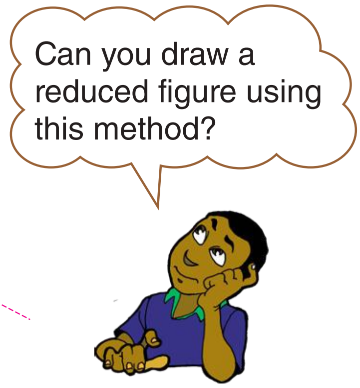
② Check and see if triangle DBE is 3 times triangle ABC.

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

6 Use point E as the centre point and think about the way to draw a 2 times enlarged quadrilateral FGHI which corresponds to quadrilateral ABCD.







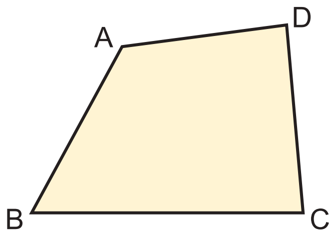
Line EA is extended.

Point F which corresponds to point A is already drawn in the diagram above.

Let's continue to complete the drawing.

Exercise

Place a centre point and draw a 2 times enlarged drawing and a $\frac{1}{2}$ reduced drawing of quadrilateral ABCD.

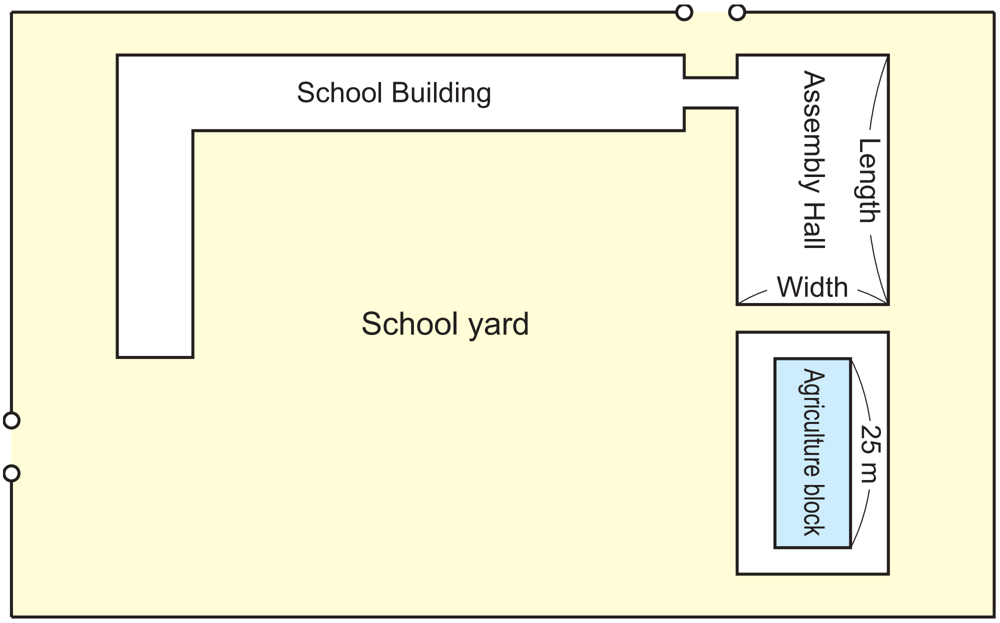


③ Uses of Reduced Figures

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

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

② How long in m is the actual length of 1 cm on the reduced drawing?



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

There are 3 ways to show a **reduced scale**.

Ⓐ $\frac{1}{1000}$ Ⓑ 1 : 1000 Ⓒ

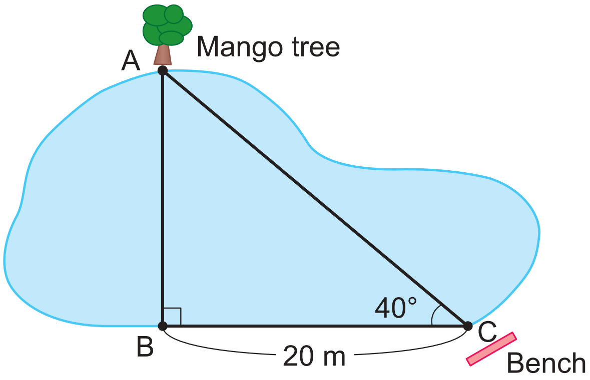
Figure Ⓒ represents 1 cm which is equal to 10 m on the scale.

③ What is the actual length and width of the school hall in m?

Width : $2 \times 1000 = \boxed{}$ cm Length: $3.3 \times 1000 = \boxed{}$ (cm)

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

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

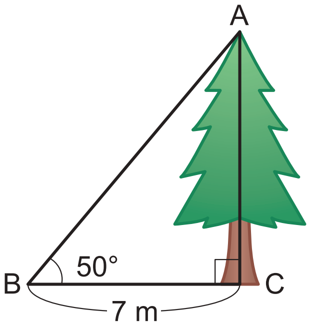


① Follow the steps below and draw a reduced drawing of the right triangle ABC in $\frac{1}{500}$ reduced scale.

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

② Measure line AB of the reduced figure and find the actual distance to the mango tree.

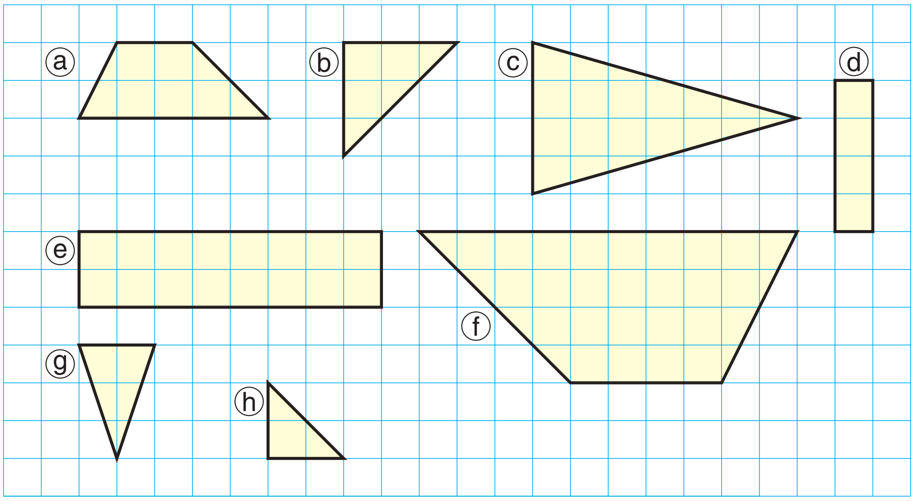
3 How tall in m is the tree shown below?
Explain the way to solve using mathematical sentences, figures and words.



EXERCISE

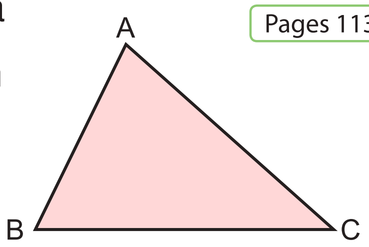
1 Which shape is an enlarged or a reduced figure of the other? Give reason.

Pages 104 to 110



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

Pages 113 to 115



3 There is a map of a school that is drawn in $\frac{1}{500}$ reduction scale.

Pages 116 and 117

In the reduced drawing, the school hall is in the shape of a rectangle 6 cm length and 3.2 cm width. What are the actual widths and lengths of the school hall in m?

Grade 6

Do you remember?

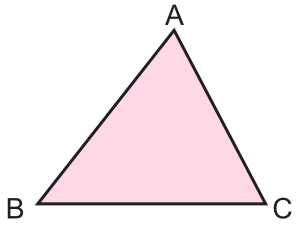
Let's calculate.

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

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

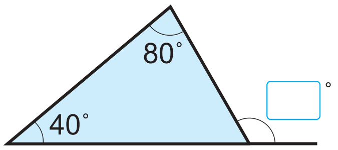
REVIEW

1 Let's draw a congruent triangle as the one on the right.
Which length and angle do you need to know in order to draw one?

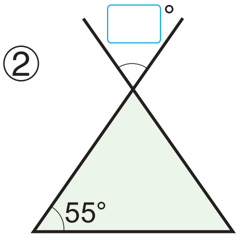


2 Let's fill in the □.

①

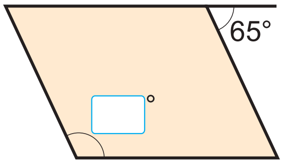


②



Isosceles triangle

③



Parallelogram

3 Let's divide in vertical form.

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

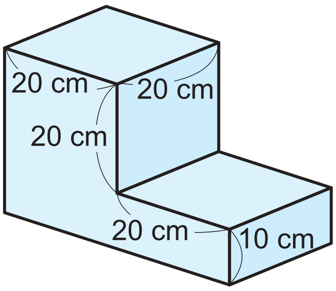
4 Let's find the quotient by (whole) number, without decimals and remainder.

① 6.1÷1.7　② 9.7÷0.6

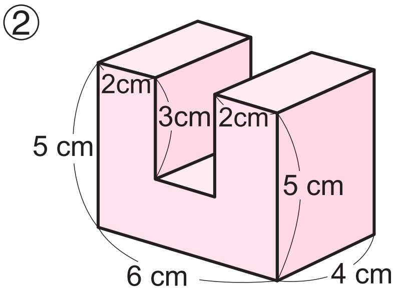
5 There are 13.5 kg of rice. If you eat 0.9 kg of the rice every day, how many days will it take to finish the rice?

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

①



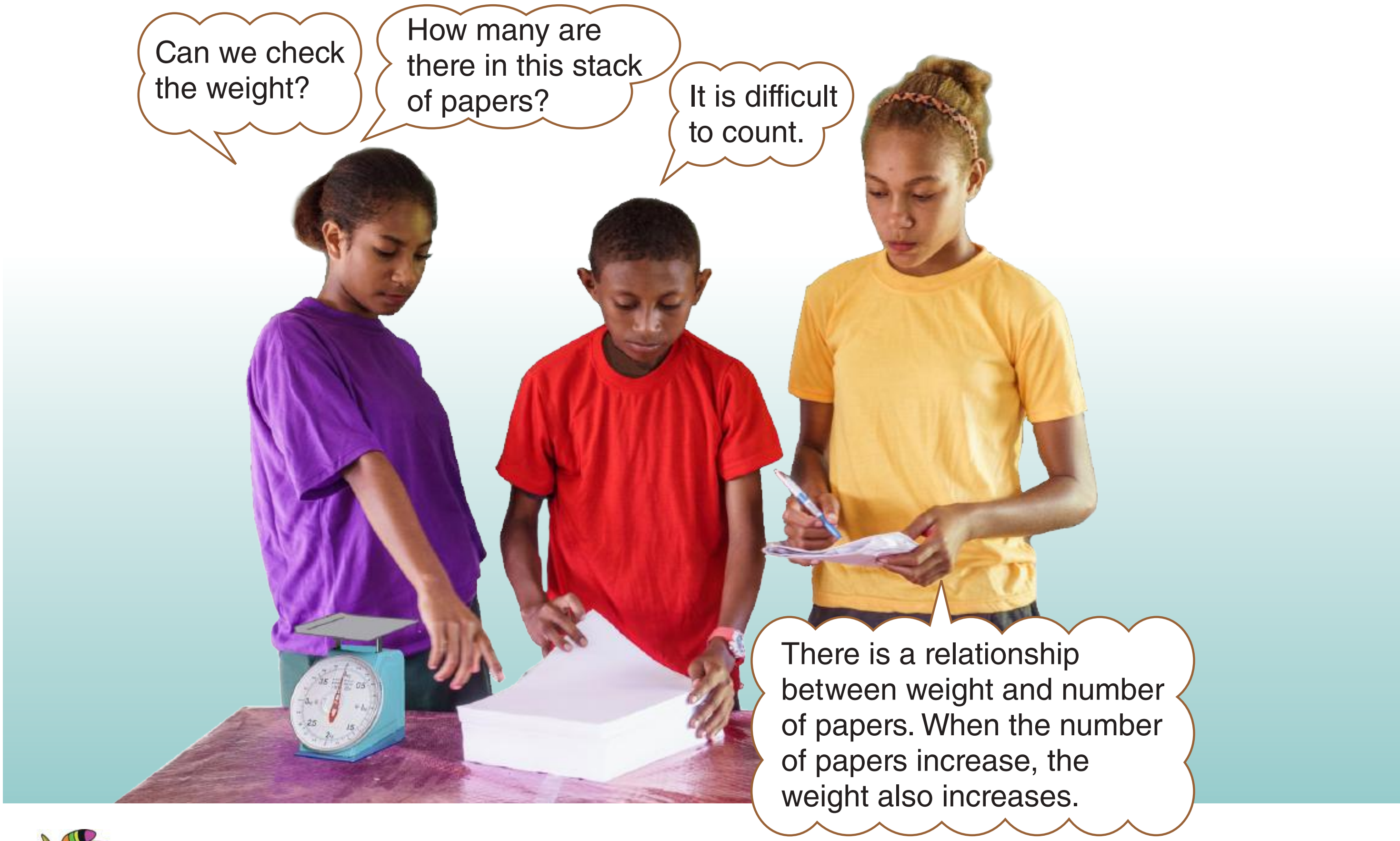
②



13

Proportion and Inverse Proportion

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



Let's do the experiment.

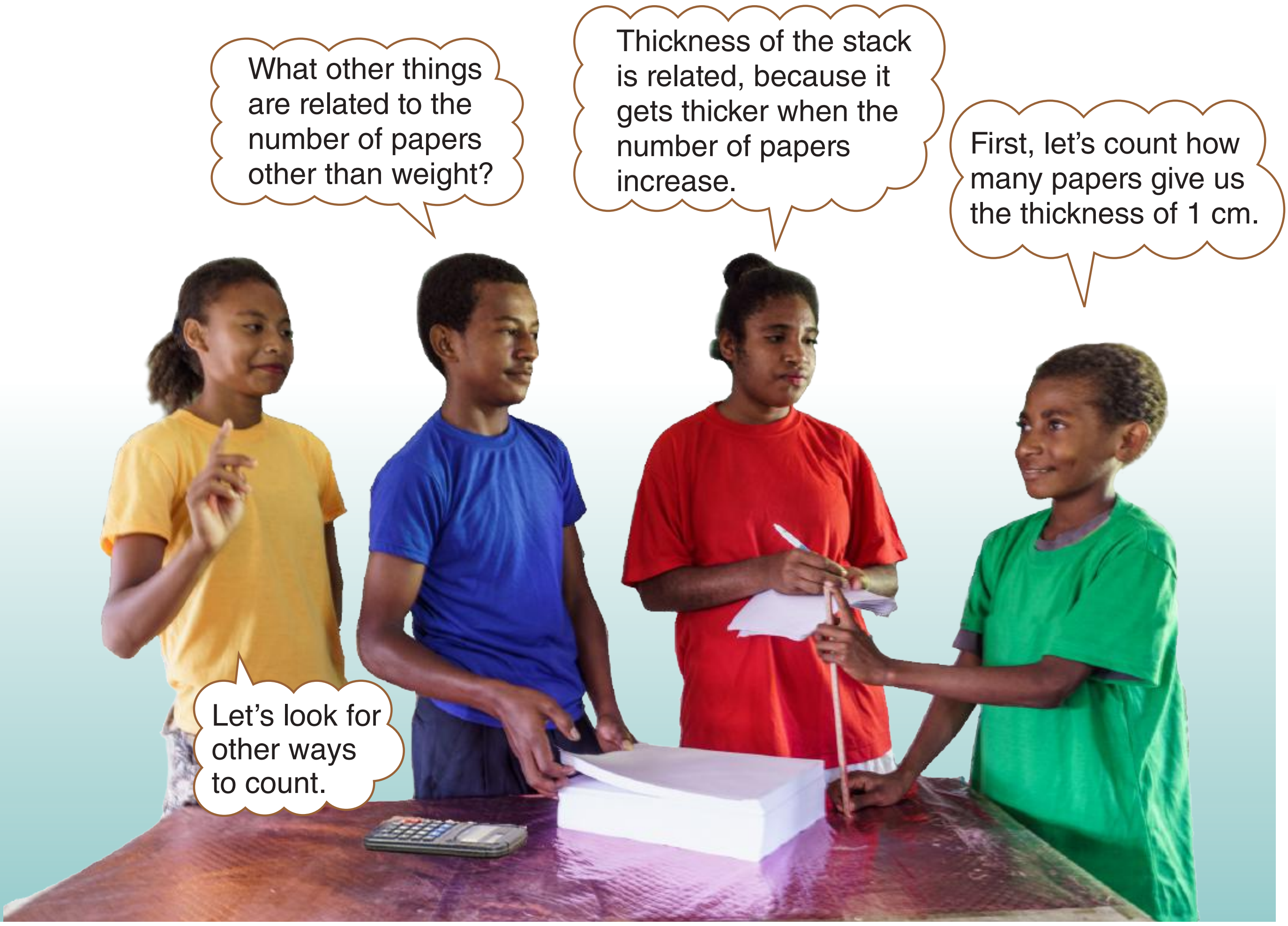
▷▷ To find how many papers are in the stack, let's investigate the relationship between the number of A4 papers and weight.

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

Number of Papers and Weight

Number of papers (sheets)	10	20	30	40	50
Weight (g)					

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



Let's do the experiment.

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

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

Number of Papers and Thickness

Number of papers (sheets)					
Thickness (cm)	1	2	3	4	5

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

1 Proportion

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

(Mathematics Report) Date: Monday, 11th November

Theme : Check out the relationship between number of papers and weight.

Materials : Stack of papers, scale and calculator.

How : Weigh each number of papers and record the weight in the table.

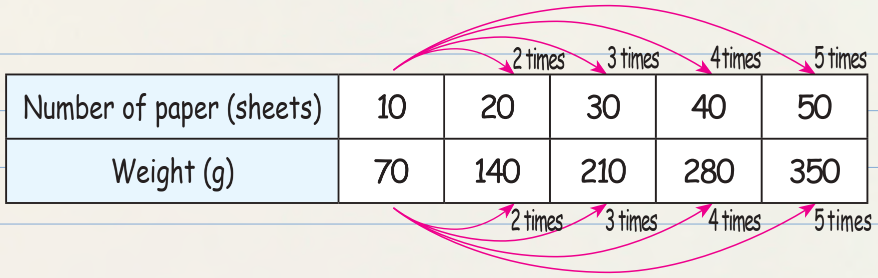
Prediction : Number of papers and weight will be in proportion.

Result :

Number of Papers and Weight

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

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



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

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

Phrase

"Therefore, it is ~"

Phrase that you use to explain reasoning from the result.

1 There are 1400 g of papers that Lucial's group weighed.

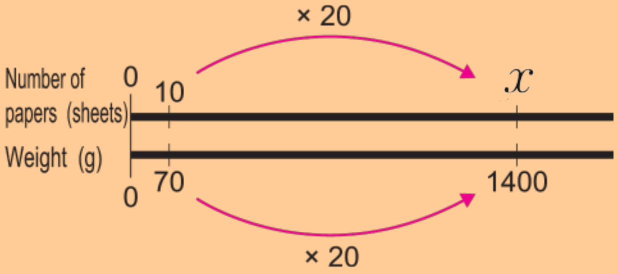
How many sheets are there in this stack?

Fill in the ☐ below and explain each idea to your friend.

Ambai's Idea

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

☐ × 20 = ☐



Gawi's Idea

Find how many papers are there in 1 g.

$10 \div 70 = \frac{1}{7}$

It is 1400 times more than 1 g of paper.

☐ × 1400 = ☐

× 1400

Number of papers (sheets)	$\frac{1}{7}$	?
Weight (g)	1	1400

× 1400

Kekeni's Idea

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

÷ ☐

$10 : x = 70 : 1400$

÷ ☐

Mero's Idea

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

× ☐

$10 : 70 = x : 1400$

× ☐

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

Number of Papers and Thickness

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

① Let's make a mathematics report based on this table.

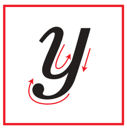
② When the thickness of the stack is 9 cm, how many sheets of paper are there?

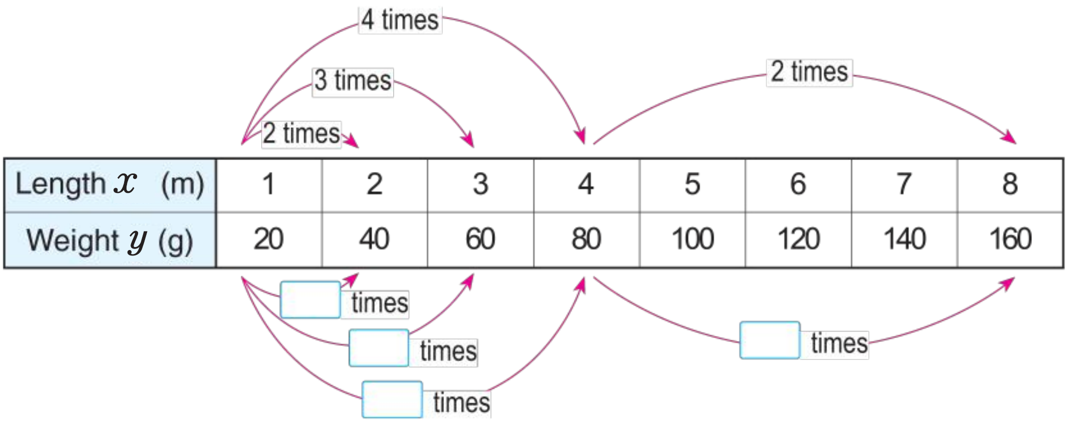
3 Investigate the relationship between the length of a wire and the weight.

