New Syllabus

Primary Mathematics

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6A

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CONTENTS

5. Percentage

6. Speed

PREFACE

The New Syllabus Primary Mathematics (NSPM) series is designed and written based on the latest primary mathematics syllabus. In this series, the concrete to abstract approach is adopted to introduce new concepts. Vivid and stimulating illustrations are used throughout the series to enhance learning. The knowledge base is built incrementally as the pupils progress up the levels so as to consolidate the linkages among mathematical concepts.

The series aims to meet the learning needs of pupils from Primary One to Six. It comprises textbooks and workbooks at each level. Every worksheet in the workbook corresponds to each concept learnt. Textbook 6A comprises 6 chapters. Each chapter comprises the following sections:

Do You Know? Relevant, thought-provoking questions are asked with regard to the real life situation presented at the beginning of each chapter to link Mathematics to daily life.

Let's Learn New concepts are explained in a straight-forward and interesting way. Creative and critical thinking, as well as an awareness of problem-solving strategies, are developed through worked examples in this section. Guided examples provide reinforcement and consolidation of the concepts taught.

Let's Explore Active participation in exploration of the concepts learnt and creative application of Mathematics to daily life, including IT and hands-on activities, help to develop lifelong learners. Social skills such as effective communication, cooperation and team spirit are encouraged through group and pair work.

Let's Think Opportunities are provided to develop higher order thinking skills and proficiency in applying the concepts learnt through non-routine and challenging questions.

Let's Try Exercises are provided for pupils to develop their problem-solving skills, so that pupils grow into confident and independent learners.

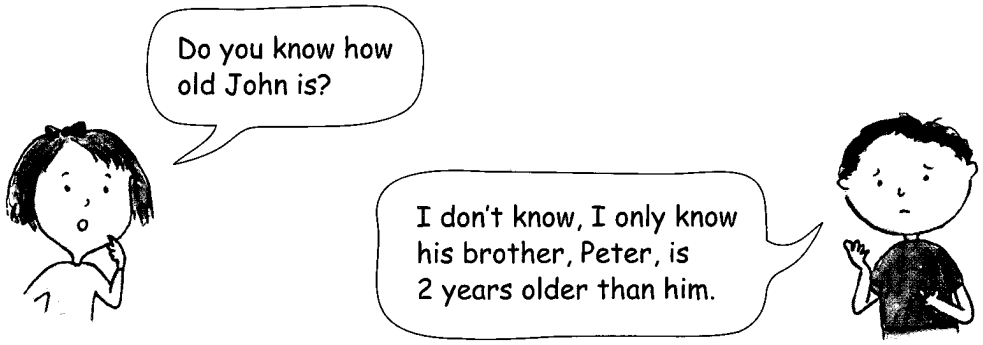
Fun with Maths Mathematical concepts are extended beyond the boundaries of the classroom and taken into the realm of games and experiments to further engage and develop pupils' interest in Mathematics.

Algebra

How can we express the height of one storey which is an unknown quantity?
How can we express the height of the building in terms of the height of each storey?

Let's Learn .•. Unknown Quantities and Algebraic Expressions

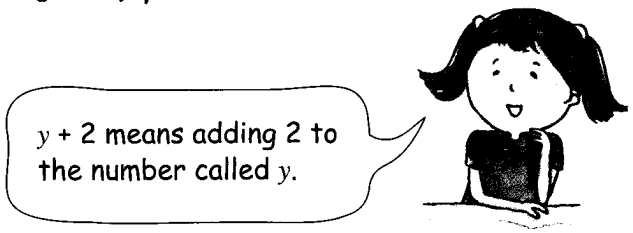
1.



John's age is unknown. We can express it using a letter such as y.

That is, John is y years old.

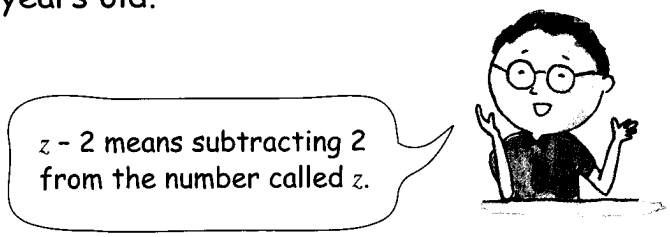
Hence, Peter is $(y + 2)$ years old.



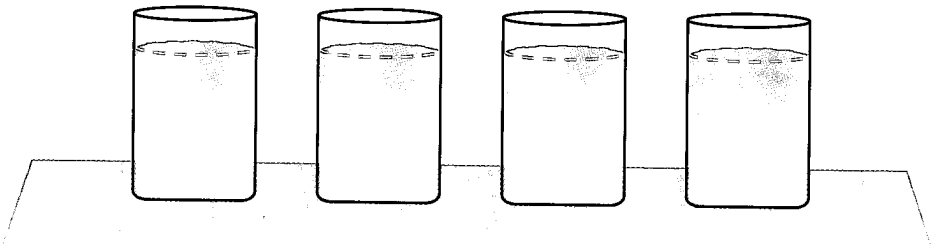
In the above situation, we can also express Peter's age using a letter such as z.

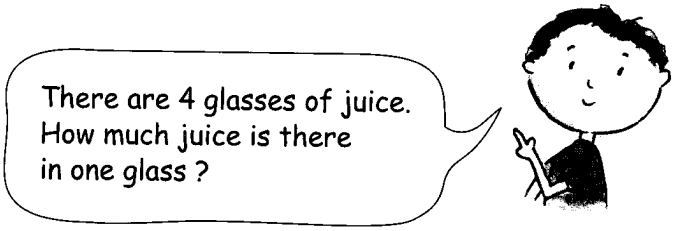
That is, Peter is z years old.

Hence, John is $(z - 2)$ years old.



2. How much juice is there in all these glasses?





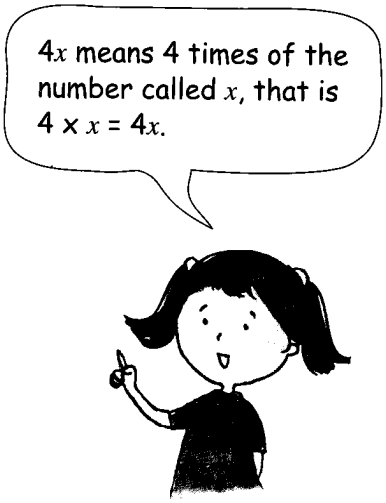
The amount of juice in one glass is unknown.
We can express it using a letter x.
That is, there is x ml of juice in one glass.

The amount of juice in 4 glasses is then

$$x + x + x + x = 4 \times x.$$

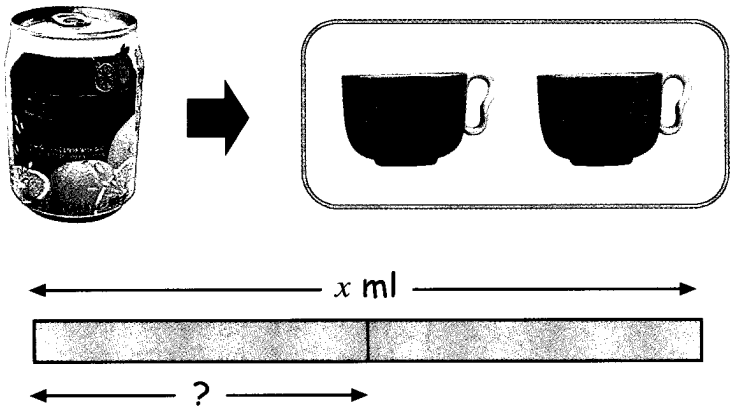
We write $4 \times x$ as $4x$.

So the amount of juice in 4 glasses is $4x$ ml given that the amount of juice in 1 glass is x ml.



We use letters like x, y, z ... to represent unknown quantities. $4x$, $y + 2$ and $z - 2$ are examples of algebraic expressions.

3. One can of orange juice can fill 2 identical cups exactly.
What is the capacity of a cup?



The volume of orange juice in the can is unknown. We express it using the letter x.

The capacity of each cup is the same as the volume of orange juice it can fill, that is $(x \div 2)$ ml.

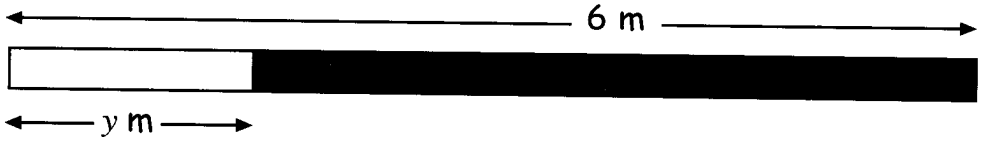
We write it as $\frac{x}{2}$ ml.

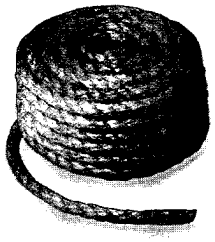
We can also express the amount of orange juice in the can using the letter y.

Then the capacity of each cup is $\frac{y}{2}$ ml.

We can express an unknown quantity using any letter.

4. A rope is 6 m long. After an unknown length of y m is cut from it, the remaining length is cut equally into 4 parts. How long is each part?



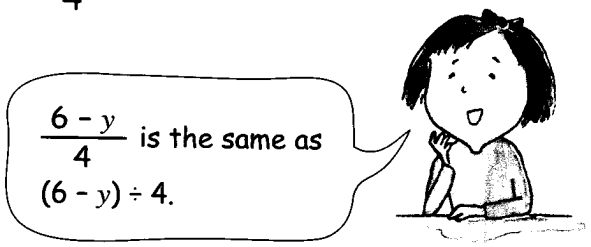


Length of the rope cut at the beginning = y m

Remaining length of the rope = $(6 - y)$ m

Divided the remaining length equally into 4 parts.

Length of each part = $\frac{6 - y}{4}$ m



5. There are x pupils in a class. 12 of them are girls. 5 pupils wear glasses.

Using the information above, write down the algebraic expression for each situation shown below:

Situation	Algebraic expression
The number of boys in the class.	
The number of pupils not wearing glasses in the class.	

Work in pairs.

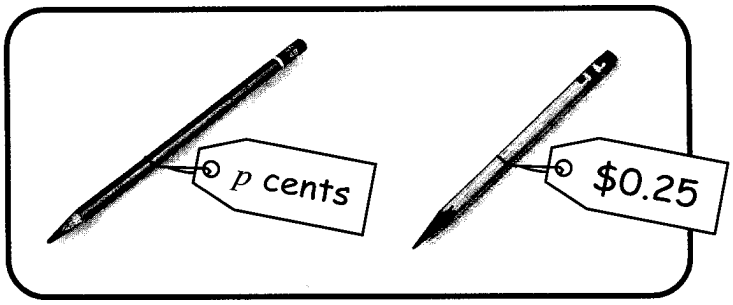
A Work out with your partner the algebraic expression in each case given below:

1. Your age after x years from now will be ▢.

   Your partner's age y years ago was ▢.

2. A box has y oranges. 5 oranges are rotten and removed.
   The remaining oranges are to be placed equally in 2 containers.
   Each container will have ▢ oranges.

3. A pencil costs p cents. Another pencil costs 25 cents.
   The average cost for the two pencils is ▢.



B Take turns with your parther to make up some situations involving unknowns and work out the algebraic expressions.

Unknown Quantities and Algebratic Expressions

1. Write an algebraic expression for each of the following cases below.

   (a) 9 is added to y.
   (b) 3 is subtracted from p.
   (c) m is divided by 3.
   (d) 6 is added to $5n$.
   (e) 2 is subtracted from $4q$.

2. Write an algebraic expression for each of the following cases below.

   (a) Jane had \$$x$ at first. After she got \$15 from her grandmother, how much did she have?
   (b) Mary has a string with the length x metres. She cuts the string into 5 parts equally. How long is one part?
   (c) The volume of water in a bottle is p ml. After filling up 5 identical cups fully, there is still 200 ml of water left in the bottle. What is the capacity of each cup?

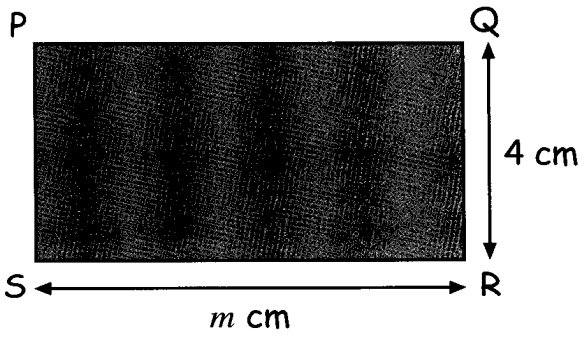
3. Form an algebraic expression in each case by using a letter of your choice for the unknown number or quantity.

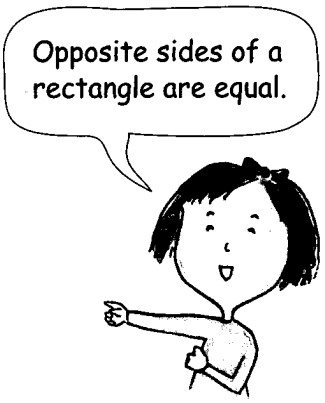
   (a) I think of a number. I double it and then subtract 5.
   (b) The sum of an unknown number and 11.
   (c) A bottle contains 1000 cm^3 of water. Some of the water is used to fill up 3 glasses of equal capacity. The capacity of each glass is unknown. Find the volume of the remaining water in the bottle.

Let's Learn .. Simplification and Evaluation of Algebraic Expressions

Simplifying Algebraic Expressions

Look at the rectangle PQRS whose length is m cm. Its breadth is 4 cm.

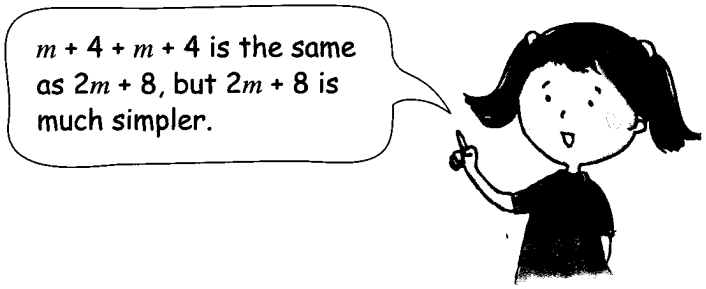


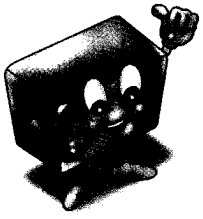


Its perimeter is $(m + 4 + m + 4)$ cm.

To get the perimeter, we can also add the sides SR and PQ first, that is $m + m = 2m$, then add PS and QR, that is $4 + 4 = 8$. Finally, adding them together, we get $2m + 8$.

$m + 4 + m + 4$
$= m + m + 4 + 4$
$= 2m + 8$



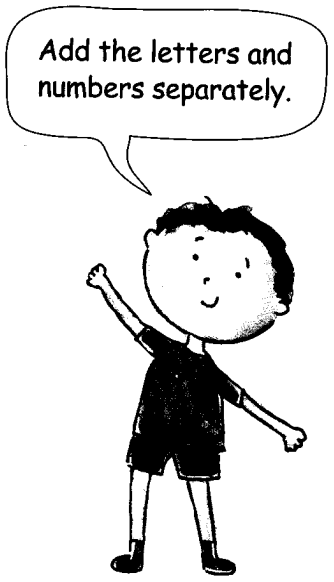


To simplify an algebraic expression, we can add the letters and numbers separately.

Simplify the following algebraic expressions.

1. $2y + 10 + 3y - 7$

$2y + 10 + 3y - 7$
$= 2y + 3y + 10 - 7$
$= 5y + 3$



2. $5x + 4 - 2x + 3$

$5x + 4 - 2x + 3$
$= 5x - 2x + 4 + 3$
$= 3x + 7$

3. $6x + 4 - 2x - 3 + 3x + 7$

$6x + 4 - 2x - 3 + 3x + 7$
$= 6x - 2x + 3x + 4 - 3 + 7$
$= 7x + 8$

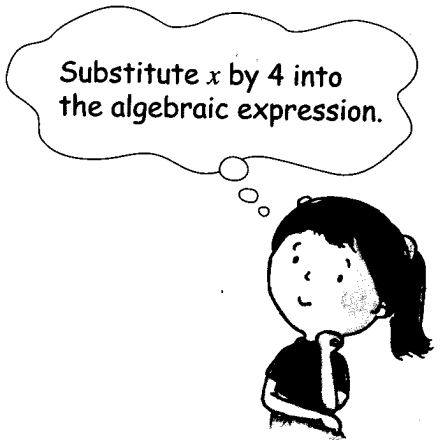
Evaluating Algebraic Expressions by Substitution

The value of an algebraic expression can be found by substituting a known numerical value for the unknown quantity.

4. Find the value of $3x - 2$ when $x = 4$.

$3x - 2 = 3 \times 4 - 2$
$= 12 - 2$
$= 10$

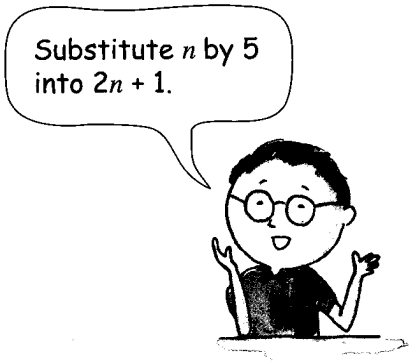
So, when $x = 4$, the value of $3x - 2$ is 10.



5. An odd number can be represented by the expression $2n + 1$. What is the odd number when $n = 5$?

$2n + 1 = 2 \times 5 + 1$
$= 10 + 1$
$= 11$

The odd number is 11 when $n = 5$.



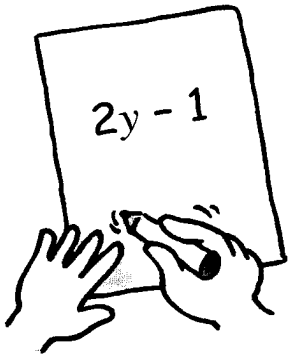
6. Find the value of $\frac{18 - 2y}{4}$ when $y = 5$.

$\frac{18 - 2y}{4} = \frac{18 - 2 \times \square}{4}$ (substitute y by 5)

$= \frac{18 - \square}{4}$

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

$= \square$



Work in pairs.

Take turns with your partner to find the values of the expression $2y - 1$ for different values of y from 1 to 10.

Simplification and Evaluation of Algebraic Expressions

1. Simplify the following algebraic expressions.

   (a) $x + x + x + x$

   (b) $5y - y$

   (c) $4m - 2m + 3m$

   (d) $7 + 6n - 3 + n$

   (e) $12k + 5 - 7k - 2$

2. Find the value of the following.

   (a) $4x - 3$ when $x = 4$

   (b) $8 - 2y$ when $y = 3$

   (c) $\frac{5p}{4}$ when $p = 8$

   (d) $\frac{3k + 1}{2}$ when $k = 7$

   (e) $\frac{m}{2} + 1$ when $m = 6$

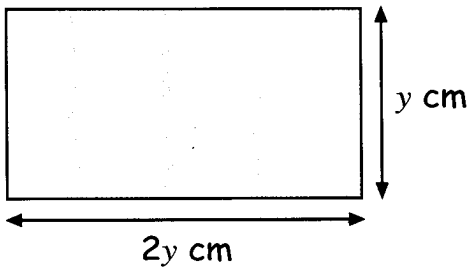
Let's Learn .. Word Problems

1. The width of a rectangle is y cm. The length of the rectangle is twice its width. What is its perimeter in terms of y?
When $y = 4$, find the perimeter.

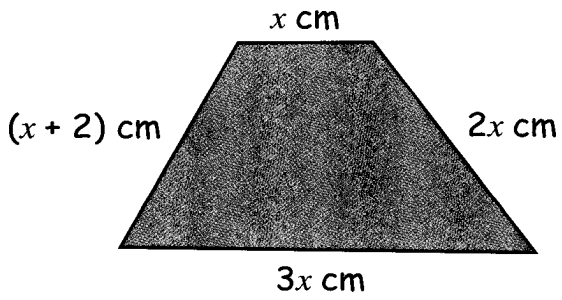
The perimeter of the rectangle = $(2y + 2y + y + y)$ cm = $6y$ cm

When $y = 4$, perimeter = $6y$
$= 6 \times 4$
$= 24$ cm

The perimeter is 24 cm when $y = 4$.



2. The lengths of the sides of a 4-sided figure are shown as in the diagram below.



(a) Express the perimeter of the figure in terms of x.
(b) When $x = 4$, find the perimeter of the figure.

(a) Perimeter = $x + x + 2 + 3x + 2x$
$= 7x + 2$

The perimeter is $7x + 2$.

(b) When $x = 4$, perimeter = $7x + 2$
$= 7 \times 4 + 2$
$= 28 + 2$
$= 30$ cm

When $x = 4$, the perimeter is 30 cm.

3. Class 6A has m pupils. Class 6B has 3 pupils more than Class 6A. Class 6C has 2 pupils more than Class 6B.

(a) What is the number of pupils in Class 6B and in Class 6C in terms of m?

(b) Express the total number of pupils in all 3 classes in terms of m.

(c) If Class 6A has 36 pupils, what is the total number of pupils in all 3 classes?

(a) Number of pupils in Class 6A = m

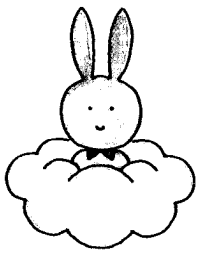
Number of pupils in Class 6B = Numbers of pupils in Class 6A + 3
= $m + 3$

Number of pupils in Class 6C = Number of pupils in Class 6B + 2
= $m + 3 + 2$
= $m + 5$

(b) Total number of pupils in all 3 classes = $m + m + 3 + m + 5$
= $3m + 8$

(c) When m = 36, the total number of pupils in all 3 classes
= $3m + 8$
= $3 \times 36 + 8$ (substitute m by 36)
= $108 + 8$
= 116

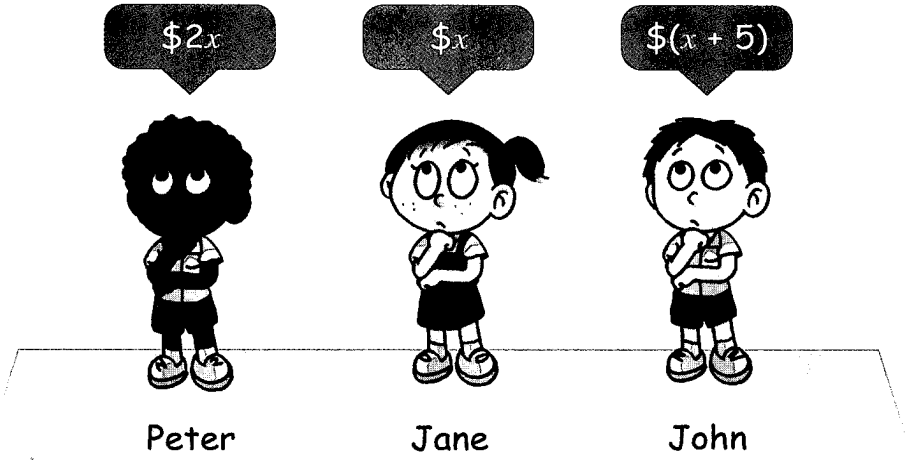
The total number of pupils in all 3 classes is 116.



4. Peter has two times as much money as Jane. John has \$5 more than Jane. Jane has \$$x$.

   (a) What is the average amount of money for the three children?

   (b) If Jane has \$25, what is the average amount of money for them?



(a) Jane has \$$x$.
John has \$$(x + 5)$.
Peter has \$$2x$.

The average = $\$\left(\frac{x + x + 5 + 2x}{3}\right)$

$= \$\left(\frac{4x + 5}{3}\right)$

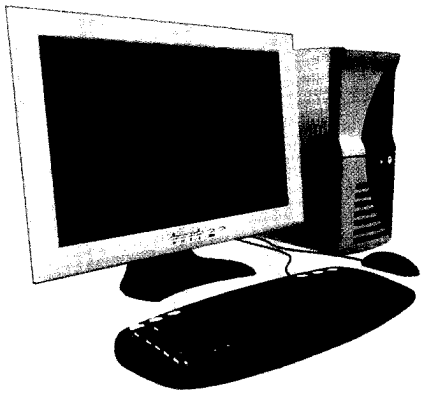
(b) When $x = 25$, the average = $\$\left(\frac{4 \times 25 + 5}{3}\right)$

$= \$35$

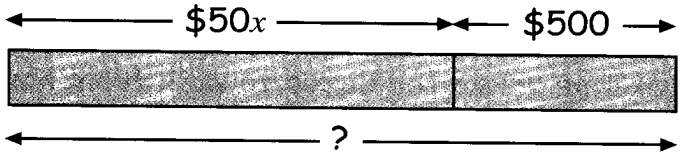
The average amount of money for the three children is \$35.

5. Jane is a sales executive in a computer company. She is paid a basic salary of $500 per month.
In addition, she is paid $50 for each computer she sells. She sold x computers in a particular month.

(a) Express her pay for that month in terms of x.
(b) If x = 30, how much was she paid that month?



(a) 1 computer ⟶ $50
x computers ⟶ 50x$



Total pay = $(500 + 50$x$)

(b) Substitute x by 30.

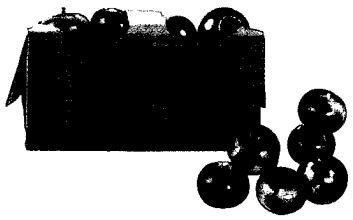
500 + 50x = 500 + 50 x 30
= 500 + 1500
= 2000

She was paid $2000 that month.

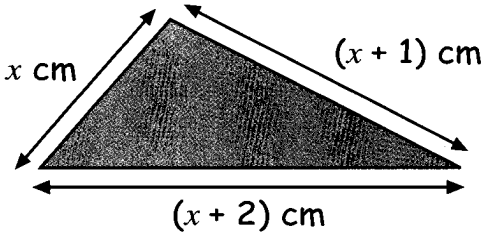
Let's Try .. Word Problems

1. An even number can be represented by $2n$ where n is any whole number. Lily is thinking of an even number with $n = 11$. What number is Lily thinking of?

2. A box had p apples. 6 apples were taken from the box.
   (a) Express the remaining number of apples in terms of p.
   (b) If the number of apples in the box at the beginning was 14 (i.e. $p = 14$), find the remaining number of apples in the box.

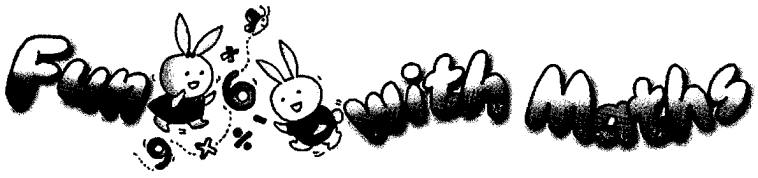


3. The lengths of the sides of a triangle are x cm, $(x + 1)$ cm and $(x + 2)$ cm.
   (a) Express the perimeter of the triangle in terms of x.
   (b) If $x = 5$, find the perimeter of the triangle.



