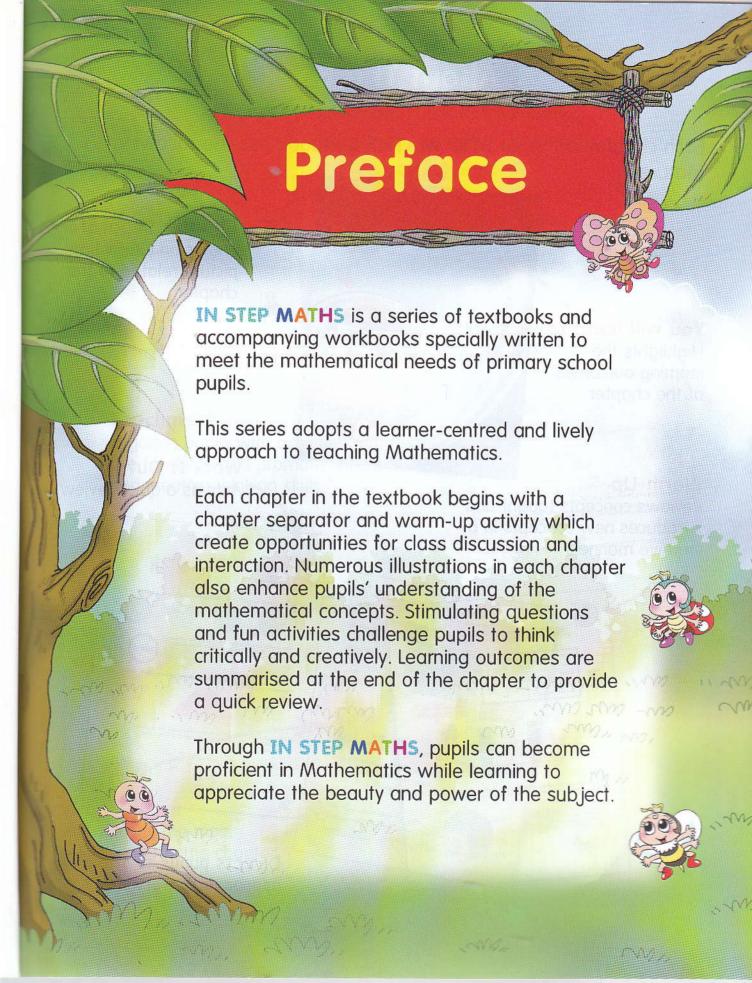




Dr Lai Chee Chong Leong Weng Kee General Editor: Sin Kwai Meng





About The Book

Each chapter in the IN STEP MATHS textbook has the following features:

Percentage

You will learn to

Highlights the learning outcomes of the chapter.

Chapter Separator

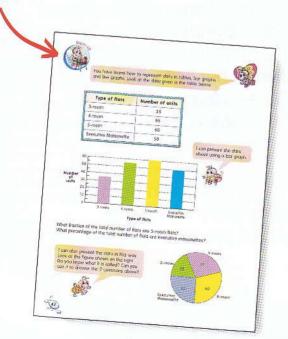
Shows an interesting picture related to the chapter.

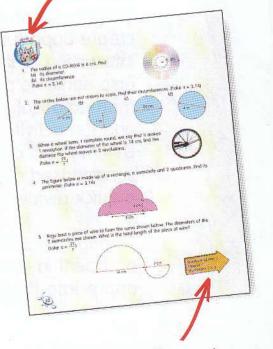
Work It Out

Acts as a quick review.