Length of a Wire and Weight

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

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

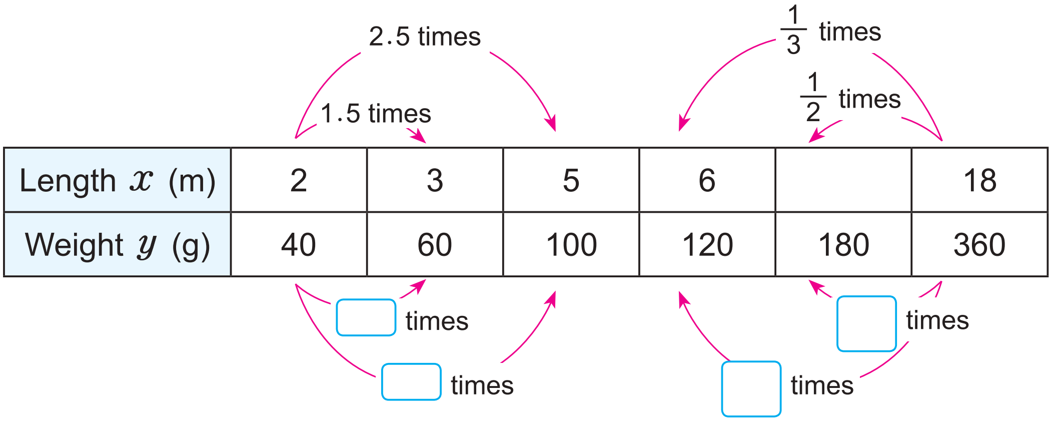




Length x (m)	1	2	3	4	5	6	7	8
Weight y (g)	20	40	60	80	100	120	140	160

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

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



Length x (m)	2	3	5	6		18
Weight y (g)	40	60	100	120	180	360

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

Exercise

Let's investigate the relationship between x and y.

① Fill in the blanks on the table with numbers.

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

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

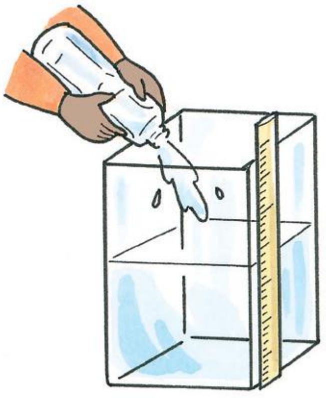
Ⓑ Side and Area of a Square

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

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

Mathematics Sentence of Proportion

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



Volume of Water and Depth of Water in the Tank

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

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

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

Increase by 1 Increase by 1 Increase by 3 Increase by 4

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

Increase by 2 Increase by ☐ Increase by ☐ Increase by ☐

The rule of how the water increases.

When you pour 1 L of water, the depth increases by ☐ cm.

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

$2 \div 1 = \square$
$4 \div 2 = \square$
$6 \div 3 = \square$
$\vdots$

Ⓐ What does the quotient of $y \div x$ mean?

Ⓑ Compare the quotient and the rule of how the water increases.

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

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

$$\boxed{y = \square \times x}$$

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

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

Length of a Wire and Weight

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

① Find the quotient of $y \div x$.

② Represent the relationship of x and y in a mathematical sentence.

$$y = \boxed{} \times \boxed{}$$

③ Find the weight of 12 cm of wire.

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

$$y = \text{constant number} \times x$$

The constant number in a proportion relationship represents

① How much value of y increases when x value increases by 1.

② Quotient of $y \div x$.

③ Value of y when value of x is 1.

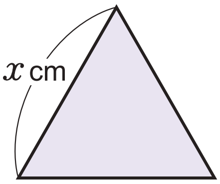
Exercise

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

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

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

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



Side and Perimeter of an Equilateral Triangle

Side x (cm)	1	2	3	4	5	6
Perimeter y (cm)	3	6				

① Let's fill in the table.

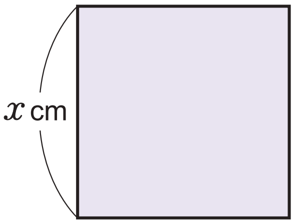
② Is y directly proportional to x?

③ Let's represent the relationship of x and y in a mathematical sentence. What does the constant number represent?

When y is proportional to x, it is also represented by a mathematical sentence below.

$$y = x \times \text{constant number}$$

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



Exercise

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

① Diameter x cm and perimeter y cm in a circle.

② 50 kina ball, x ball and total cost y kina.

③ A side x cm and perimeter y cm in a hexagon.

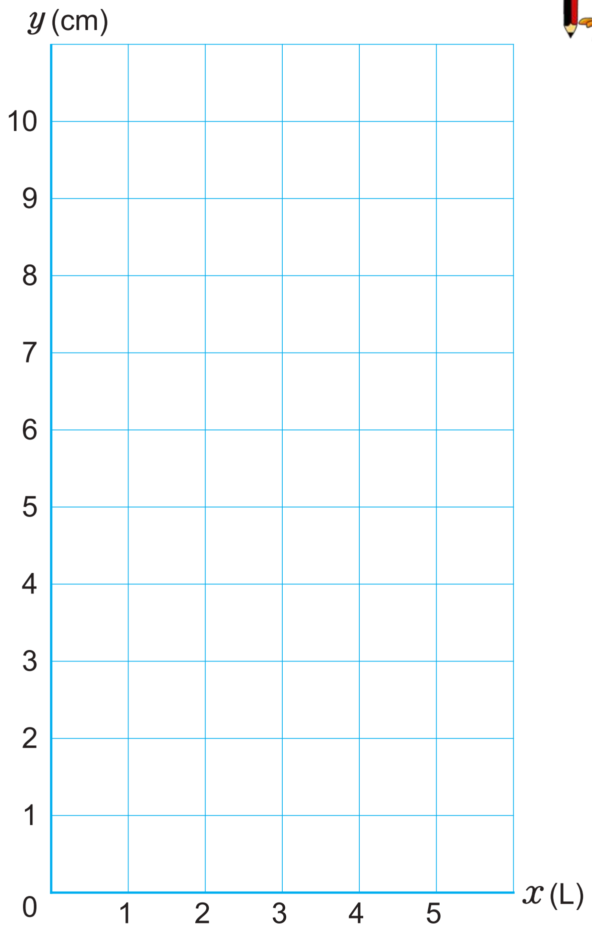
2 Graphs of Proportion

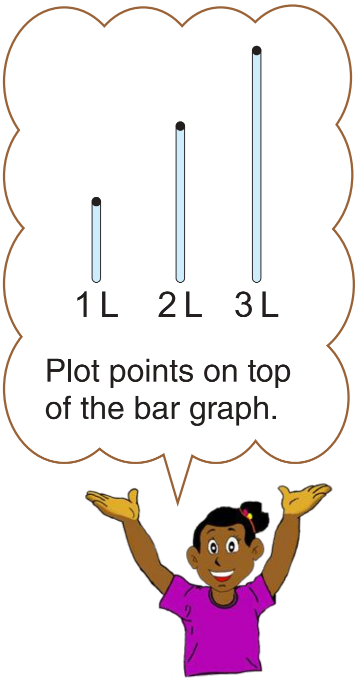
1 Let's make a graph that represents the relationship between the volume of water x L and the depth of water y cm when poured into a tank.

Volume of Water and Depth

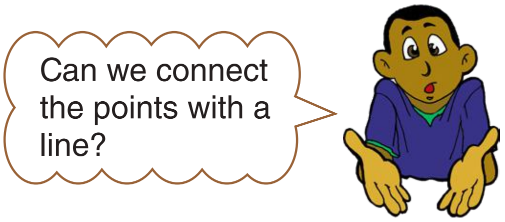
Volume of water x (L)	0	1	2	3	4	5
Depth y (cm)	0	2	4	6	8	10

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


Volume of Water and Depth



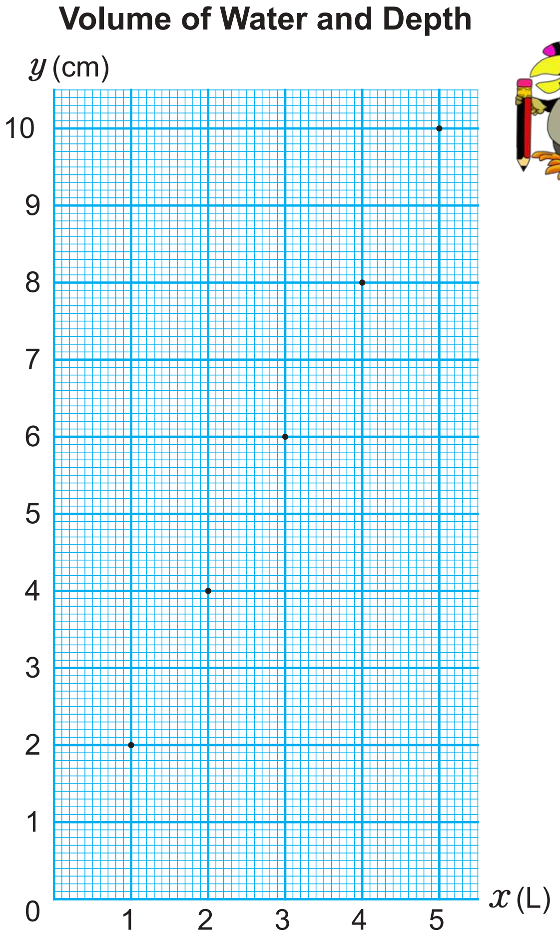
② How are the points lining up?



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

Volume of Water and Depth

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



The mathematical sentence in words is:
2×volume of water=depth

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

x and y can be a decimal.

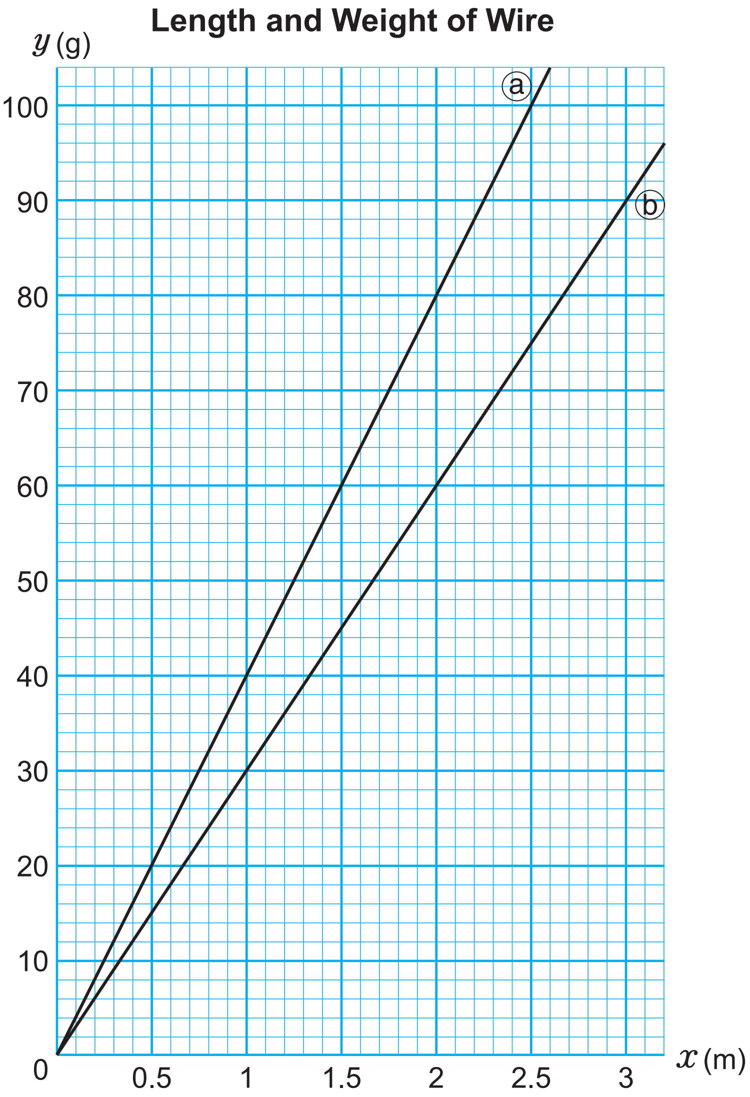
When you draw a proportional relationship in the graph, it becomes a straight line that goes through the origin.

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

❶ Which wire weighs more?
How did you find it from the graph?

❷ Read the lengths or weights of each wire.
① Weights of 2.4 m of wire ⓐ and ⓑ.
② Lengths of 48 g of wire ⓐ and ⓑ.

❸ How much is the weight of each wire per m?



❹ What do the following wires represent, ⓐ or ⓑ?
Ⓐ 3.8 m and 114 g of wire.
Ⓑ 4.2 m and 168 g of wire.

③ Using the Properties of Proportion

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

Volume of Cola and Sugar

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

① Is the weight of sugar y g, proportional to the volume of cola x millilitres (mL)?

② How many grams of sugar is in 250 mL of cola?

Sare's Idea

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

×5

x	50	250
y	6	?

×5

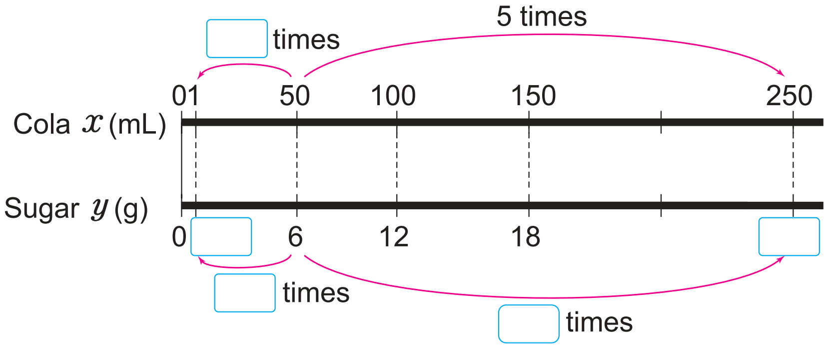
Vavi's Idea

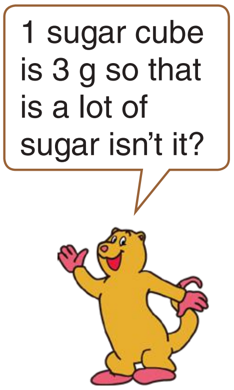
The weight of sugar per millilitre of cola is constant, therefore I can make a mathematical sentence.

×250

x	1	250
y	☐	?

×250





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

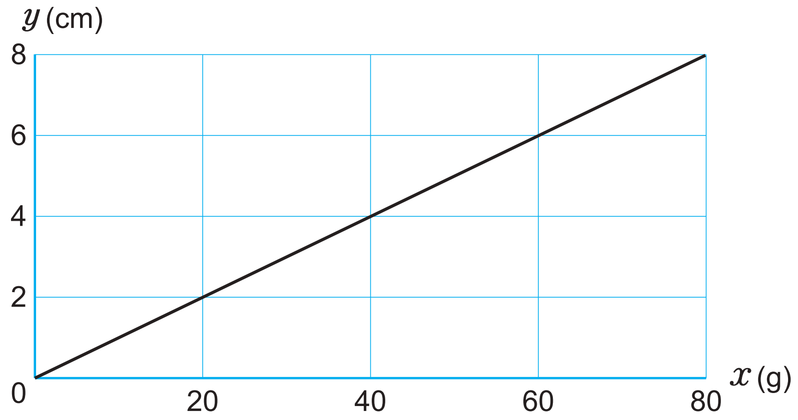
Ⓑ Let's represent the relationship between x and y in a mathematical sentence using Vavi's idea.

$$y = \boxed{} \times x$$

③ How many g of sugar are in 180 mL cola?

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

Weight and Extended Length of Rubber



❶ If the weight increases by 20 g, how long does the rubber extend in cm?

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

❸ If you attach a stone onto the rubber and it extends to13 cm. What is the weight of this stone?

Exercise

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

Number of Nails and Weight

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

① Is y proportional to x?

② Find the number that goes into ⓐ, ⓑ and ⓒ.

③ Represent the relationship between x and y in a mathematical sentence. How many nails are there if the weight is 240 g?

Predict the Global Environment

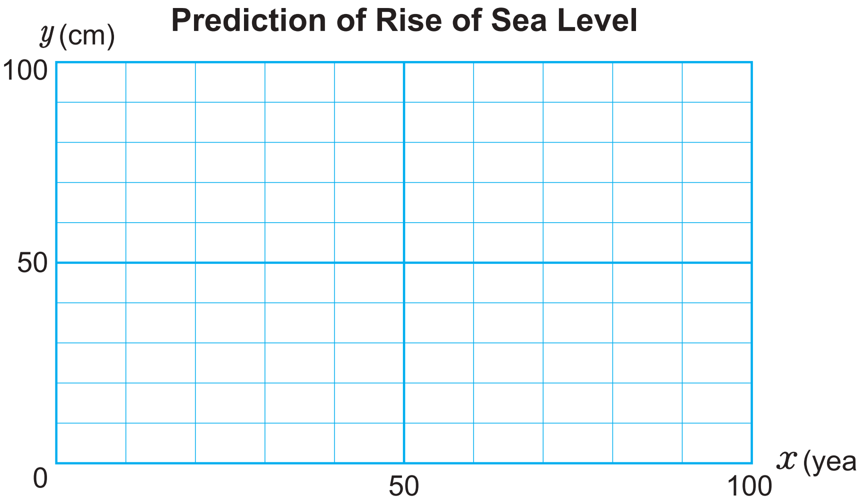

Manus Island

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

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

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

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



② After how many years, will the land that is 50 cm above the sea level be covered by the sea completely?


(Funafuti, Tuvalu)

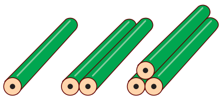
EXERCISE

1 Complete the tables below.

Pages 120 to 125

① **Number of Pencils and Price**

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



② **Walking Time and Distance**

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

2 Represent the following relationship of x and y in a mathematical sentence.

Pages 123 to 129

Length and Weight of Wire

Length x (cm)	0	1	2	3	4	5	6
Weight y (g)	0	3	6	9	12	15	18

3 A ribbon costs 80 toea per 1 m.

Pages 130 to 134

① Show the relationship between the length of ribbon x cm and its cost y toea in the table below.

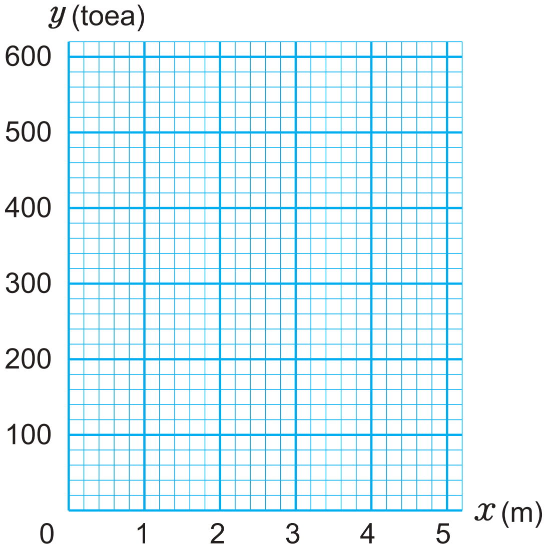
Length and Price of Ribbon

Length x (cm)	0	1	2	3	4	5
Cost y (toea)	0	80				

② Represent the relationship of x and y in a mathematical sentence.

③ Show the relationship of values x and y, on the graph.

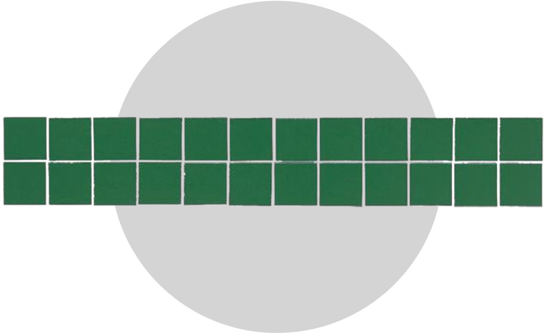
Length and Price of Ribbon

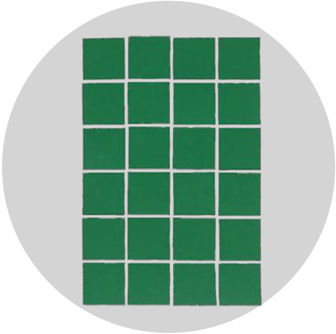


4 Inverse Proportion

1 How does the length and width of a rectangle with a fixed area of 24 cm² change?

① Make many kinds of different rectangles using 24 of 1 cm² squares and complete the table below.