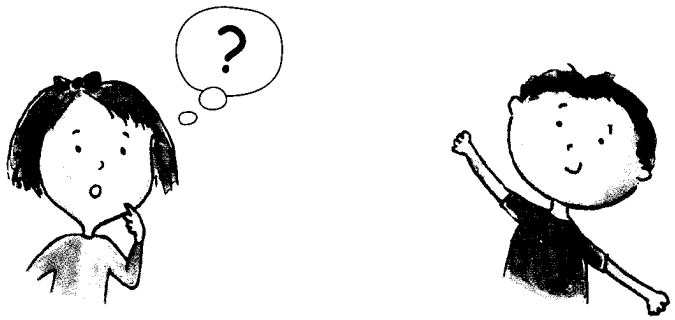
4. Lexus takes x minutes to walk from home to the library and 5 minutes more to walk from the library to school than from home to the library.
   (a) Express the total time taken for Lexus to walk from home to school via the library in terms of x.
   (b) On a certain day, he took 14 minutes to walk from home to the library. How long did he take to walk from home to school via the library on that day?

5. A bottle of orange juice costs $\$m$. A tin of milk powder costs 2 times as much as the orange juice. Mary bought 3 bottles of orange juice and one tin of milk powder.
   (a) Express the total amount of money Mary paid in terms of m.
   (b) If a bottle of orange juice is \$2, how much did Mary pay?

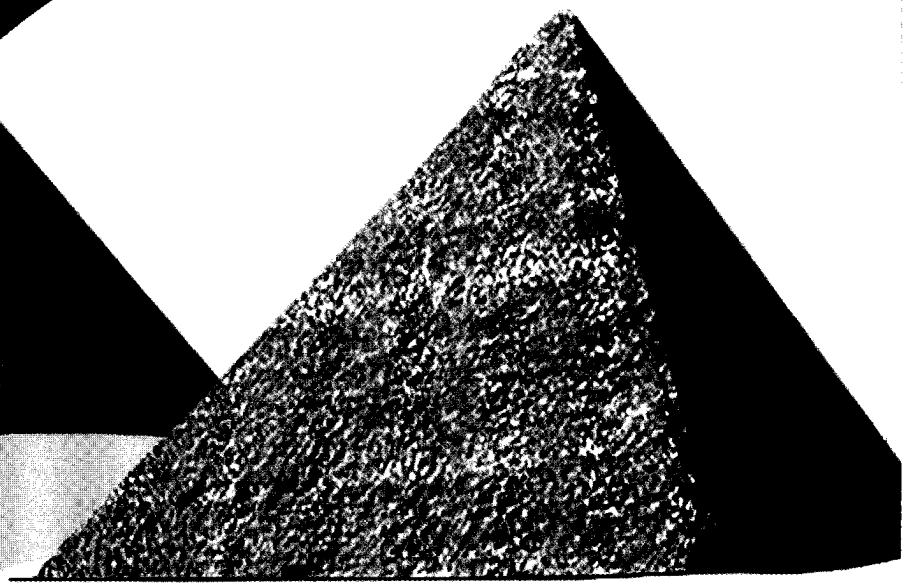


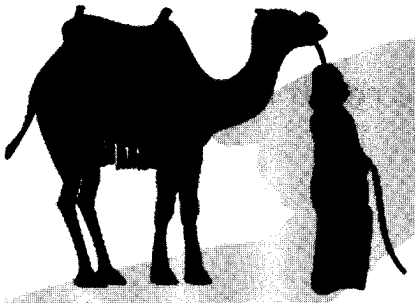
Now, with some knowledge of Algebra, you will know why the following situation is always true:

- Think of any number.
- Multiply the number by 2 and add 8 to the product, then subtract 7.
- Subtract the number you think of from the result.
- Is the answer 1 more than the number you think of?
- Now work out the process using Algebra.
- Let the number you think of be n.
- Follow the above steps and form the algebraic expression and simplify it.
- Is the result $n + 1$?



Solid Figures



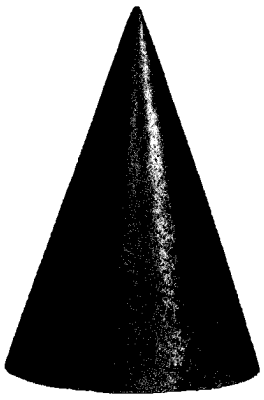


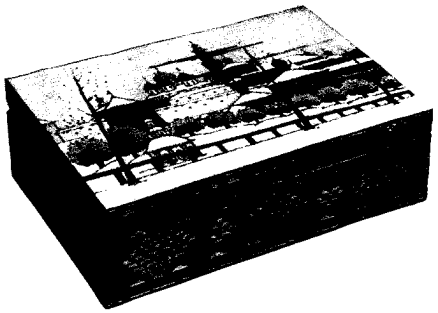
DO YOU KNOW?

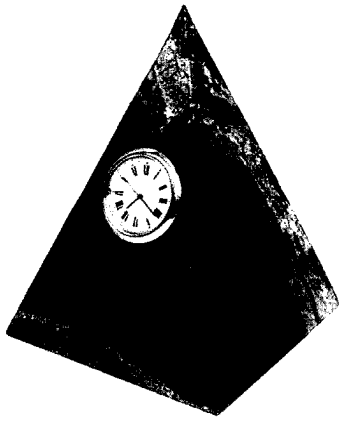
An Egyptian pyramid is made up of pieces of rock.
It has a square base and 4 isosceles triangles.
Do you know how to draw a pyramid?

Let's Learn .•. Drawings of Solid Figures

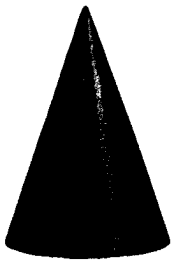
Look at the following objects around us.

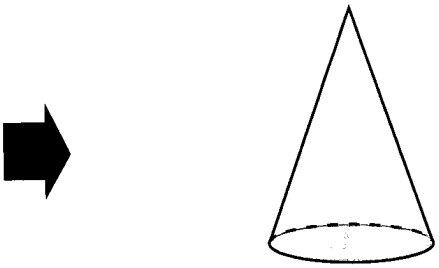


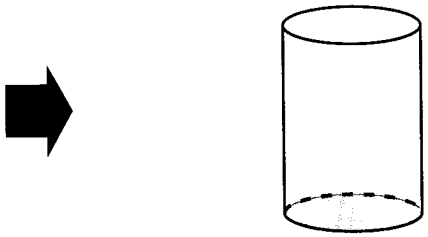


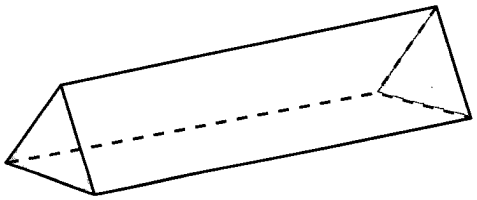


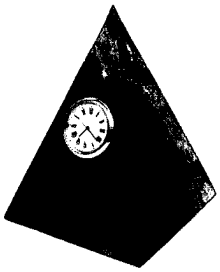
We can draw the solids like below.

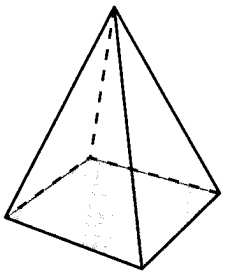


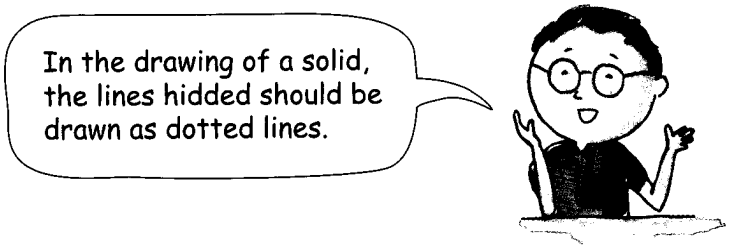




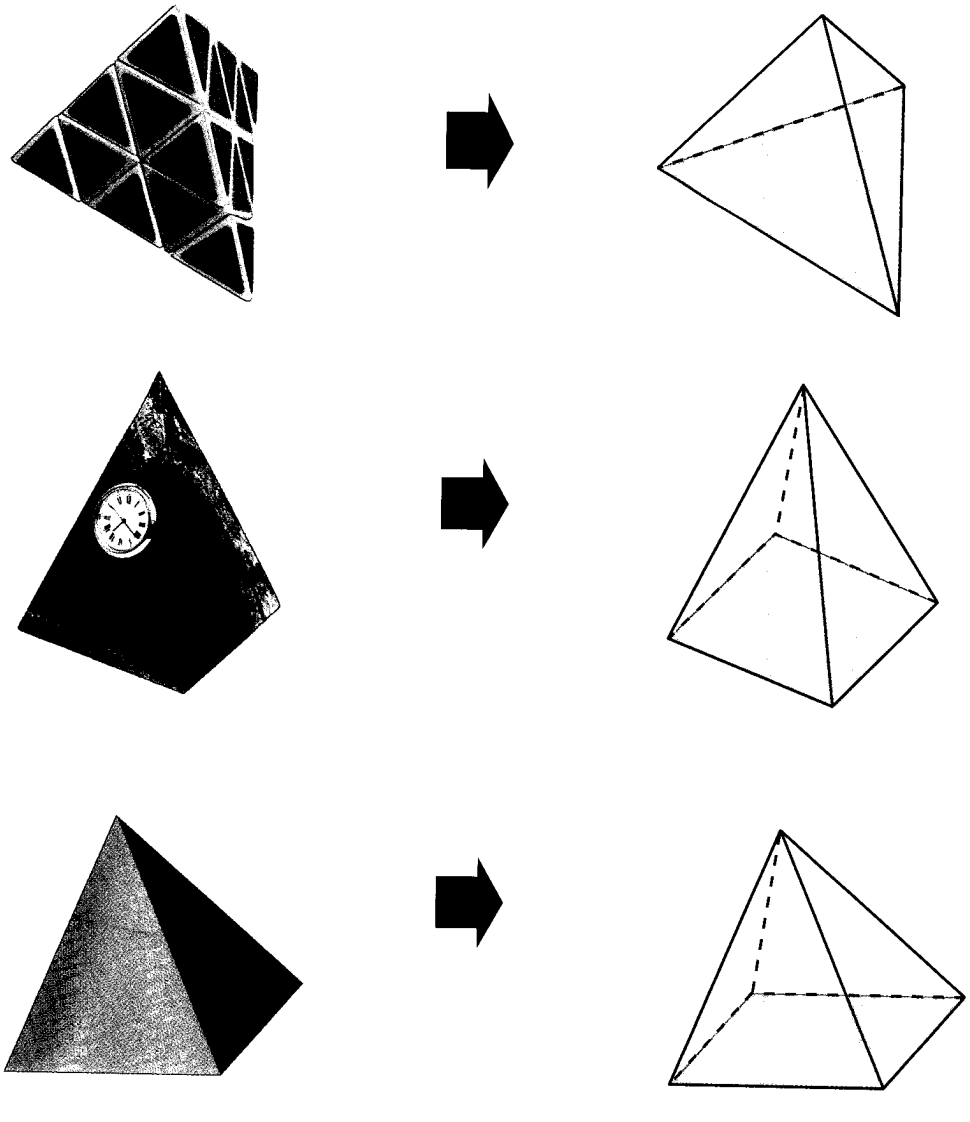


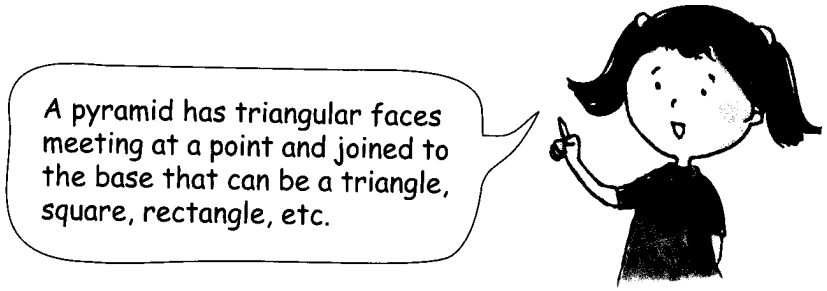




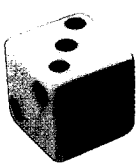


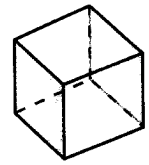
The following solids shown here are pyramids. Their drawings are on the right.

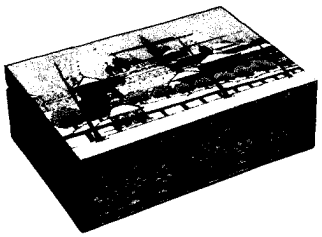


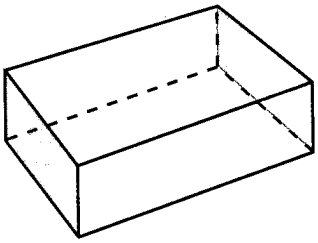


The following solids are cube and cuboids. Their drawings are on the right.

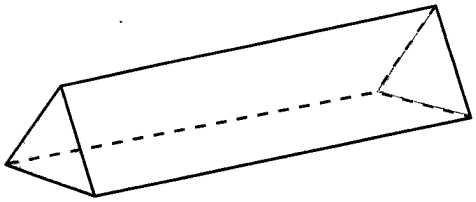


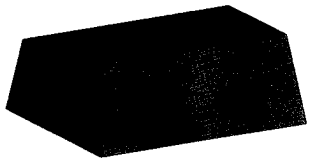


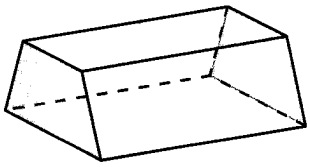




The following solids are prisms. Their drawings are on the right.





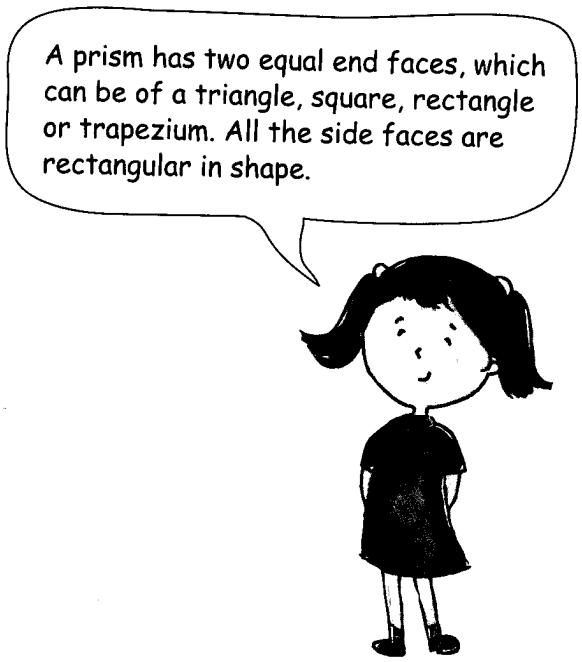


Study the prisms and their drawings.

What do you observe about the shape of their faces?

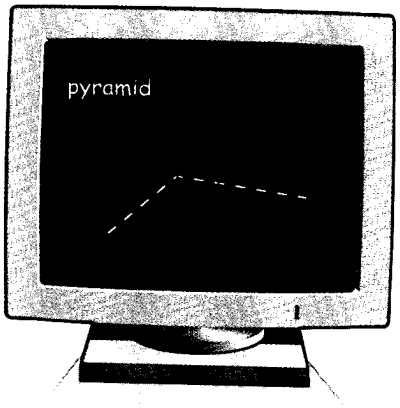
What are the shapes of the non-shaded faces in the drawings?

What are the shapes of the shaded faces in the drawings?



Search the Internet. Find the various drawings of cube, cuboid, prism and pyramid.

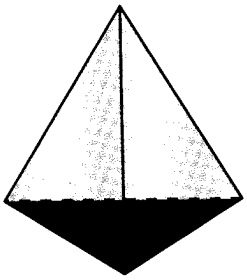
- Print out your work.
- Share your work with your classmates.



Let's Try .. Drawings of Solid Figures

1. Which of the drawings represent a prism?

(a)



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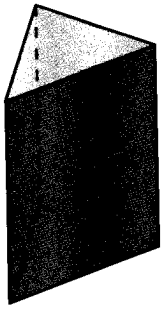
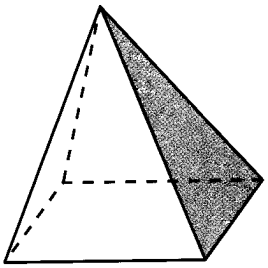
(b)



☐

(c)



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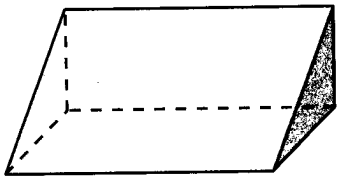
(d)



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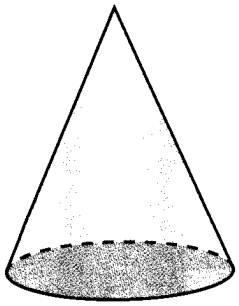
(e)



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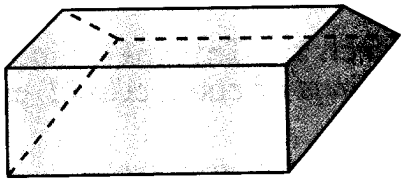
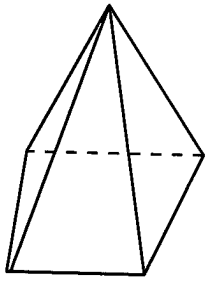
(f)



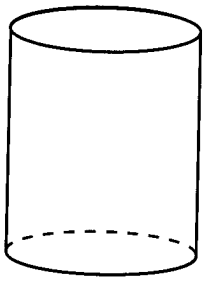
☐

2. Which of the drawings represent a pyramid?

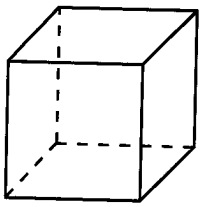
(a)



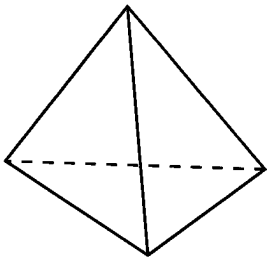
(b)



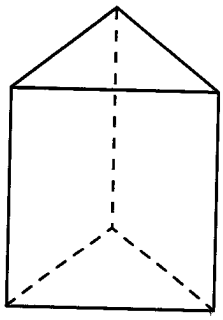
(c)



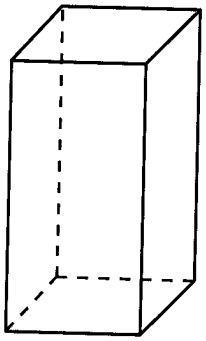
(d)



(e)

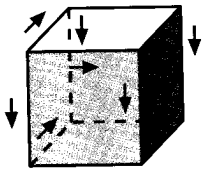


(f)



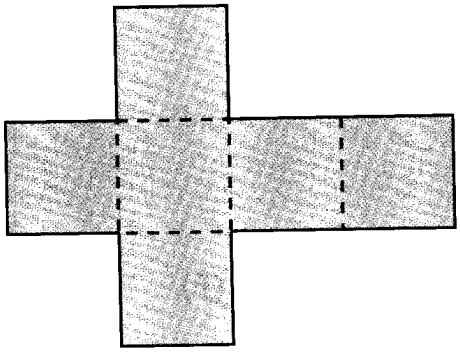
Let's Learn .. Nets of Cubes

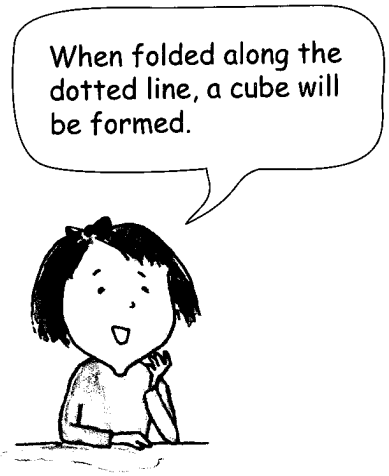
A square box is a cube with 6 equal square faces.
Cut along the edges of a cube and open it up as shown below.
You will get a layout of a cube.

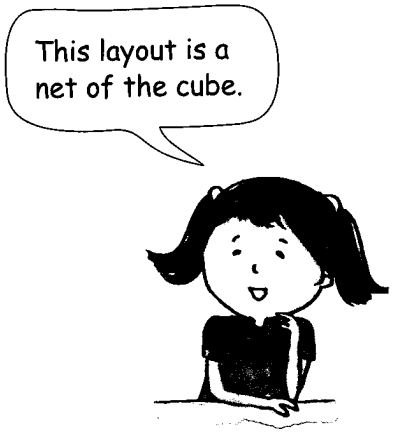


a square box
(cube)

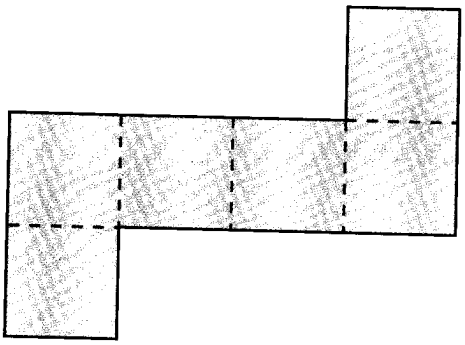
open up

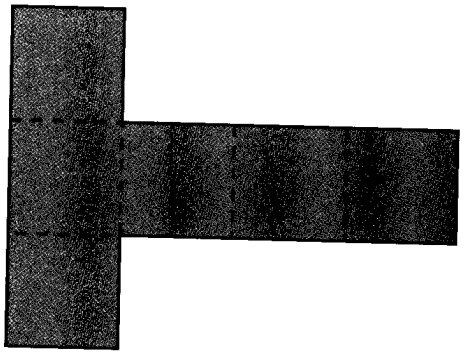


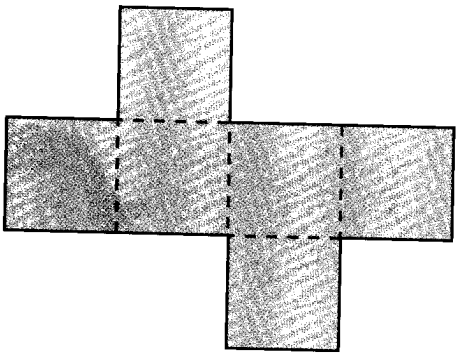




Below are other nets which, when folded, will also form cubes.

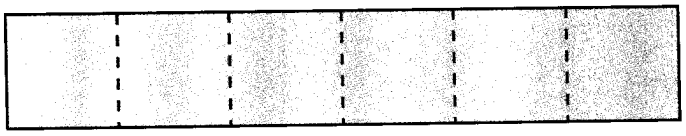




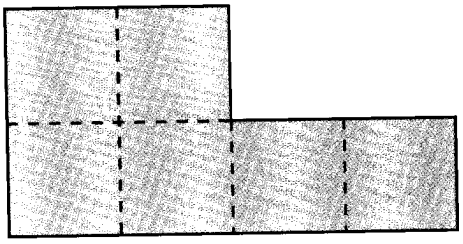


Trace and cut out these figures. Fold them and see if each forms a cube.

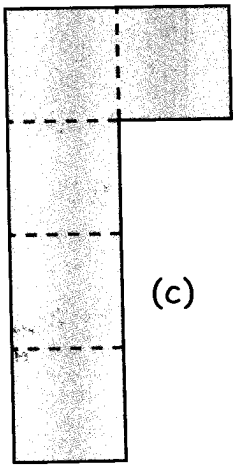
Look at more diagrams below.



(a)



(b)



(c)

Are they nets of a cube?

Trace and cut out these figures. Fold them to find out.

Work in groups of 4 - 5.

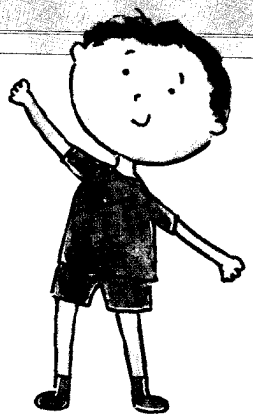
A Follow the steps and make a cube:

- ▶ Copy a net of a cube on a hard paper.
- ▶ Cut out the net.
- ▶ Fold it into a cube.
- ▶ Use scotch tape to hold the faces together.

B Repeat the above steps and make a few cubes.

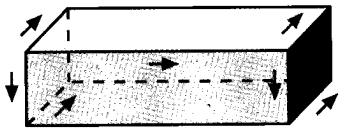
C Cut in different ways along the edges of the cubes you have made. Open up each of them to obtain a net.

D Compare the different nets that your group has obtained. How many different nets of a cube has your group obtained?

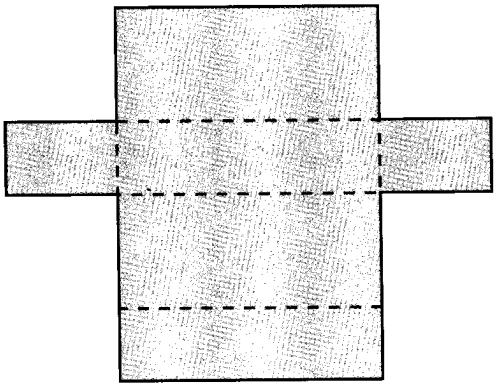


Let's Learn ... Nets of Cuboids

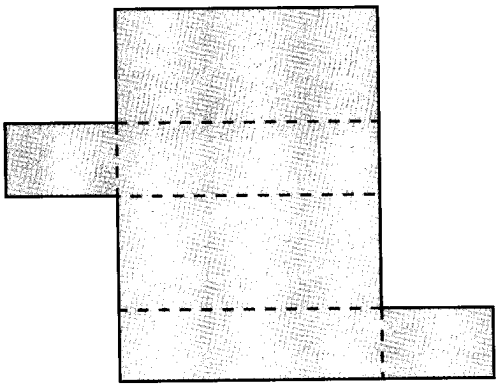
This is a cuboid. It has 3 pairs of identical rectangular faces.



Cut the cuboid along the edge shown above. Open it up. We get a net of the cuboid.