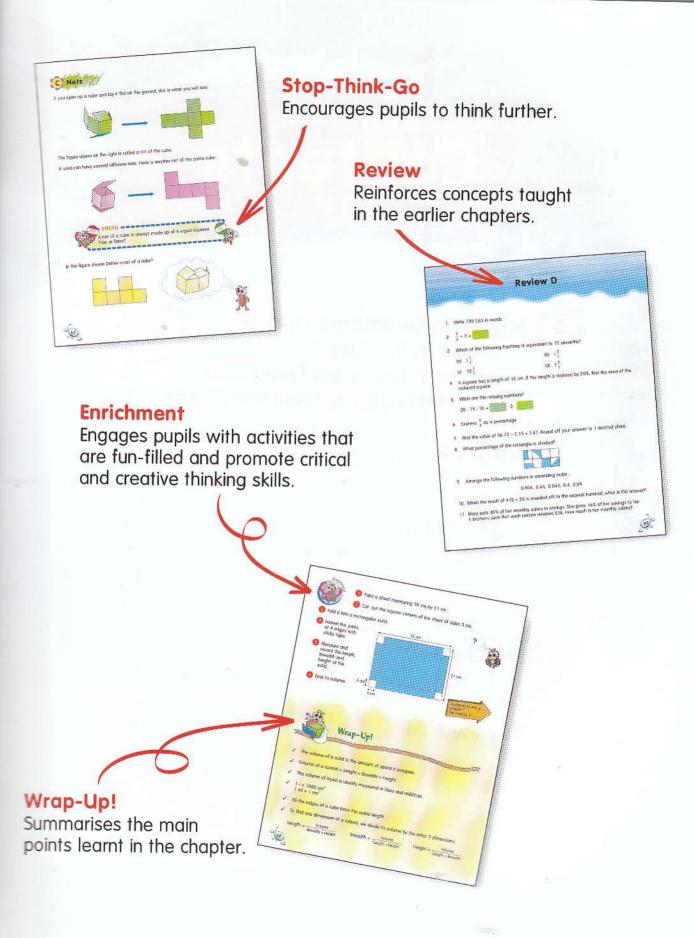
Warm-Up

Reviews concepts taught and introduces new concepts in a creative manner.



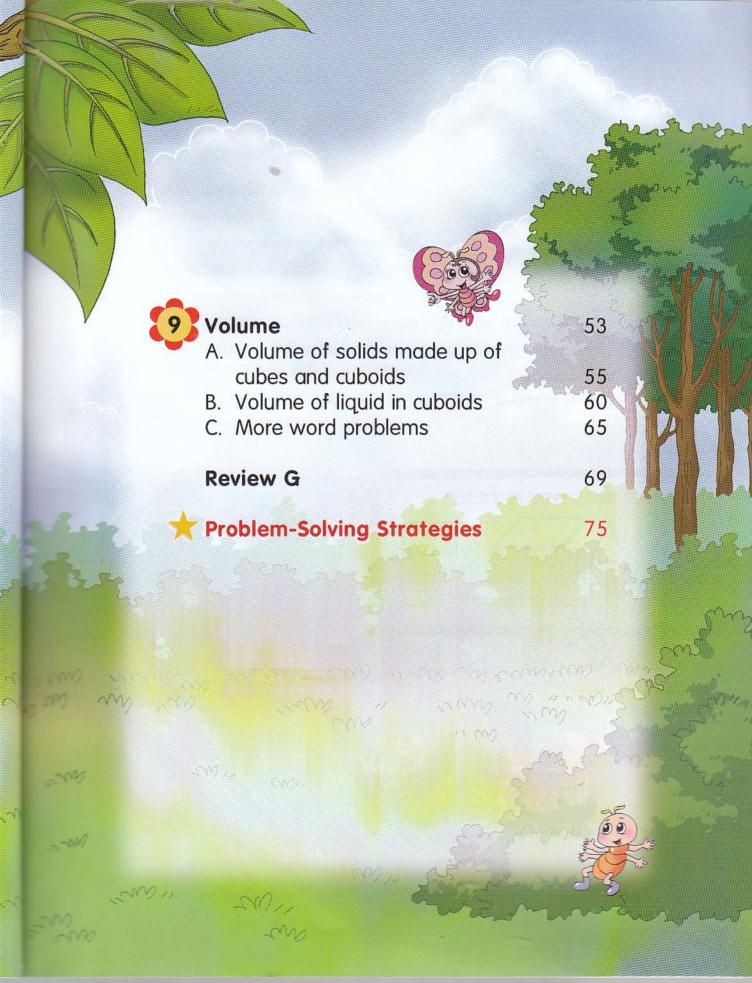


Directs pupils to the appropriate worksheet.





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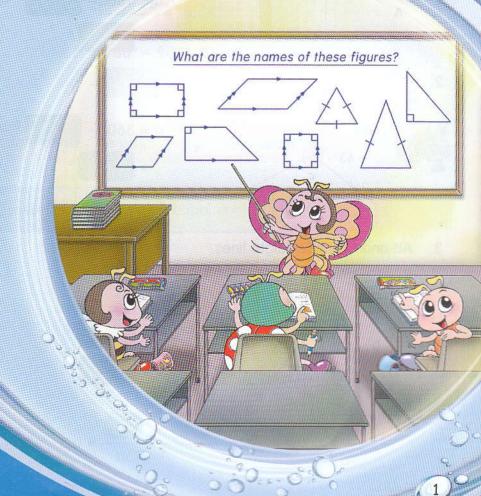




Angles In Geometric Figures

You will learn to

- · find unknown angles in geometric figures using the properties of
 - angles on a straight line.
 - angles at a point.
 - vertically opposite angles.
 - triangles including right-angled, isosceles and equilateral triangles.
 - four-sided figures such as squares, rectangles, parallelograms, rhombuses and trapeziums.