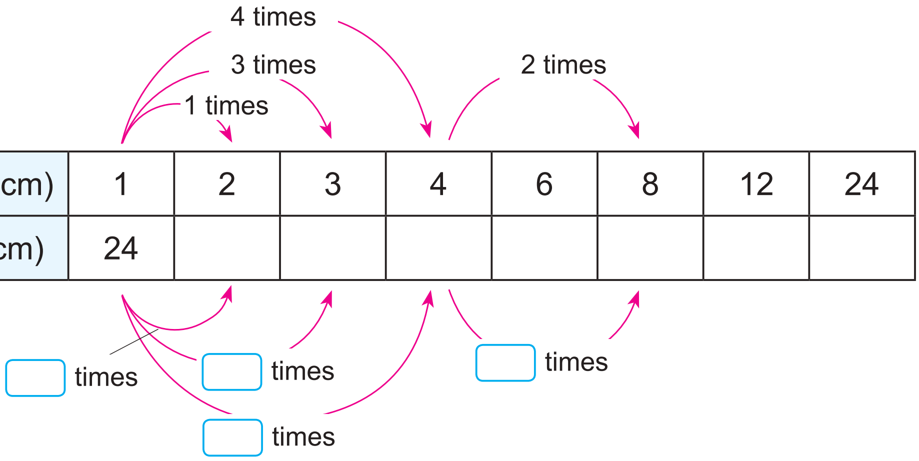




Length and Width of a Rectangle with an Area of 24 cm²

Length x (cm)	1	2	3	4	6	8	12	24
Width y (cm)	24							

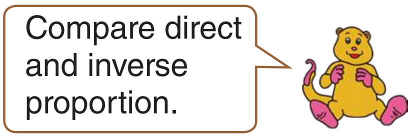
② If the value of x changes 2 times, 3 times and so on, how does the value of y change?



Length x (cm)	1	2	3	4	6	8	12	24
Width y (cm)	24							

When there are two changing quantities x and y, and if the value of y changes by $\frac{1}{2}$ and $\frac{1}{3}$ times as the value of x changes 2 and 3 times respectively, we say that y is **inversely proportional** to x.

Proportion can be called direct proportion or inverse proportion.



③ If the value of x changes $\frac{1}{2}$ and $\frac{1}{3}$ times, how does the value of y change?

$\frac{1}{3}$ times

$\frac{1}{2}$ times

Length x (cm)	2	3	6
Width y (cm)	12	8	4

☐ times

☐ times

Exercise

Are two quantities inversely proportional?

Ⓐ The x cm length and y cm width of a rectangle, when the fixed sum of all its lengths is 24 cm.

Length x (cm)	1	2	3	4	5	6
Width y (cm)	11	10	9	8	7	6

Ⓑ Speed and time when you ride 100 km by bicycle.

Speed x (km/h)	5	10	20	25
Time y (hour)	20	10	5	4

2 Represent the relationship of length x cm and width y cm of a rectangle, when its fixed area is 24 cm² in a mathematical sentence and on the graph.

Length and Width of a Rectangle with a Fixed Area of 24 cm²

Length x (cm)	1	2	3	4	6	8	12	24
Width y (cm)	24	12	8	6	4	3	2	1

① What kind of pattern is there between x and y?

② Find the product of the corresponding values of x and y. What does the product mean?

Length (cm)		Width (cm)		Area (cm²)
1	×	24	=	24
2	×	12	=	24
3	×	8	=	☐
4	×	6	=	☐
x	×	y	=	☐

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

$x \times y =$ Constant number

③ Find the value of y when value of x is 5.

$5 \times y = 24$

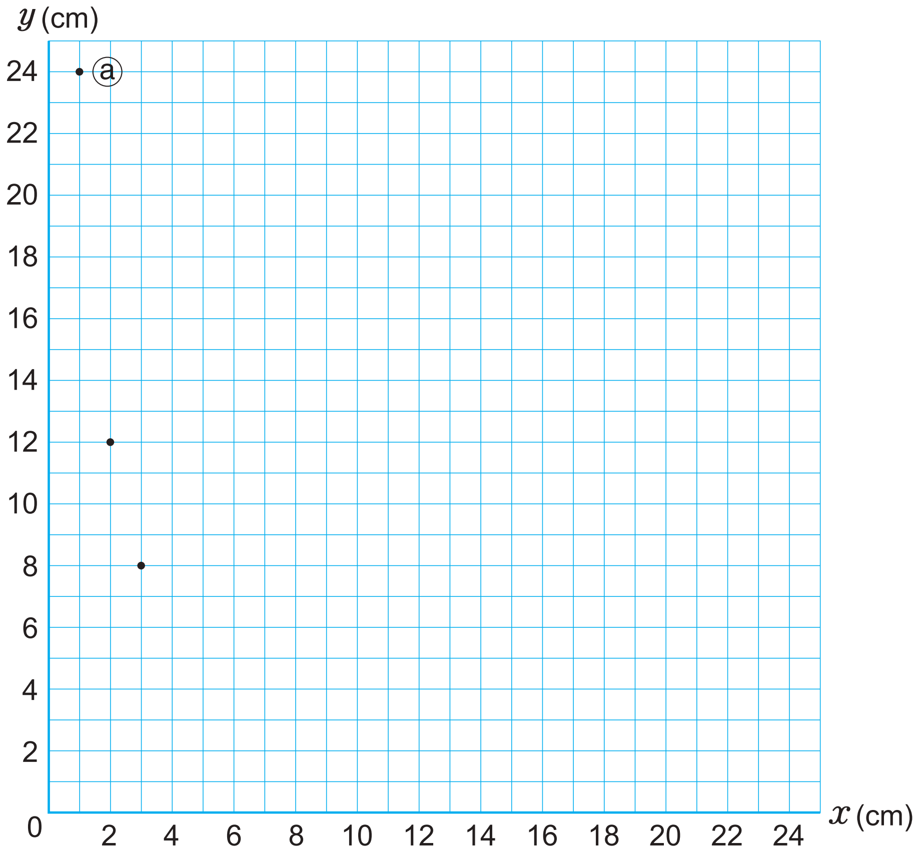
$y = 24 \div 5$

When y is inversely proportional to x, it is also represented in the mathematical sentence below.

$y =$ constant number $\div x$

④ Plot points on the value of x and its corresponding y value on the graph and connect them with straight lines.

Length and Width of a Rectangle with a Fixed Area of 24 cm²



⑤ Compare it with a graph that shows proportion on page 132.

Point ⓐ is $x = 1$ and $y = 24$.

3 There is the job which takes 60 days to complete when 1 person does the same amount of work per day.

① Represent the relationship of x and y in a mathematical sentence.

② Using the mathematical sentence from problem ①, find how many days it takes to complete the job with 5 people.

③ Using the mathematical sentence from problem ①, find how many people are needed to complete the job in 10 days.

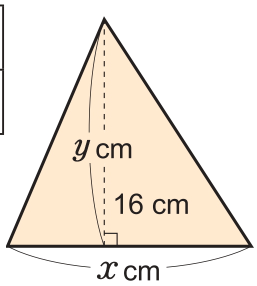
EXERCISE

① The table below shows the relationship of the base x cm and height of a triangle y cm which has a fixed area of 16 cm².

Pages 137 to 140

Base and Height of a Triangle, Which Has a Fixed Area of 16 cm²

Base x (cm)	1		4	5	8		32
Height y (cm)		16			4	2	



① Complete the table above.

② Is y inversely proportional to x?

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

④ When the base is 10 cm, what will be the height?

② Zoe rides a bike at a speed of x km/h for a 100 km distance.

① Show the relationship of speed (x) and time (y) by filling in the table.

Relationship of Speed and Time for a 100 km Distance

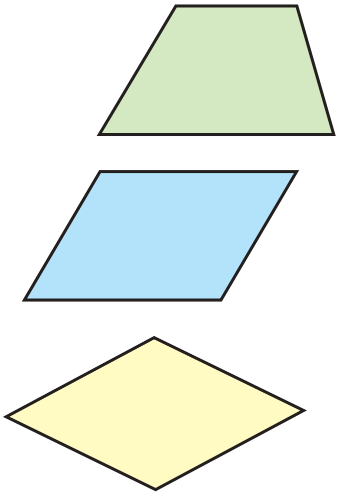
Speed x (km/h)	1	2	4	5	10	20	25
Time y (hours)	100	50		20			

② Represent the relationship of x and y in a mathematical sentence.

③ What will be the time taken to travel 100 km at a speed of 100 km/h?

REVIEW

1 Write the correct words in the ☐ by looking at the figures on the right.

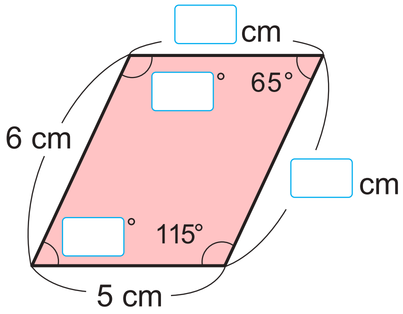


① A quadrilateral that has one pair of ☐ opposite sides is called ☐.

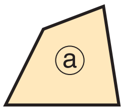
② A quadrilateral in which the opposite sides are both ☐ is called ☐.

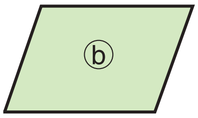
③ A quadrilateral in which all 4 sides are ☐ in length is called ☐.

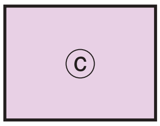
2 The figure on the right is a parallelogram. Fill in the ☐ with appropriate numbers. Construct a parallelogram that has the same sides and angles.

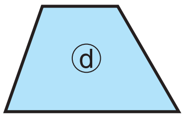


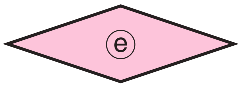
3 Which of these quadrilaterals have the following characteristics?

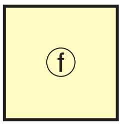












① Two pairs of parallel sides.

② Four angles of equal size.

③ Diagonals of equal length.

④ Opposite sides with equal length.

⑤ Opposite angles with equal size.

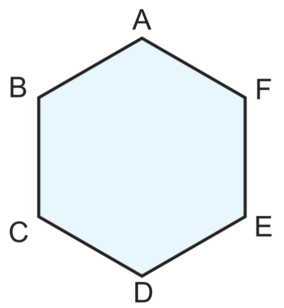
⑥ No parallel sides.

④ A regular hexagon on the right has line symmetry.

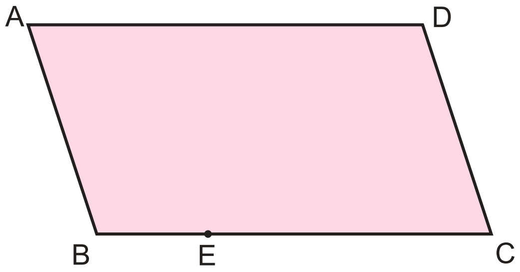
① How many lines of symmetry are there?

② When the corresponding point of C is F, draw a line of symmetry on the figure.

③ If line CF is the line of symmetry, what is the corresponding point of D?



⑤ The parallelogram ABCD has point symmetry.



① Which point corresponds to point D?

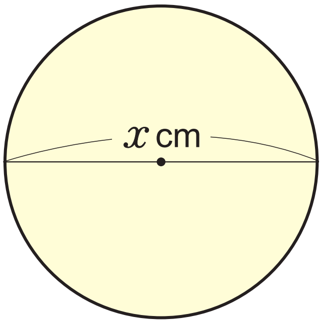
② Draw the point of symmetry on the figure.

③ Draw a point which corresponds with point E on the figure.

⑥ The mathematical formula to find the circumference of a circle is diameter×3.14.

① Write an expression to calculate the circumference of a circle with a diameter of x cm.

② Use the expression with x to calculate the circumference of a circle with the diameter of 12.56 cm.



14 How to Explore Data

Earthquake (2018)

South Pacific Games Opening Ceremony (2015)

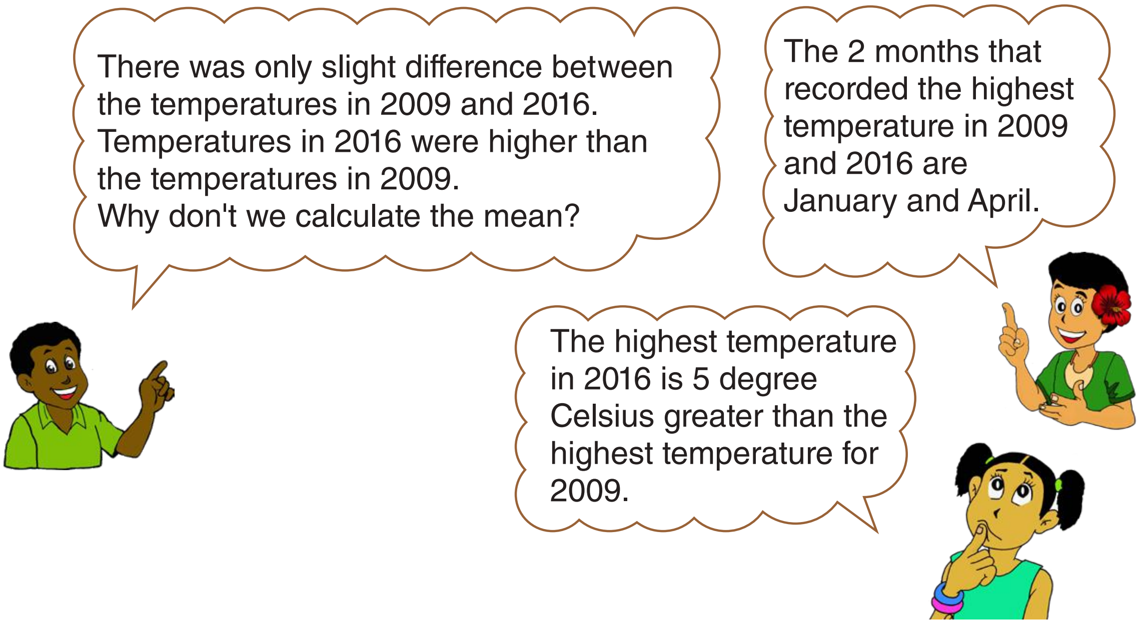
1 Mean

1 The table below shows the data of the highest monthly temperatures in NCD in 2009 and 2016.

Highest Monthly Temperature in NCD (°C)

Month Year	1	2	3	4	5	6	7	8	9	10	11	12
2009	31.0	30.1	28.9	31.3	30.3	30.0	29.9	29.1	30.0	30.8	30.9	30.8
2016	35.5	35.0	35.9	36.0	35.7	35.0	34.8	33.0	34.0	34.7	34.9	35.0

① Let's talk about what you can tell from this table.



② Ratu looked at the table and decided to compare the average highest monthly temperature of the year.
How is he calculating the mean?
Fill in the ☐ with a number and explain.

How to calculate the mean of highest monthly temperature of the year in 2009.

(Sum of highest monthly temperature from January to December) ÷ ☐

③ Ratu calculated the mean of highest monthly temperatures of the year for each year and said 2016 was hotter than 2009.
Like what Ratu did, calculate the mean and round them off to tenths place and compare them.

Exercise

The number of classes in 16 primary schools in Angoram District, East Sepik Province is shown below.
Calculate the mean and round off to the tenths place.

6, 12, 6, 6, 6, 12, 16, 6, 16, 10, 11, 12, 7, 12, 12, 6

2 The numbers below show the heights of 13 members of a PNG basketball team.
What is the average height of this team in cm?
Round off to the tenths place.

Team PNG - South Pacific Games

188, 198, 179, 183, 191, 205, 195, 196, 185, 203, 187, 194, 199 (cm)

① Fill in the ☐ with numbers and explain how to find the mean.

Sare's Idea

(☐ + 198 + 179 + 183 + 191 + 205 + 195 + 196 + 185 + 203 +
187 + 194 + 199) ÷ ☐ = ☐

Therefore, the mean is ☐ cm.

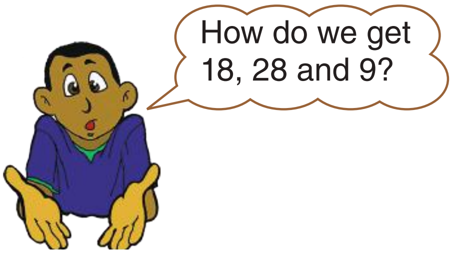
Vavi's Idea

(18 + 28 + 9 + ☐ + ☐ + ☐ + ☐ + ☐ + ☐ + ☐ +
☐ + ☐ + 29) ÷ ☐ = ☐

170 + ☐ = ☐

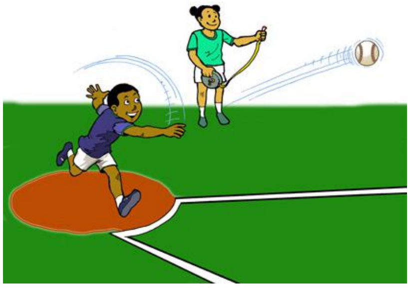
Therefore, the mean is ☐ cm.

② Compare Sare's and Vavi's ideas.



2 How to Explore Distribution

The following are records of throwing a softball for two groups.



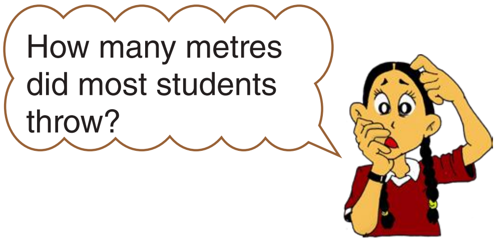
Records of Throwing a Softball

Group A			
Number	Distance (m)	Number	Distance (m)
①	22	⑪	26
②	31	⑫	16
③	42	⑬	42
④	23	⑭	18
⑤	24	⑮	22
⑥	35	⑯	38
⑦	45	⑰	29
⑧	23	⑱	28
⑨	31	⑲	31
⑩	41	⑳	33

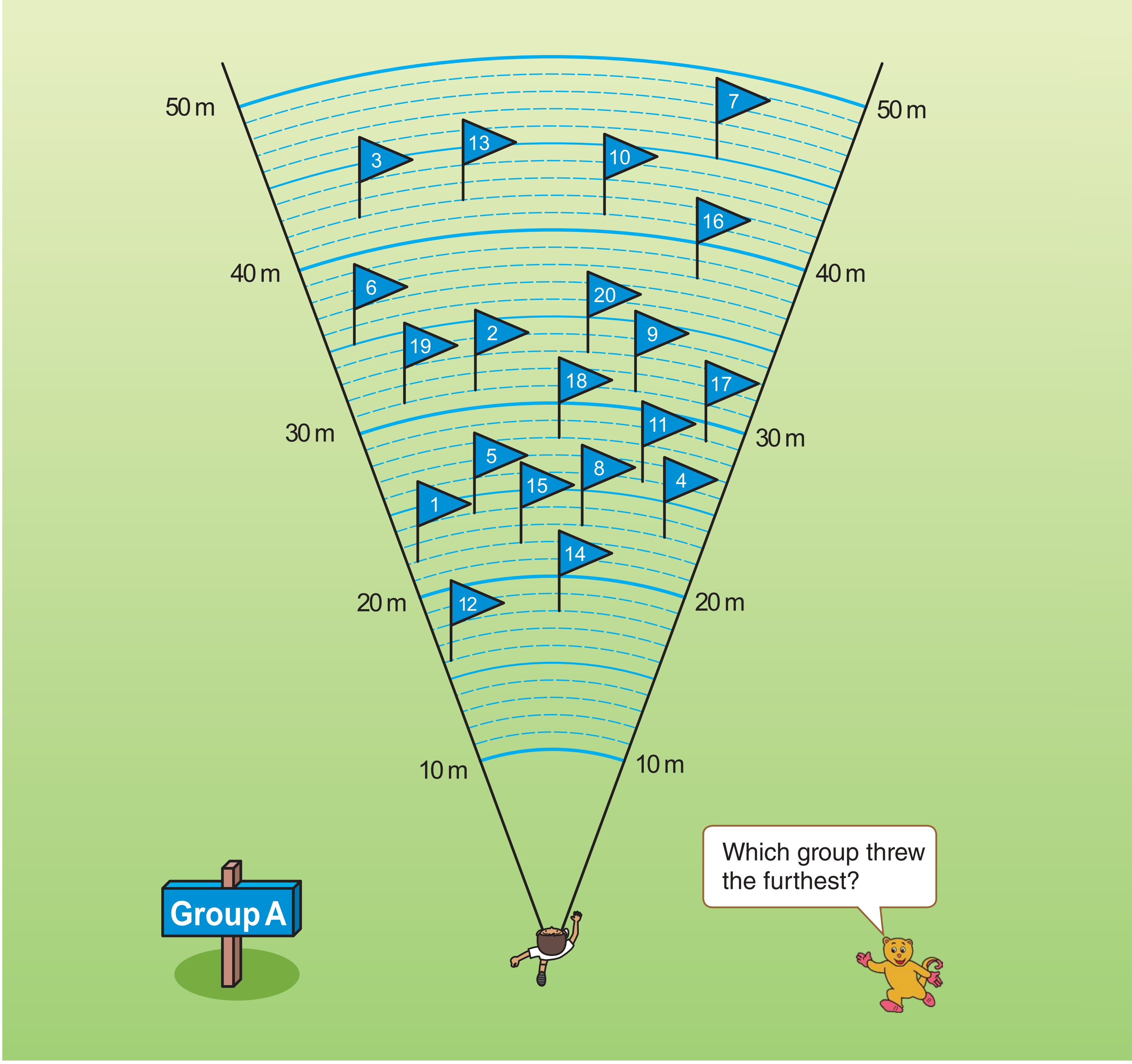
Group B			
Number	Distance (m)	Number	Distance (m)
①	40	⑪	37
②	34	⑫	30
③	26	⑬	28
④	30	⑭	32
⑤	19	⑮	42
⑥	21	⑯	37
⑦	33	⑰	30
⑧	16	⑱	32
⑨	38	⑲	21
⑩	24		