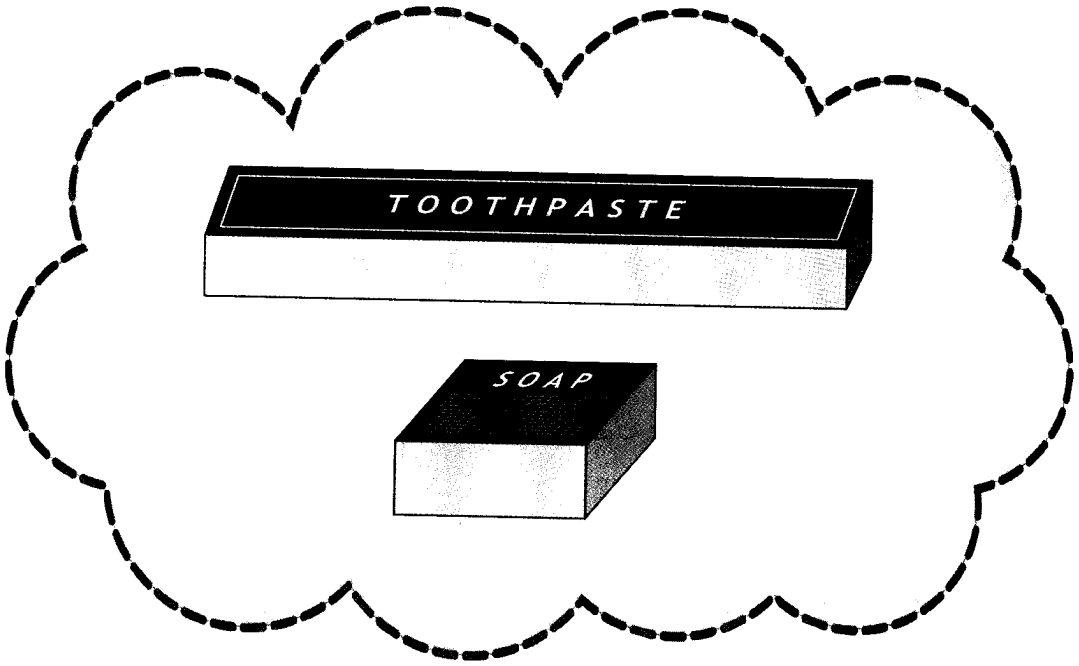


There are many different nets of a cuboid. The following is another one.

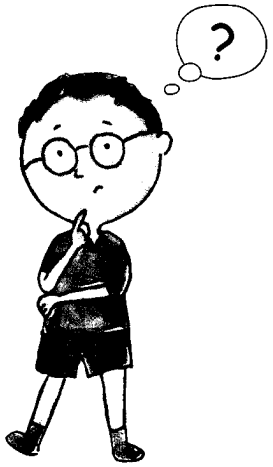


Can you think of one more net of the cuboid?

Take a toothpaste box or soap box, cut it out and obtain a net.
Lay it flat on the table.

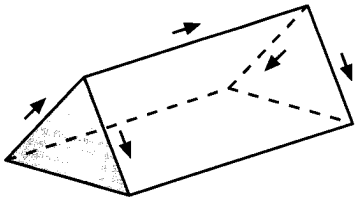


What do you observe about the shape of the flat layout?
How many rectangles are there to form a net of a cuboid?

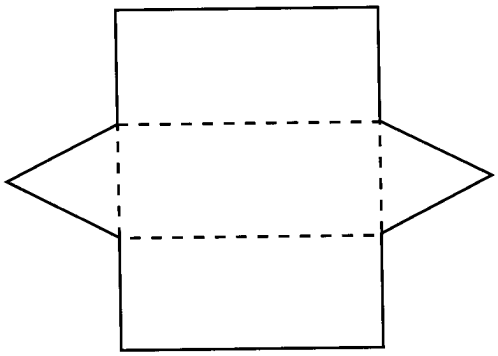


Let's Learn .. Nets of Prisms

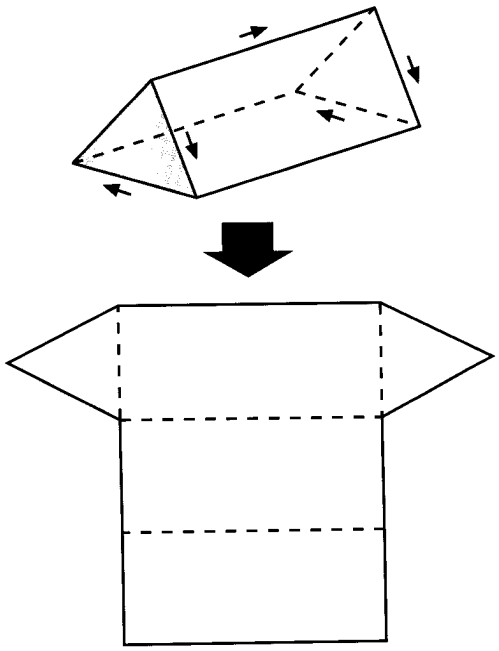
This is a prism. It has three rectangular faces and two identical triangular faces.



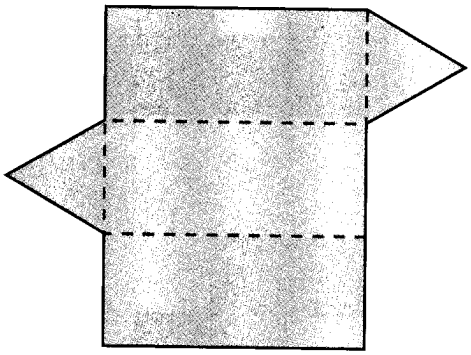
Cut along the edges of the prism as shown. Open it up to obtain the net shown below.

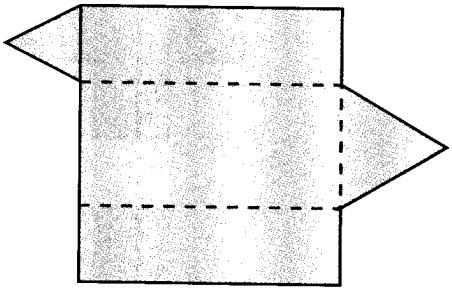


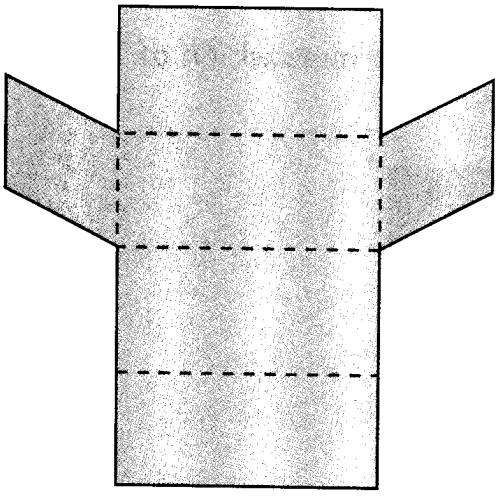
It is a net of the prism.
We can also cut along the edges of the prism in a different way.
We get another net of the prism.

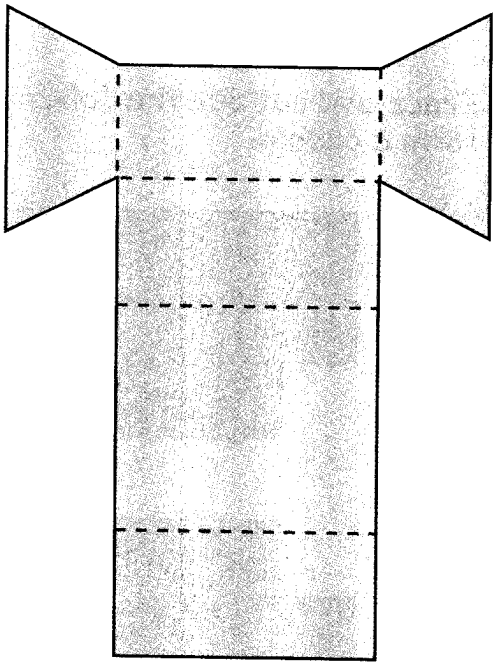


Trace and cut out the following figures. Fold them and see if each of them is a net of a prism.





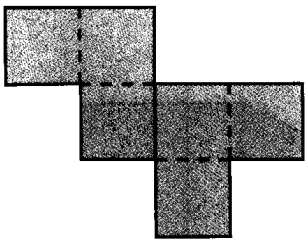




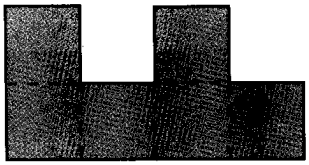
Nets of Cubes
Nets of Cuboids
Nets of Prisms

1. Trace and cut out the following figures. Determine which of them will form a cube when folded.

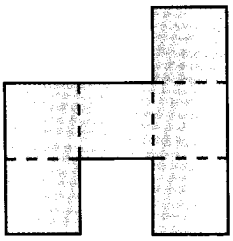
(a)



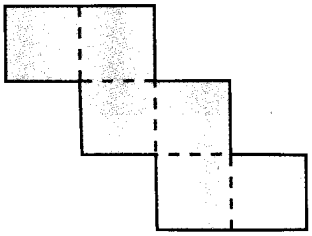
(b)



(c)

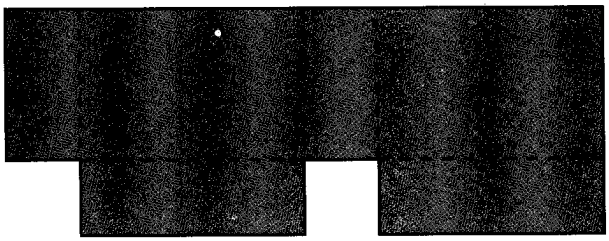


(d)

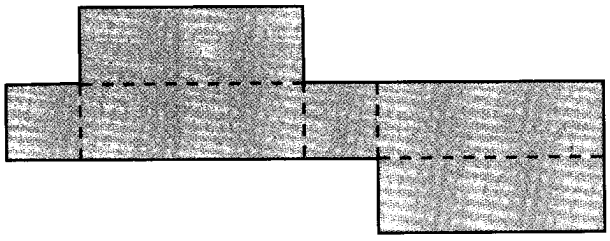


2. Trace and cut out the following figures. Determine which of them will form a cuboid.

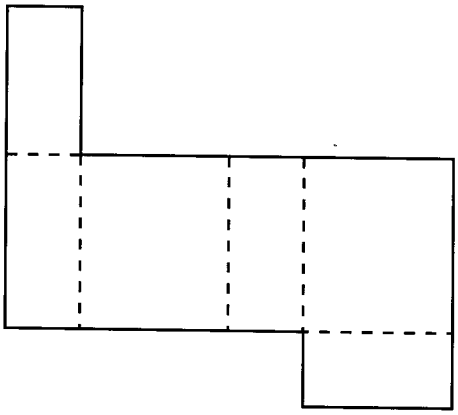
(a)

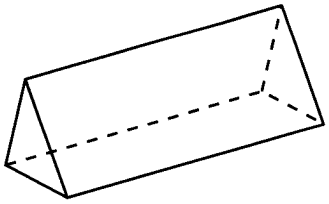


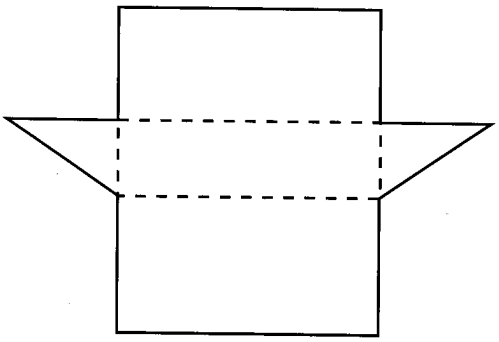
(b)

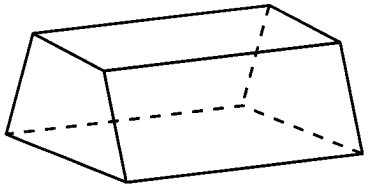


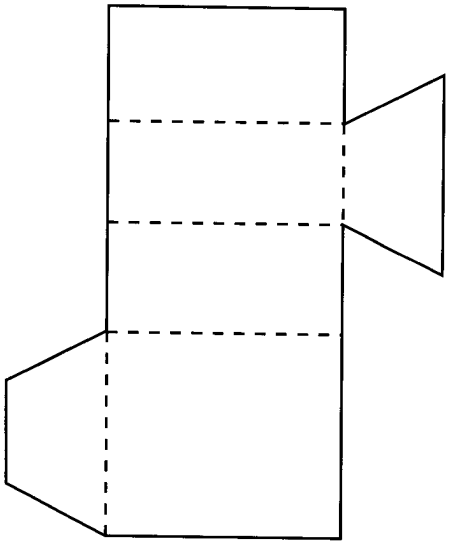
3. Match each drawing of a solid with its net.

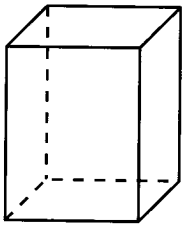






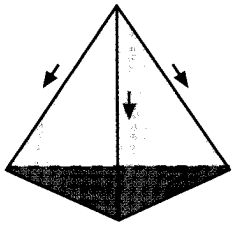




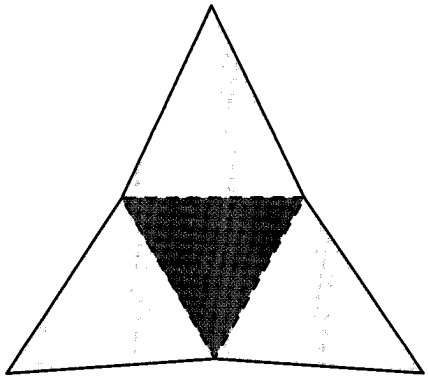


Let's Learn .. Nets of Pyramids

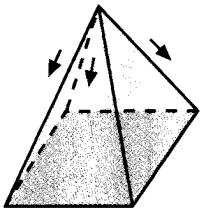
This is a pyramid. Its base is an equilateral triangle.

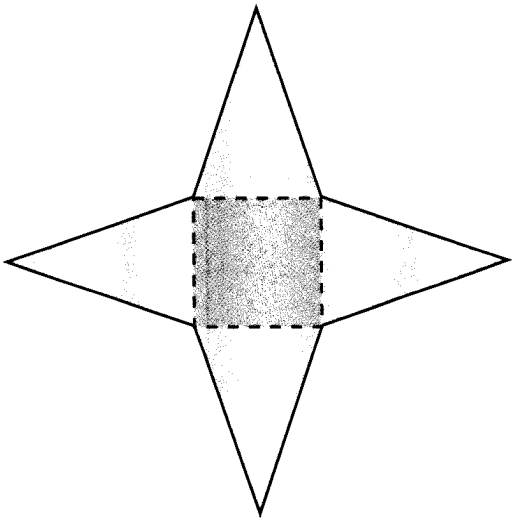


Cut along the edges of the pyramid as shown. Open it up to obtain a net of the pyramid.



This is a pyramid with a square base. One of its nets is shown on the right.

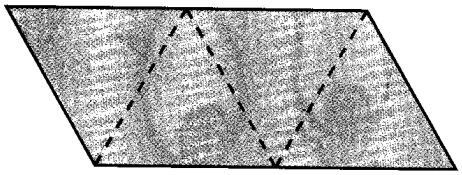




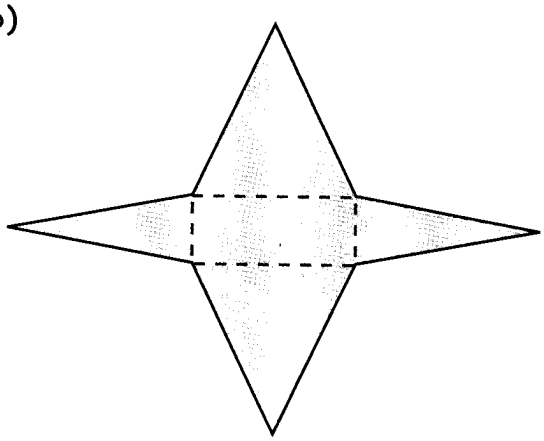
Let's Try .. Nets of Pyramids

1. Which of the following figures can form a pyramid?

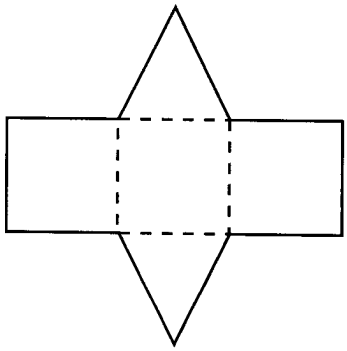
(a)



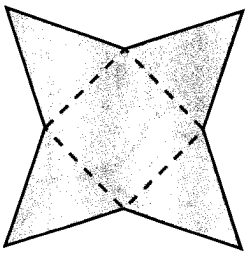
(b)

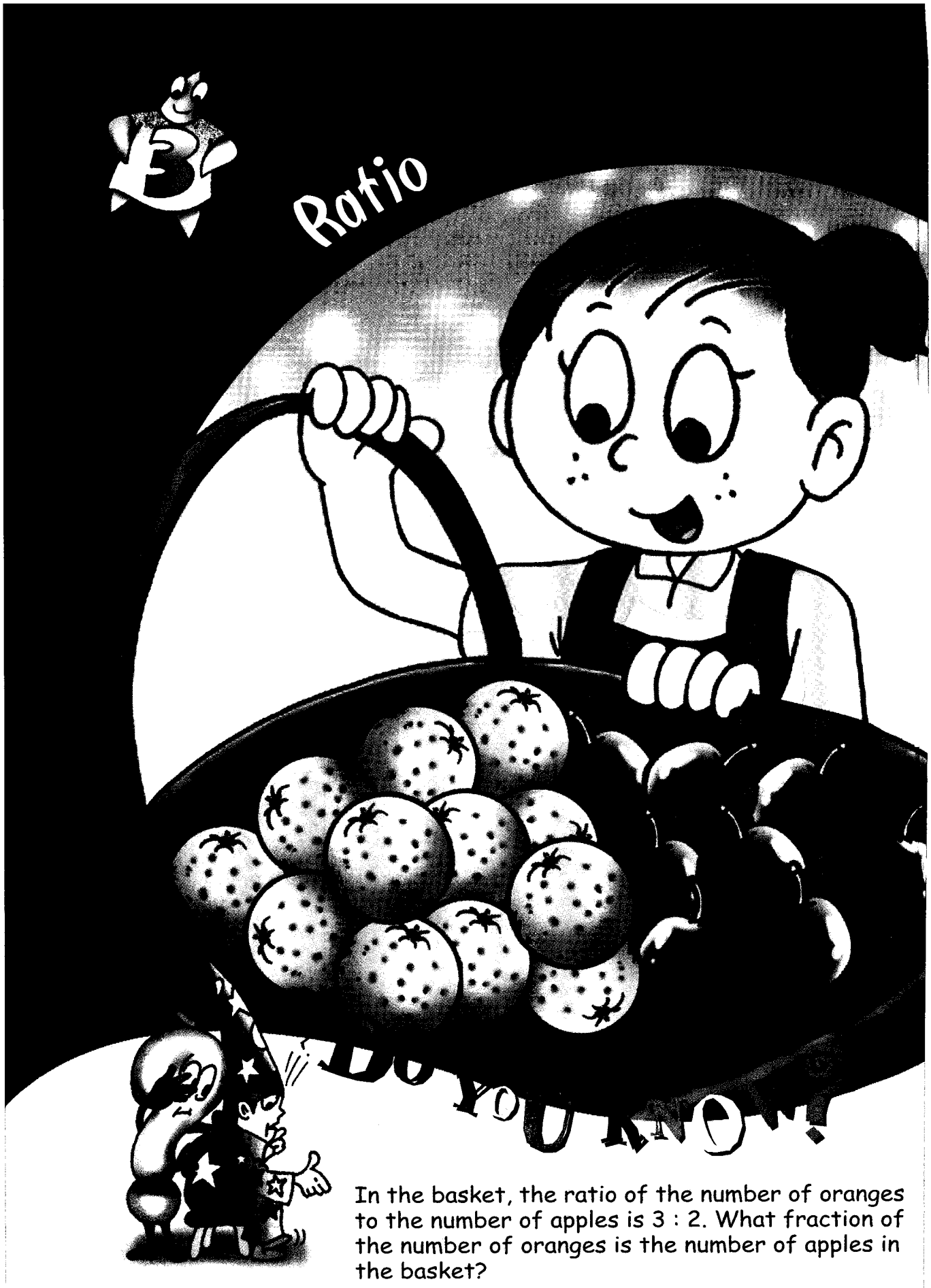


(c)



(d)

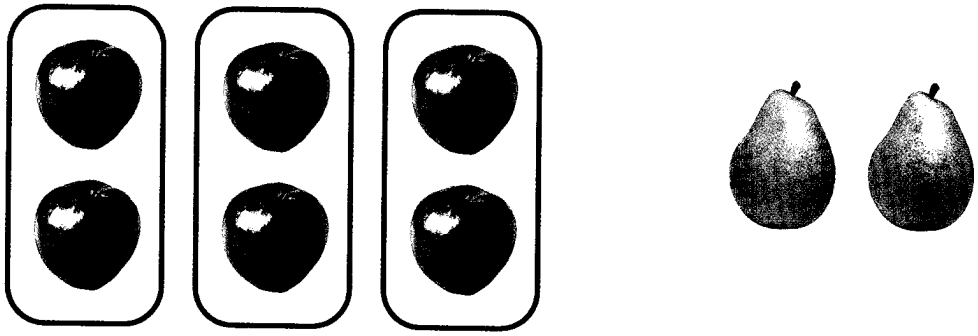




In the basket, the ratio of the number of oranges to the number of apples is 3 : 2. What fraction of the number of oranges is the number of apples in the basket?

Let's Learn .•. Comparing Two Quantities

1.



Compare the number of apples with the number of pears.

There are 6 apples and 2 pears.

$$6 \div 2 = 3$$

There are 3 times as many apples as pears.
We can also say that the number of apples is 3 times the number of pears.

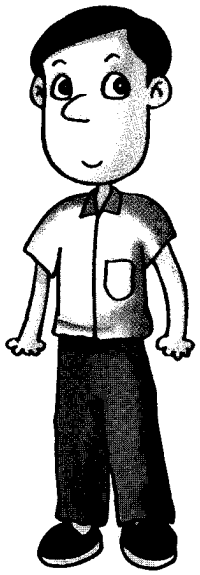
Conversely, compare the number of pears with the number of apples.

$$2 \div 6 = \frac{2}{6} = \frac{1}{3}$$

The number of pears is $\frac{1}{3}$ of the number of apples.

2.

John
30 kg



Mr Wong
60 kg

John's mass is 30 kg and Mr Wong's mass is 60 kg.

$$60 \div 30 = \frac{60}{30} = 2$$

Mr Wong's mass is 2 times as much as John's mass. Or,

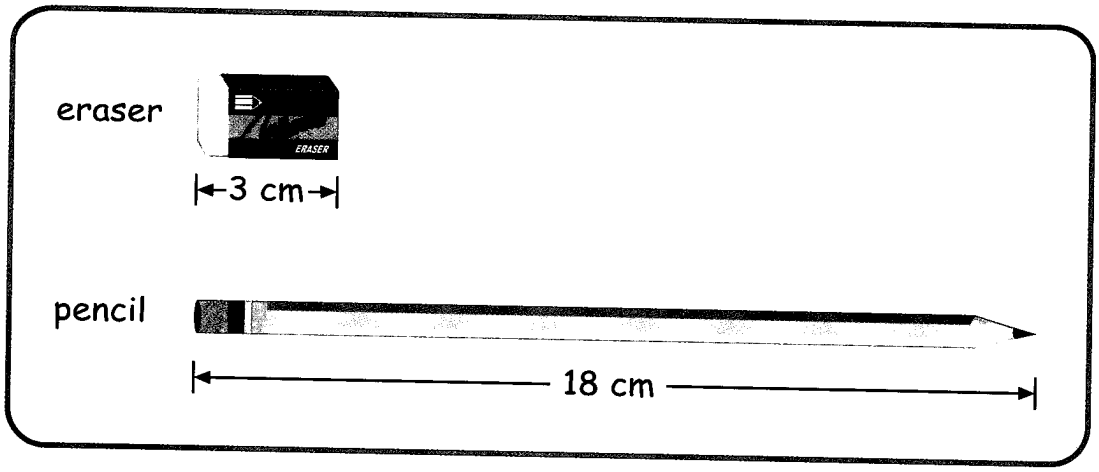
The mass of Mr Wong is 2 times the mass of John.

Conversely,

$$30 \div 60 = \frac{30}{60} = \frac{1}{2}$$

John's mass is $\frac{1}{2}$ of Mr Wong's mass.

3.



The length of the eraser is 3 cm.

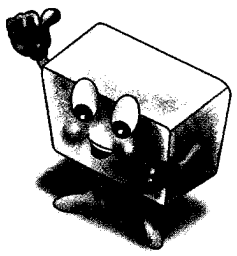
The length of the pencil is 18 cm.

$18 \div 3 = \frac{18}{3} = 6$

The length of the pencil is 6 times the length of the eraser.

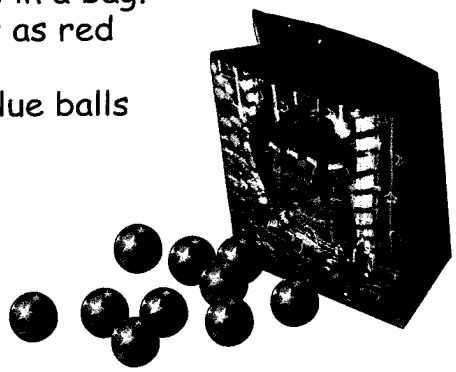
$3 \div 18 = \frac{3}{18} = \frac{1}{6}$

The length of the eraser is $\frac{1}{6}$ of the length of the pencil.



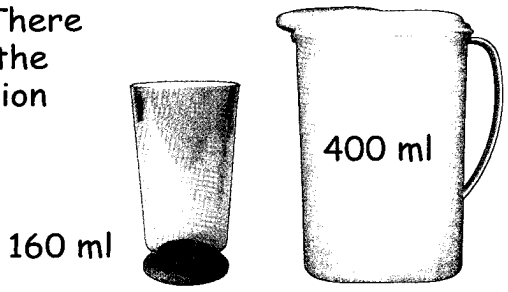
Let's Try .. Comparing Two Quantities

1. There are 15 red balls and 60 blue balls in a bag.
   (a) How many times as many blue balls as red balls are there?
   (b) What fraction of the number of blue balls is the number of red balls?

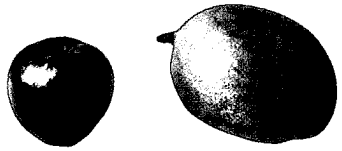


2. Mary has $15 and John has $12. Express the amount of money John has as a fraction of the amount of money Mary has.

3. There is 160 ml of water in the glass. There is 400 ml of water in the jug. Express the amount of water in the glass as a fraction of the amount of water in the jug.

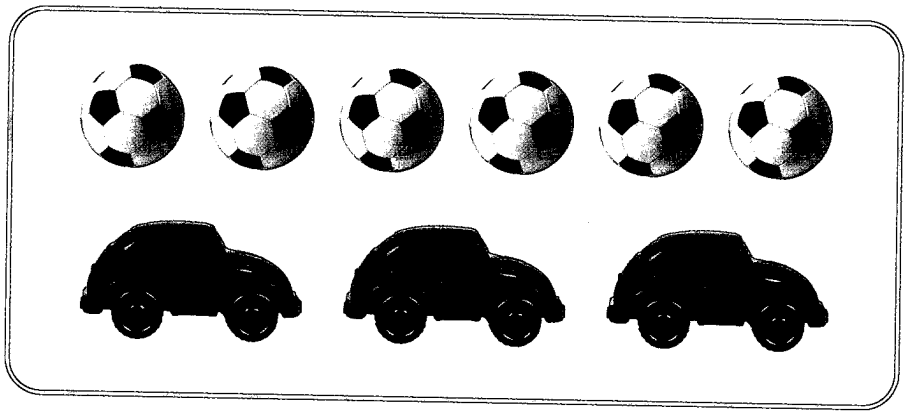


4. The mass of the apple is 200 g. The mass of the mango is 700 g. Express the mass of the apple as a fraction of the mass of the mango.