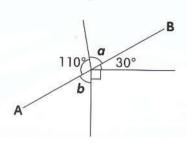




Here are some of the basic angle properties that you learnt last year.



- The sum of angles on a straight line is 180°.
- The sum of angles at a point is 360°.
- Vertically opposite angles are equal.
- 1. AB is a straight line.

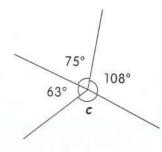


Try these.

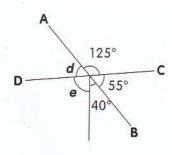




2.

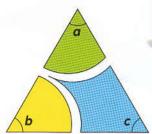


3. AB and CD are straight lines.





Angles in triangles

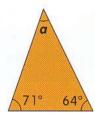


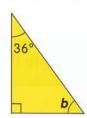
Let us recall some of the angle properties of triangles that we have learnt.





The sum of all 3 angles in a triangle is 180°.

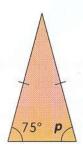


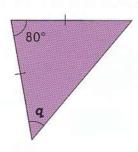




A right-angled triangle has 1 right angle. The other 2 angles add up to 90°.

An isosceles triangle has 2 equal angles.



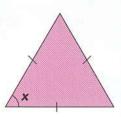


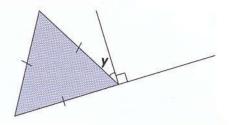
What do the strokes on the sides mean?





An equilateral triangle has 3 equal angles. Each angle is 60°.

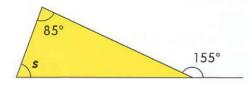




$$\angle y = 180^{\circ} - \bigcirc \circ - \bigcirc \circ$$

$$= \bigcirc \circ$$

The exterior angle of a triangle is equal to the sum of the interior opposite angles.



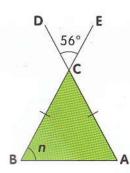
$$\angle s + 85^{\circ} = 155^{\circ}$$

 $\angle s = \bigcirc$



Let us look at some more examples of finding angles in triangles.

1. ABC is an isosceles triangle. ACD and BCE are straight lines. Find $\angle n$.



$$\angle BCA = 56^{\circ}$$

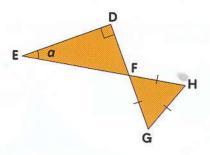
$$\angle n = \frac{180^{\circ} - 56^{\circ}}{2}$$

$$= \bigcirc \circ$$

We can use the property of vertically opposite angles and isosceles triangles to find the answer.



2. DEF is a right-angled triangle. FGH is an equilateral triangle. DFG and EFH are straight lines. Find $\angle a$.



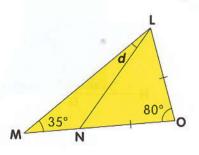
$$\angle$$
HFG = 60 ° \angle DFE = 60°

∠a =

- 1. Equilateral triangle
- 2. Vertically opposite angles
- 3. Sum of angles in a triangle



3. LNO is an isosceles triangle. MNO is a straight line. Find $\angle d$.



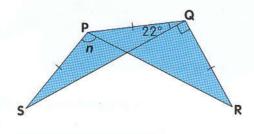
$$\angle LNO = \frac{180^{\circ} - 80^{\circ}}{2} = 50^{\circ}$$

$$\angle d + 35^{\circ} = 50^{\circ}$$

- 1. Isosceles triangle
- 2. Exterior angle of a triangle



4. PQR and PQS are isosceles triangles. Find $\angle n$.



$$\angle SPQ = 180^{\circ} - 22^{\circ} - 22^{\circ} = 136^{\circ}$$

$$\angle PQR = 90^{\circ} + 22^{\circ} = 112^{\circ}$$

$$\angle QPR = \frac{180^{\circ} - 112^{\circ}}{2} = 34^{\circ}$$

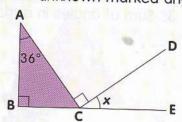


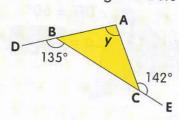


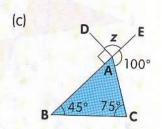


1. Find the unknown marked angles in each of the figures below.

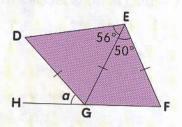
(a) A (b)



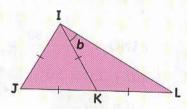




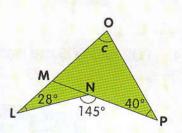
2. EFG and DEG are isosceles triangles. HGF is a straight line. Find $\angle a$.