1 Which group has better records? Let's investigate the following statistics and talk about it.

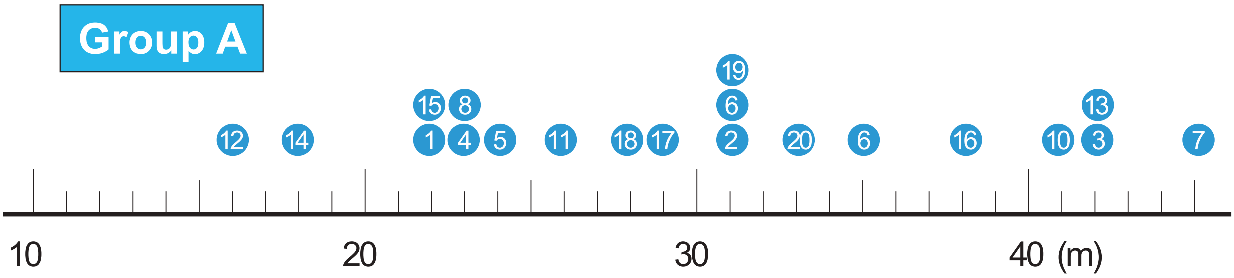
① Best and worst record ② Average

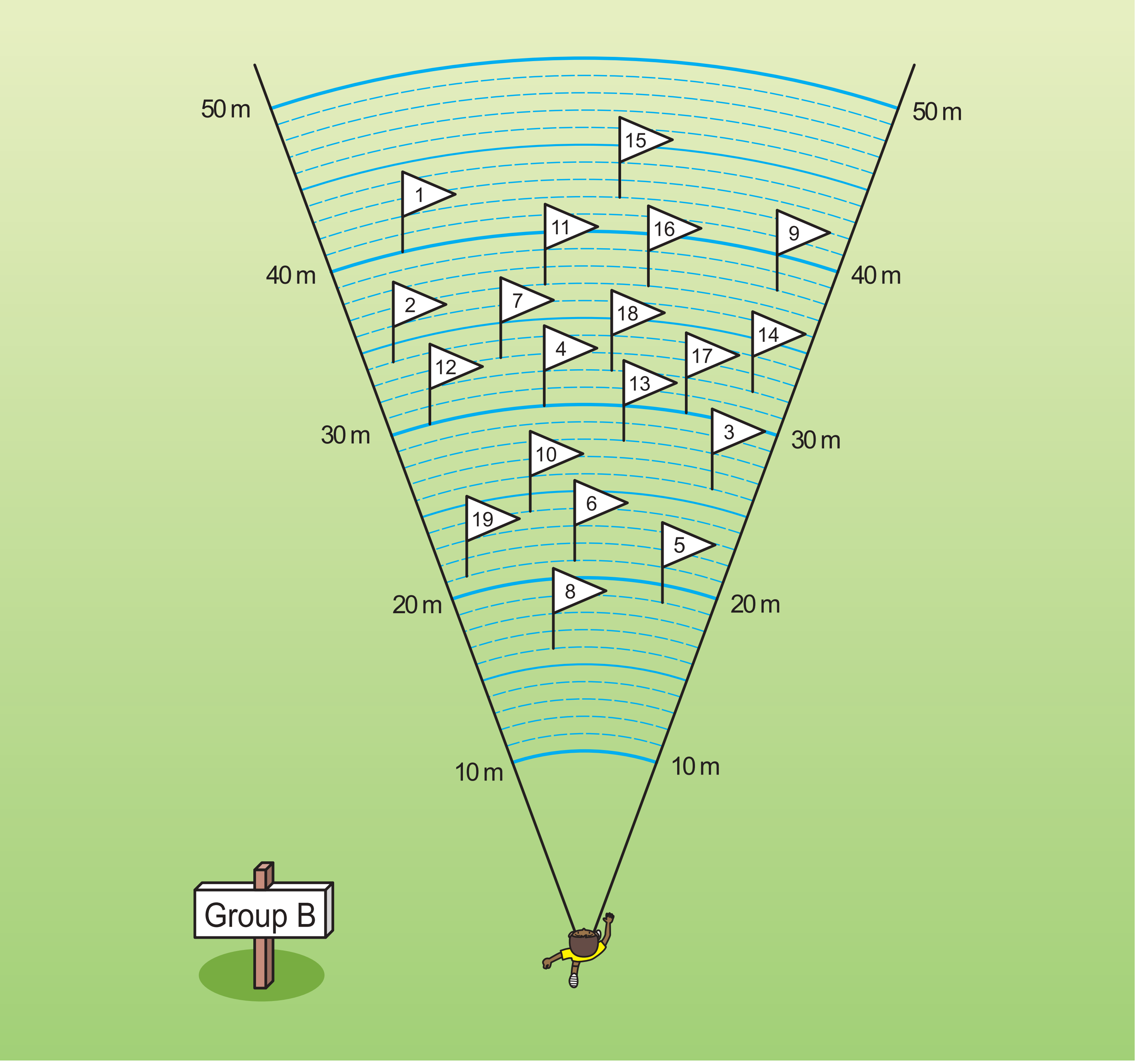


Let's investigate the data in various ways.



2 To make the records easy to read, represent each data on the number line. Data for group A is done.
Do the same for group B and compare the distribution.

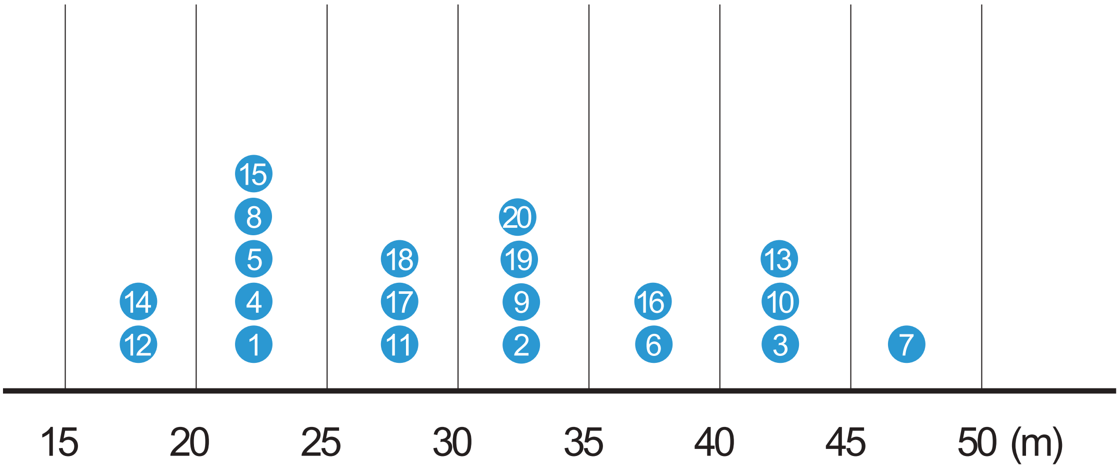



50 m
50 m
15
1
11
16
9
40 m
40 m
2
7
18
14
12
4
17
13
30 m
3
30 m
10
6
19
5
20 m
8
20 m
10 m
10 m
Group B

Group B


10
20
30
40 (m)

3 To organise the distribution in more detail, they separated the data by intervals of 5 m and made a table.



① Organise the distribution above in the table.

Record of Throwing a Softball (Group A)

Distance (m)	Number of students
Greater or Equal 15 ~ Less Than 20	
20 ~ 25	
25 ~ 30	
30 ~ 35	
35 ~ 40	
40 ~ 45	
45 ~ 50	

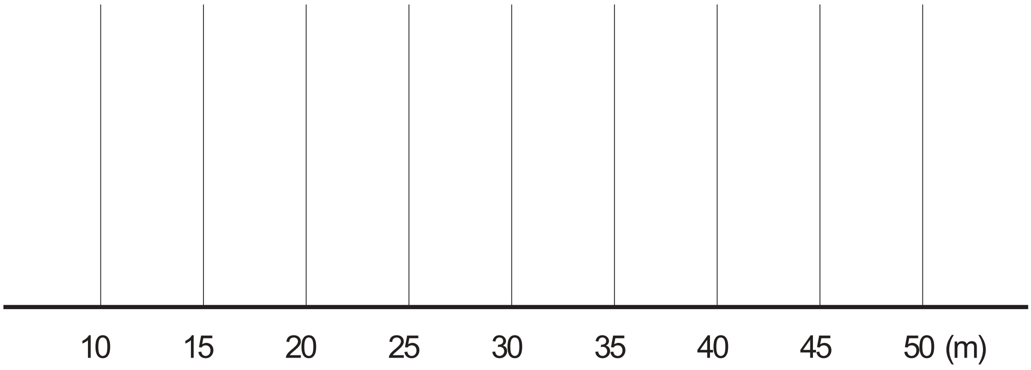
This table includes the shortest to longest records. They divided the recorded distance by 5 m into 7 classes to find out how many students belong to each class.

② How many students belong to the recorded distance that is greater or equal to 25 m and less than 30 m?

③ In which class greater or equal to and less than do 4 students belong to?

4 Explore the data for group B and compare it with group A.

① Separate the records by intervals of 5 m and complete the table.



② Record the distribution above in the table.

Record of Throwing a Softball (Group B)

Distance (m)			Number of students
Greater or Equal		Less Than	
15	~	20	
20	~	25	
25	~	30	
30	~	35	
35	~	40	
40	~	45	
45	~	50	

③ Compare the records of group A and B.

Ⓐ Which group has more records that are greater or equal to 40 m?

Ⓑ Which group has more records that are less than 25 m?

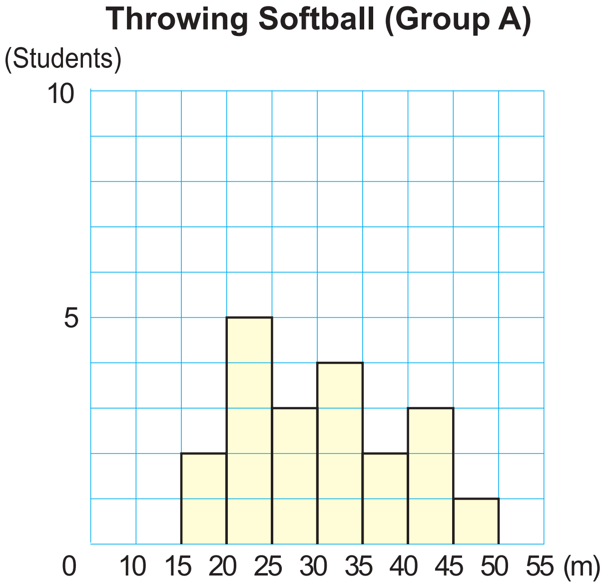
Ⓒ Which group has more records that are greater or equal to 25 m and less than 35 m?

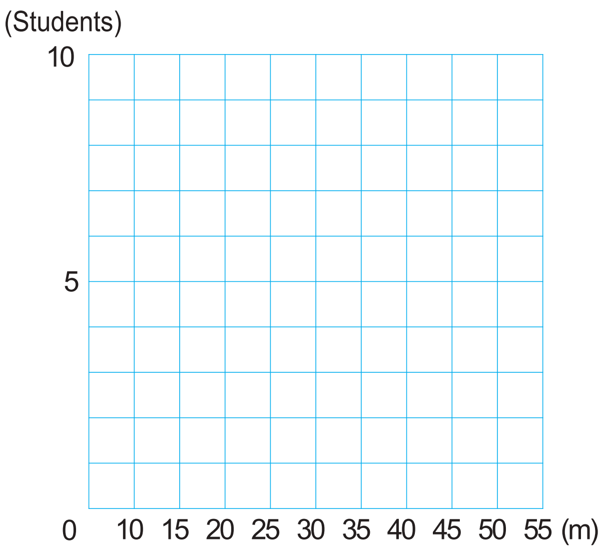
Histogram

5 Based on the table of group A on page 150, they drew a graph to compare the distribution records of throwing a softball in group A and B.

① How many students threw a softball greater than or equal to 35 m and less than 40 m in group A?

② In which class, greater or equal and less than, does 1 student belong to in group A?





The graph, which looks like the above, is called a **histogram**.
It is easy to read the distribution by looking at the bars.
In the **histogram**, the horizontal axis represents the range and vertical axis represents how many students are in each range.

③ Draw a histogram for group B.

④ Compare the shapes of the 2 histograms and discuss about how they are distributed.

⑤ In which class, greater or equal and less than, do most students belong to in each group?
What is the percentage ratio of this class out of all for each group?

⑥ In which class, greater or equal and less than, does the fifth student belong to for each group?

6 Fill in the table to compare the distribution records of group A and B.
What can you tell from this table?

	Group A	Group B
Longest Record (m)		
Shortest Record (m)		
Mean (m)		
Class that most students belong to (m)	Greater or Equal ~ Less Than	Greater or Equal ~ Less Than
Percentage (%) of students whose record is less than 20 m.		
Percentage (%) of students whose record is greater or equal to 20 m and less than 35 m.		
Percentage (%) of students whose record is greater or equal to 40 m.		

7 Let's investigate the records of throwing a softball in your school.

8 The data below shows the record of throwing a softball for grade 6 boys in West Primary School.

Record of throwing a softball

No	Distance	No	Distance	No	Distance
(1)	35 (m)	(12)	22 (m)	(23)	42 (m)
(2)	13	(13)	42	(24)	34
(3)	42	(14)	17	(25)	44
(4)	26	(15)	15	(26)	19
(5)	24	(16)	29	(27)	36
(6)	22	(17)	38	(28)	14
(7)	45	(18)	18	(29)	21
(8)	23	(19)	28	(30)	24
(9)	31	(20)	34	(31)	43
(10)	41	(21)	48	(32)	22
(11)	17	(22)	30	(33)	37

① How is the record distributed?

The record is distributed between ☐ m and ☐ m.

② What is the average of the record?

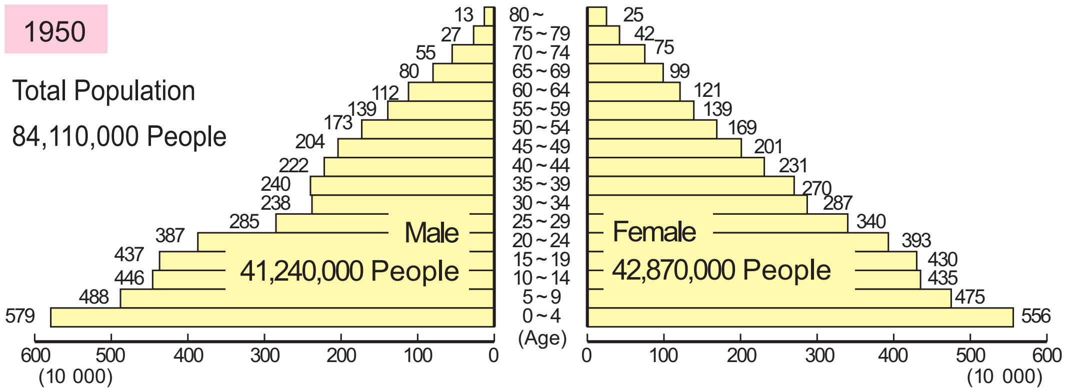
③ How many students belong to the recorded distance that is greater or equal to 25 m and less than 40 m?

④ When ordering the record, whose throw is in the middle of the class?

PROBLEMS

① The type of graph below is a population pyramid. It shows the male and female population by ages in 1950 in Japan.

● Making a graph from data.

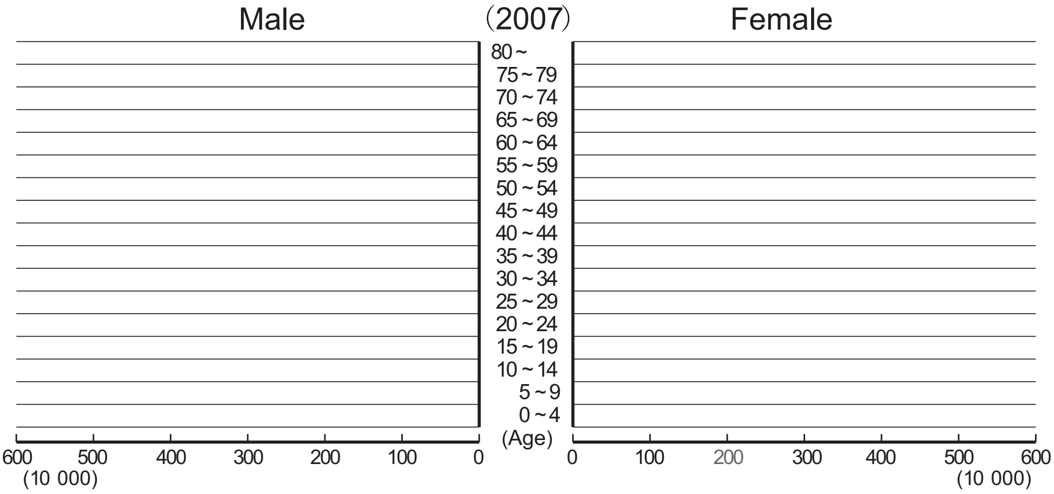


The data below is a table of population of male and female by ages in 2007. Make a population pyramid based on this data.

(10 000)

Age	Male	Female	Total of male and female	Age	Male	Female	Total of male and female
0 ~ 4	278	265	543	45 ~ 49	388	385	773
5 ~ 9	301	286	588	50 ~ 54	402	403	805
10 ~ 14	307	292	598	55 ~ 59	516	527	1043
15 ~ 19	322	306	628	60 ~ 64	413	434	847
20 ~ 24	372	352	724	65 ~ 69	375	409	784
25 ~ 29	397	383	780	70 ~ 74	319	373	692
30 ~ 34	475	462	936	75 ~ 79	241	316	557
35 ~ 39	476	466	943	80 ~	235	478	714
40 ~ 44	414	408	822	Sum Total	6231	6546	12777

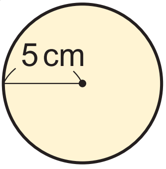
(The numbers are rounded off, therefore, some calculations do not match.)



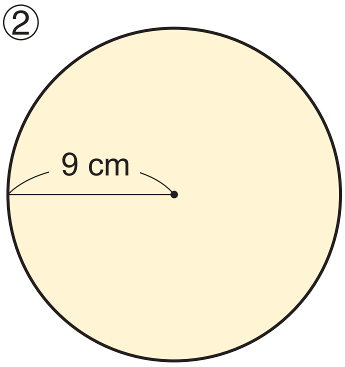
REVIEW

1 Calculate the circumference and the area of these circles.

①



②



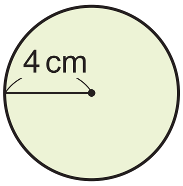
2 Calculate the diameter and the area of these circles.

① A circle with 9.42 cm circumference.

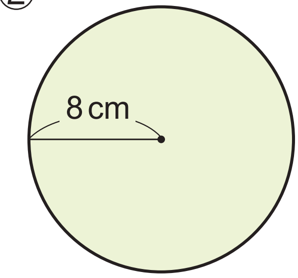
② A circle with 18.84 cm circumference.

3 Find the circumference and area of the following:

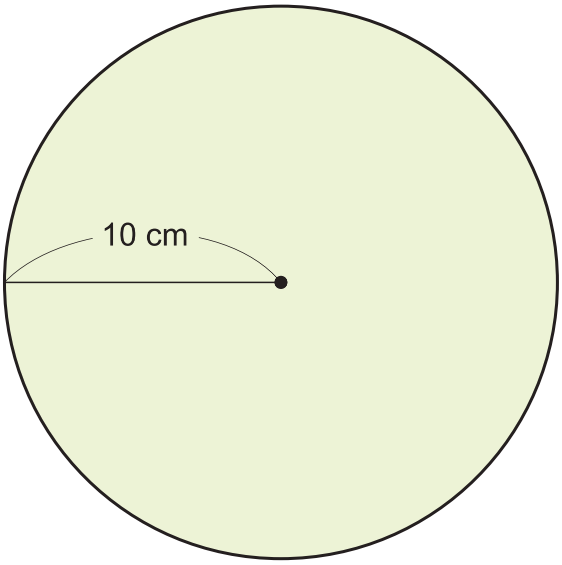
①



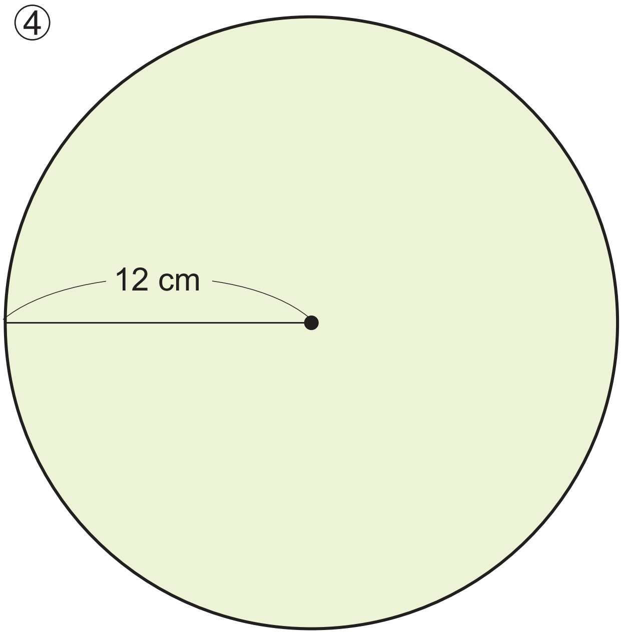
②



③

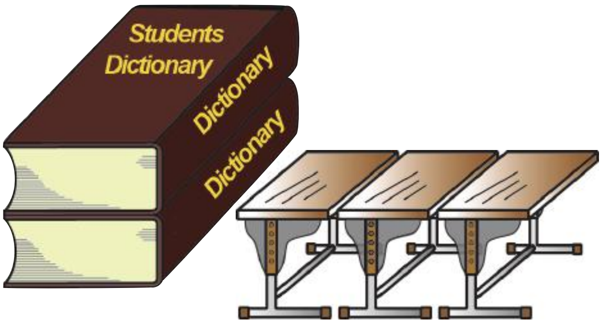


④



15 Quantity and Unit

① How to Represent Quantity



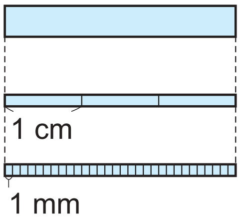
There are many kinds of quantities for things. For example, there are number of pages, length and width, area of cover, weight and volume for books. There are number of pieces, weight, area and volume of desks. "2 volumes" or "3 books" are used to describe number of books. "5 m" is used to describe the length of a string and "2.3 kg" is used to describe the weight of clay.