Let's Learn ... Ratio and Fraction

1. There are 6 balls and 3 toy cars.



The ratio of the number of balls to the number of toy cars is 6 : 3 = 2 : 1.

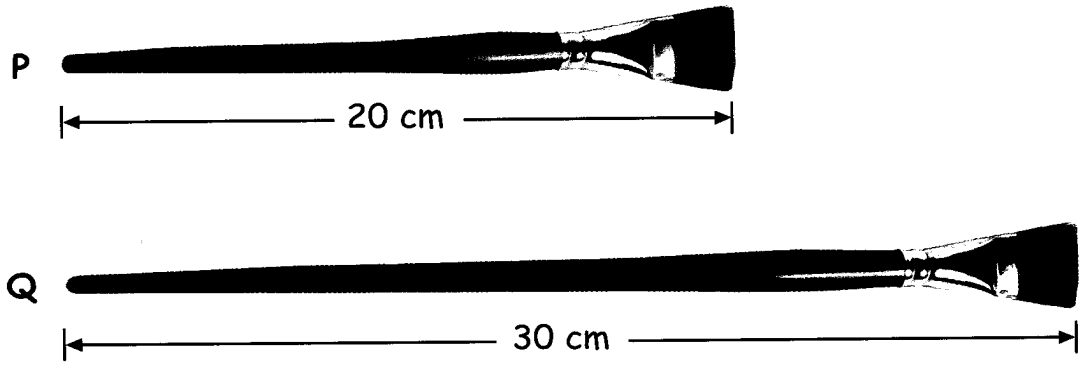
$6 \div 3 = \frac{6}{3} = \frac{2}{1} = 2$

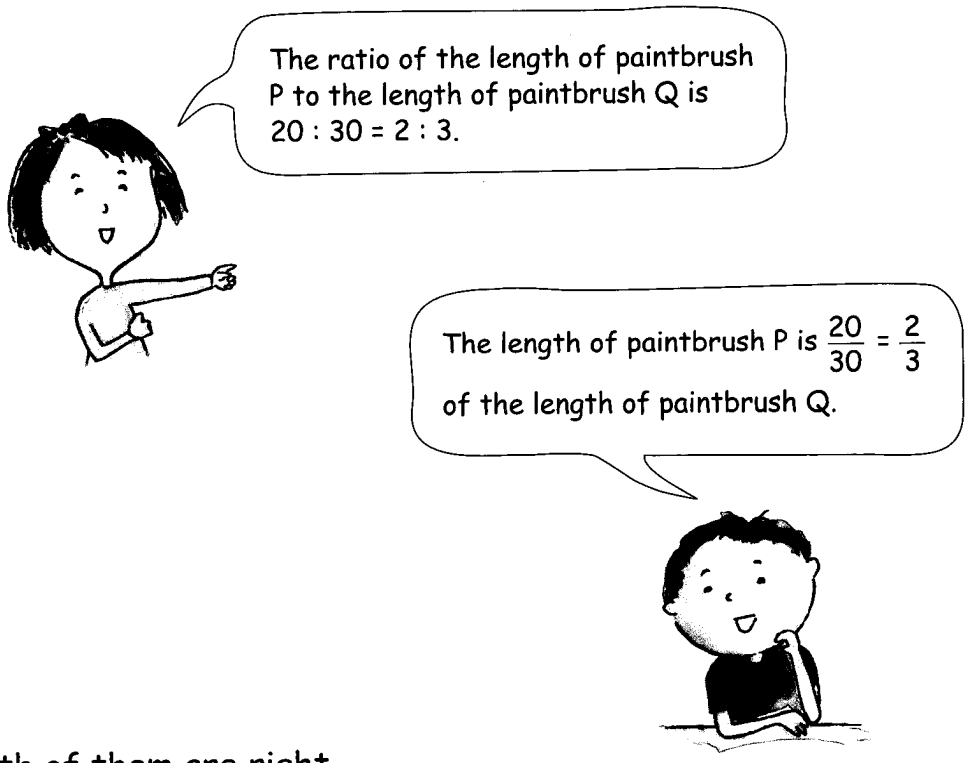
The number of balls is 2 times as many as the number of toy cars.

Both of them are right.

$2 : 1$ and $\frac{2}{1}$ express the same relationship between the two numbers.

2. Look at the lengths of the paintbrushes P and Q.

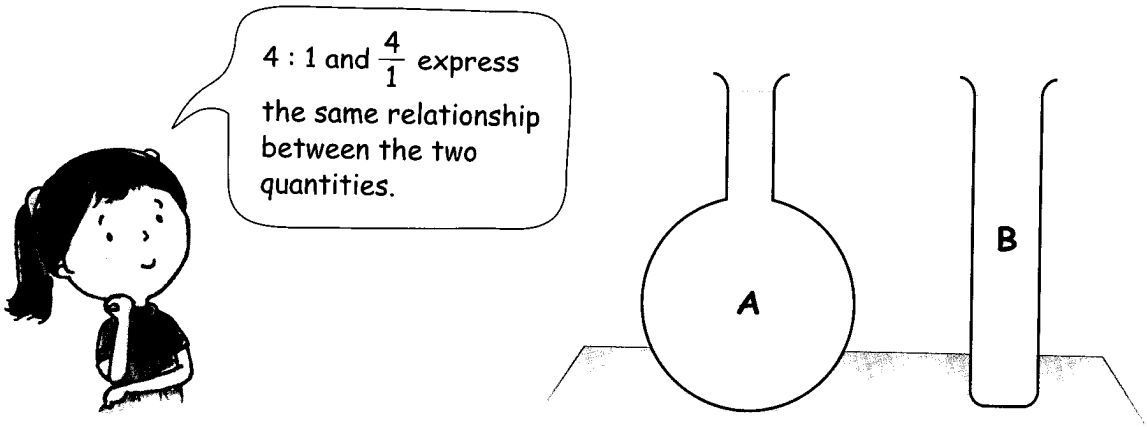




Both of them are right.

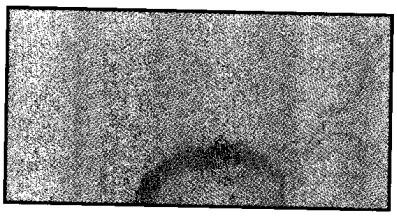
2 : 3 and $\frac{2}{3}$ express the same relationship between the two numbers.

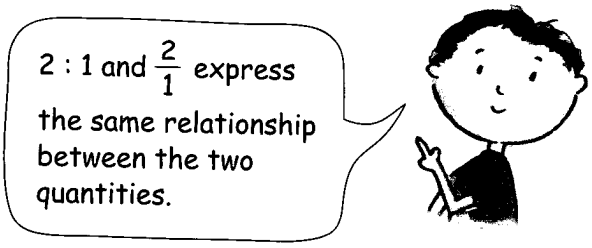
3. The ratio of the amount of water in container A to the amount of water in container B is 4 : 1. How many times is the amount of water in container A as much as that in container B?



The amount of water in container A is 4 times as much as that in container B.

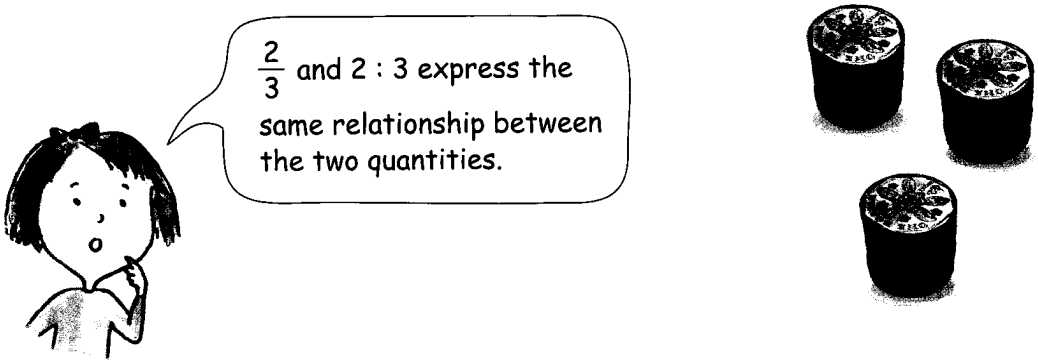
4. The length of a rectangle is 2 times as long as its breadth. What is the ratio of the length to the breadth of the rectangle?





The ratio of the length to the breadth of the rectangle is 2 : 1.

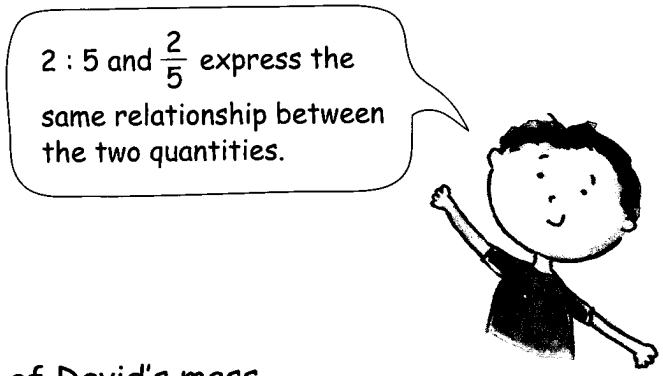
5. Betty has $\frac{2}{3}$ as much savings as John. What is the ratio of Betty's savings to John's savings?



The ratio of Betty's savings to John's savings is 2 : 3.

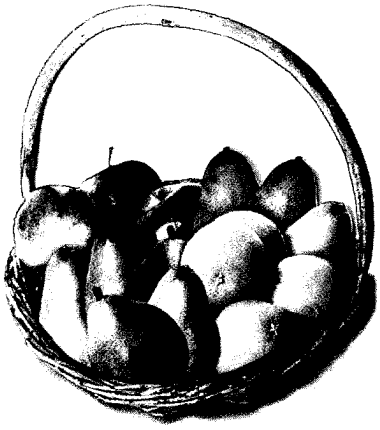
6. The ratio of David's mass to Rajen's mass is 5 : 2. Express Rajen's mass as a fraction of David's mass.

The ratio of Rajen's mass to David's mass is 2 : 5.



Rajen's mass is $\frac{2}{5}$ of David's mass.

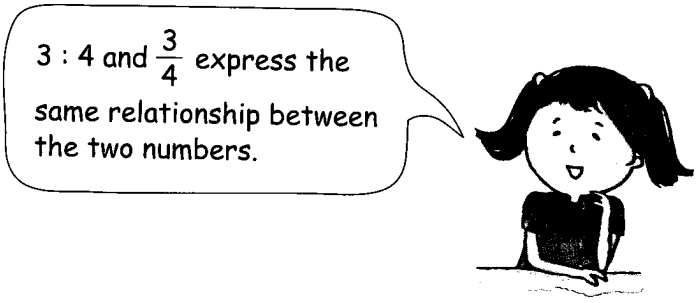
7. The ratio of the number of oranges to the number of apples to the number of pears in a basket is 3 : 4 : 8.



(a) What fraction of the number of apples is the number of oranges in the basket?

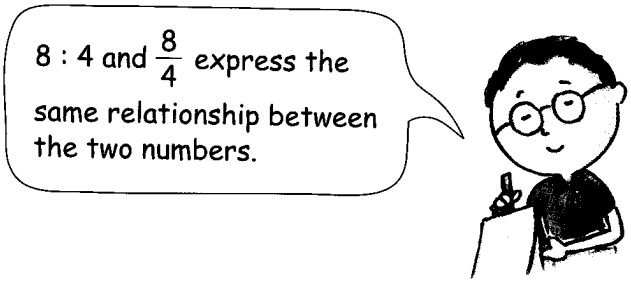
(b) How many times as many pears as apples are there in the basket?

(a) The ratio of the number of oranges to the number of apples is 3 : 4.



The number of oranges is $\frac{3}{4}$ of the number of apples.

(b) The ratio of the number of pears to the number of apples is 8 : 4.



There are 2 times as many pears as apples in the basket.

Work in groups.

The number of pupils in each group is 4 to 6.
Make sure that there are pupils wearing glasses in each group.

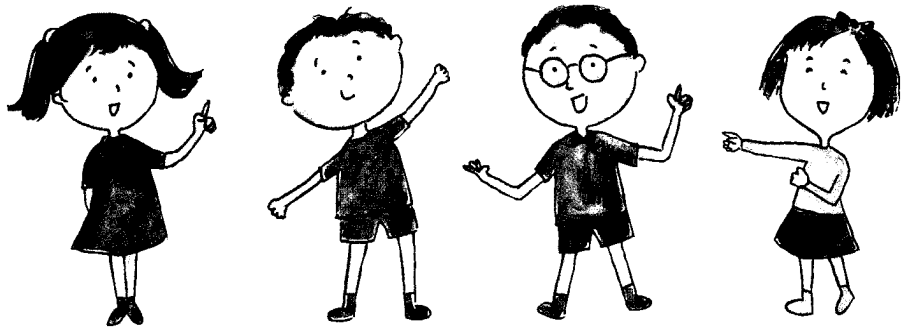
Count the number of pupils wearing glasses in your group.

(a) What is the ratio of the number of pupils wearing glasses to the number of pupils not wearing glasses in your group?

(b) What is the ratio of the number of pupils wearing glasses to the total number of pupils in your group?

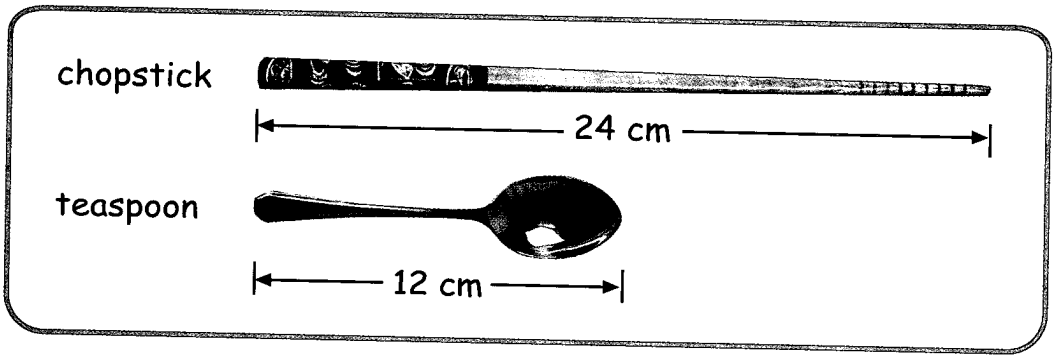
(c) What fraction of the number of pupils not wearing glasses is the number of pupils wearing glasses?

(d) What fraction of the total number of pupils is the number of pupils not wearing glasses ?



Let's Try .. Ratio and Fraction

1.



The picture above shows the lengths of a chopstick and a teaspoon.
(a) What is the ratio of the length of the chopstick to the length of the teaspoon?
(b) What fraction of the length of the chopstick is the length of the teaspoon?
(c) How many times is the chopstick as long as the teaspoon?

2. Grace scored 80 marks in a Maths test. Siti scored 95 marks in the same test. Express
(a) the ratio of Grace's score to Siti's score in the simplest form,
(b) Siti's score as a fraction of Grace's score in the simplest form.

3. Write the following ratios as fractions.
(a) 3 : 7
(b) 8 : 5
(c) 4 cm to 8 cm
(d) 45 min to $1\frac{1}{4}$ hour

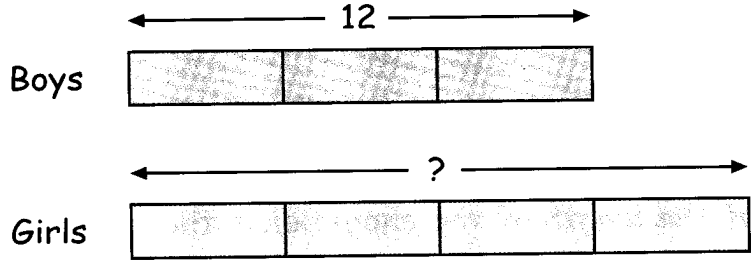
4. Write the following fractions as ratios.
(a) $\frac{4}{5}$
(b) $\frac{9}{7}$

5. The expenditures of Mr Lai for 3 days are in the ratio of 2 : 1 : 3.
(a) What fraction of his expenditure on the last day is his expenditure on the first day?
(b) How many times is his expenditure on the last day as much as his expenditure on the second day?

Let's Learn ... Part and Whole

1. The ratio of the number of boys to the number of girls in a class is 3 : 4. There are 12 boys in the class.

   (a) How many girls are there in the class?
   (b) How many pupils are there in the class?



3 units ⟶ 12

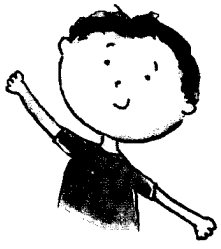
1 unit ⟶ 12 ÷ 3 = 4

(a) 4 units ⟶ 4 x 3 = 16

There are 16 girls in the class.

(b) 7 units ⟶ 7 x 4 = 28

There are 28 pupils in the class.



2. Mr Lin mixed red paint and blue paint in the ratio 7 : 5 for a painting job. He made 10 ℓ of such paint.

(a) How many litres of red paint did he use?
(b) How many litres of blue paint did he use?

Give your answers correct to the nearest 0.1 ℓ.

12 units $\longrightarrow$ 10 ℓ

1 unit $\longrightarrow$ $\frac{10}{12}$ ℓ

(a) 7 units $\longrightarrow$ $7 \times \frac{10}{12} = \frac{70}{12} \approx 5.8$ ℓ

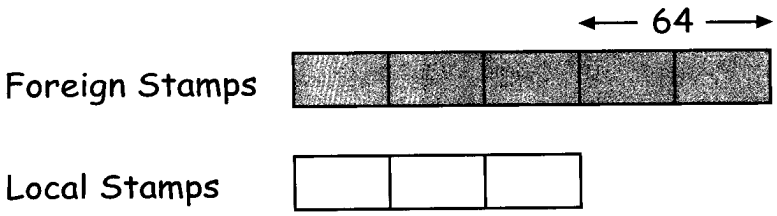
He used 5.8 ℓ of red paint.

(b) 5 units $\longrightarrow$ $5 \times \frac{10}{12} = \frac{50}{12} \approx 4.2$ ℓ

He used 4.2 ℓ of blue paint.

3. The ratio of the number of foreign stamps to the number of local stamps in Mary's collection is 5 : 3. Mary has 64 more foreign stamps than local stamps.

(a) How many foreign stamps does Mary have?
(b) How many local stamps does Mary have?



2 units ⟶ 64

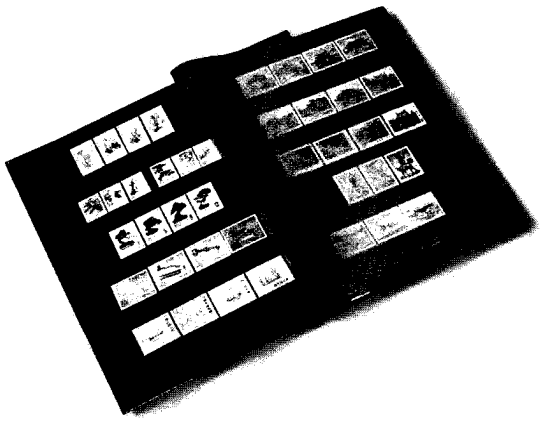
1 unit ⟶ 64 ÷ 2 = 32

(a) 5 units ⟶ 5 x 32 = 160

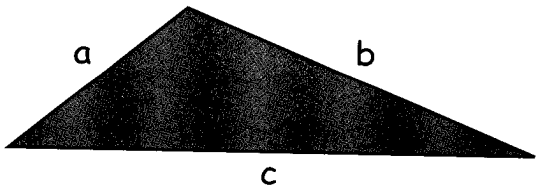
Mary has 160 foreign stamps.

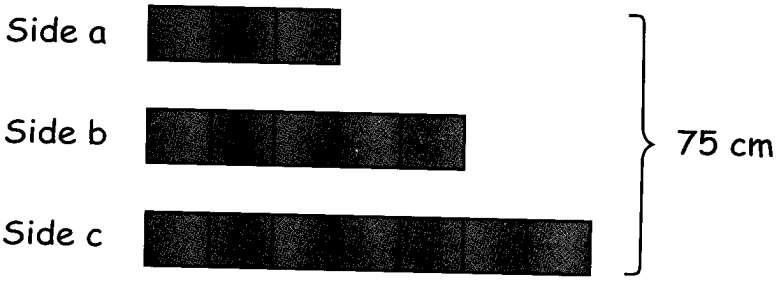
(b) 3 units ⟶ 3 x 32 = 96

Mary has 96 local stamps.



4. The sides of a triangle are in the ratio 3 : 5 : 7. The perimeter of the triangle is 75 cm. Find the length of each side of the triangle.





15 units ⟶ 75 cm

1 unit ⟶ 75 ÷ 15 = 5 cm

3 units ⟶ 3 x 5 = 15 cm

5 units ⟶ 5 x 5 = 25 cm

7 units ⟶ 7 x 5 = 35 cm

The length of the three sides of the triangle are 15 cm, 25 cm and 35 cm.

In Example 1 on page 50, we can also solve the problem using equivalent ratios.

Boys	:	Girls	:	Total
3	:	4	:	(3 + 4)
↓ x 4		↓ x 4		↓ x 4
12	:	16	:	28

There are 16 girls.
There are 28 pupils in the class.

Use the method above to work out Examples 2, 3 and 4 on page 51 to page 53.

Let's Try .0. Part and Whole

1. The ratio of the number of pears to the number of apples in a basket is 2 : 5. There are 25 apples in the basket. How many pears and apples are there altogether in the basket?

2. To make fruit juice, John's mother mixed some apple syrup and water in the ratio of 2 : 3. She made 1800 ml of such fruit juice.
   (a) How many millilitres of apple syrup did she use?
   (b) How many millilitres of water did she use?

3. The ratio of the number of cards Mary has to the number of cards John has is 5 : 2. Mary has 60 cards more than John.
   (a) How many cards does Mary have?
   (b) How many cards does John have?

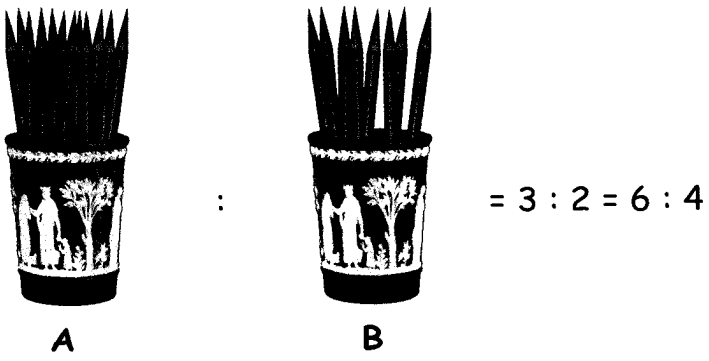
4. In a primary school, the ratio of the number of girls to the number of boys is 6 : 7. There are 1820 pupils altogether. How many boys are there in the school?

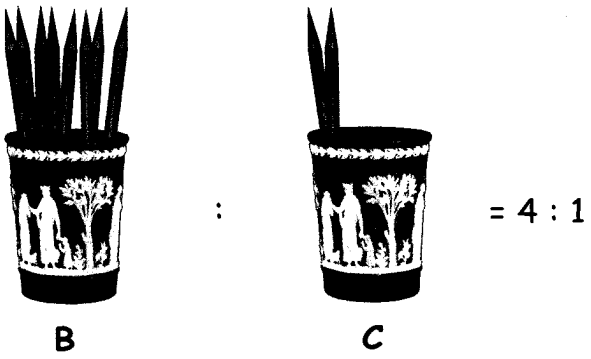
5. A string with a length of 150 cm is cut into 3 parts in the ratio of 3 : 6 : 4. What is the length of each of the three parts? Give your answer correct to the nearest cm.

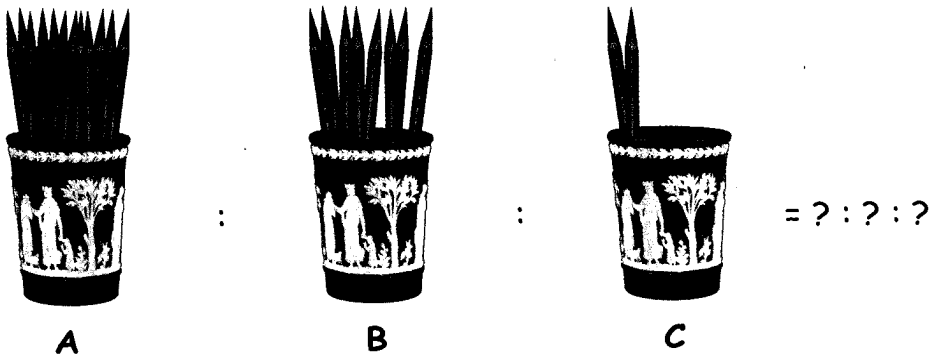
Let's Learn ... Word Problems

1. There are three pencil holders. The ratio of the number of pencils in Holder A to the number of pencils in Holder B is 3 : 2. The ratio of the number of pencils in Holder B to the number of pencils in Holder C is 4 : 1.

   (a) Find the ratio of the number of pencils in Holder A to the number of pencils in Holder B to the number of pencils in the Holder C.
   (b) If there are 12 pencils in Holder A, how many pencils are there altogether in the three holders?

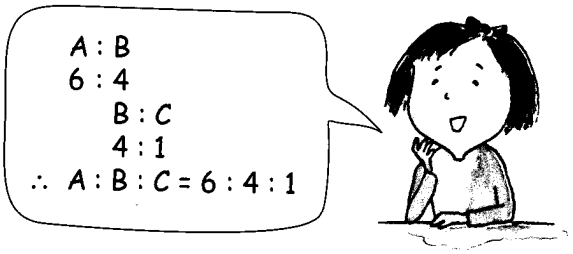




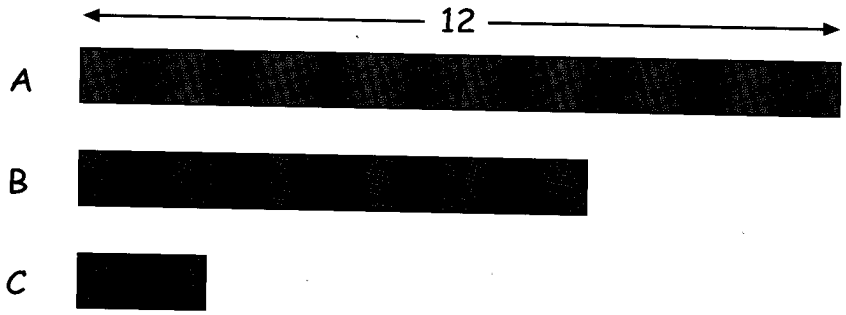


(a) The ratio of the number of pencils in Holder A to that in Holder B is 3 : 2 = 6 : 4.