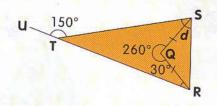
3. IJK is an equilateral triangle. IKL is an isosceles triangle. JKL is a straight line. Find $\angle b$.

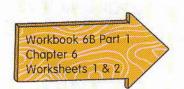


4. LMN and MOP are 2 triangles and LMO and MNP are straight lines. Find $\angle c$.



5. QRS is an isosceles triangle. RTU is a straight line. Find $\angle d$.





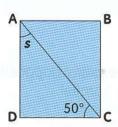


B Angles in four-sided figures

Let us recall the angle properties of four-sided figures that we have learnt.

In squares and rectangles, all 4 angles are right angles.

ABCD is a rectangle.



$$\angle s = 90^{\circ} - 50^{\circ}$$

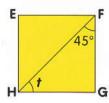
= 40°

Opposite sides are equal and parallel.

All 4 sides are equal.

Opposite sides are parallel.

EFGH is a square.

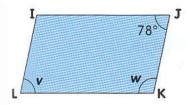




In parallelograms and rhombuses,

- the opposite angles are equal.
- the sum of each pair of angles between 2 parallel sides is 180°.

IJKL is a parallelogram.

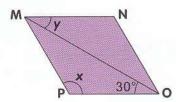


$$\angle W =$$

Opposite sides are equal and parallel.



MNOP is a rhombus.



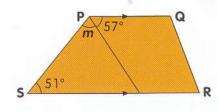
$$\angle y =$$

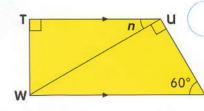
All 4 sides are equal.
Opposite sides are parallel.



In trapeziums, the sum of each pair of angles between 2 parallel sides is 180°.

PQRS and TUVW are trapeziums.





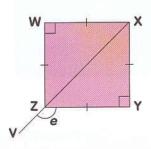
Only one pair of opposite sides is parallel.





Let us look at some more examples.

1 WXYZ is a square. XZV is a straight line. Find $\angle e$.



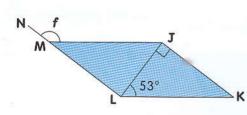


 $\angle e = 180^{\circ} - \angle XZY$

Since WXYZ is a square, \angle XYZ = 90° and XYZ is an isosceles triangle.

$$\angle XZY = \frac{180^{\circ} - 90^{\circ}}{2} = 45^{\circ}$$

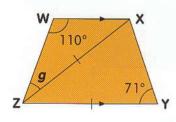
2. JKLM is a parallelogram. LMN is a straight line. Find $\angle f$.



- \angle JKL = 90° 53° = 37°
- $\angle JML = 37^{\circ}$
- ∠f = 0 °
- Sum of angles in a triangle
- 2. Opposite angles in a parallelogram
- 3. Angles on a straight line



3. WXYZ is a trapezium. ZXY is an isosceles triangle. Find $\angle g$.

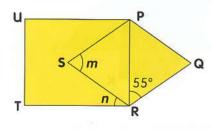


∠XZY = °

 $\angle XWZ + \angle WZY = 180^{\circ}$



4. PRTU is a rectangle. PQRS is a rhombus. Find $\angle m$ and $\angle n$.



PQRS is a rhombus \rightarrow PQ = QR

PRTU is a rectangle $\rightarrow \angle PRT = 90^{\circ}$

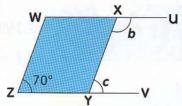


1. Find the unknown marked angles in each of the figures below.

(b)

(a) W 105° X TO U

WXYZ is a trapezium. XYV and ZYU are straight lines.

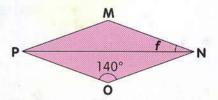


WXYZ is a parallelogram.
WXU and ZYV are straight lines.