There are two types of quantities. One quantity describes something countable that is discrete, like the number of books or desks and the other quantity describes things that are not separated but continuous like the length of string or weight of clay.

	How to count	Unit of number
Discrete quantities	• Count by piece. • Represented by whole numbers.	piece, person, sheet, etc.
Continuous quantities	• Select unit and measure. • Can be in decimal or fraction.	m, L, kg, m^2, cm^2, minute, etc.

Units like 3 m, 3 cm, 3 L, 3 kg and 3 m^2 are used for quantities like length, volume or weight and are also standard scales.

For example, 3 cm represents length in cm and tells us it is 3 of 1 cm. If we measure 3 cm in units of millimetre it is 30 of 1 mm, therefore it is 30 mm.

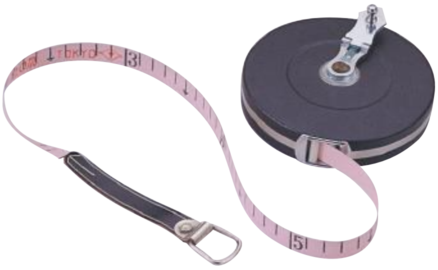


1 What units of measurement are used to represent the following quantities?

Organise the information on the table.

	Units used
① Distance from home to school	
② Volume of juice	
③ Weight of a bag	
④ Weight of an elephant	
⑤ Area of classroom	
⑥ Area of an island	
⑦ Time taken to go to school	

Let's think about other units that are used around you.






② Units of Length: km, m, cm, mm

1 What units of measurement are used to represent the following lengths?

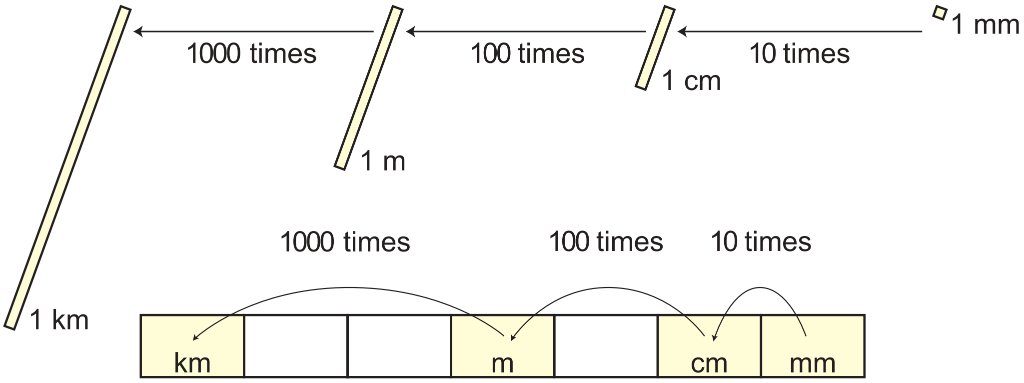
① Length of the Fly River……1050 □

② Length of a swimming pool……25 □

③ Width of a textbook……25.7 □

④ Thickness of an exercise book……4 □

2 Let's integrate the relationship of the units of length.



3 Fill in the □ with a number.

① 6 m = □ cm

② 2 km = □ m

③ 124 cm = □ m

④ 0.5 cm = □ mm

Convert Unit

0.6 km = □ m

	km			m		cm	mm
	0 .	6					
		6	0	0			

Use the unit converting tool in the appendix and find out.
In this situation, 6 is in the first decimal place, so move the strip inside on the unit converting tool and set the number 1, one place below km. Then, recognise the number of 0 and read the place value for 6.

③ Units of Area: km^2, ha, a, m^2, cm^2

1 What units are used to represent the following areas?

① Area of Central Province……29998 ☐.

② Area of a tennis court……2 ☐.

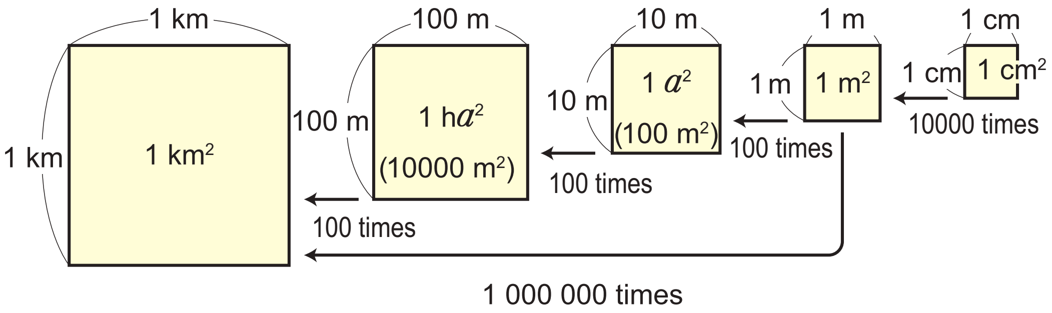
③ Area of a surface of swimming pool in a school……375 ☐.

④ Area of a postage stamp……5.5 ☐.

You learned that there are units of area like **cm^2**, **m^2**, **km^2**, a and **ha** in grade 4.

1 a = 100 m^2 1 ha = 100 a = 10000 m^2

2 Units of area are made based on units of length.
Let's integrate the relationship of units of area.



Side length of a square	1 km	100 m	10 m	1 m	1 cm
Area of a square	1 km^2	1 ha 10000 m^2	1 a 100 m^2	1 m^2	1 cm^2

Convert Unit

7 km^2 = ☐ ha

	km^2		ha		a		m^2				cm^2
	7										
	7	0	0								

4 Units of Volume: m^3, cm^3, kL, dL, mL

1 What units are used to represent the following volumes?

① Volume of water in a school swimming pool……375 □.

② Volume of an eraser……8 □.

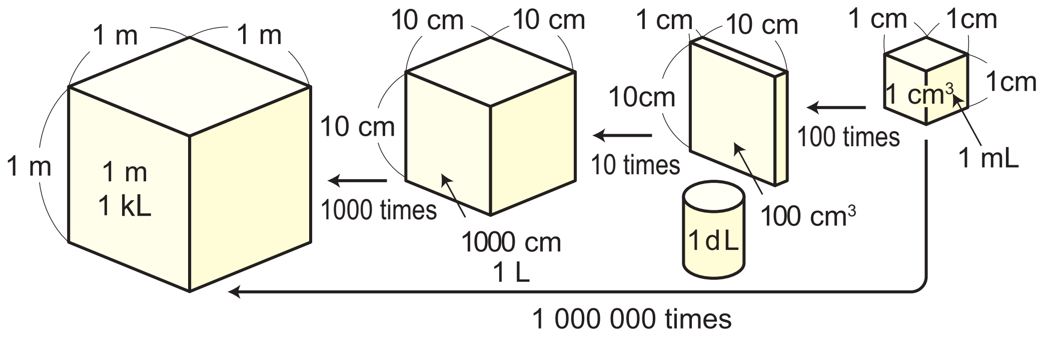
③ Volume of a pack of milk……1 □.

④ Volume of water in a plastic bottle……500 □.

Use L as a standard unit for dL or mL.
There is a unit called **kilolitre (kL)**.

1kL = 1000 L = 1 m^3

2 Units of volume are also made based on units of length.
Let's integrate the relationship of units of volumes.



Side length of a cube	1 m	10 cm		1 cm
Volume of a cube	1 m^3 1 kL	1000 cm^3 1 L	1 dL	1 cm^3 1 mL

Convert Unit

0.5 m^3 = □ L

	m^3 kL			L	dL		cm^3 mL
	0 .	5					
		5	0	0			

5 Units of Weight: t, kg, g, mg

1 What units are used to represent the following weights?

① Weight of an adult male……65 ☐.

② Weight of a small paper clip...1 ☐.

There is a unit called **milligram (mg)** other than ton(t), kg and g for units of weight.

$$1\,\text{mg} = \frac{1}{1000}\,\text{g}$$

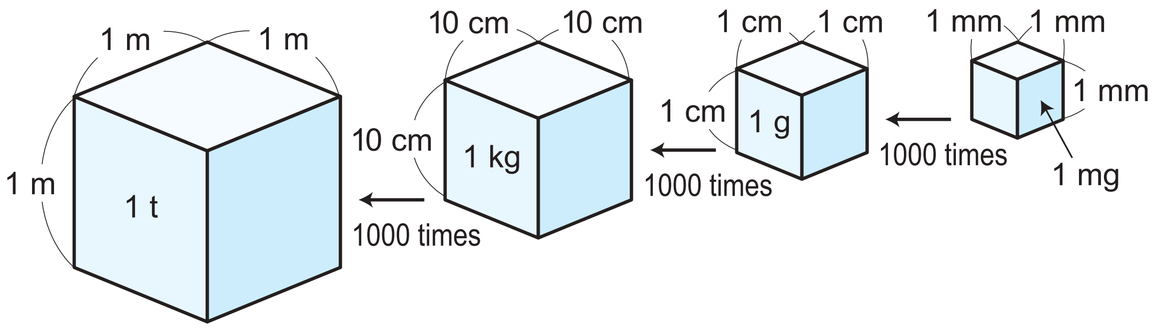
Sample of Nutrition Information

Protein	39 g
Fat	22.7 g
Carbohydrate	48.0 g
Sodium (Salt)	86 mg

2 Weight of 1 cm^3 of water is 1 g.

① Find the volumes of the following cubes.

② Let's integrate the relationship between volume and weight of water.



Convert Unit

4 t = ☐ kg

	t			kg			g			mg
	4									
	4	0	0	0						

6 Metric System

1 Group together items that have units of length, area, volume or weight with the prefix: kilo (k), hecto (h), deci (d), centi (c), milli (m).

	k	h	deca da		d	c	milli m
	1000	100	10	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
Length		/	/	metre m	/		
Area	/		/	a	/	/	/
Volume		/	/	L		/	
Weight		/	/	g	/	/	

k represents 1000 times, **h** represents 100 times, **da** represents 10 times, **d** represents $\frac{1}{10}$ times, **c** represents $\frac{1}{100}$ times and **m** represents $\frac{1}{1000}$ times.
Use units like **m** for metre or **kg** for kilogram as standard units.
The system of units that are multiples of 10 is called the **metric system**.

Exercise

1 Fill in the □ with a number.

① 1 m^2 = □ cm^2 ② 1 kL = □ L = □ mL

③ 1 m^3 = □ cm^3 ④ 1 t = □ kg

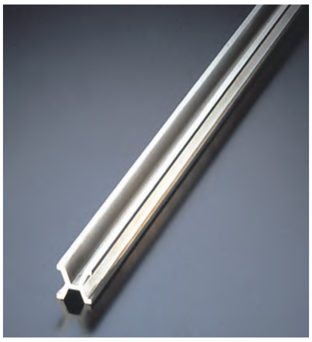
2 There is a rectangular shaped farm with length 50 m and width 20 m.
What is the area of this farm in m^2?
Also measure the area in are (a) and hectare (ha).

Units of the Metric System

The standard unit of the metric system for lengths is m for metre and for weights is kg for kilogram.

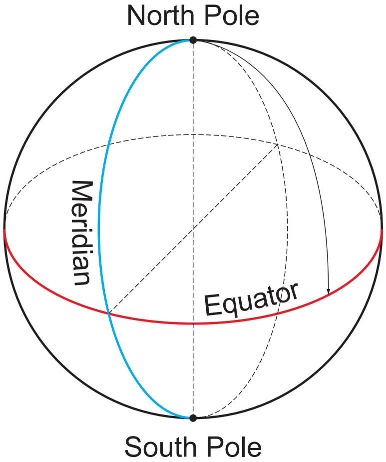
The system was created in order to have common units for different countries and French scientists took a leading role to determine the units in 1799.

The standard of metre and standard of kilogram were created as prototypes.



Standard of Metre

Standard of Kilogram

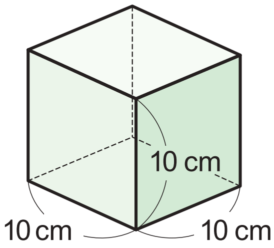


They first defined that $\frac{1}{10000000}$ of the distance of a meridian of the earth from the North Pole to the equator as 1 metre.

However, 1 metre is now defined as the distance of light in vacuum, when it moves $\frac{1}{299792458}$ second.

For the standard unit of weight, 1 kilogram is defined as the weight of 1000 cm^3 of water at 4 degree Celcius water temperature.

The standard of kilogram is still used today as the standard to measure weight.



Big Units and Small Units

There are very big numbers and small numbers around you.
We use 0 to 9 to represent these numbers, however, it is difficult if the number is too big.
And so, people came up with the idea to divide by 1000 in order to represent big numbers.
For example, 1000 times 1 m is 1 km, and 1000 times 1 km is 1 M m (mega-metre) and 1000 times 1 M m is 1 Gm (giga-metre).
This rule can be used to represent a big number with small numbers.
Let's represent the distances between the earth and the moon and the earth and the sun, using the units above.

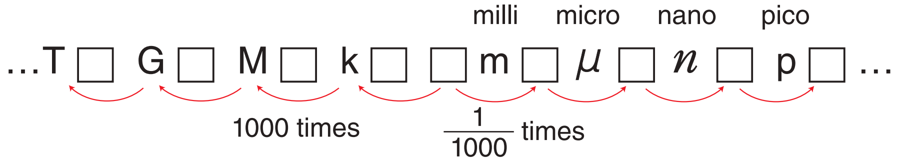
Distance between the earth and the moon

About 384 000 km = ☐ Mm

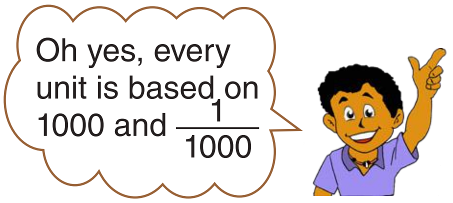
Distance between the earth and the sun

About 150 000 000 km = ☐ Mm = ☐ Gm

It is easy to estimate and compare when we use big units. There are other bigger units which are used for big numbers.
There are also smaller units for small numbers which are divided into $\frac{1}{1000}$ parts.
These units are often used to represent lengths or weights.
When you represent numbers by splitting into 1000 parts, you need to write a unit like m for metre after the number. The relationship between the units is shown below.



☐ is a basic unit.



16

Summary of Grade 3 to 6 Mathematics

Recall all the contents that you learned in 4 years of mathematics and try solving the problems below. After you finish, check by using the answers at the back of the textbook and review the ones you got wrong.

Numbers and Calculations

1 Let's integrate whole numbers and decimals.

Grade 4

① What do 3, 5 and 7 represent in the following numbers?

Ⓐ 35700 Ⓑ 3050070

Ⓒ 35.07 Ⓓ 3.057

② How many sets of the numbers in ( ) equal to the following numbers?

Ⓐ 23000 (100) Ⓑ 23000 (1000)

Ⓒ 2.3 (0.1) Ⓓ 2.3 (0.01)

2 Let's summarise fractions.

Grades 4 and 5

① Fill in the $\square$ with the equality or inequality signs.

Ⓐ $\frac{2}{5} \square \frac{3}{5}$ Ⓑ $\frac{2}{5} \square \frac{2}{7}$ Ⓒ $\frac{2}{5} \square \frac{8}{20}$

② Fill in the $\square$ with a number.

Grade 3

Ⓐ $\frac{3}{5}$ is $\square$ times of $\frac{1}{5}$ Ⓑ $\frac{9}{7}$ is 9 times of $\square$

③ Change the mixed fractions to improper fractions or the improper fractions to mixed fractions.

Grade 4

Ⓐ $1\frac{2}{3}$ Ⓑ $4\frac{3}{5}$ Ⓒ $\frac{7}{4}$ Ⓓ $\frac{8}{3}$

3 Let's integrate the relationship of integers, decimals and fractions.

Grade 5

① Change the following integers and decimals to fractions and fractions to decimals.

Ⓐ 4 Ⓑ 0.7 Ⓒ 3.08 Ⓓ $\frac{13}{25}$ Ⓔ $1\frac{3}{4}$

② Line up the following numbers from the smallest to the largest.

$\frac{2}{5}$ $\frac{1}{3}$ $\frac{7}{15}$ 0.3 0.41

4 Let's consolidate calculations.

Grades 4 to 6

① Let's calculate.

Ⓐ $4+2\times6-3$ $(4+2)\times6-3$ $4+2\times(6-3)$

Ⓑ $4.2+1.5$ $4.2-1.5$ 4.2×1.5 $4.2\div1.5$

Ⓒ $64.8+1.8$ $64.8-1.8$ 64.8×1.8 $64.8\div1.8$

Ⓓ $\frac{2}{5}+\frac{1}{3}$ $\frac{2}{5}-\frac{1}{3}$ $\frac{2}{5}\times\frac{1}{3}$ $\frac{2}{5}\div\frac{1}{3}$

② Find the value of x.

Grade 6

Ⓐ $8+x=15$

Ⓑ $x\times7=56$

5 Let's organise the properties of whole numbers.

Grade 5

① Find a number that has 3 divisors from 1 to 50.

② Find the least common multiple and greatest common divisor for following pairs of numbers.

Ⓐ (12, 18)

Ⓑ (8, 16)

Quantity and Measurement

Grades 4 to 6

1 Let's integrate quantities of units that are used around you.

① Fill in the ☐ with the appropriate unit.

Ⓐ Area of the cover of a mathematics textbook is about 470 ☐.

Ⓑ Volume of milk in a pack is about 200 ☐.

Ⓒ Weight of an egg is about 50 ☐.

Ⓓ The longest river in Papua New Guinea is the Fly River and it is about 1050 ☐.

② Solve the following problems.

Ⓐ Raka walked 1.6 km. How many more metres does she have to walk in order to say that she has walked 2 km?

Ⓑ There is a flowerbed in the shape of a rectangle with a length of 3 m and width of 1 m. What is the area of this flowerbed in m^2 and cm^2?

Ⓒ There are 4 plastic bottles that contain 500 dL.
How much water in total can they contain in L and dL?

2 Let's recall how to calculate area.

Grades 4 to 6

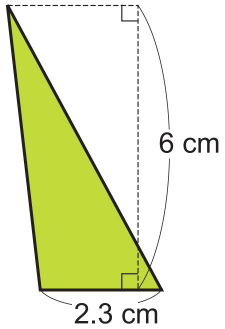
① Write a mathematical formula of how to calculate an area of the following shapes.

Area of a rectangle = ☐ × ☐
Area of a square = ☐ × ☐
Area of a parallelogram = ☐ × ☐
Area of a triangle = ☐ × ☐ ÷ ☐
Area of a circle = ☐ × ☐ × ☐

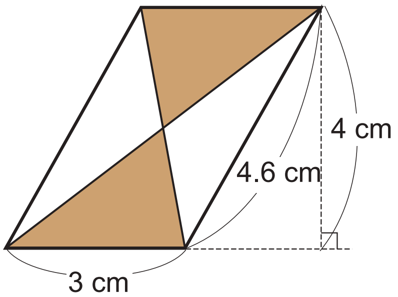
② Draw 2 figures with an area of 20 cm^2.

③ Find the area of the coloured part.

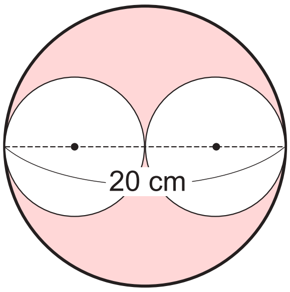
Ⓐ



Ⓑ Parallelogram



Ⓒ



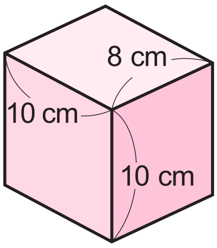
3 Let's recall how to calculate volume.

Grade 5

① Write mathematical formulas for calculating the volume of a rectangular prism and a cube.

② Find the volume of the following solids.

Ⓐ



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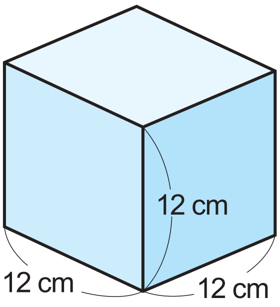

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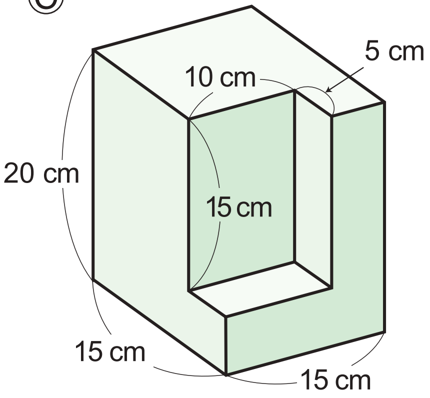


4 Let's recall what we learned about speed.

Grade 6

① Represent the relationship of speed, distance and time in a mathematical sentence.