So the ratio of the number of pencils in Holder A to that in Holder B to that in Holder C is 6 : 4 : 1.



(b)



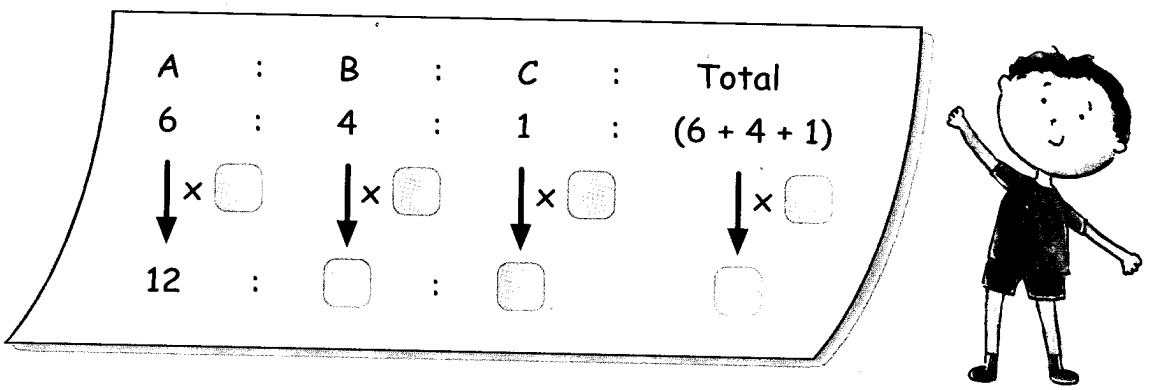
6 units ⟶ 12

1 unit ⟶ 12 ÷ 6 = 2

11 units ⟶ 11 x 2 = 22

There are 22 pencils altogether in the three pencil boxes.

Can you solve part (b) using equivalent ratios?



2. The ratio of the number of pupils in Class 6A to the number of pupils in Class 6B is 8 : 7.

   The ratio of the number of pupils in Class 6B to the number of pupils in Class 6C is 14 : 15.

   (a) Find the ratio of the number of pupils in Class 6A to the number of pupils in Class 6B to the number of pupils in Class 6C.

   (b) If Class 6B has 28 pupils, how many pupils are there in Class 6A and in Class 6C?

   (a) The ratio of the number of pupils in Class 6A to the number of pupils in Class 6B is

   $$8 : 7 = 16 : 14$$

   The ratio of the number of pupils in Class 6B to the number of pupils in Class 6C is

   $$14 : 15$$

   Combine the ratios to form a ratio involving the 3 classes.

   The ratio of the number of pupils in Class 6A to the number of pupils in Class 6B to the number of pupils in Class 6C is

   $$16 : 14 : 15$$

   (b) If Class 6B has 28 pupils.

   14 units $\longrightarrow$ 28

   1 unit $\longrightarrow$ 2

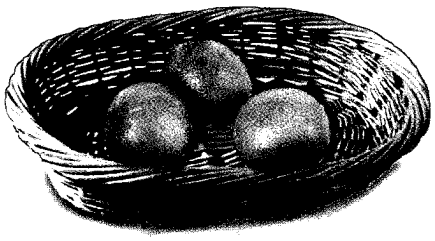
   16 units $\longrightarrow$ $2 \times 16 = 32$

   15 units $\longrightarrow$ $2 \times 15 = 30$

   There are 32 pupils in Class 6A and 30 pupils in Class 6C.

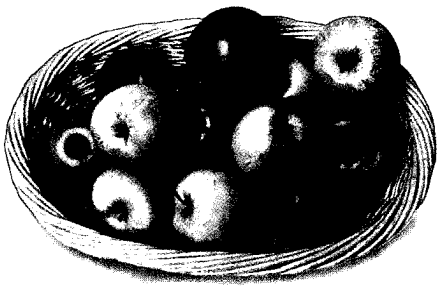
3. There are 3 oranges in Basket A and 12 apples in Basket B at first. Two more oranges are added to Basket A. How many more apples must be added to Basket B so that the ratio of the number of oranges to the number of apples remains the same as before?

A



3 oranges

B



12 apples

The ratio of the number of oranges to the number of apples at first is 3 : 12 = 1 : 4.

After 2 more oranges are added, these are 3 + 2 = 5 oranges in Basket A.

oranges	:	apples
1	:	4
↓ x 5		↓ x 5
5	:	20

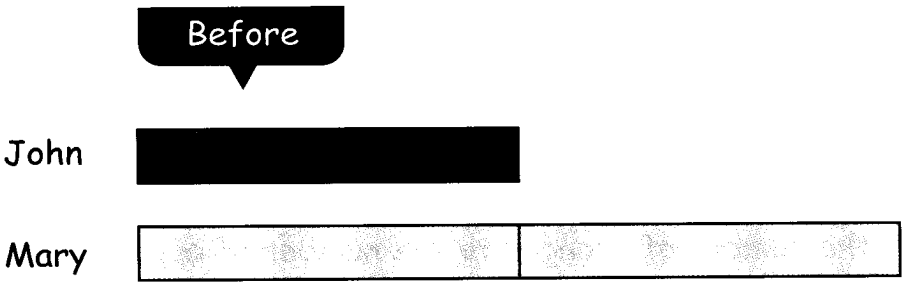
Since 1 : 4 = 5 : 20, to have the same ratio, there must be 20 apples in Basket B.

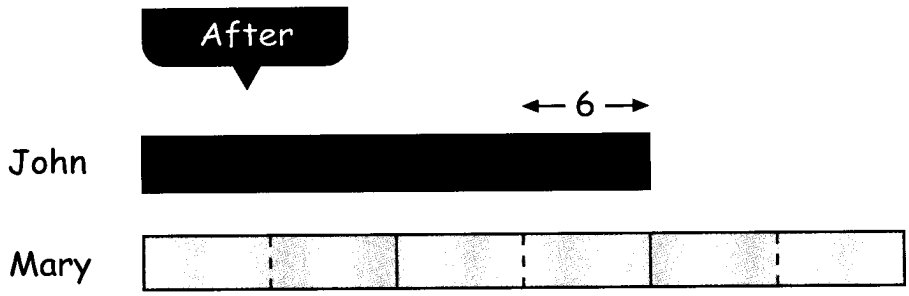
20 - 12 = 8

8 apples must be added to Basket B.

4. The ratio of the number of stamps John had to the number of stamps Mary had was 1 : 2. The ratio became 2 : 3 after John got 6 more stamps. How many stamps did Mary and John each have finally?

Before
John : Mary = 1 : 2 = 3 : 6
After
John : Mary = 2 : 3 = 4 : 6
There is no change in Mary's stamps.





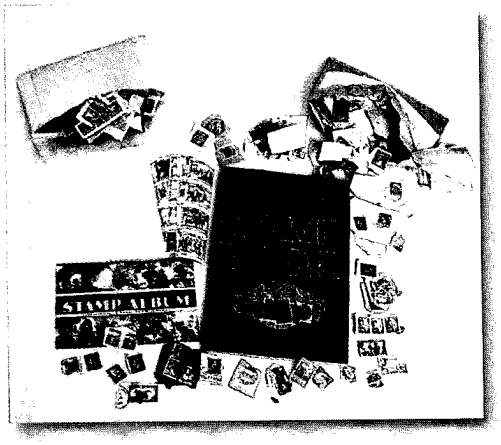
1 unit ⟶ 6

4 units ⟶ 4 x 6 = 24

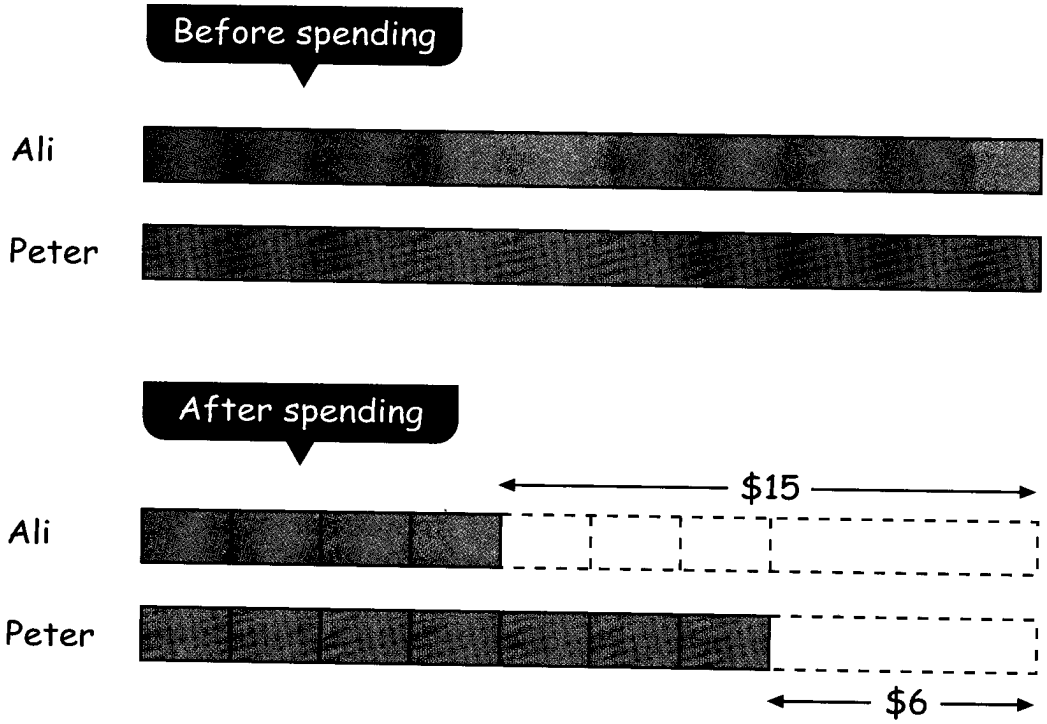
6 units ⟶ 6 x 6 = 36

John had 24 stamps finallly.

Mary had 36 stamps finally.



5. Ali and Peter had an equal amount of money each. After Ali spent $15 and Peter spent $6, the ratio of the amount of money Ali had to that Peter had was 4 : 7. How much money did Ali have at first?



$15 - $6 = $9

After spending, Peter had $9 more than Ali.

3 units ⟶ $9

1 unit ⟶ $9 ÷ 3 = $3

4 units ⟶ $3 x 4 = $12

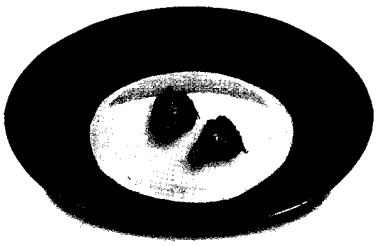
$12 + $15 = $27

Ali had $27 at first.

Let's Try .. Word Problems

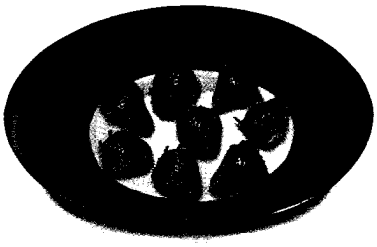
1.

Plate A



2 strawberries

Plate B



8 strawberries

(a) Find the ratio of the number of strawberries in Plate A to the number of strawberries in Plate B in its simplest form.

(b) How many times is the number of strawberries in Plate B as many as the number of strawberries in Plate A?

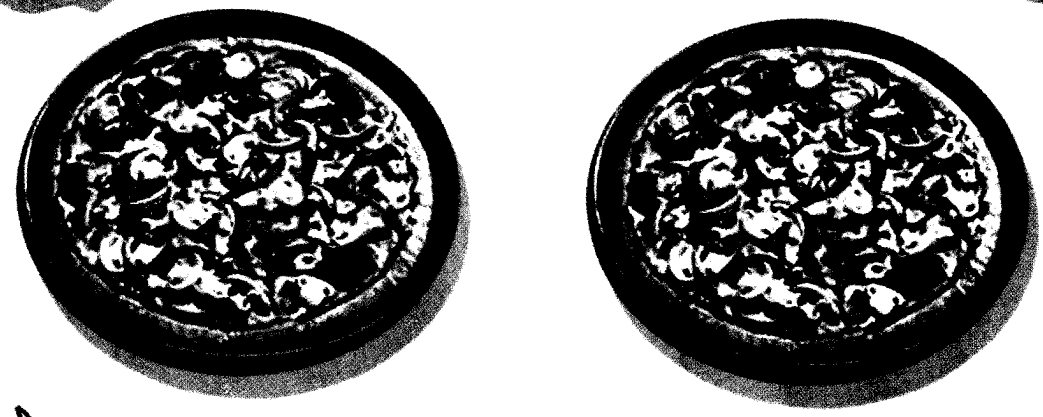
(c) If 3 more strawberries are added to Plate A, how many strawberries must be added to Plate B so that the ratio of the number of strawberries in Plate A to the number of strawberries in Plate B remains the same as before?

2. The ratio of the number of cars to the number of vans in a car park is 5 : 1. The ratio of the number of vans to the number of motorcycles in the same car park is 3 : 2.

(a) Find the ratio of the number of cars to the number of vans to the number of motorcycles in that car park.
(b) If there were 30 cars in the car park, how many motorcycles are there?

3. The ratio of the amount of money Gopal had to the amount of money Jane had was 5 : 6. After Gopal spent $5, the ratio became 2 : 3. How much money did Gopal have at first?

Fractions



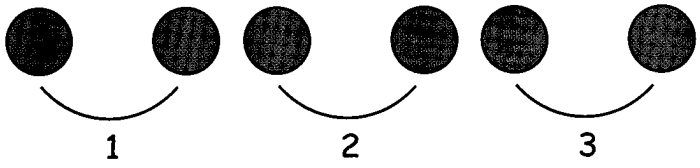
Do You Know?

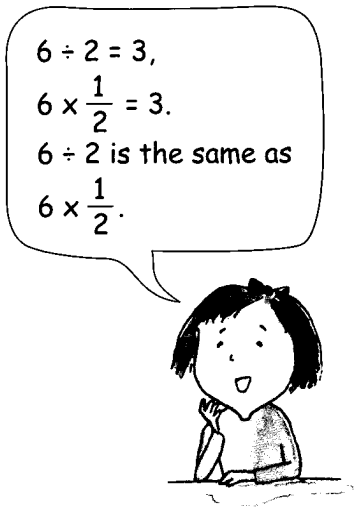
8 children are sharing two pizzas. If each child is given $\frac{1}{4}$ of a pizza, does every child get a piece of pizza?

Let's Learn .. Division of a Whole Number by a Proper Fraction

1. 6 balls are put equally into groups. Each group has 2 balls.
   How many groups are there?

   $6 \div 2 = ?$



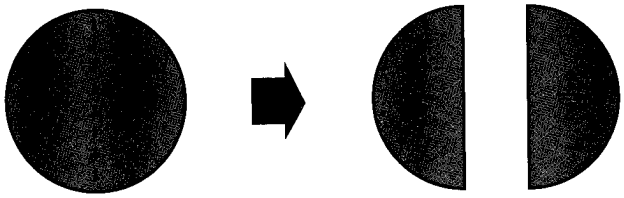


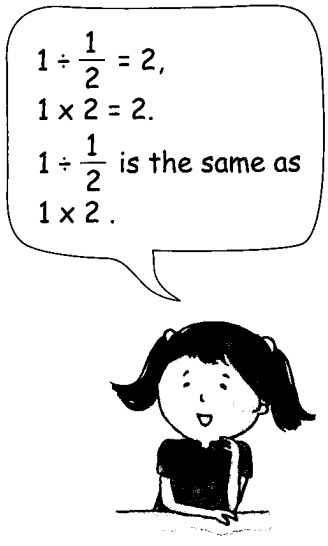
   $6 \div 2 = 3$

   There are 3 groups.

2. 1 watermelon is cut into equal parts. Each part is $\frac{1}{2}$ of the watermelon.
   How many parts are there?

   $1 \div \frac{1}{2} = ?$



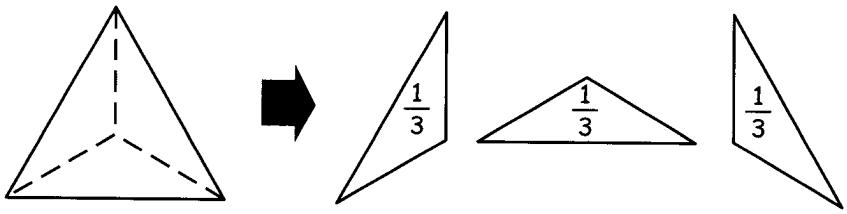


   $1 \div \frac{1}{2} = 2$

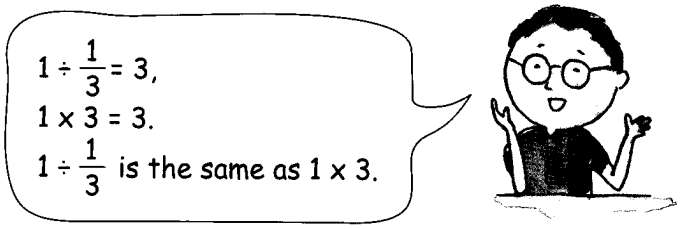
   There are 2 parts.

3. 1 cake is cut into equal parts. Each part is $\frac{1}{3}$ of the cake. How many parts are there?

$1 \div \frac{1}{3} = ?$



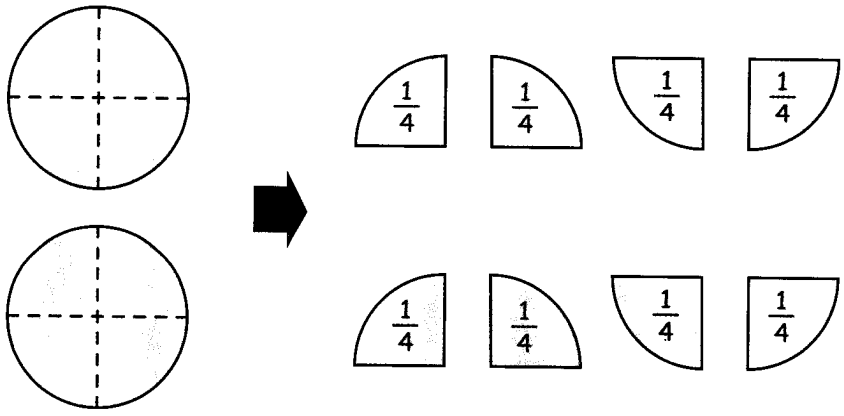
$1 \div \frac{1}{3} = 3$



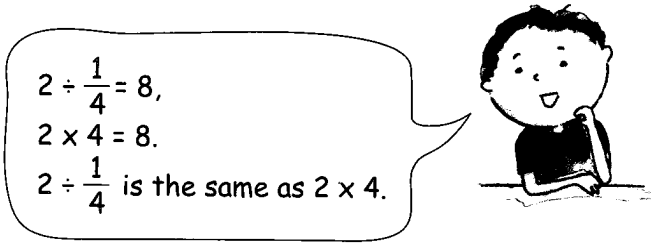
There are 3 parts.

4. 2 similar pizzas are cut into equal parts. Each part is $\frac{1}{4}$ of a pizza. How many parts are there?

$2 \div \frac{1}{4} = ?$



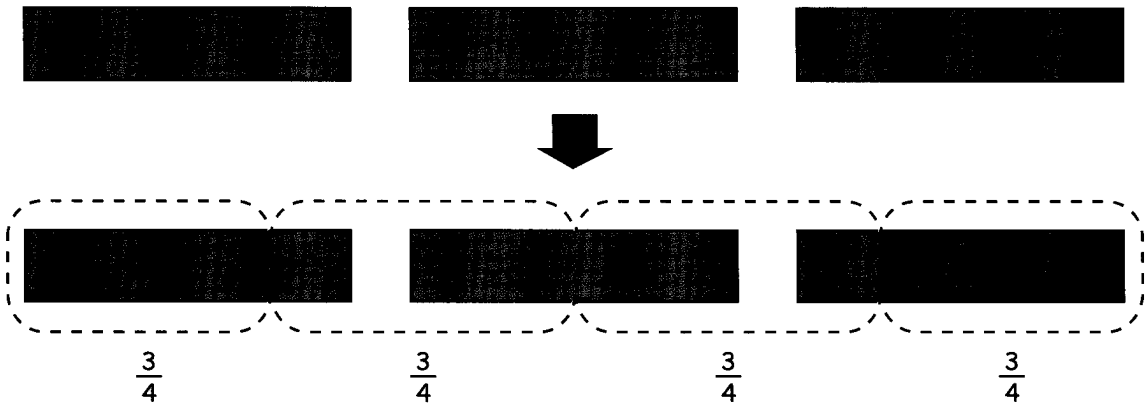
$2 \div \frac{1}{4} = 8$



There are 8 parts.

5. 3 chocolate bars are shared among some children. Each child gets $\frac{3}{4}$ of a chocolate bar. How many children are there?

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



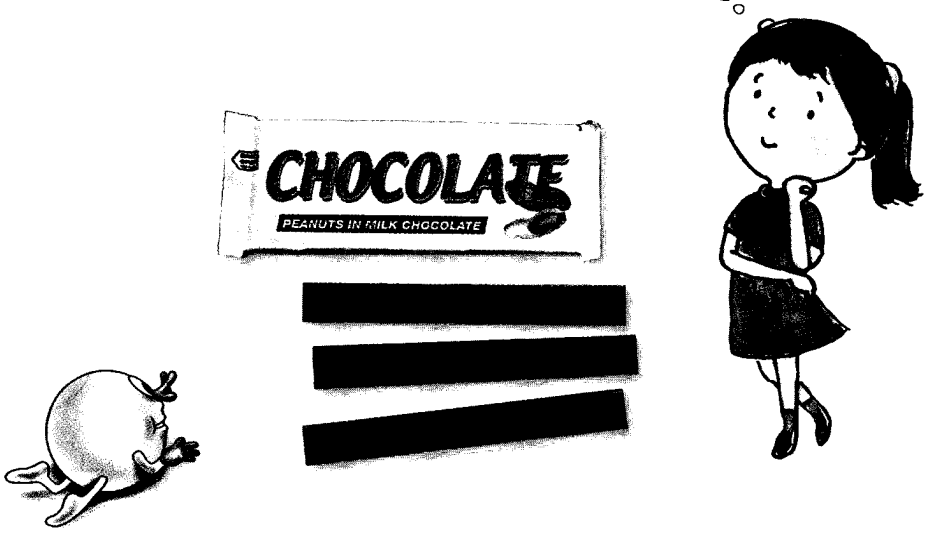
$3 \div \frac{3}{4} = 4$

There are 4 children.

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

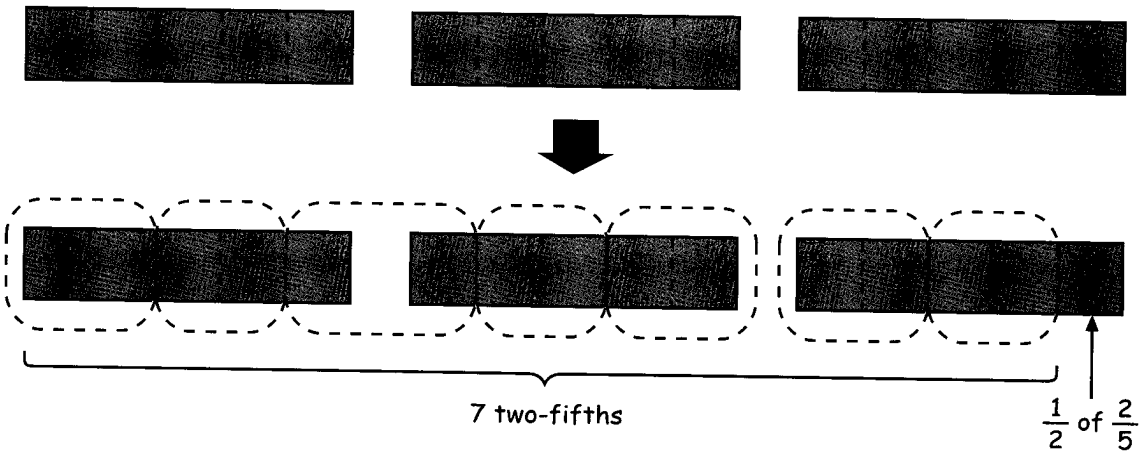
$3 \times \frac{4}{3} = 4.$

$3 \div \frac{3}{4}$ is the same as $3 \times \frac{4}{3}$.



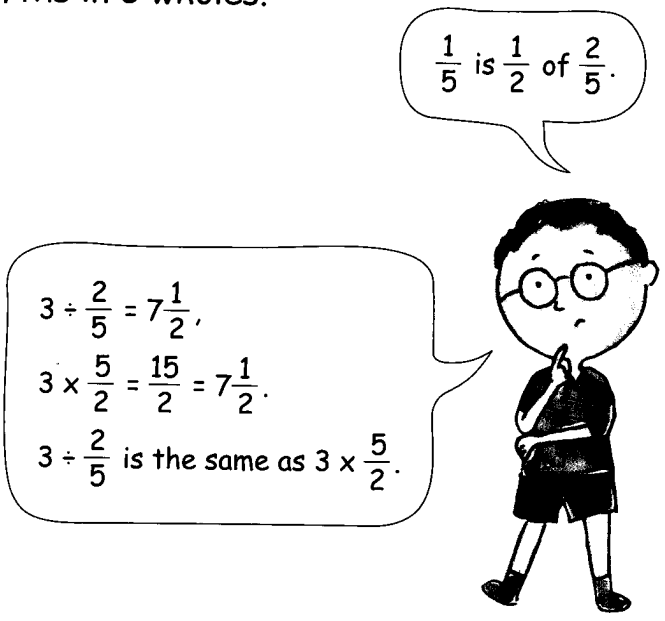
6. How many two-fifths are there in 3 wholes?

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



$3 \div \frac{3}{4} = 7\frac{1}{2}$

There are $7\frac{1}{2}$ two-fifths in 3 wholes.



A 1. Cut out 2 pieces of paper strips, each of length 20 cm and breadth 2 cm.

2. Cut each strip into 5 equal parts. Write $\frac{1}{5}$ on each small part.

3. Use 2 parts to form equal groups such that each group has $\frac{2}{5}$.

4. How many groups do you get? Do you get 5 groups?

5. Explain what is $2 \div \frac{2}{5}$ from your result in step 4.

6. Calculate $2 \times \frac{5}{2}$. Is the result the same as the number you get in step 4?

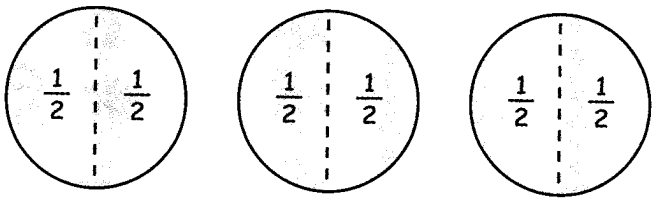
7. Explain how the above activity shows that: $2 \div \frac{2}{5} = 2 \times \frac{5}{2}$.