② Tom walks at a speed of 4 km/hour.
He started walking to get to a place that is 8 km away.
After 1.5 hours, how many more km does he have to walk to reach his destination?

Shapes and Figures

1 Let's organise the characteristics of figures. Grades 4 and 5

① Select the figures that have the properties of the following for these four quadrilaterals.

Parallelogram, Rhombus, Rectangle, Square

Ⓐ 2 pairs of sides that are parallel.

Ⓑ All 4 angles that are right angles.

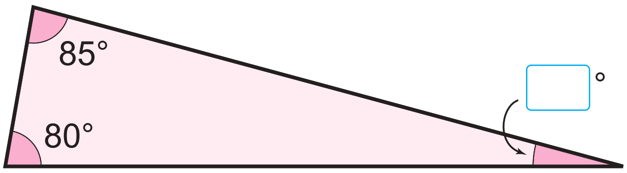
Ⓒ 4 sides that are equal in length.

Ⓓ 2 diagonal lines that are perpendicular.

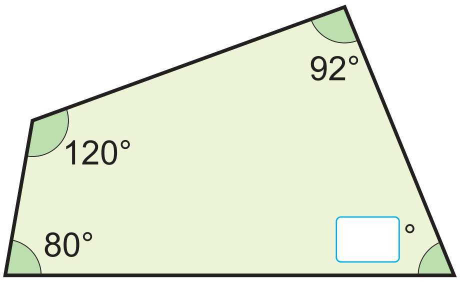
Ⓔ Sum of adjacent angles are 180°.

② Fill in the □ with the correct angle size. Grade 5

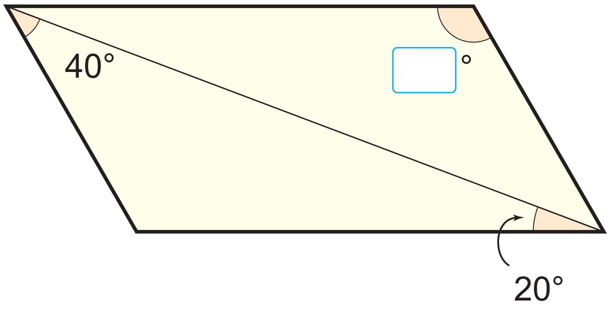
Ⓐ Triangle



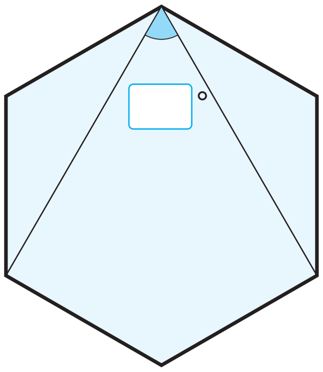
Ⓑ Quadrilateral



Ⓒ Parallelogram



Ⓓ Regular hexagon

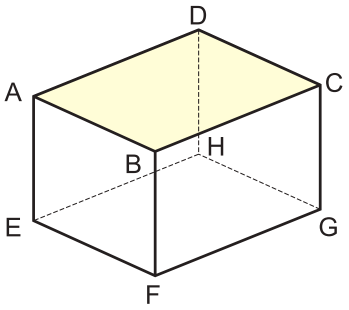


③ Investigate the rectangular prism on the right.

Grade 4

Ⓐ Which surface is parallel to face ABCD?

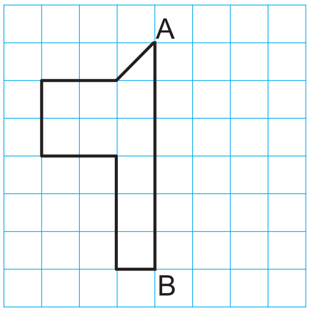
Ⓑ Which side is parallel to side AB?



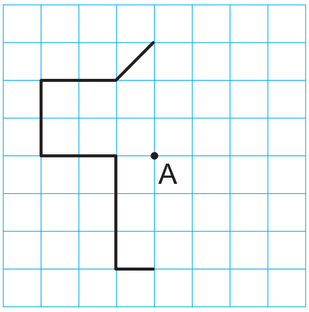
2 Draw the following figures.

Grade 6

① Figure with AB as the line of symmetry.



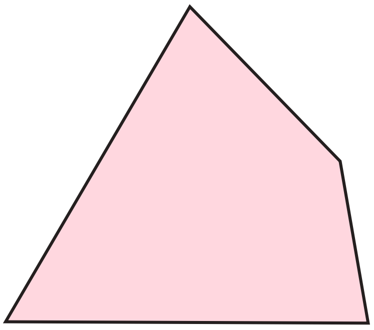
② Figure with point A as a point of symmetry.



3 Trace the figure below and draw similar figures with the following conditions:

① Twice enlarged drawing.

② $\frac{1}{2}$ reduced drawing.



Data and Relations

1 Let's organise how to represent the relationship of numerical quantities.

① What graph should you use to represent the following?

Ⓐ Types of imported goods and ratio of imported amount.

Ⓑ Change in amount of exports.

Ⓒ Oil Palm plantation in each country.

Grade 5

② The table on the right represents the number of publications of books and magazines in a year.

Ⓐ What is the percentage of monthly magazines out of all publications for each year?

Ⓑ Represent the ratio of each publication on a bar graph for each year and discuss what you noticed.

Number of Magazines in 1995 and 2005
(Unit : One hundred million)

	1995	2005
Special magazine	14.6	12.6
Weekly magazine	19.4	13.3
Monthly magazine	31.2	28.2
Total	65.2	54.1

③ Dan mixes 35 g of flour and 14 g of sugar to make sweet flour balls.

Grade 6

Ⓐ If Dan says that the quantity of sugar is 2, how much is the quantity of flour?

$35 : 14 = \boxed{} : 2$

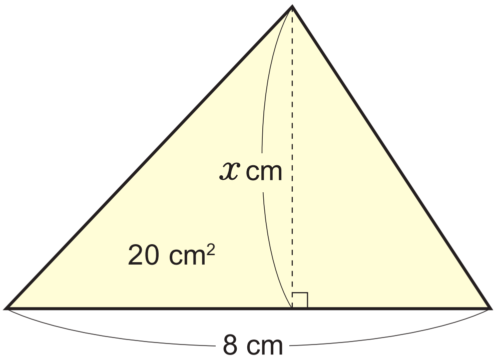
Ⓑ You want to make soya flour with the same sweetness. There is 140 g of soya flour, how many g of sugar do you need?

2 Represent quantities with a mathematical sentence or a graph.

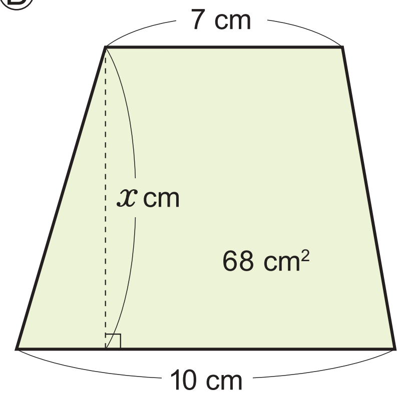
Grades 5 and 6

① Represent the area of the following triangle and trapezoid using a mathematical sentence with x and solve for x.

Ⓐ



Ⓑ



② Let's investigate the relationship of x and y in the following table (a) and (b).

Grade 6

(a)

Number of people x	2	3	4	6	8
Length of a string per person y (m)	12	8	6	4	3

(b)

Length of a string x (m)	1	2	3	4	5
Weight of a string y (g)	8	16	24	32	40

Ⓐ In which case is y directly proportional to x?
In which case is y inversely proportional to x?

Ⓑ Represent the relationship of x and y for table (a) and (b) in a mathematical sentence.

Ⓒ Draw a graph that represents a proportional relationship.

Math Adventure

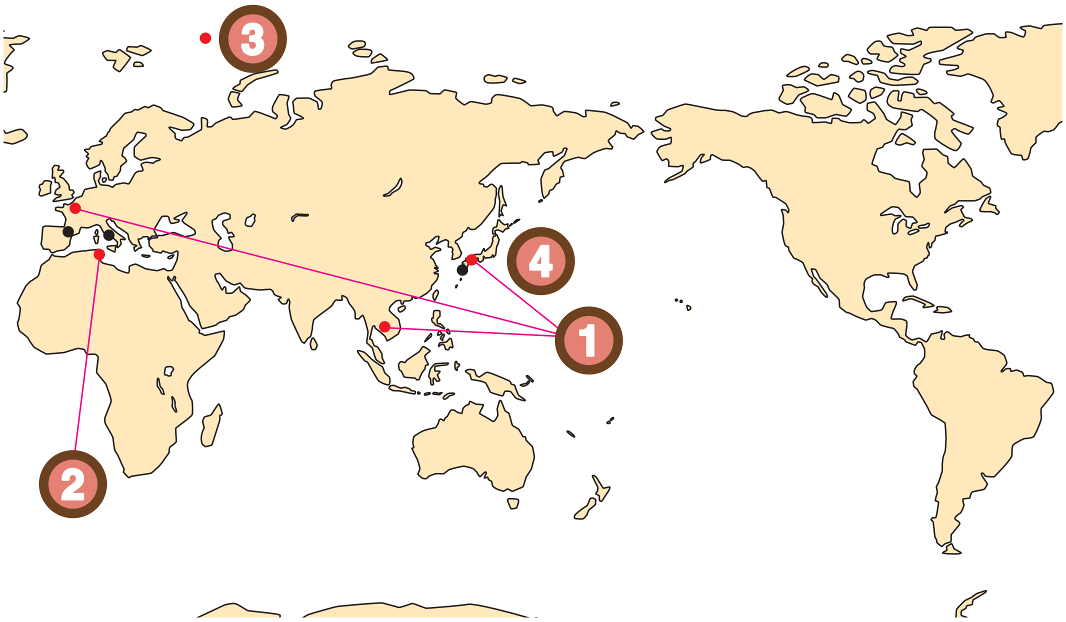
Part 1

In the world, you can find many beautiful shapes and patterns: Let's exlpore them. Let's find endangered animal species, too.

Professor Steven

The places of the fragments

1. Beautiful Shapes
2. Mosaic Patterns
3. Polar Bear Facing in the Crunch
4. Dividing a Map by Colouring



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

1 Beautiful Shapes

World Heritage Sites include a number of ancient buildings. Most of them have beautiful symmetric structures.

The Palace of Versailles in Paris, Itsukushima Shrine in Japan, Angkor Wat Ruins in Cambodia are some of the examples. Let's find other examples.


The Palace of Versailles


Itsukushima Shrine


Angkor Wat

There are a number of symmetric structures in our surroundings.

The Tokyo Tower and the National Parliament are also symmetric in structure.

The shape of a car is also symmetric from the front view.

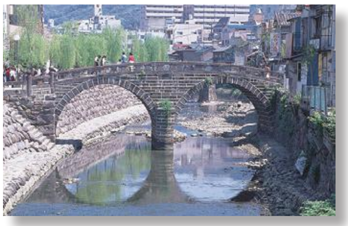
A Symmetry-structure is beautiful and stable.

While we are walking in town, we can see buildings with beautiful glasses and the reflection in the glasses is symmetric to the real objects.

Yes, I also saw a picture of Mt. Fuji, which is symmetric Mt. Fuji reflected on the lake, is known as upside-down Fuji.


Reflection of Fuji

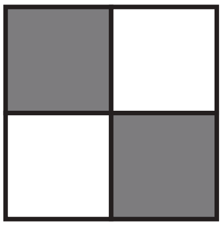
In Nagasaki, there is a bridge called Spectacle Bridge because the Bridge looks like spectacles when its reflected on the surface of the river.

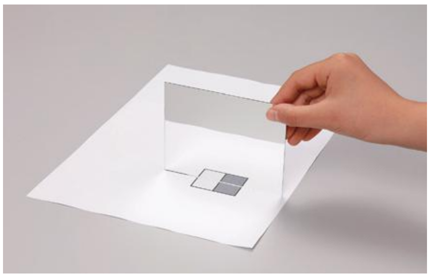

Spectacle Bridge

We can see these reflections only when the waters in the lakes and rivers are clear.

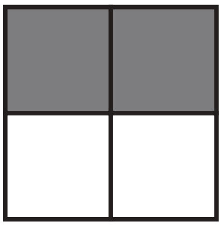
Here, let's identify symmetric shapes which can be created by reflection in a mirror.

Let's explore the position of the mirror where we can create the images of the same shapes for (1) to (4).

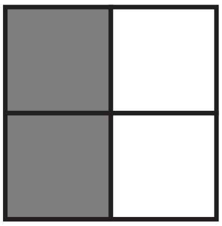




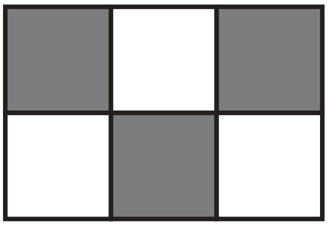
(1)



(2)

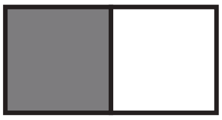


(3)



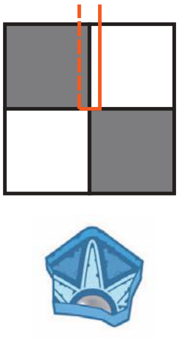
(4)

Where should we place the mirror to create the view on the right?

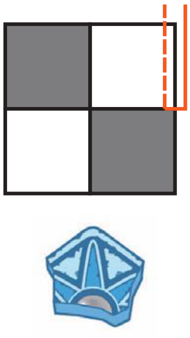


The side represented by - - - is the front side of the mirror.

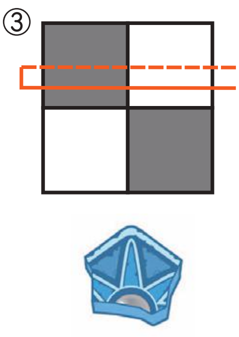
①



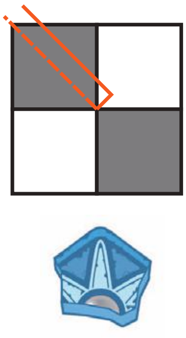
②



③



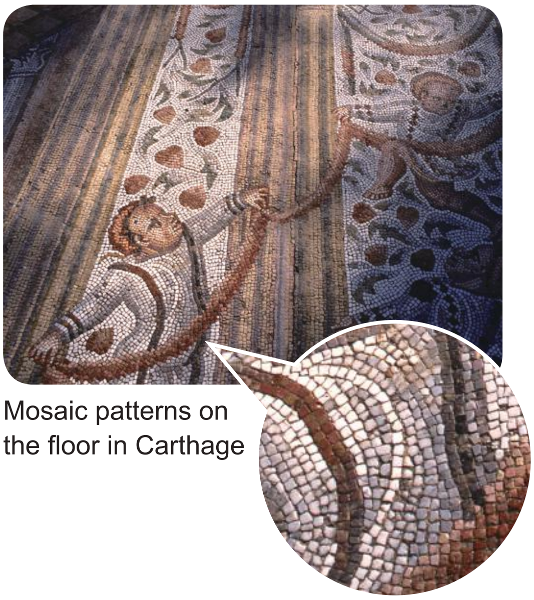
④



- Let's trace and cut out the fragments on page 198 and paste on the last page.

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

2 Mosaic Patterns



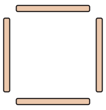
Mosaic patterns on the floor in Carthage

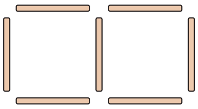
There was a country named Carthage which prospered about 2600 years ago in the Mediterranean Sea. Beautiful mosaic patterns still remain on the floors and walls there even after the country was conquered by the Roman Empire.

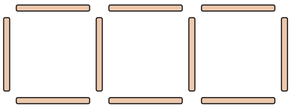
There are a number of small square tiles.

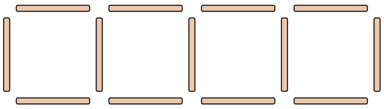
Various paintings were carefully developed by the tiles. How many tiles are necessary for developing them?

If we represent these square tiles by the same size sticks, how many sticks do we need?

If 1 square,  4 sticks.

If 2 squares,  7 sticks.

If 3 squares,  10 sticks.

If 4 squares,  ?

If we increase the number of squares, how many sticks do we need?
How about if the number of square is four?

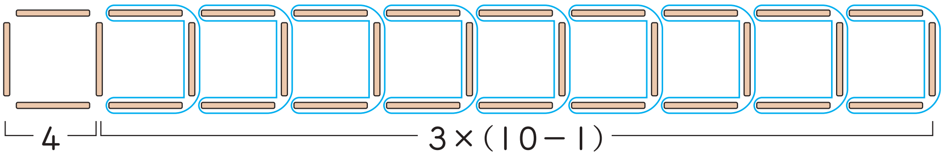
13 sticks.

Have you counted by each?

No, the number of sticks was increasing by 3, so I calculated by adding 3 to the last answer which is 10 + 3.

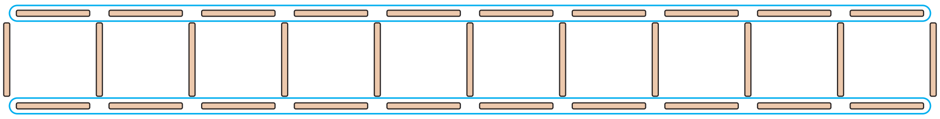
Now, how many sticks do we need for 10 squares?

We started with 4 sticks for 1 square and the number of sticks increased by 3 if the number of squares increased by 1, so we can get an answer by $4+3\times9$. “9” means 9 squares except for the first square. So, we can write $4+3\times(10-1)$, too.



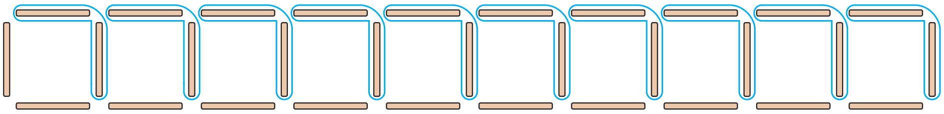
I see. If doing so, we can get the number of sticks by the number of squares at once.If we use symbols, we can represent the number of squares by x and the expression for the number of needed sticks is $4\times3\times(x-1)$.

If the number of squares is represented by $(x$, we can represent the number of needed sticks by $x\times2+(x+1)$, too. We can get it if we use the following figure.

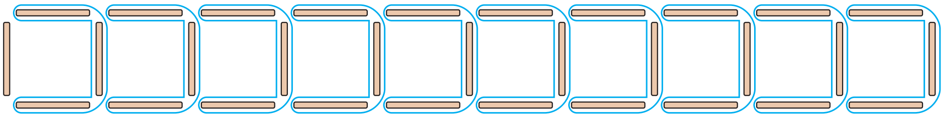


A friend developed the expression $x\times4-(x-1)$. How did he think about it? In the following, which figure explains his thinking?

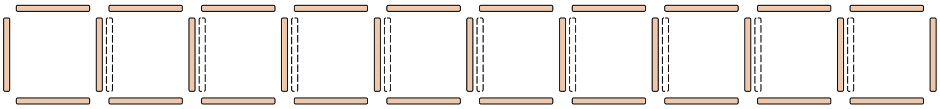
A



B



C



A

B

C

- Let’s trace and cut out the fragments on page 198 and paste on the last page.

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

3 Polar Bear Facing the Crunch

Polar Bears are animals which live in the coast of the Arctic circle.

The average height of the bear is 2.4 m and its weight is about 750 kg.

But, the number has been gradually decreasing and the government of the United States declared them as endangered species in May, 2008. During the announcement they said, “in the Arctic Ocean, the sea ice which is necessary for polar bears moving and catching food has been decreasing in the past decades because of the impact of Global warming.

If the situation is not changed, they face the danger of extinction in about 45 years.”

Polar bear (Insert: Its family)

That’s right. The main food for polar bears is seals. So, they search places to catch their food, moving on the sea ice.

But the sea ice has been decreasing too.

Furthermore, polar bears do not hibernate and so eat food to save fat during the winter and survive by burning its fat during the summer.

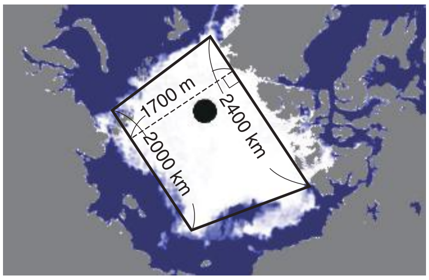
But, the summers are getting longer and longer every year.

Global warming of the earth has various impacts on the lives of different species.

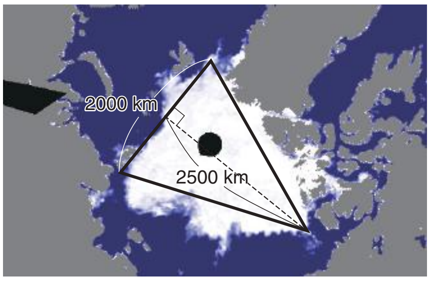
These are pictures of the sea ice in the Arctic Ocean which were taken from the top view of the North Pole by an artificial satellite.