B Repeat all the steps in A to show that $2 \div \frac{2}{3} = 2 \times \frac{3}{2}$.

Some steps need to be changed accordingly.

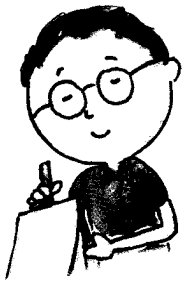
Based on the results of Examples 1 – 6 on page 64 to 67, and the results you get here, can you get a general rule about division by a fraction?

7. How many halves are there in 3 wholes?



$3 \div \frac{1}{2} = 3 \times 2 = 6$

There are 6 halves in 3 wholes.



8. Divide the following:

(a)

$1 \div \frac{1}{6} = 1 \times 6 =$ ▢

(b)

$3 \div \frac{1}{5} = 3$ ▢ $5 =$ ▢

(c)

$1 \div \frac{3}{4} = 1 \times$ ▢/▢ $=$ ▢/▢

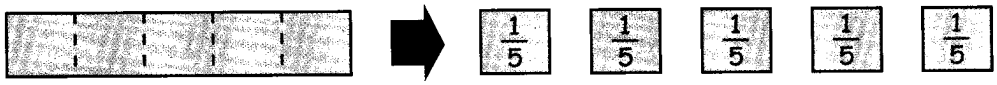
(d)

$2 \div \frac{3}{5} = 2$ ▢ ▢/▢ $=$ ▢/▢

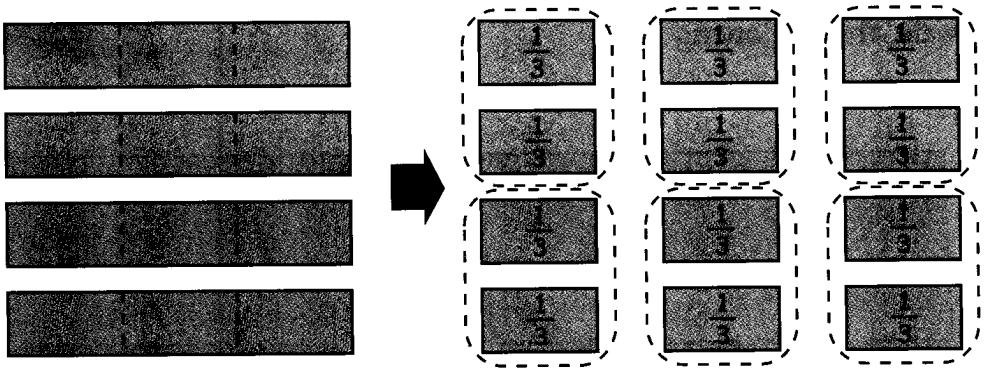
Division of a Whole Number by a Proper Fraction

1. Divide the following based on the pictorial representations.

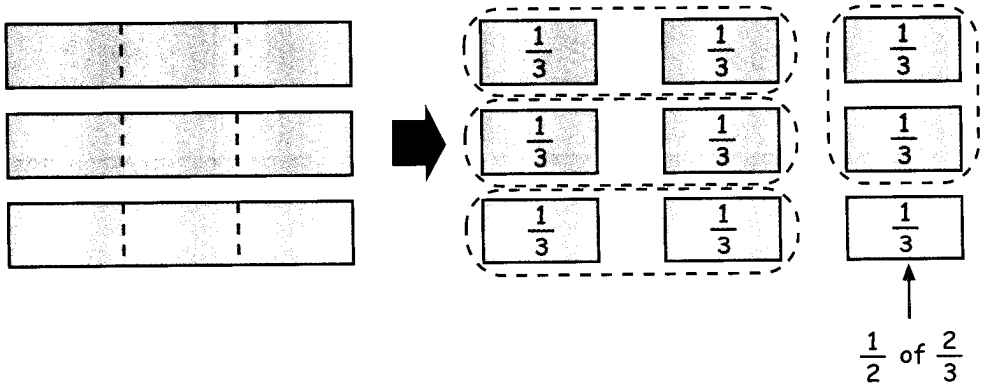
(a) $1 \div \frac{1}{5} =$ ☐



(b) $4 \div \frac{2}{3} =$ ☐



(c) $3 \div \frac{2}{3} =$ ☐



2. Divide the following:

(a) $1 \div \frac{1}{6}$

(b) $5 \div \frac{1}{2}$

(c) $4 \div \frac{2}{5}$

(d) $6 \div \frac{2}{3}$

(e) $1 \div \frac{3}{4}$

(f) $7 \div \frac{5}{6}$

3. How many one-thirds are there in 4 wholes?

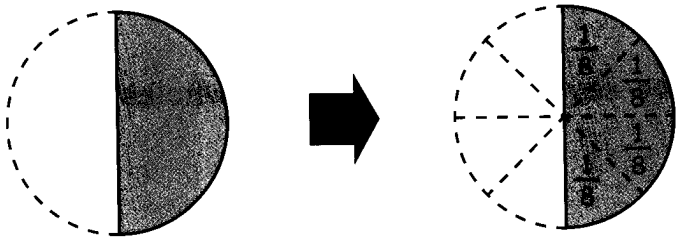
4. How many two-sevenths are there in 6 wholes?

5. Some pupils shared 4 pizzas equally. Each pupil received $\frac{2}{3}$ of a pizza. How many pupils were there?

Division of a Proper Fraction by a Proper Fraction

1. Hamid has $\frac{1}{2}$ of a watermelon. He wants to cut it into equal pieces such that each piece is $\frac{1}{8}$ of a watermelon. How many pieces of watermelon can he get?

$\frac{1}{2} \div \frac{1}{8} = ?$

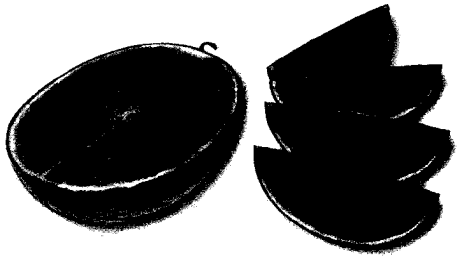


1 whole of a watermelon can be cut into 8 pieces of $\frac{1}{8}$ of a watermelon.

$\frac{1}{2}$ of a whole watermelon can be cut into $\frac{1}{2}$ of 8 pieces (i.e. 4 pieces) of $\frac{1}{8}$ of a watermelon.

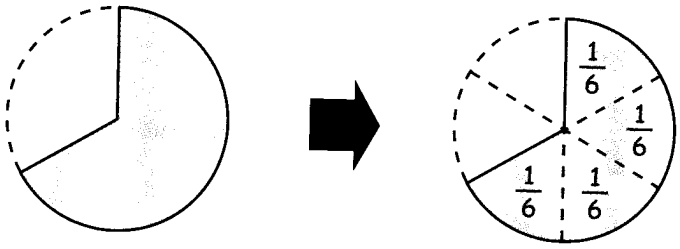
$$\frac{1}{2} \div \frac{1}{8} = \frac{1}{2} \times 8 = 4$$

He can get 4 pieces of watermelon.



2. Mei Ling has $\frac{2}{3}$ of a pizza. She wants to cut it into equal pieces such that each piece is $\frac{1}{6}$ of a whole pizza. How many pieces of pizza can she get?

$\frac{2}{3} \div \frac{1}{6} = ?$



1 whole pizza can be cut into 6 pieces of $\frac{1}{6}$ of a pizza.

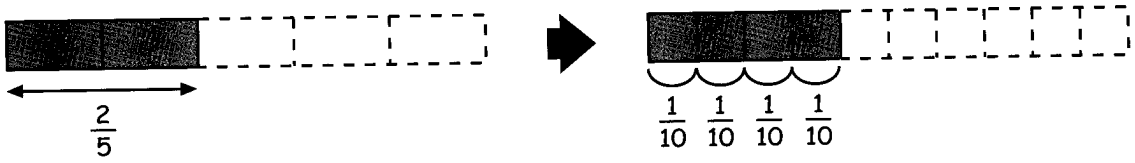
So $\frac{2}{3}$ of a pizza can be cut into $\frac{2}{3}$ of 6 pieces (i.e. 4 pieces) of $\frac{1}{6}$ of a whole pizza.

$\frac{2}{3} \div \frac{1}{6} = \frac{2}{3} \times 6 = 4$

She can get 4 pieces of pizza.

3. How many one-tenths are there in $\frac{2}{5}$?

$\frac{2}{5} \div \frac{1}{10} = ?$



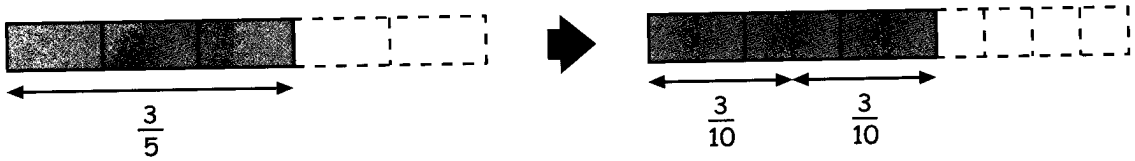
There are 10 one-tenths in 1 whole.

So, there are $\frac{2}{5}$ of 10 one-tenths (i.e. 4 one-tenths) in $\frac{2}{5}$.

$$\frac{2}{5} \div \frac{1}{10} = \frac{2}{5} \times 10 = 4$$

4. How many three-tenths are there in $\frac{3}{5}$?

$\frac{3}{5} \div \frac{3}{10} = ?$



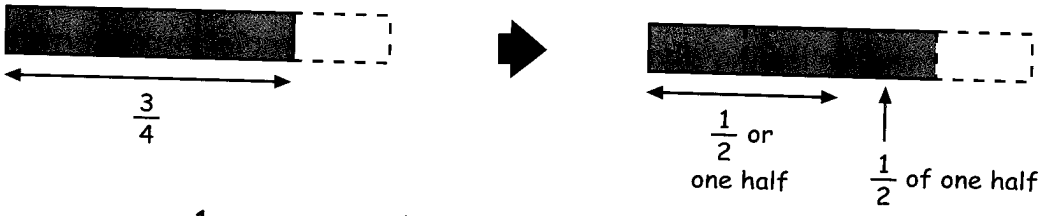
There are 10 one-tenths in 1 whole.

There are 2 three-tenths in $\frac{3}{5}$.

$$\frac{3}{5} \div \frac{3}{10} = \frac{3}{5} \times \frac{10}{3} = 2$$

5. How many halves are there in $\frac{3}{4}$?

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



There are $1\frac{1}{2}$ halves in $\frac{3}{4}$.

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

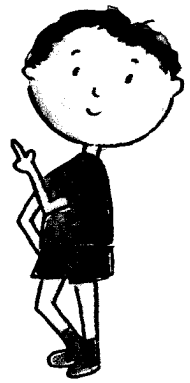
6. Calculate the following:

(a) $\frac{1}{3} \div \frac{1}{6} = \frac{1}{3} \times \square = \square$

(b) $\frac{1}{5} \div \frac{7}{10} = \frac{1}{5} \square \frac{10}{7} = \frac{\square}{\square}$

(c) $\frac{3}{5} \div \frac{14}{15} = \frac{3}{5} \square \frac{\square}{\square} = \frac{\square}{\square}$

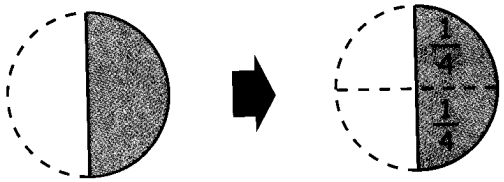
(d) $\frac{5}{14} \div \frac{2}{7} = \frac{5}{14} \square \frac{\square}{\square} = \frac{\square}{\square} = \square \frac{\square}{\square}$



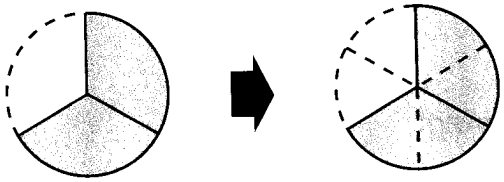
Let's Try .. Division of a Proper Fraction by a Proper Fraction

1. Calculate the following divisions based on the pictorial representations.

   (a) $\frac{1}{2} \div \frac{1}{4}$



   (b) $\frac{2}{3} \div \frac{1}{6}$



2. Find the following:

   (a) $\frac{1}{4} \div \frac{1}{6}$

   (b) $\frac{3}{4} \div \frac{1}{5}$

   (c) $\frac{2}{3} \div \frac{5}{6}$

   (d) $\frac{1}{5} \div \frac{7}{15}$

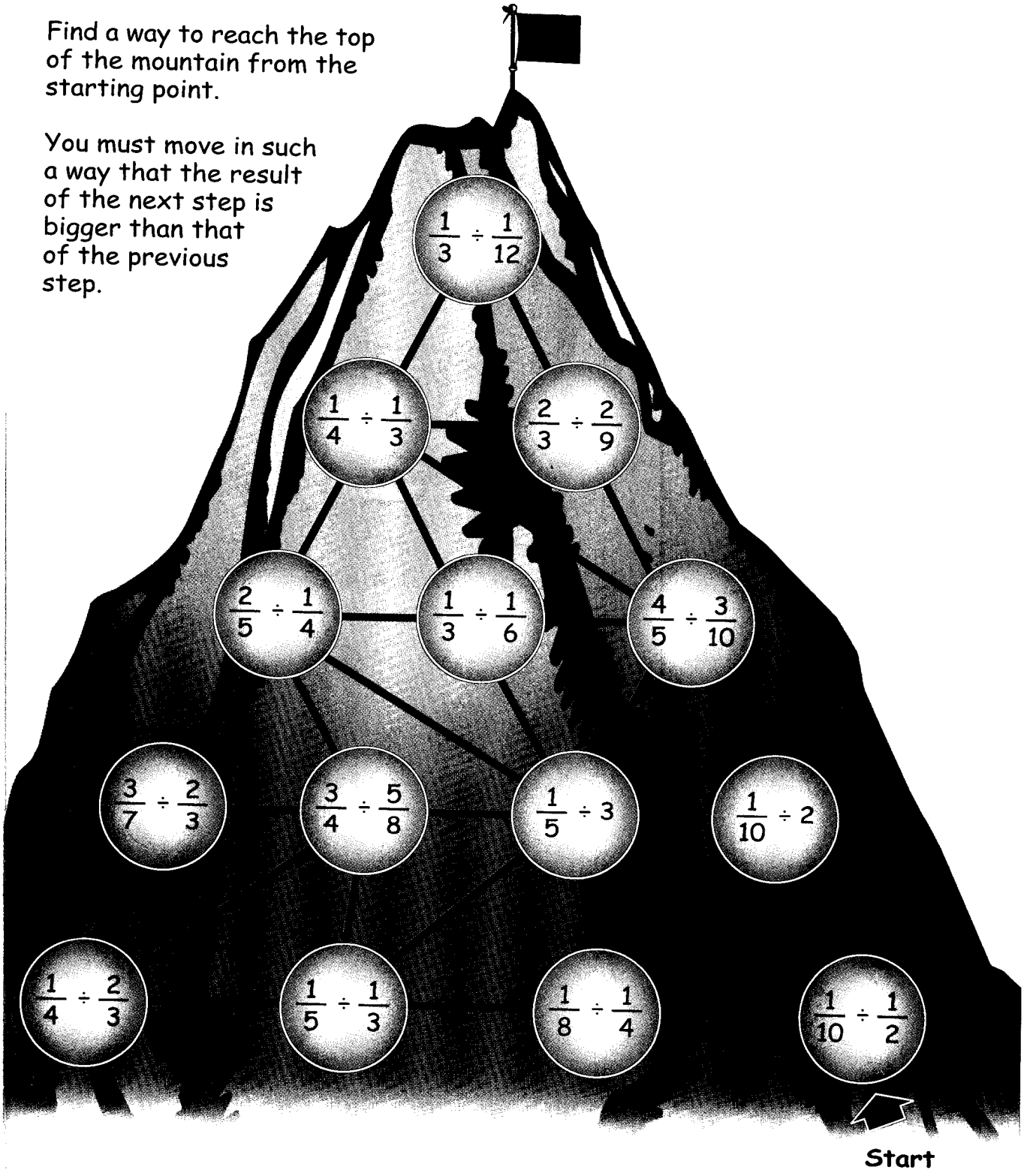
3. How many one-eighths are there in $\frac{3}{4}$?

4. $\frac{3}{4}$ of a whole cake is to be cut into equal parts such that each part is $\frac{1}{12}$ of a whole cake. How many pieces of cake can we get?

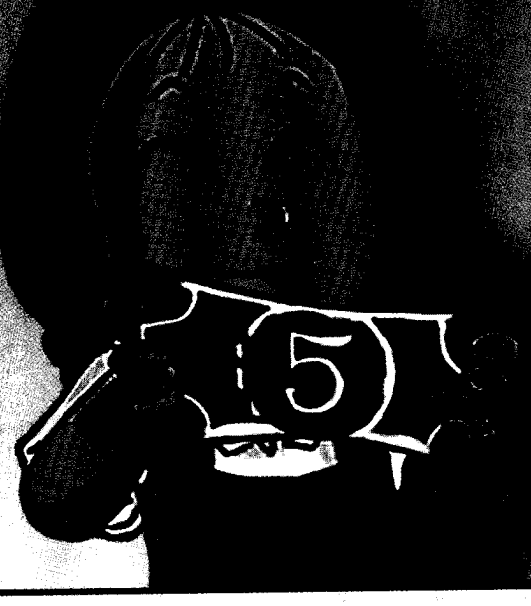
Fun with Maths

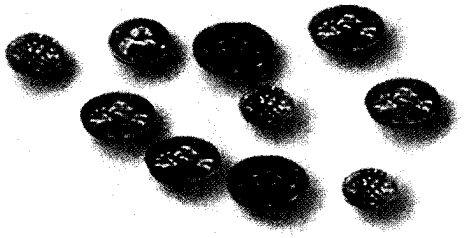
Find a way to reach the top of the mountain from the starting point.

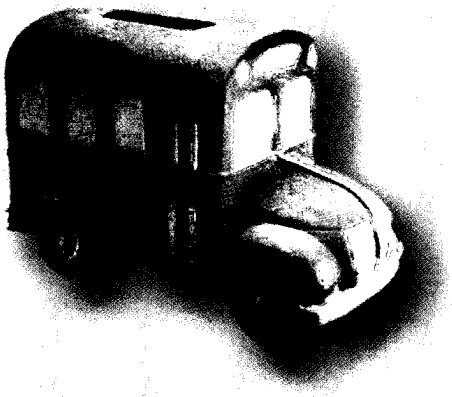
You must move in such a way that the result of the next step is bigger than that of the previous step.



Percentage





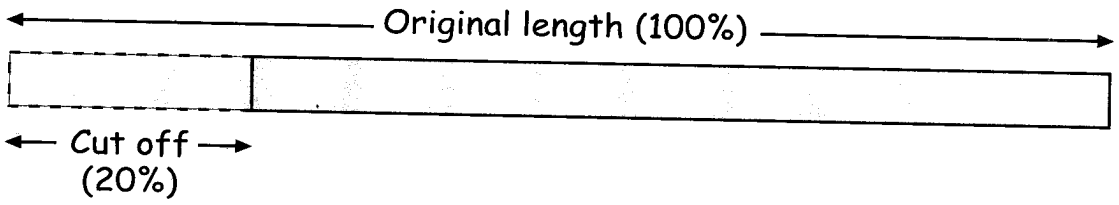


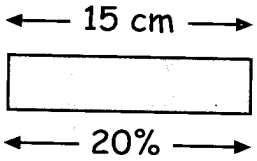
DO YOU KNOW?

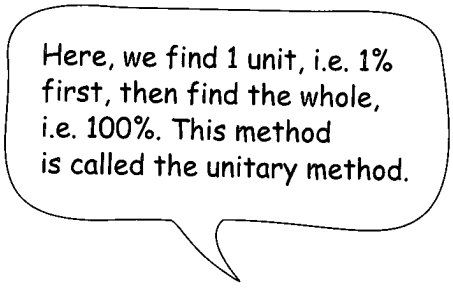
Mary's savings was $8 last month. Now it is $10.
What is the percentage increase in Mary's savings?

Find the Whole Given a Part and the Percentage

1. 20% of a stick is cut off. The length of the cut-off part is 15 cm. What is the original length of the stick?







20% of the original length is 15 cm.

1% of the original length is $\frac{15}{20}$ cm.

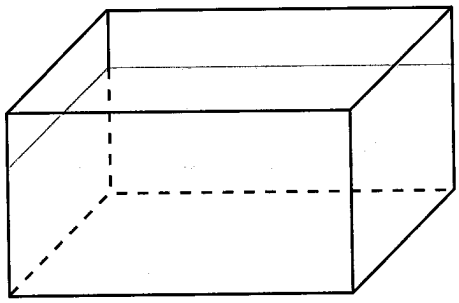
100% of the original length = $\frac{15}{\cancel{20}} \times \overset{5}{\cancel{100}}$

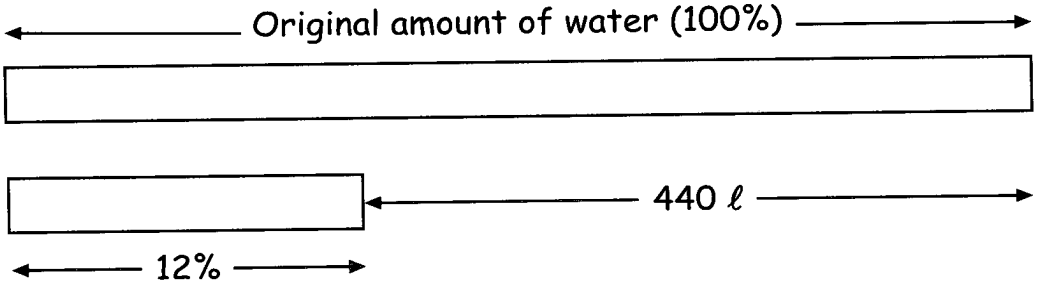
= 15 x 5

= 75 cm

The original length of the stick is 75 cm.

2. At first, a tank was full of water. After 12% of the water was poured out, there was 440 ℓ of water left. Find the amount of water in the tank at first.





100% - 12% = 88%

88% of the water was left in the tank. Its volume was 440 ℓ.

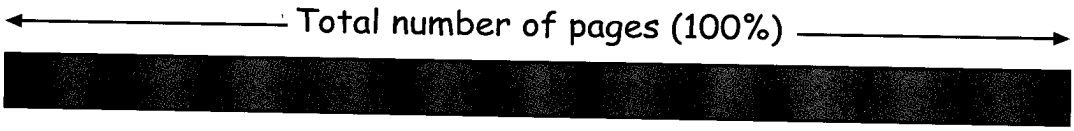
1% of the water in the tank is $\frac{440}{88}$ ℓ.

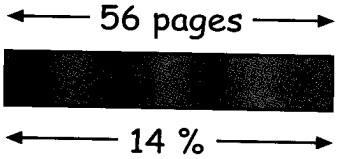
100% of the water in the tank is $\frac{440}{88} \times 100$

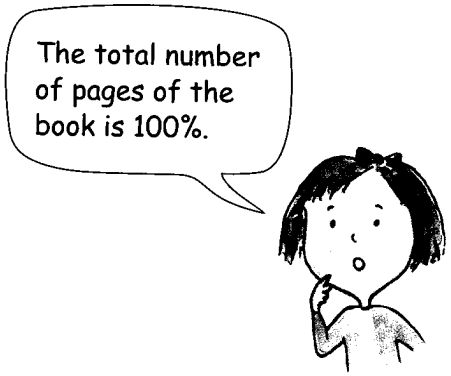
$= 500\ \ell$

The amount of water in the tank was 500 ℓ at first.

3. Rachael reads 56 pages which is 14% of a book. What is the total number of pages in the book?







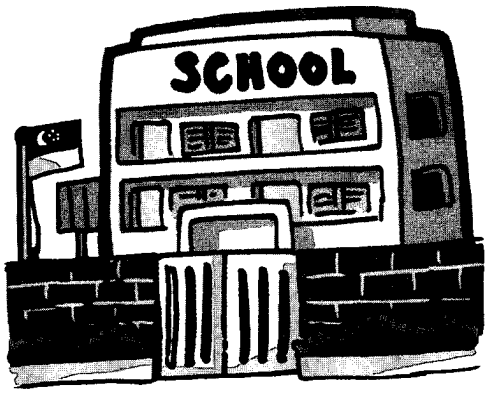
14% ⟶ 56

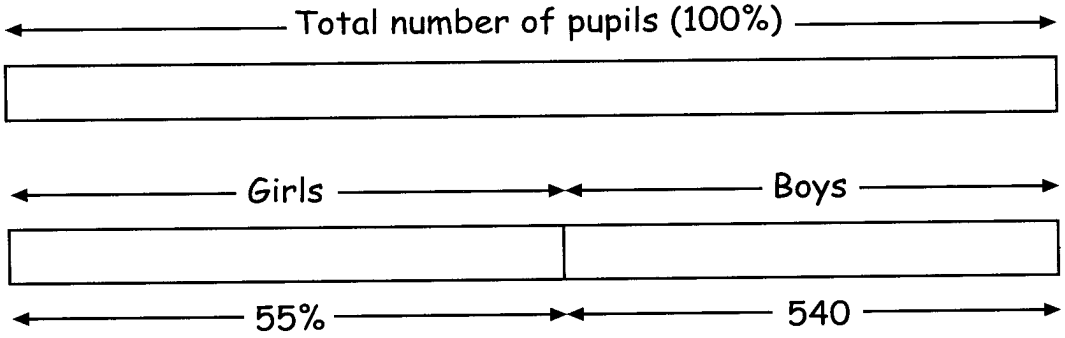
1% ⟶ $\frac{56}{14}$ = ☐

100% ⟶ 100 × ☐ = ☐

The total number of pages in the book is ☐.

4. In a primary school, 55% of the pupils are girls. There are 540 boys in the school. How many pupils are there in the school?





100% - 55% = 45%

45% ⟶ 540

1% ⟶ $\frac{540}{45}$ = 12

100% ⟶ 100 x 12 = 1200

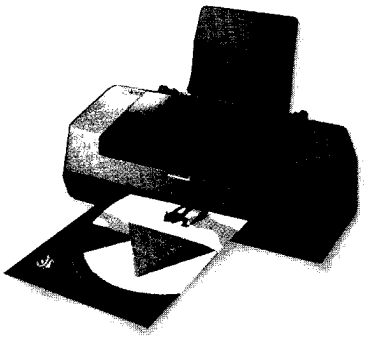
There are 1200 pupils in the school.

Find the Whole Given a Part and the Percentage

1. 20% of the number of pupils in a class is 6. What is the total number of pupils in the class?

2. 16% of a journey is 28 km. Find the total distance of the journey.

3. After spending 95% of his money on a printer, John had $35 left. How much money did John have before buying the printer?