These pictures were shot in September when there is less amount of the sea ice than any other month.

14/9/2006



23/9/2008



Based on these pictures, the shape of the ice in the picture on the left is a trapezoid and a triangle in the picture on the right.

From these figures, let's find the areas of the ice every year in rounded numbers to the ten thousands place. The earth is a sphere.

The actual area of the ice is bigger than what we can see.

The area of the sea ice in September, 2006

The area of the sea ice in September, 2008

By how many percents did the area of the sea ice in September, 2008 decreased since September, 2006?

A. about 20 %

B. about 24 %

C. about 33 %

D. about 40 %

- Let's trace and cut out the fragments on page 198 and paste it on the last page.

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

4 Dividing a Map by Colouring

What are you doing?

We are recording the World Heritage Sites and Japanese towns that are frequently visited by tourists on the blank map.

If we divide the provinces by colours, it will be easy to see.

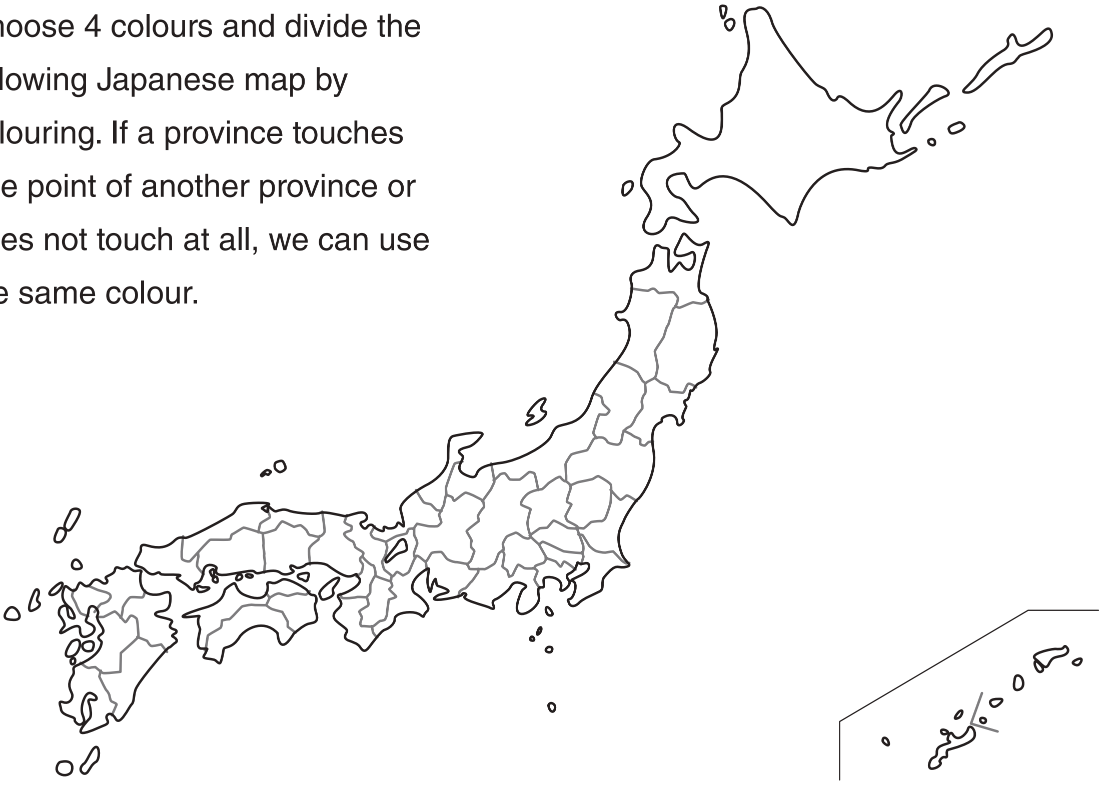
How many coloured pencils do you think is necessary so as not to make adjoined provinces coloured the same?

I am thinking, about 10 colours.

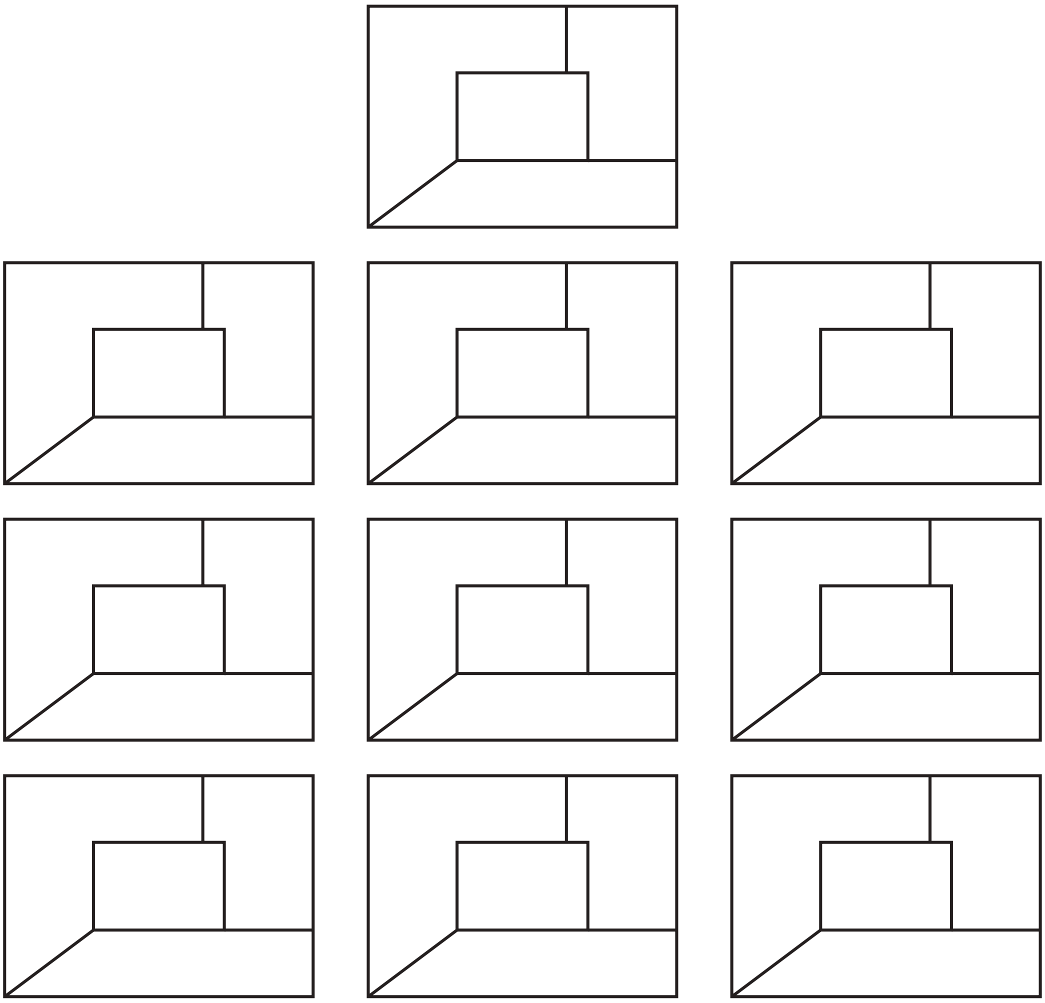
In fact, we can make adjoined provinces on any map painted by different colours if we have 4 colours.

Really?

Choose 4 colours and divide the following Japanese map by colouring. If a province touches one point of another province or does not touch at all, we can use the same colour.



Have you finished? I will give you a problem. If you colour the following figures with the same 4 colours, how many patterns can be made?
Let’s try and find out.



If the number of figures on this page is not enough, draw them in your exericse book. How many patterns can you draw?
Compare it with your friends’ colouring.

(1) 6 patterns

(2) 10 patterns

(3) 16 patterns

(4) 24 patterns

- Let’s trace and cut out the fragments on page 198 and paste it on the last page and make the key complete.

Parliament House of Papua New Guinea

The current Parliament building was officially opened by His Royal Highness, Prince Charles, on 8th August 1984. We can find many symmetrical design in this significant building. There are 4 parts of the building, each part of the building represents the 4 region's symbols. Entrance style of a Maprik Haus Tambaran (house of spirits from East Sepik Province) is a representation of Momase region. Circular cafeteria as Highlands design principles and a mosaic features unmistakably PNG motifs. Can you notice any symmetrical figures from the inserted pictures of the Parliament House?

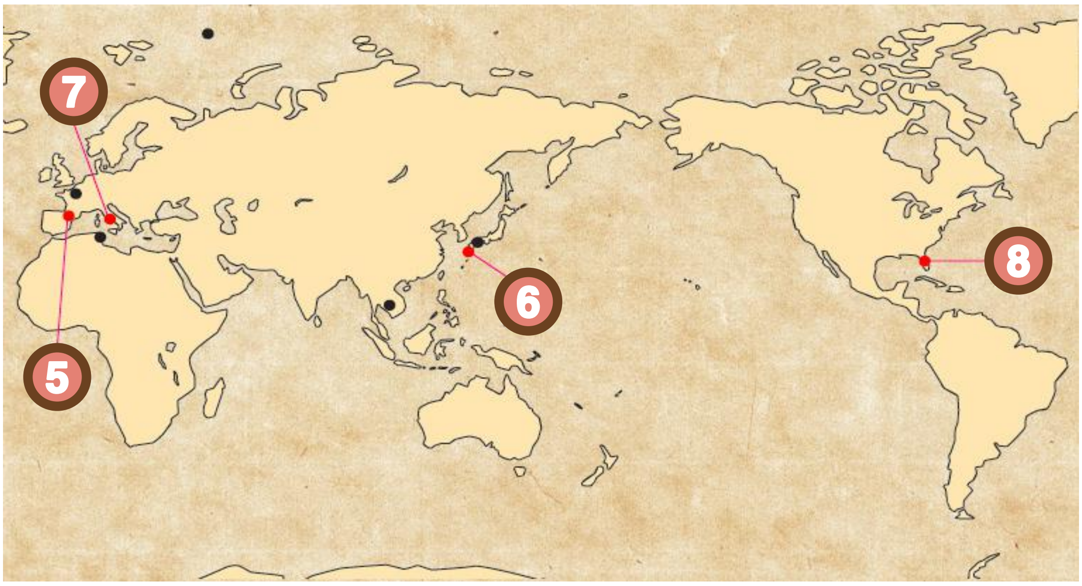
Math Adventure

Part 2

Finally, you are starting your last adventure to find a key. Let's look for applications in the society and the challenges to space.

The places of the fragments

- ⑤ Length of a Spiral
- ⑥ Sand Castle Art
- ⑦ Numbers Used in Ancient Rome
- ⑧ Challenge to Space



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

5 Length of a Spiral

There is a bridge in Spain that is quite interesting. It is called the Vizcaya Bridge and was declared a World Heritage Site in 2006.

The bridge hangs gondolas.

Why would they need to make a bridge for gondolas?

The height of this bridge is 50 m. There are a lot of vessels below this bridge and they are used for the industries around this district. Therefore it is necessary to make the bridge girder high.
Another reason is that there are already many buildings built by the river and there is not enough space to build a road up to this height.

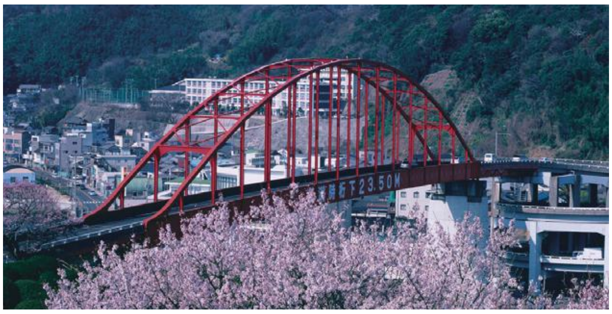
I see.

There is a similar bridge like this in Japan.

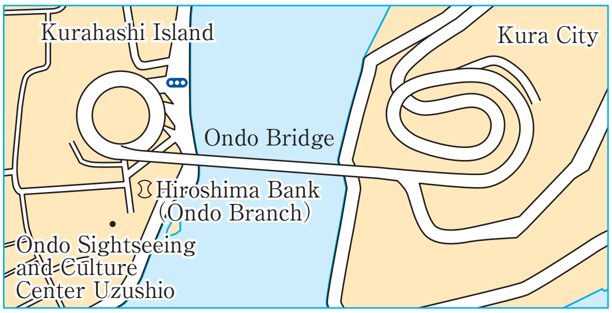
Vizcaya Bridge

Where is it?

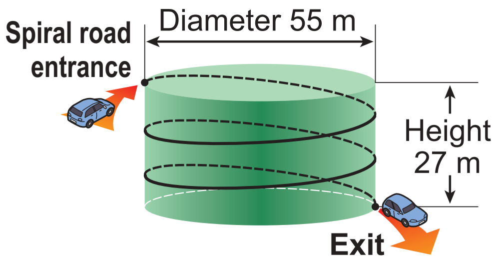
It is the Ondo Bridge in Hiroshima. It connects Kura City on the mainland to Kurahashi Island. This bridge is also built in a place where there are a lot of ships, so people call this place "Ginza in Ondo." Therefore it is necessary to make the bridge girder high. On the Mainland side, it is elevated but on the Kurahashi Island side it is as low as the sea level. There is not enough land to make a long road on the Kurahashi Island side. Consequently, people built a spiral shaped road, so they can go right underneath the bridge.



Ondo Bridge



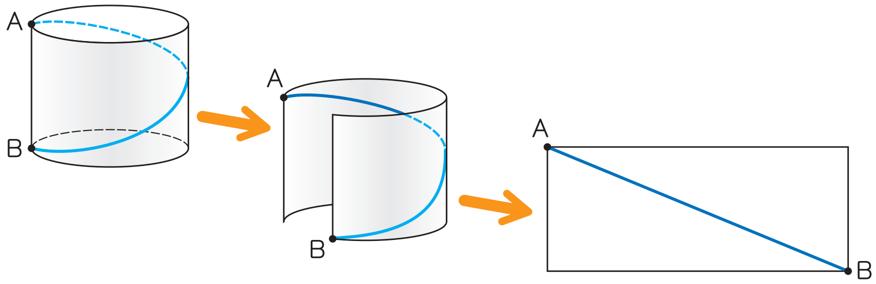
When you draw a spiral road using a cylinder, it will look like the picture on the right. The diameter of the bottom face is 55 m and the height is 27 m.



People go around the cylinder 2 and a half times.

The question is how long is the length of this spiral road.

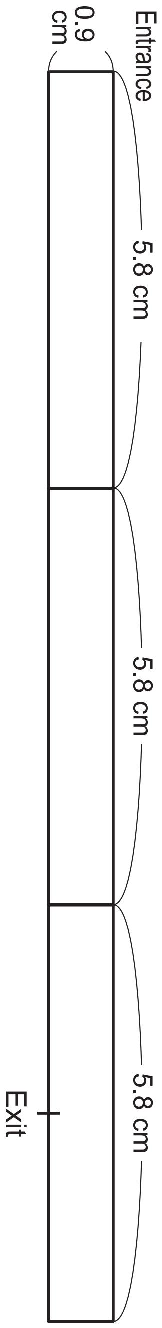
We can find it using an extended elevation.
For example, a spiral from point A, which is on the top of the top face, to point B, placed directly below point A, is a diagonal line of the rectangle on an extended elevation.



But it is 2 and a half rounds for this problem.

We can line up 3 side faces.

It will look like the picture on the right if you draw it in $\frac{1}{3000}$ reduced drawing.



How long in metres is the length of the spiral road at Ondo Bridge?

(1) About 300 m

(2) About 335 m

(3) About 400 m

(4) About 435 m

- Let's trace and cut out a key fragment on page 199 and paste on the last page.

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

6 Sand Castle Art

One of the three major sand hills in Japan, is Fukiage Beach in Minami-Satsuma City, Kagoshima Prefecture.

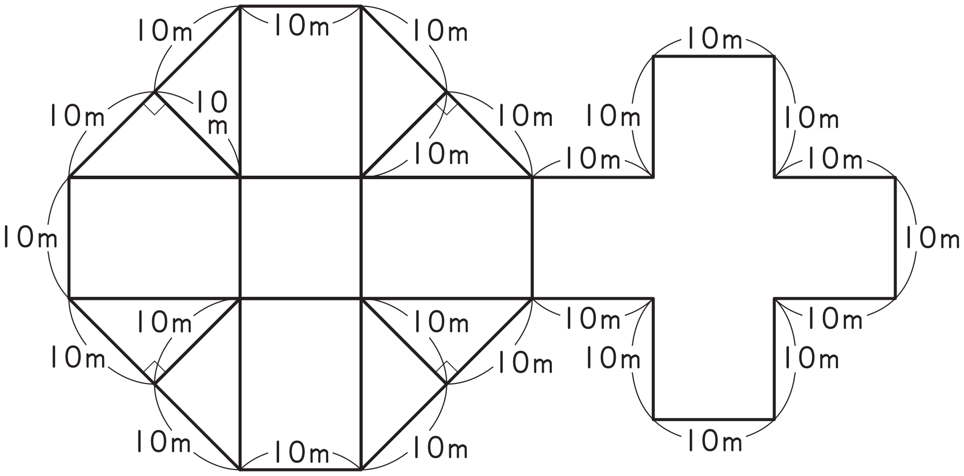
There is an event called Sand Festival every year and people make famous buildings or persons around the world including Japan using sand. In 2008, they built the Westminster Cathedral in England, the Palace of Versailles and the Notre Dame de Paris in France.

How is the Notre Dame de Paris built?

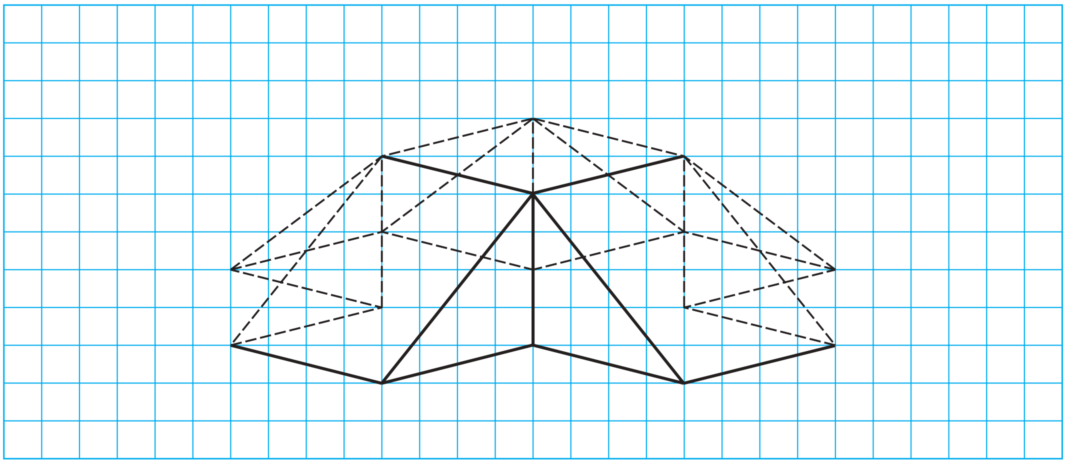
They harden the sand first and then it is dug out.

That's right. They first build a rough approximation on a board, put sand in it and harden it. Then, they remove the board one by one and build it high.

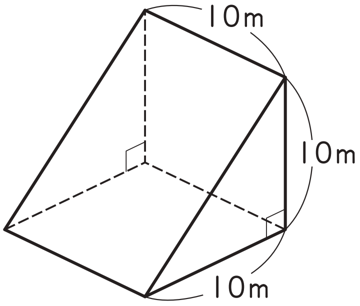
Now, it is time for a question. If you make a base, which looks like the shape of the built structure in this picture, how much is the volume in m³?

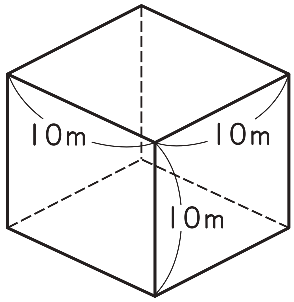


First, complete the blueprint below. Leave the part where you cannot see with a dotted line and connect the line of the part where you can see.
Build the figure on the previous page into a structure.



This shape is made with 4 parts of triangular prisms and 1 cube, which are shown below.





Calculate the volume of this solid and tell your friend how you calculated.

(1) 2500 m³

(2) 3000 m³

(3) 3500 m³

(4) 4000 m³

- Let's trace and cut out a key fragment on page 199 and paste on the last page.

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

7 Numbers Used in Ancient Rome

Out of the many world heritage sites with high historical value, Lyon and Rome in Italy are the places where many heritage of the Roman Emperor are found.


Historic District in Rome


Historic District in Lyon

Do you know how numbers are represented in ancient Rome?

I don't know. How are they represented?

The 2 pictures below show numbers used in ancient Rome, called Roman numerals. These numbers are still used today.

What are these numbers used for?


Milestone in ancient Rome

Clock

Have you ever seen symbols like I, II, III, IV, V, VI, VII, VIII, IX, X, XI and XII on a watch dial? These symbols represent; 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12.

Another example is shown at the end of a movie.

Example: Copyrights MCMLXXXVIII

Do you understand what they represent?

First VIII seems like it represents 8, when you look at the clock face.
Probably X represents 10. But I don't really understand the rule.

I understand. Roman numerals correspond to numbers like below.