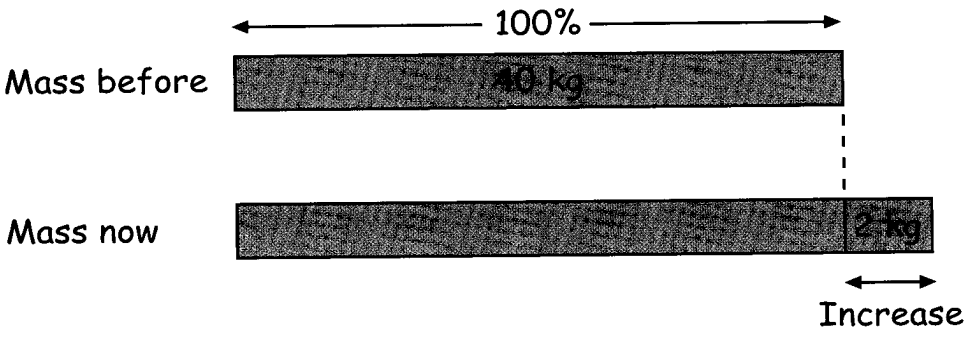


4. 54% of Jane's stamps are foreign stamps. Jane has 81 foreign stamps. How many stamps does Jane have in total?

5. There are 540 girls in a school. 52% of the total number of pupils in the school are boys. How many pupils are there in the school?

Percentage Increase and Percentage Decrease

1. 3 months ago, Subra's mass was 40 kg. Today, his mass is 42 kg. What is the percentage increase in Subra's mass?



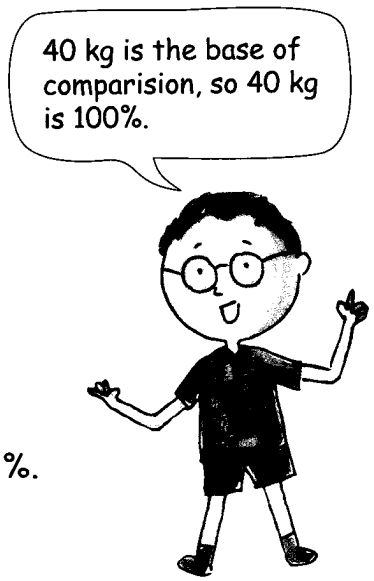
Increase in mass = 42 - 40 = 2 kg.

40 kg ⟶ 100%

1 kg ⟶ $\frac{1}{40}$ x 100%

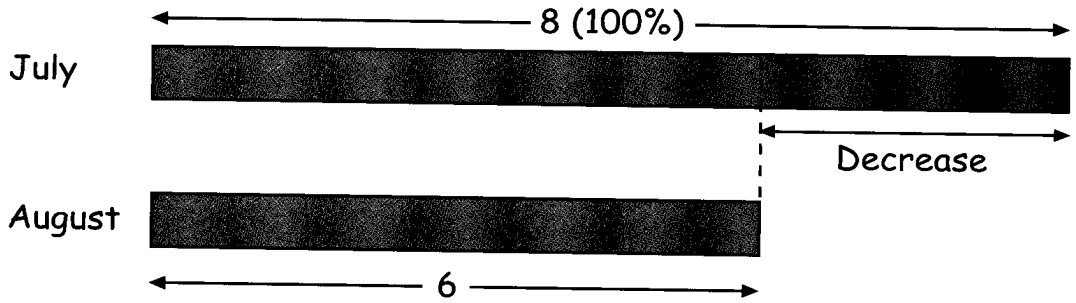
2 kg ⟶ $\frac{2}{40}$ x 100%

= 5%



The percentage increase in Subra's mass is 5%.

2. There were 8 absentees in class 6D in July. It decreased to 6 absentees in August. What was the percentage decrease in the number of absentees?



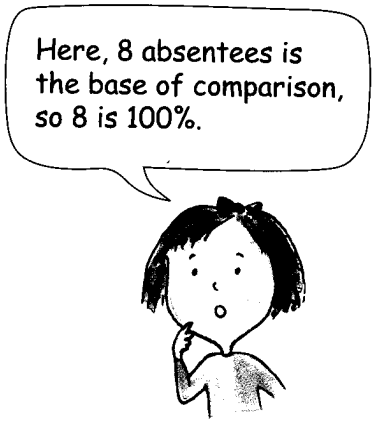
The decrease in absentees = 8 - 6 = 2.

8 absentees ⟶ 100%

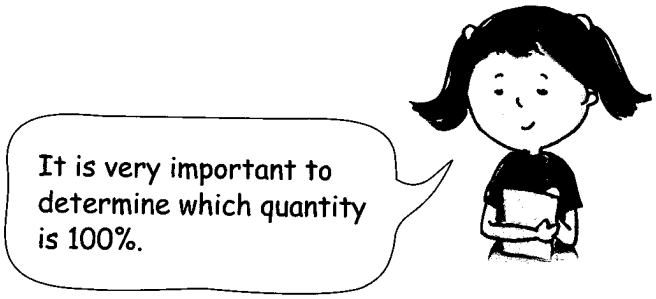
1 absentee ⟶ $\frac{1}{8} \times 100\%$

2 absentees ⟶ $\frac{2}{8} \times 100\%$

$= 25\%$



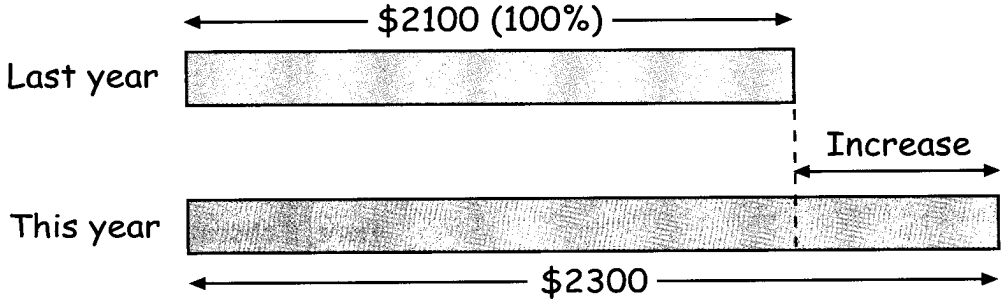
The percentage decrease in the number of absentees was 25%.



3. The table below shows the salary of a bank officer in the two years:

Salary last year	$2100 per month
Salary this year	$2300 per month

Find the percentage increase in his/her monthly salary. Give your answer correct to the nearest 1%.



Increase in his/her monthly salary = $2300 – $2100
= $200

$2100 ⟶ 100%

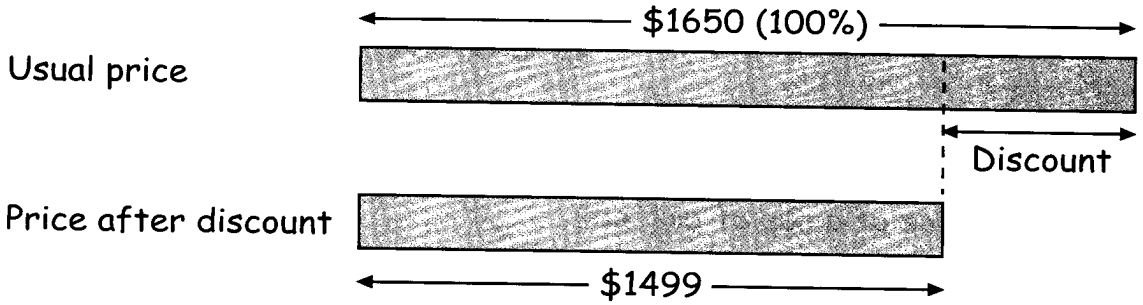
$1 ⟶ $\frac{1}{2100} \times 100\%$

$200 ⟶ $\frac{200}{2100} \times 100\%$

= 10% (correct to the nearest 1%)

The percentage increase in the bank officer's monthly salary is 10%.

4. The usual price of a computer was $1650. During a promotion, it was sold at $1499. What was the percentage discount on the price of the computer?
Give your answer correct to the nearest 1%.



$1650 - $1499 = $151

Discounted amount is $151.

$1650 ⟶ 100%

$1 ⟶ $\frac{1}{1650} \times 100\%$

$151 ⟶ $\frac{151}{1650} \times 100\%$

= 9% (correct to the nearest 1%)

The percentage discount on the price of the computer was 9%.

Let's Try .. Percentage Increase and Percentage Decrease

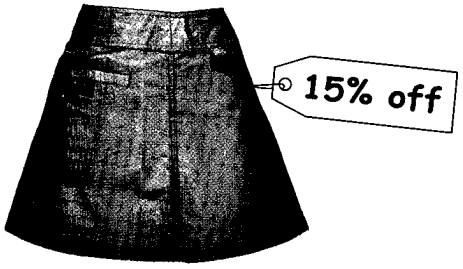
1. The price of a cup of coffee was 50¢ last year. It is 65¢ now. What is the percentage increase in the price of a cup of coffee?

2. There were 550 ℓ in a tank. After some water was poured in, the volume of water in the tank was 770 ℓ. What is the percentage increase in the volume of water in the tank?

3. The expenditure of Mr Wang in May was $1600. But in June, his expenditure was reduced to $1400. What was the percentage decrease in Mr. Wang's expenditure?

4. John got 90 marks in the last Mathematics test. But he got 72 marks in the recent Mathematics test. What was the percentage decrease in John's scores of the Mathematics test?

5. During a promotion, a shop gave a 15% discount for all items. Alice bought a skirt. The usual price of the skirt was $25. How much did she save?



Let's Learn ... Word Problems

1. John had $2. He gave his sister 70¢. What percentage of his money did he give his sister?

$2 = 200¢

Here, $2 or 200¢ is 100%.

$200¢ \longrightarrow 100\%$

$1¢ \longrightarrow \frac{1}{200} \times 100\%$

$70¢ \longrightarrow \frac{70}{200} \times 100\%$

$= 35\%$

We can also do it in a direct way:

$2 = 200¢

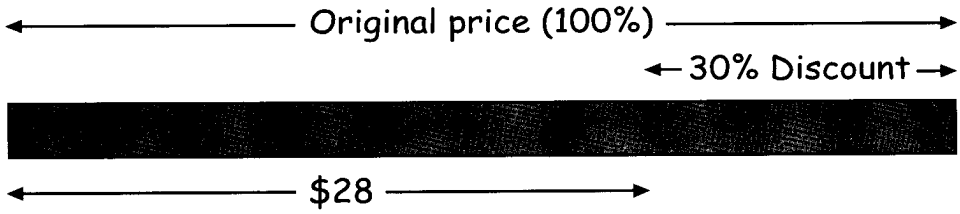
$\frac{70}{200} = \frac{35}{100} = 35\%$

John gave 35% of his money to his sister.

2. In a sale, Jasmin bought a jacket with a 30% discount. She only paid $28 for the jacket.

   (a) What was the original price of the jacket?

   (b) How much did Jasmin save?



(a) 100% - 30% = 70%

With 30% discount, Jasmin only paid 70% the original price.

$$70\% \longrightarrow \$28$$

$$1\% \longrightarrow \$\frac{28}{70}$$

$$100\% \longrightarrow \$\frac{28}{70} \times 100$$

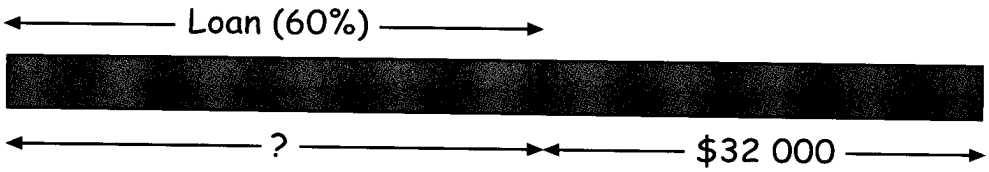
$$= \$40$$

The original price of the jacket was $40.

(b) $40 - $28 = $12

Jasmin saved $12.

3. Mr Lim bought a car. He obtained 60% loan from a bank. He paid the balance of $32 000 by cash. How much did he borrow from the bank?



100% - 60% = 40%

The balance of $32 000 paid by cash is 40% of the price of the car.

40% ⟶ $32 000

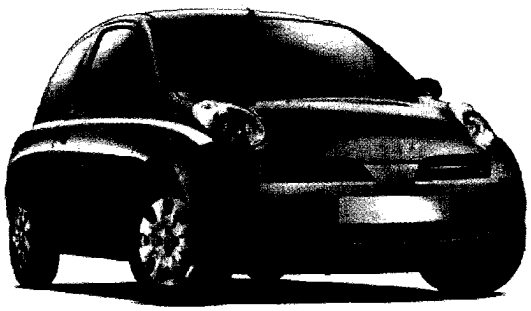
1% ⟶ $\frac{\$32\,000}{40}$

= $800

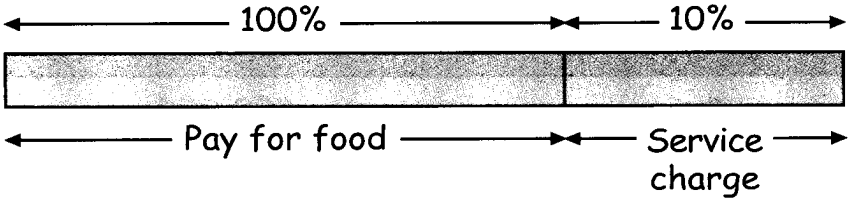
60% ⟶ $800 x 60

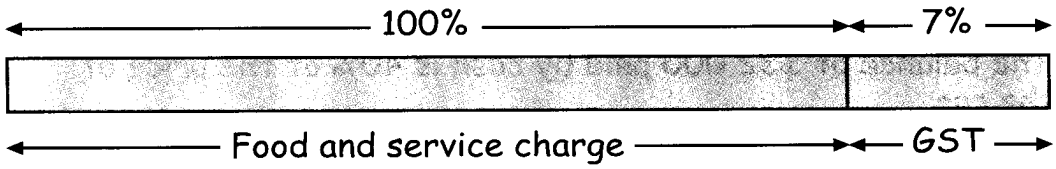
= $48 000

Mr Lim borrowed $48 000 from the bank.



4. Lee family went to a restaurant for dinner. They ordered $160 of food. Besides the food, they had to pay 10% service charge and 7% GST (Goods and Services Tax). How much did they pay in total for the dinner?





$160 x 10% = $16

Lee family had to pay $16 for the service charge.

$160 + $16 = $176

Lee family paid $176 for the food and the service.

$176 x 7% = $12.32

Lee family paid $12.32 for the GST.

$176 + $12.32 = $188.32

Lee family paid $188.32 in total for the dinner.

John did Example 4 in page 92 as below:

$160 x 7% = $11.2

$160 + $11.2 = $171.2

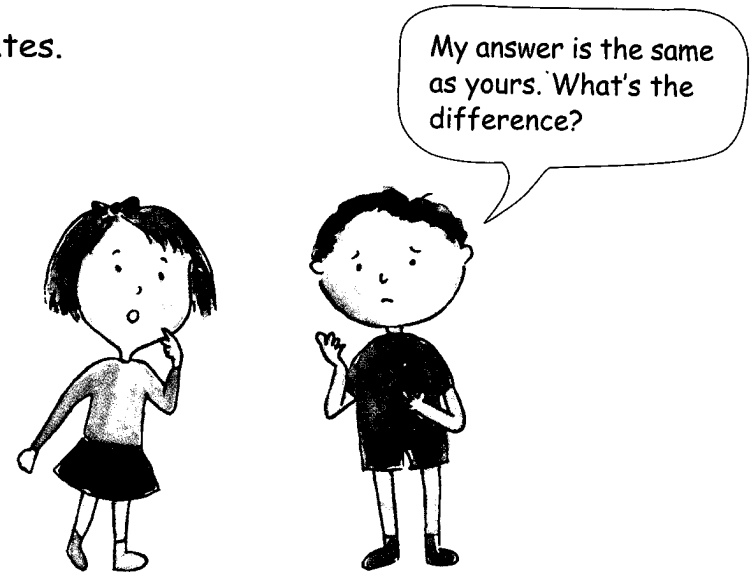
$171.2 x 10% = $17.12

$171.2 + $17.12 = $188.32

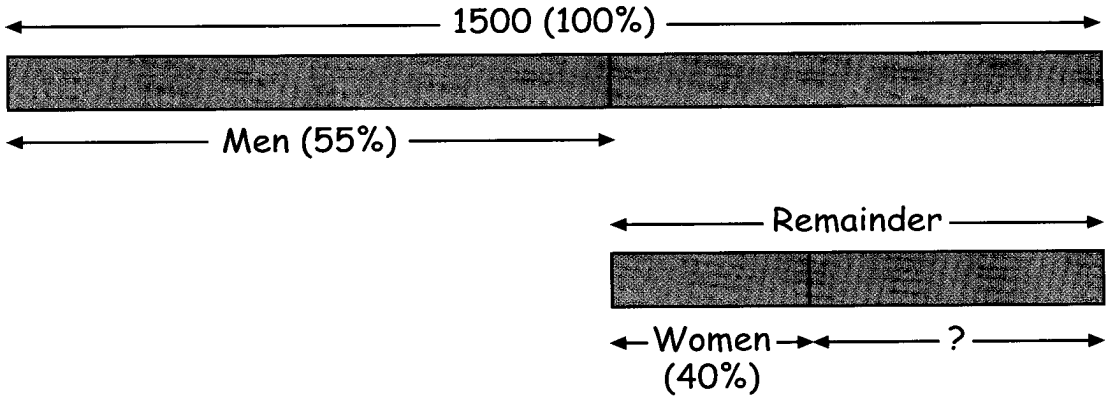
Lee family paid $188.32 for the dinner.

Do you think John's solution is meaningful? Why?

Discuss it with your classmates.



5. There are 1500 participants at a concert. 55% of the participants are men. 40% of the remainder are women. The rest are children. How many children are there at the concert?



1500 x 55% = 825

There are 825 men at the concert.

1500 - 825 = 675

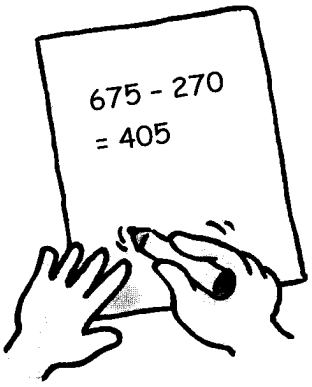
There are 675 women and children at the concert.

675 x 40% = 270

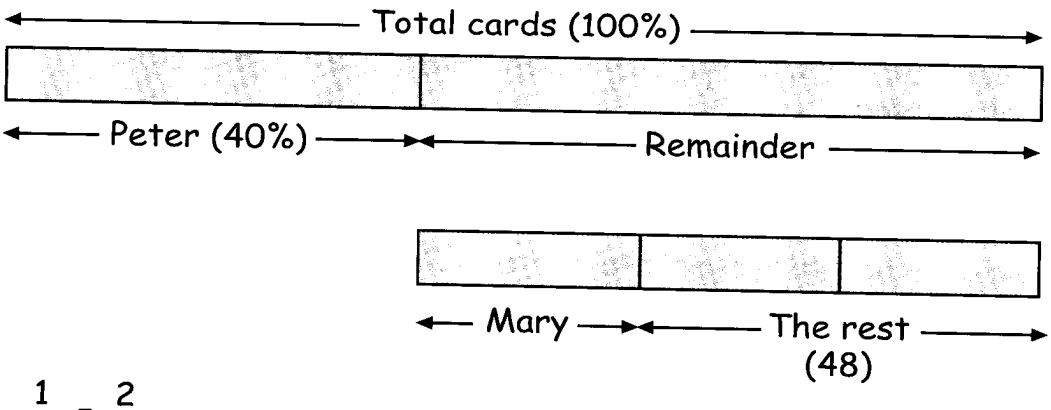
There are 270 women at the concert.

675 - 270 = 405

There are 405 children at the concert.



6. John shared his cards with two friends. He gave 40% of his cards to Peter. Then he gave $\frac{1}{3}$ of the remainder to Mary. He kept the rest of 48 cards. How many cards did John have at first?



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

The number of cards left finally is $\frac{2}{3}$ of the remainder.

2 units ⟶ 48

1 unit ⟶ 24

3 units ⟶ 72

After giving some cards to Peter, John had 72 cards left.

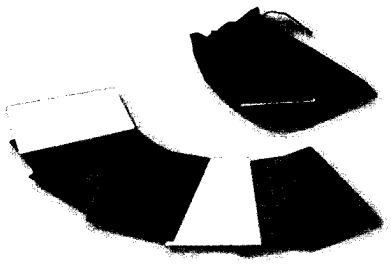
100% - 40% = 60%

The remainder after giving to Peter is 60% of the total cards.

60% ⟶ 72

1% ⟶ $\frac{72}{60}$

100% ⟶ $\frac{72}{60} \times 100 = 120$



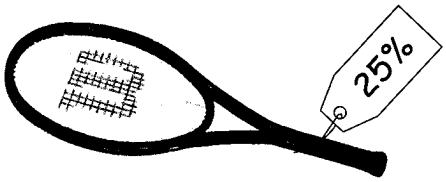
John had 120 cards at first.

Let's Try ... Word Problems

1. (a) Express 25 cm as a percentage of 2 m.
   (b) Express 80¢ as a percentage of $10.

2. In class 6B, 20% of the pupils wear glasses. 28 pupils do not wear glasses .
   (a) How many pupils are there in class 6B?
   (b) How many pupils wear glasses?

3. Lawrence bought a tennis racket at a 25% discount. He paid $78 for the racket.
   (a) What was the original price of the tennis racket?
   (b) How much did he save?

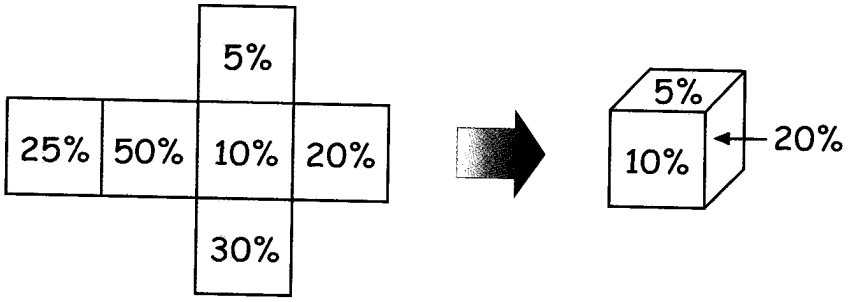


4. Mr Wang deposited some money in a bank. The annual interest rate is 2%. After one year, he got $328 of interest. How much did he deposit in the bank at first?

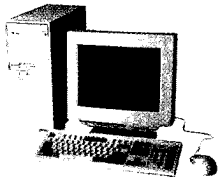
5. Last year, an adult club had 50 female members and 40 male members. The number of female members increased by 10% and the number of male members increased by 15% this year.
   (a) What is the total number of the members in the club this year?
   (b) What is the percentage increase in the number of members of the club? Give your answer correct to the nearest 1%.

6. Two years ago, Miss Tab's salary was $2300. She got a 5% increment last year and a 10% increment this year. What is Miss Tan's salary now?

Work in pairs and make a dice with the following faces as shown below.



For each item below, roll the dice to determine the discount for the item. Find the amount of money saved when the item is bought at this discount.