I	V	X	L	C	D	M
1	5	10	50	100	500	1000

They write a bigger number from the left and the sum of all digits is the number that this Roman numeral represents.

However, the left symbol is smaller for IV.

When a smaller number is written on the left side of a bigger number, you subtract the number written before from the number written after.
For example, in IV you subtract 1 from 5, which represents 4.
You can also write it like IIII.

Then, for CM you subtract 100 from 1000, which means 900.

I got it. When you think it as M CM LXXX VIII, it means
$1000+900+80+8=1988$.

The way of representing numbers adopts an idea of positional notation.
Here is an exercise. Calculate the mathematical sentence written in Roman numerals below and also write the answer in Roman Numerals.

MCMLXXXVII + MCMXCIX

(1) M M D C C C L X X VII


(2) M M M D C C C L X X X VII


(3) M M M C M L X X X VI


(4) M M C M L X X X VII


• Let's trace and cut out a key fragment on page 199 and paste on the last page.

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

8 Challenge to Space

The view of the earth from space

Let’s look back on this adventure. We started our journey from where we are to an exciting adventure that brought us all around the world.

Mathematics has power to answer gloomy questions. We learned about the earth and now I want to know about space.

When you look out into space, there might be several planets where intelligent life forms live like on the earth.

The Voyager space probe, launched in 1977 from America, carried a record to show the existence of life forms and cultures on the earth. It has 115 photos and the “Sounds of Earth”, that includes the sounds of waves, winds, thunders and noises of birds and animals. In addition, it even contains world music and 55 languages. It included performances of the Japanese bamboo flute for world music and the Japanese language.


Record in Voyager

It was a message for other celestial life forms, to let them know about the nature and civilization of the earth. It will be wonderful if somebody out there finds them.

There is an interesting sound in one message. It is called the Morse code, which is represented with dots and dashes.
Morse invented the electrical telegraph system in the 19th century.
It is not used much today, but it is useful under noisy situations because it is represented with 2 simple sounds.

Morse Code

A	•–	G	––•	M	––	S	•••	W	•––
B	–•••	H	••••	N	–•	T	–	X	–••–
C	–•–•	I	••	O	–––	U	••–	Y	–•––
D	–••	J	•–––	P	•––•	V	•••–	Y	––••
E	•	K	–•–	Q	––•–				
F	••–•	L	•–••	R	•–•				

Rules for the Morse Code

(1) A dash is equal to 3 dots.
(2) The space between parts of the same letter is equal to one dot.
(3) The space between two letters is equal to three dots.
(4) The space between two words is equal to seven dots.

When you send a word below using Morse code, how long is the length of the Morse code? Count it with the number of dots.

– –	– •	–	• • • •	• • •
M	A	T	H	S

U is “ • • –”. There will be a dot between “ • ” and “ • ” and “ • ” and “–”.
A dash equals to 3 dots, so it will be 7 dots.
The space between two letters is equal to 3 dots. Therefore, the number of dots will be like below.

M		A		T		H		S
7	3	5	3	3	3	7	3	5

The word that was included to the records of the Voyager space probe using Morse code is,

“ad astra per aspera”

which means “Through hardships to the stars” in Latin. When you write this word with Morse code, it will look like below.
If you state 1 dot is $\frac{1}{3}$ second, how long is the length of the word in seconds? Read the rules and find out.

• –	– • •	• –	• • •	–	• – •	• –	• – – •	•	• – •
a	d	a	s	t	r	a	p	e	r
• –	• • •	• – – •	•	• – •	• –				
a	s	p	e	r	a				

(1) 36 seconds

(2) 39 seconds

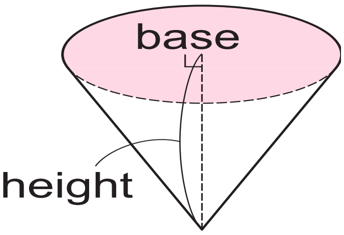
(3) 46 seconds

(4) 49 seconds

- Let’s trace and cut out a key fragment on page 199, paste on the last page and complete the key.

Mining pots in Papua New Guinea

Since 1970, the mining industry has dominated PNG's economy. Mineral exports are gold, copper, silver, nickel and cobalt. PNG mines are spread across the country, the largest of which include: Ok Tedi Copper and Gold Mine, Porgera Gold Mine, Lihir Gold Mine, Hidden Valley Gold Mine, Simberi Gold Mine, Tolukuma Gold Mine and Ramu Nickel Mine. The Porgera Gold Mine is a large gold and silver mining operation in Enga province, Papua New Guinea. The open pit mine moves about 160 000 tonnes of rock material.



The mining pit is a like cylinder shape as shown in the picture. The blast left a crater of 400 metres wide and 150 metres deep. Estimate the volume of the rock and soil that were removed using the method of calculation learned in this grade.

Answers

Chapter 1 Excercise: Page 17

❶ See teacher

❷ Line symmetry Ⓑ 2, Ⓒ 1, Ⓓ 4, Ⓔ 1
Point symmetry Ⓑ, Ⓓ, Ⓕ

Do you remember?: Page 17

① 51.6 ② 126 ③ 35.28 ④ 64.5
⑤ 56 ⑥ 94.75 ⑦ 2.4 ⑧ 13

Chapter 1 Problems: Page 18

❶ Line symmetry: ①, ②, ④ & ⑤
Point symmetry: ③ & ④

❷ See teacher ❸ See teacher

❹ ① See teacher ② Point of symmetry
③ See teacher

Chapter 1 Problems: Page 19

❶ ① See teacher ② See teacher

Chapter 2 Excercise: Page 28

❶ ① $x\times6=720$ $x=120$ ② $x\times5=650$ $x=130$
③ $20+x=52$ $x=32$ ④ $x-50=60$ $x=110$

❷ ① 14 ② 8 ③ 10.5 ④ 1.5

Chapter 2 Problems: Page 28

❶ ① $90\times x$ ② 50 cm ③ See teacher

Chapter 2 Review: Page 29

❶ ① 1, 0.1, 0.01 ② 2, 0.001

❷ ① 72.6 ② 726 ③ 0.726 ④ 0.0726

❸ ① 280 kina ② 1960 kina

❹ Outdoor is more crowded.

❺ ① 6.4 ② 4 ③ 17.1 ④ 6.48 ⑤ 1.04 ⑥ 4.2
⑦ 0.3 ⑧ 2 ⑨ 6.12 ⑩ 11.68 ⑪ 42.976 ⑫ 19.8

❻ 27 kg, 2.88 kg

Chapter 3 Excercise: Page 38

❶ ① $\frac{3}{20}$ ② $\frac{15}{56}$ ③ $\frac{12}{35}$ ④ $\frac{8}{27}$ ⑤ $\frac{5}{9}$
⑥ $\frac{1}{6}$ ⑦ $\frac{1}{4}$ ⑧ $\frac{4}{9}$ ⑨ $4\frac{1}{2}$ ⑩ $3\frac{3}{4}$
⑪ $\frac{1}{3}$ ⑫ 2 ⑬ $5\frac{3}{5}$ ⑭ 6 ⑮ $6\frac{3}{4}$ ⑯ 26

❷ $5\times\frac{5}{6}$ and $5\times\frac{9}{10}$

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

Chapter 3 Problems: Page 38

❶ $\frac{5}{14}$ kg ❷ $\frac{1}{5}$ m²

❸ ① See teacher ② $\frac{3}{2}\times\frac{4}{6}$
③ $\frac{8}{2}\times\frac{3}{6}$ (② and ③ are examples.)

Chapter 4 Excercise: Page 45

❶ ① $\frac{14}{15}$ ② $\frac{2}{9}$ ③ $\frac{2}{3}$ ④ $\frac{4}{5}$ ⑤ $7\frac{1}{2}$ ⑥ $4\frac{1}{2}$
⑦ $1\frac{4}{11}$ ⑧ $3\frac{3}{5}$ ⑨ $\frac{1}{4}$ ⑩ $\frac{1}{14}$ ⑪ $7\frac{7}{9}$ ⑫ 3

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

❹ $\frac{15}{8}$ cm ❺ 6 pieces

Do you remember?: Page 45

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

Chapter 4 Problems: Page 46

❶ ① $1\frac{2}{7}$ ② $\frac{2}{7}$ ③ $\frac{9}{10}$ ④ $\frac{4}{5}$
⑤ $17\frac{1}{2}$ ⑥ $19\frac{1}{4}$ ⑦ $4\frac{2}{3}$ ⑧ $1\frac{2}{3}$

❷ ① $x=\frac{4}{7}$ ② $x=1$ ❸ $1\frac{1}{8}$ kg ❹ $1\frac{1}{3}$ cm

❺ $\frac{1}{5}$ ❻ 10 necklaces ❼ 8 hours

Chapter 6 Excercise: Page 58

❶ ① 5.38, 1.12, 6.9225, 1.5
② 12.43, 3.69, 35.2222, 0.5
③ 15.75, 2.61, 60.3126, 1.4
④ 6.17, 4.47, 4.522, 0.2

❷ ① $\frac{5}{6}$, $\frac{1}{6}$, $\frac{1}{6}$, $1\frac{1}{2}$ ② $\frac{13}{21}$, $\frac{1}{21}$, $\frac{2}{21}$, $1\frac{1}{6}$
③ $2\frac{13}{24}$, $\frac{19}{24}$, $1\frac{11}{24}$, $1\frac{19}{21}$ ④ $6\frac{1}{12}$, $1\frac{5}{12}$, $8\frac{3}{4}$, $1\frac{17}{28}$

❸ ① $\frac{2}{9}$ ② $21\frac{1}{3}$ ③ $1\frac{3}{7}$ ④ $5\frac{5}{9}$ ⑤ $3\frac{4}{7}$ ⑥ 4

❹ $1\frac{1}{4}$ cm

Do you remember?: Page 58

See teacher

Chapter 7 Excercise: Page 66

❶ ① 78.5 cm² ② 153.86 cm² ❷ 59.66 cm²

Do you remember?: Page 66

① $1\frac{1}{6}$ ② $3\frac{1}{12}$ ③ $3\frac{9}{10}$ ④ $6\frac{8}{21}$
⑤ $\frac{7}{15}$ ⑥ $\frac{19}{20}$ ⑦ $\frac{12}{35}$ ⑧ $1\frac{1}{24}$

Chapter 7 Problems: Page 67

❶ ① Circumference: 18.84 cm, Area: 28.26 cm²
② Circumference: 37.68 cm, Area:113.04 cm²

❷ ① Diameter: 2 cm, Area: 3.14 cm²
② Diameter: 4 cm, Area: 12.56 cm²

❸ ① Circumference: 12.56 cm, Area: 12.56 cm²
② Circumference: 25.12 cm, Area: 50.24 cm²
③ Circumference: 31.4 cm, Area: 78.5 cm²
④ Circumference: 62.8 cm, Area: 314 cm²

Chapter 8 Excercise: Page 75

❶ abc, acb, bac, bca, cab, cba ❷ 16 combinations

❸ ① 45
② 345, 354, 435, 453, 534, 543, 6 numbers
③ 3 & 4, 3 & 5, 4 & 5, 3 combinations

Do you remember?: Page 75

ⓐ 6 cm² ⓑ 8 cm² ⓒ 8 cm²

Chapter 8 Problems: Page 76

❶ 6 ways

❷ ① 18 numbers: 1023, 1032, 1203, 1230, 1302, 1320, 2013, 2031, 2103, 2130, 2301, 2310, 3012, 3021, 3102, 3120, 3201, 3210
② 10 numbers: 1032, 1230, 1302, 1320, 2130, 2310, 3012, 3102, 3120, 3210

❸ 12 ways

Chapter 8 Review: Page 77

❶ ① $\frac{6}{35}$ ② $\frac{5}{6}$ ③ $\frac{5}{12}$ ④ 8 ⑤ $\frac{15}{16}$
⑥ $1\frac{1}{3}$ ⑦ $\frac{3}{8}$ ⑧ $1\frac{1}{6}$ ⑨ $\frac{4}{25}$ ⑩ 1 ⑪ $1\frac{4}{5}$

❷ $\frac{2}{3}$ kg and $2\frac{1}{3}$ kg ❸ 15 pieces

❹ ① $1\frac{1}{3}$ times ② 360 cm ❺ $1\frac{3}{5}$ cm³

Chapter 9 Excercise: Page 84

❶ ① 70 km/h ② 80 km/h

❷

	Speed/hour	Speed/min	Speed/sec
Small plane	270 km	4.5 km	75 m
Racing car	240 km	4 km	$66\frac{2}{3}$ m
Sound	1224 km	20.4 km	340 m

❸ ① 800 metres/min ② 3200 m

Do you remember?: Page 84

① 28.26 cm² ② 1256 cm²
③ 78.5 cm² ④ 1256 cm²

Chapter 9 Problems: Page 85

❶ 600 km/h ❷ A 1.8 km/min train is faster.
❸ ① 300 km ② 16 hours ❹ 840 m
❺ ① 900 m ② 3.6 km ③ 4 hours 30 minutes

Chapter 10 Excercise: Page 90

❶ ① 480 cm³ ② 125.6 cm³
❷ ① 81 cm³ ② 336 cm³

Do you remember?: Page 90

① 3.6 ② 11.1 ③ 10 ④ 6.12 ⑤ 15.84
⑥ 31.62 ⑦ 13.09 ⑧ 4.428 ⑨ 70.956

Chapter 10 Problems: Page 91

❶ ① 750 cm³ ② 380 cm³
❷ 628 cm³ ❸ 1.23 cm³

Chapter 11 Excercise: Page 101

❶ ① 100 : 50 (2 : 1) ② 8 : 16(1 : 2)
❷ ① $x=6$ ② $x=20$ ③ $x=128$ ④ $x=75$
❸ ① 3 : 4 ② 4 : 7 ③ 3 : 2 ❹ 12 cm

Do you remember?: Page 101

① 4.32 ② 0.6 ③ 5.12 ④ 1.2 ⑤ 38.663 ⑥ 0.8
⑦ $\frac{2}{3}$ ⑧ $\frac{1}{5}$ ⑨ $1\frac{11}{24}$ ⑩ $\frac{5}{6}$ ⑪ $2\frac{7}{12}$ ⑫ $1\frac{3}{8}$

Chapter 11 Problems: Page 102

❶ ① Rice: 200 g, Curry: 20 g
② Rice: 800 g, Curry: 80 g ③ 60 g
❷ 21 balls ❸ 8 cm
❹ 14 cm length, 16 cm width

Chapter 12 Excercise: Page 118

❶ a&f, b&h, c&g, d&e ❷ See teacher
❸ Lenght is 30 metres and width is 16 metres.

Do you remember?: Page 118

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

Chapter 12 Review: Page 119

❶ Side AB, BC and Angle B, Side BC, CA and Angle C, Side CA, AB and Angle A, Side BC and Angle B, C, Side AB and Angle A, B, Side AC and Angle A, C, Side AB, BC, CA
❷ ① 120° ② 70° ③ 115°
❸ ① 4 ② 15 ③ 0.4 ④ 1.5 ⑤ 1.5
⑥ 15.25 ⑦ 1.6 ⑧ 2.2 ⑨ 5.7
❹ ① 3 remainder 1 ② 16 remainder 0.1
❺ 15 days ❻ ① 16000 cm³ ② 96 cm³

Chapter 13 Excercise: Page 136

❶ ①

x	1	2	3	4	5
y	50	100	150	200	250

②

x	1	2	3	4	5
y	4	8	12	16	20

❷ $y=3\times x$

❸ ①

x	0	1	2	3	4	5
y	0	80	160	240	320	400

② $y=80\times x$ ③ See teacher

Chapter 13 Excercise: Page 141

❶ ①

x cm	1	2	4	5	8	16	32
y cm	32	16	8	6.4	4	2	1

② Yes ③ $x\times y=32$ ($y=32\div x$) ④ 3.2 cm

❶ ①

x km/h	1	2	4	5	10	20	25
y (hours)	100	50	25	20	10	5	4

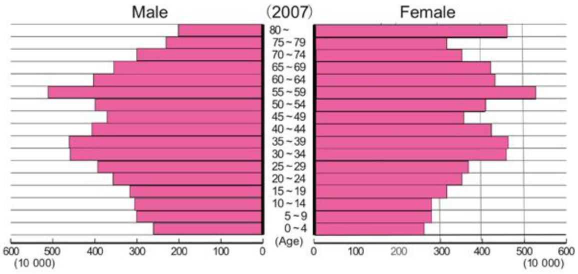
② $x\times y=100$ ($y=100\div x$) ③ 1 hour

Chapter 13 Review: Page 142-143

❶ ① parallel, trapezoid ② parallel, parallelogram
③ equal, rhombus
❷ See teacher
❸ ① b, c, e, f ② c, f ③ c, f
④ b, c, e, f ⑤ b, c, e, f ⑥ a
❹ ① 6 lines ② See teacher ③ B
❺ ① B ② See teacher ③ See teacher
❻ ① $x\times 3.14$ ② 39.4384 cm

Chapter 14 Problems: Page 155

❶



Chapter 14 Review: Page 156

❶ ① Circumference: 31.4 cm, Area: 78.5 cm²
② Circumference: 56.52 cm, Area: 254.34 cm²
❷ ① Diameter: 3 cm, Area: 7.065 cm²
② Diameter: 6 cm, Area: 28.26 cm²
❸ ① Circumference: 25.12 cm, Area:50.24 cm²
② Circumference: 50.24 cm, Area: 200.96 cm²
③ Circumference: 62.8 cm, Area: 314 cm²
④ Circumference: 75.36 cm, Area: 452.16 cm²

Glossary

Corresponding Angles is the matching angles of a figure when using line and point symmetry. · · · · · · · · · · · · · · · · · 5

Corresponding Points is the matching points of a figure when using line and point symmetry. · · · · · · · · · · · · · · · · · 5

Corresponding Sides is the matching sides of a figure when using line and point symmetry. · · · · · · · · · · · · · · · · · 5

Enlarged Figure is when each corresponding angle is equal, and all lengths of corresponding sides are extended in the same ratio. · · · · · · · · · · · · · · · · 106

Equivalent Ratio is when the value of 2 ratios are equal. · · · · · · · · · · · · · · · 95

Giga is the Mathematical prefix for Billion · · · · · · · · · · · · · · · · 165

Integrate is used in mathematics when 2 rules, approaches or concepts are combined together to solve a problem or situation. · · · · · · · · · · · · · · · · 159

Inverse of a number is when product of 2 fractions is 1, one fraction of the other is called the other fraction's reciprocal. · · · · · · · · · · · · · · · · 37

Kilolitre is a unit of volume. 1000 L is called 1 Kiloliter and is written as 1 KL. · · · · · · · · · · · · · · · · 161

Line Symmetry is the folding line that a figure makes when folded in half and the shape fits exactly on top of each other. · · · · · · · · · · · · · · · · · 4

Mega is the mathematical prefix for Million · · · · · · · · · · · · · · · · 165

Metric system use units like m or kg as a standard and the system of units that are multiples of 10. · · · · · · · · · · · · · · · · 163

Milligram is a unit of weight. $\frac{1}{1000}$ g is called milligram and is written as 1mg. · · · · · · · · · · · · · · · · 162

Multiplicand is the number or factor that is to be multiplied. · · · · · · · · · · · · 35

Ommision is to leave out or exclude. · · · · · · · · · · · · · · · · 76

Plot is to mark a position or point on a graph. · · · · · · · · · · · · · · · · 130

Point of Symmetry is when a figure is rotated 180° at a fixed point and the shape matches its original exactly. The fixed point is called the point of symmetry. · · · · · · · · · · · · · · · · · 8

Radii is the plural (more than one) for ***Radius***. · · · · · · · · · · · · · · · · 66

Rate is when comparing two quantities while considering the base quantity as 1, the relationship is called rate. ················ 47

Ratio is the relationship between two amounts, showing number of times one contains the other. ················ 94

Reduced Figure is when each corresponding angle is equal and all lengths of corresponding sides are decreased in the same ratio. ············· 106

Reduced Scale is the ratio that represents how much it is reduced from the real size or length. ················ 116

Repetition is repeating or happening again. ················ 70

Respectively is when a number of things are mentioned one by one, referring back to a previous statement about the subject. ··············· 5

Simplifying a ratio is not changing the value of the ratio while changing the ratio into smaller whole numbers. ················ 98

Suppose is to think to be true or to think that it is most likely to occur. ···· 49

Quadrangular Prism is any prism that has a quadrilateral as the base. ··· 86

Attachments

Let’s match fragments of the key to the last page of the Adventure.

Beautiful Shapes (Page 176)

①


②


③


④


Mosaic Patterns (Page 178)

A


B


C


Polar Bears Facing the Crunch (Page 180)

A

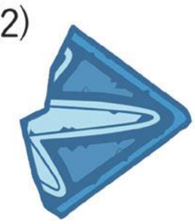

B


C


D


Dividing a Map by colouring (Page 182)

(1)


(2)


(3)


(4)


Let’s match fragments of the key to the last page of the Adventure.

Length of a Spiral (Page 186)

(1)


(2)


(3)


(4)


Sand Castle Art (Page 188)

(1)


(2)


(3)


(4)


Numbers used in Ancient Rome (Page 190)

(1)


(2)

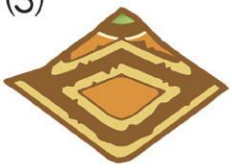

(3)


(4)


Challenge to Space (Page 192)

(1)


(2)


(3)


(4)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