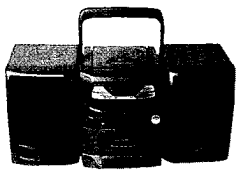


Computer

Usual Price: $1999

Discount: ▒▒ %

Amount of money saved: $ ▒▒

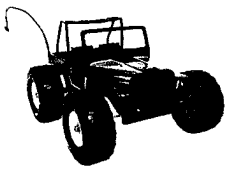


Portable HIFI

Usual Price: $380

Discount: ▒▒ %

Amount of money saved: $ ▒▒

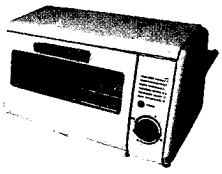


Radio Control Toy Car

Usual Price: $85

Discount: ▒▒ %

Amount of money saved: $ ▒▒

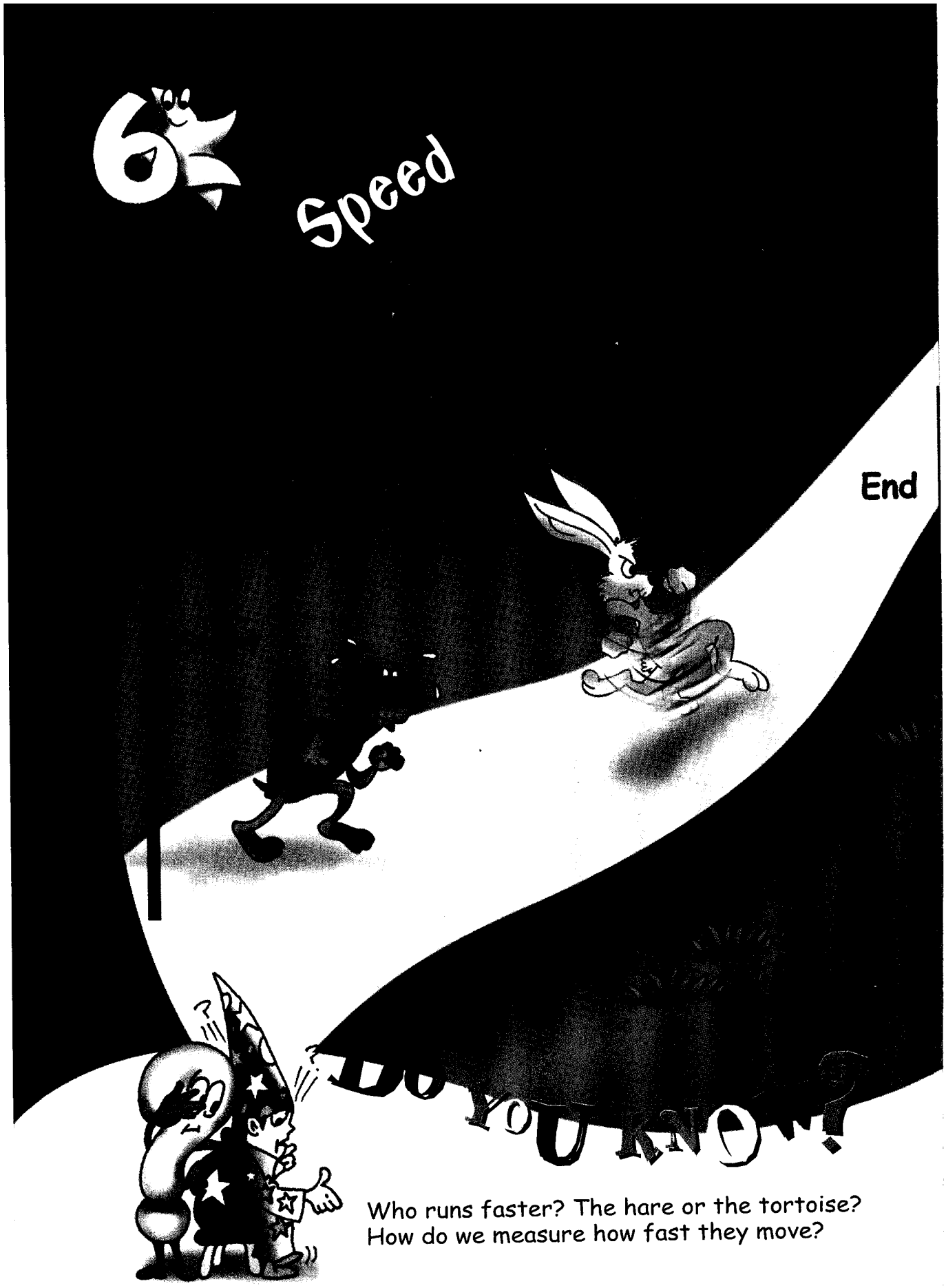


Toaster

Usual Price: $70

Discount: ▒▒ %

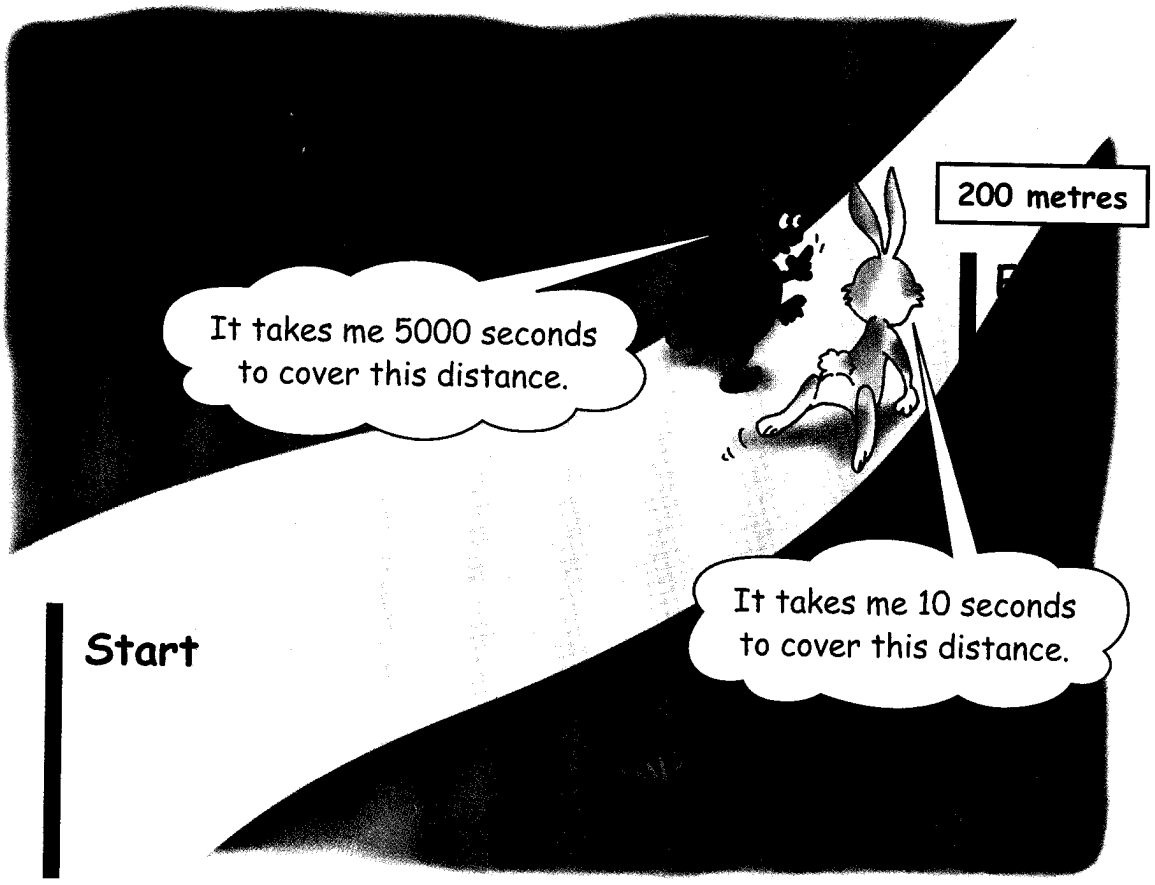
Amount of money saved: $ ▒▒

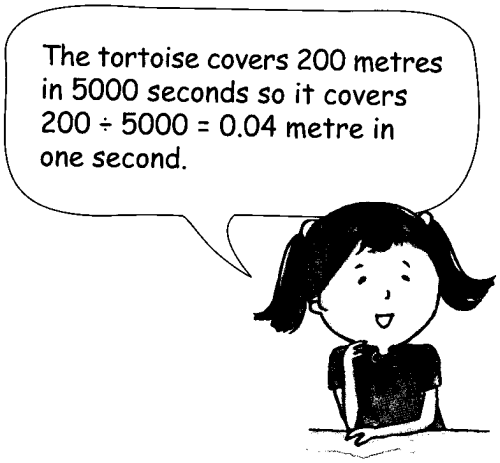


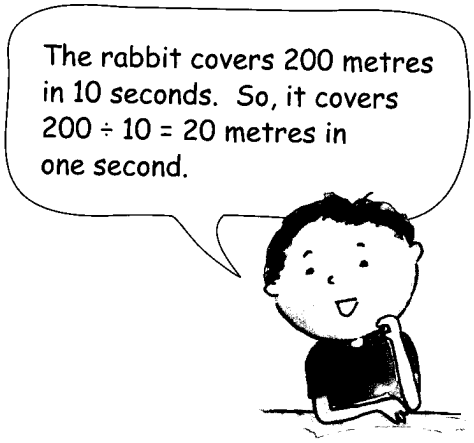
Who runs faster? The hare or the tortoise?
How do we measure how fast they move?

Let's Learn .... Speed

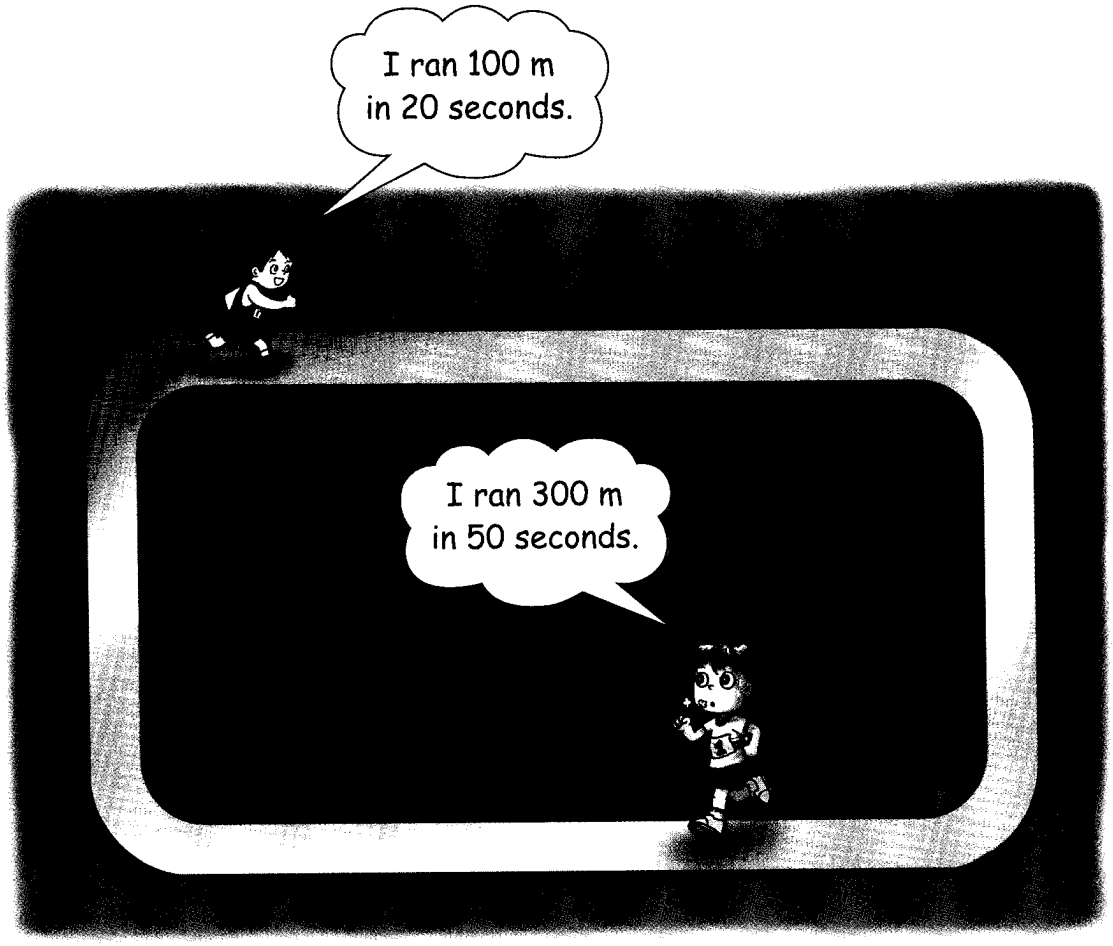
1. Let's look at the race between the rabbit and the tortoise.







2.



Who ran faster?

Peter took less time than John. Can we say that Peter ran faster than John?

$100 \div 20 = 5$
Peter ran 5 m for in one second.

$300 \div 50 = 6$
John ran 6 m in one second.

Hence, John ran faster than Peter.

From the above two examples, we can see that to compare who moves faster, we have to consider the distance covered in a unit time. This is called the speed.

$$\text{Speed} = \text{Distance covered} \div \text{Time taken}$$

$$= \frac{\text{Distance covered}}{\text{Time taken}}$$

3. A bus took 2 hours to travel 140 km. Find the speed of the bus.

$$\text{Speed} = \frac{\text{Distance travelled}}{\text{Time taken}}$$

$$= \frac{140}{2}$$

$$= 70 \text{ km/h}$$

The speed of the bus was 70 km/h, i.e. it travelled 70 km in 1 hour.

4. A snail travels 50 cm in 28 minutes. Find the speed of the snail. Give your answer correct to 2 decimal places.

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$= \frac{50}{28}$$

$$\approx 1.79 \text{ cm/min}$$

The speed of the snail is 1.79 cm/min.

5. An eagle flew a distance of 18 km in 20 minutes. Find the speed of the eagle in km/h.

$$20 \text{ min} = \frac{20}{60} \text{ h} = \frac{1}{3} \text{ h}$$

$$\text{Speed} = \frac{\text{Distance flown}}{\text{Time taken}}$$

$$= 18 \div \frac{1}{3}$$

$$= 18 \times 3$$

$$= 54 \text{ km/h}$$

The speed of the eagle was 54 km/h.

6. Ravi jogged 2600 m from 07 15 to 0740 on a Saturday morning. Find the speed he jogged that morning.

From 0715 to 0740, it was 25 minutes.

$$\text{Speed} = \frac{\text{Distance covered}}{\text{Time taken}}$$

$$= \frac{2600}{25}$$

$$= 104 \text{ m/min}$$

The speed he jogged was 104 m/min.

7. The distance from City A to City B is 1658 km. A train left City A at 10.30 a.m. for City B. It arrived in City B at 4.30 a.m. next day. Find the speed of the train. Give your answer correct to one decimal place.

From 10.30 a.m. to 4.30 a.m. next day, it was 18 hours.

$$\text{Speed} = \frac{\text{Distance covered}}{\text{Time taken}}$$

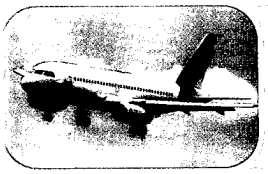
$$= \frac{1658}{18}$$

$$\approx 92.1 \text{ km/h}$$

The speed of the train was 92.1 km/h, or it travelled 92.1 km in 1 hour.

Work in pairs.

Calculate the speed in terms of the units shown in each case.

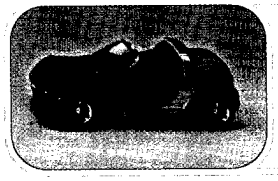


A plane flew a distance of 1700 km in 2 h.

Its speed = ▢ km/h

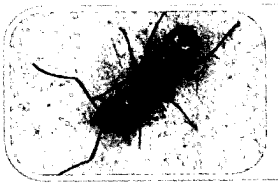
A cyclist covered 1 km in 5 min.

Its speed = ▢ m/min



A toy car covered 12 m in 4 s.

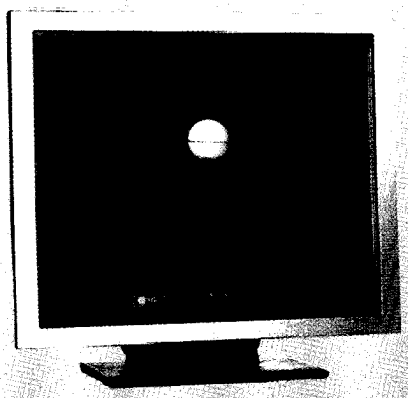
Its speed = ▢ m/s



An ant moved a distance of 30 cm in 6 s.

Its speed = ▢ cm/s

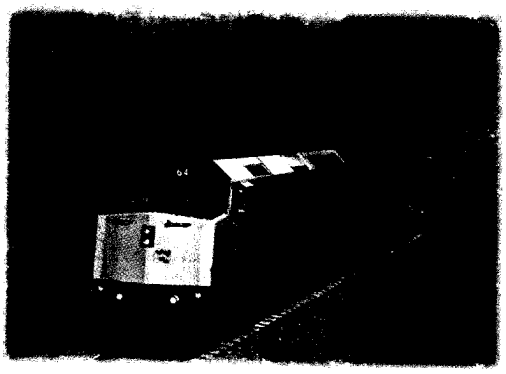
Search the Internet to find the speed at which the earth moves around the sun and the speed at which the moon moves around the earth.



Let's Try .. Speed

1. Alvin walked a distance of 176 m to school in 8 minutes. Find his speed.

2. A train travelled a distance of 205 km from 08 15 to 12 15. Find its speed.



3. In a 100-metre race, Peter took 16 seconds to complete the race and John took 15 seconds to complete the race. Find the speed of each of them. Give your answer correct to 2 decimal places.

4. An ant covered a distance of 60 cm in 35 seconds. A tortoise covered 150 cm in 80 seconds.
   (a) Find the speed of the ant and the speed of the tortoise. Give your answer correct to one decimal place.
   (b) Who travelled faster?

Distance, Time and Speed

1. Ricky rowed a canoe at a speed of 20 m/min. What was the distance covered in 15 minutes?

   The speed is 20 m/min. It means that the distance covered is 20 m in one minute. That is, the distance covered in 1 minute is 20 metres, in 2 minutes is 2 x 20 = 40 m, in 3 minutes is 3 x 20 = 60 m, ... We list the results in the following table.

Time Taken (min)	Distance Covered (m)
1	20 x 1
2	20 x 2
3	20 x 3
4	20 x 4
⋮	⋮

From the table, we can see that

Distance Covered = Speed x Time Taken

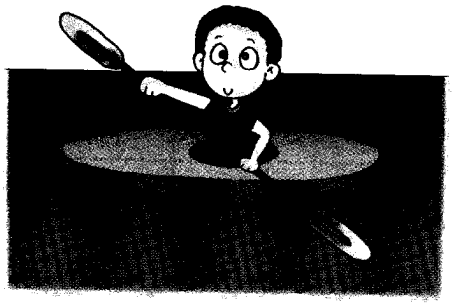
Then,

Distance covered = Speed x Time taken

= 20 x 15

= 300 m

The distance covered in 15 minutes was 300 m.



2. A car took $2\frac{1}{2}$ hours to travel from Town A to Town B at a speed of 58 km/h. How far is Town A from Town B?

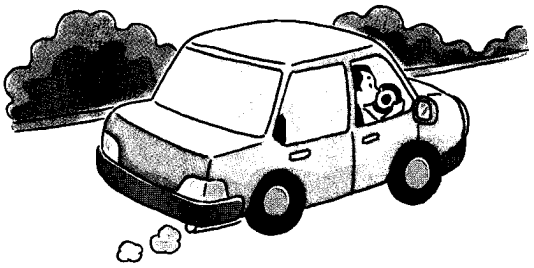
Distance = speed x time taken

= $58 \times 2\frac{1}{2}$

= $58 \times \frac{5}{2}$

= 145 km

Town A is 145 km from Town B.



3. A train is travelling at a speed of 75 km/h. In how many hours will it travel 675 km?

The speed of the train is 75 km/h. It means that the train takes 1 hour to travel 75 km, 2 hours to travel 150 km, 3 hours to travel 225 km, 4 hours to travel 300 km, ...

We list the results in the table.

Distance Covered (km)	Time Taken (h)
75	$\frac{75}{75} = 1$
150	$\frac{150}{75} = 2$
225	$\frac{225}{75} = 3$
300	$\frac{300}{75} = 4$
⋮	⋮

From the table, we can see that

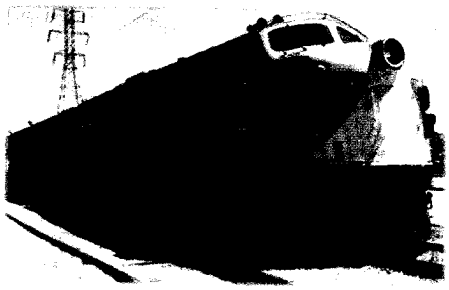
$$\text{Time taken} = \frac{\text{Distance covered}}{\text{Speed}}$$

Then,

$$\text{Time taken} = \frac{\text{Distance covered}}{\text{Speed}}$$

$$= \frac{675}{75}$$

$$= 9 \text{ h}$$



The train will need 9 hours to travel 675 km.

4. The speed of a car is 80 km/h. How long does it take to cover a distance of 12 km? Give your answer in minutes.

$$\text{Time taken} = \frac{\text{Distance covered}}{\text{Speed}}$$

$$= \frac{12}{80}$$

$$= \frac{3}{20} \text{ h}$$

$$\frac{3}{20} \text{ h} = \frac{3}{20} \times 60 \text{ min}$$

$$= 9 \text{ min}$$

The car takes 9 minutes to cover 12 km.

Distance, Time and Speed

1. Ravi took 8 minutes to walk from his home to his school at a speed of 45 m/min. How far is his home from his school?

2. A motorist travelled 260 km at a speed of 65 km/h. How much time did he take to travel this distance?

3. A snail covered 15 cm at a speed of $\frac{1}{6}$ cm/s.

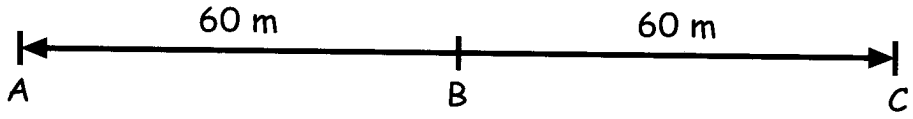
   How much time did the snail take to cover this distance?

4. John jogged at a speed of 95 m/min for 35 minutes. How far did he jog?

5. A car travelled on a highway at a speed of 80 km/h for 6 minutes. How far did it cover?

Let's Learn .. Average Speed and Word Problems

1. AB and BC are two parts of a running track. The length of each part is 60 m.



Siva ran from A to B in 10 seconds. Then he ran from B to C in 15 seconds.

His speed from A to B is $\frac{60}{10}$ = 6 m/s

His speed from B to C is $\frac{60}{15}$ = 4 m/s

Siva ran at different speeds from A to B and from B to C. To describe how fast Siva ran for the whole journey, we need to calculate the average speed.

$$\text{Average speed} = \frac{\text{Total distance covered}}{\text{Total time taken}}$$

The total distance A → B → C : 60 + 60 = 120 m

The total time Siva took: 10 + 15 = 25 s

The average speed = $\frac{120}{25}$

= 4.8 m/s

2. A bus travelled at an average speed of 80 km/h for $1\frac{1}{2}$ hours. It then increased its speed and travelled at an average speed of 90 km/h for the next 2 hours. Find the total distance covered by the bus.

In the first $1\frac{1}{2}$ hours,

the distance covered = $80 \times 1\frac{1}{2}$

= 120 km

In the next 2 hours,
the distance covered = 90×2

= 180 km

Total distance covered = 120 + 180
= 300 km

The total distance covered was 300 km.

A runner ran at 6 m/s for 8 seconds. He continued to run for another 12 seconds at 5 m/s.
What is his average speed for the whole journey?

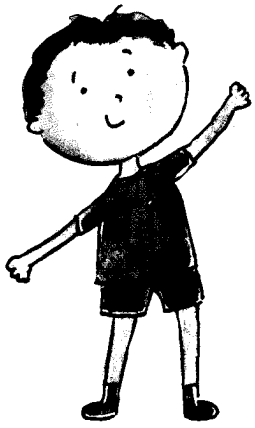
Work in pairs.

John solves the question above as follows.

The speed for the first part is 6 m/s.
The speed for the second part is 5 m/s.

So the average speed is $\frac{6 + 5}{2}$ = 5.5 m/s.

Is John right? Why? Discuss with your partner.



3. Mr Lim jogged a distance of 1500 m at an average speed of 100 m/min and then a distance of 3000 m at an average speed of 60 m/min. How much time did Mr Lim spend jogging altogether?

Time spent in the first 1500 m:

1500 ÷ 100

= 15 min

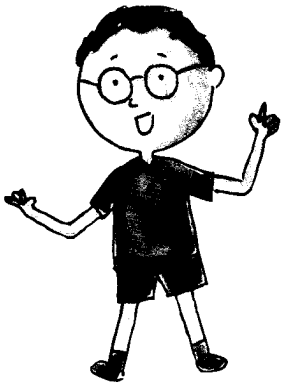
Time spent in the next 3000 m:

3000 ÷ 60
= 50 min

Total time spent on jogging:

15 min + 50 min
= 65 min

Mr Lim spent 65 minutes jogging altogether.



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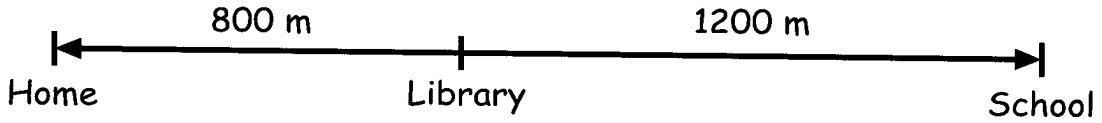


At 8.30 a.m., Jane started cycling from home to school via the library. Her average speed for the journey was 165 m/min. When did Jane arrive in school?

(Give your answer correct to the nearest min.)

The total distance from home to school is

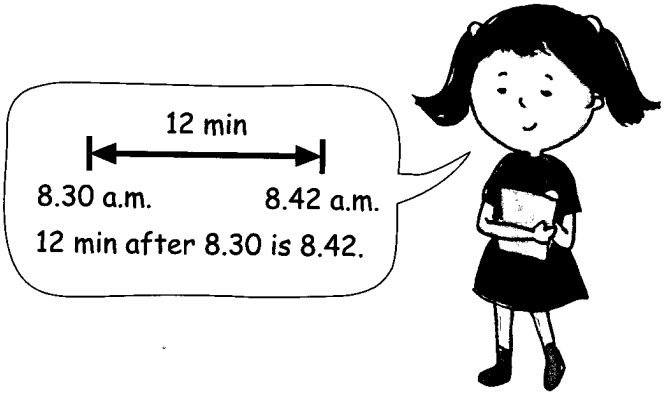
$$800 \text{ m} + 1200 \text{ m}$$
$$= 2000 \text{ m}$$

The total time Jane took is

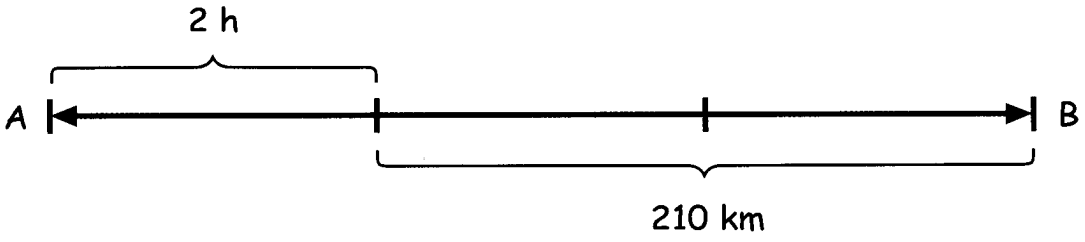
$$2000 \div 165$$
$$\approx 12 \text{ min}$$

Jane arrived in school 12 min after 8.30 a.m.

Jane arrived in school at 8.42 a.m.



5. Mr. Wang drove from Town A to Town B. He covered $\frac{1}{3}$ of the journey in the first 2 hours. Then he finished the remaining 210 km in 3 hours. What's the average speed for the whole journey?



2 units ⟶ 210 km

1 unit ⟶ $\frac{210}{2}$

3 units ⟶ $\frac{210}{2}$ x 3 = 315 km

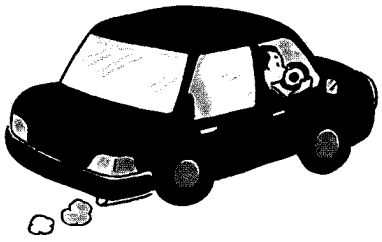
Mr. Wong covered 315 km in the whole journey.

2 + 3 = 5

Mr. Wang took 5 h in total to cover the whole journey.

315 ÷ 5 = 63 km/h

The average speed for the whole journey is 63 km/h.

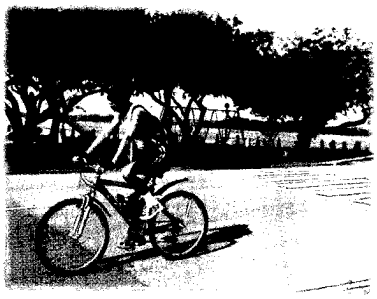


Let's Try 11. Average Speed and Word Problems

1. Mr Chong drove at an average speed of 80 km/h from Town A to Town B. The distance from Town A to Town B is 400 km. On the way back, he increased his speed by 20 km/h. How much time did Mr Chong take to cover the return journey?

2. A motorcyclist and a taxi driver started together at the same time and travelled along the same route. The motorcyclist travelled at an average speed of 80 km/h while the taxi driver drove at an average speed of 90 km/h. How far apart were they after $1\frac{1}{2}$ hours?

3. A cyclist rode his bicycle from Town P to Town Q at an average speed of 8 km/h. The distance between Town P and Town Q is 18 km. He started his ride at 7.30 a.m. Find the time he arrived in Town Q.



4. Peter drove from his home to the airport. He took 15 minutes to travel $\frac{4}{5}$ of the journey and 6 minutes to travel the remaining 5 km. Find the average speed in km/h for the whole journey. Give your answer correct to the nearest whole number.

The fastest known speed is the speed of light.

Find out from the library or the Internet what the speed of light is.

Speed of light = ▢ m/s

The speed of sound is slower than the speed of light. That is why you will see lightning first before you hear the sound of thunder.

Find out from the library or the Internet what the speed of sound is.

Speed of sound = ▢ m/s