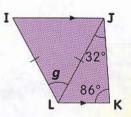
2. ABCD and EFGH are parallelograms. Find $\angle e$.

(a) A 119° e B

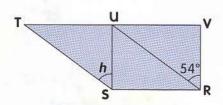
- H 40°
- 3. MNOP is a rhombus. Find $\angle f$.

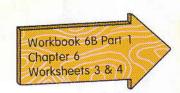


4. IJKL is a trapezium. LI = LJ. Find $\angle g$.



5. RSTU is a parallelogram. UVRS is a rectangle. Find $\angle h$.

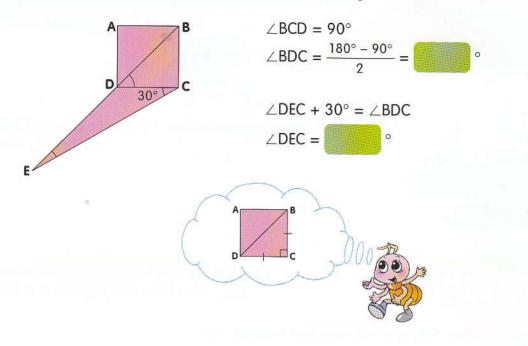




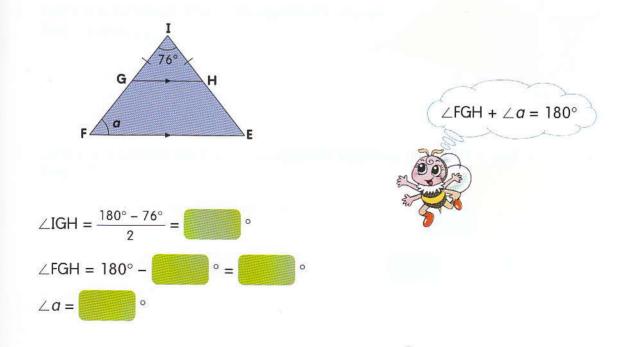


C More on angles in geometric figures

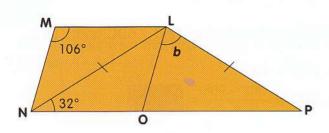
1. In the figure below, ABCD is a square. BDE is a straight line. Find \angle BDC and \angle DEC.

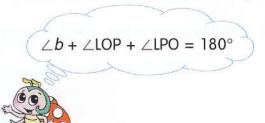


2. EFGH is a trapezium. GHI is an isosceles triangle. FGI and EHI are straight lines. Find $\angle a$.



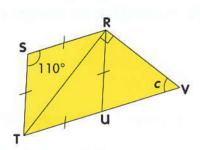
3. LMNO is a parallelogram. LNP is an isosceles triangle. Find $\angle b$.





$$\angle$$
LPO = 32°
 \angle LON = 106°
 \angle LOP = 180° - °
= °
 \angle b = °

4. RSTU is a rhombus. TRV is a right-angled triangle. Find $\angle c$.



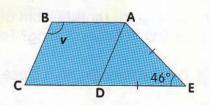
RSTU is a rhombus \rightarrow RTU is an isosceles triangle

$$\angle TUR = 110^{\circ}$$
 $\angle RTU = \frac{180^{\circ} - 110^{\circ}}{2} = 0$
 $\triangle c = 180^{\circ} - 0$
 $\Rightarrow 0$

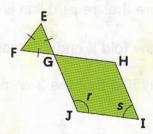




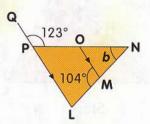
1. ABCD is a parallelogram. ADE is an isosceles triangle. CDE is a straight line. Find $\angle v$.



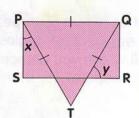
2. GHIJ is a parallelogram. EFG is an equilateral triangle. Find $\angle r$ and $\angle s$.



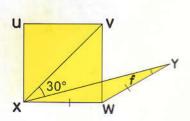
3. LMOP is a trapezium. MNO is a triangle. LPQ is a straight line. Find $\angle b$.

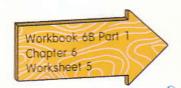


4. PQRS is a rectangle. PQT is an equilateral triangle. Find $\angle x$ and $\angle y$.



5. UVWX is a square. WXY is an isosceles triangle. Find $\angle f$.



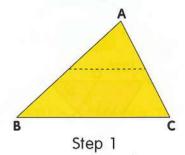


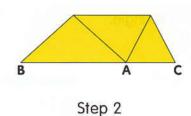


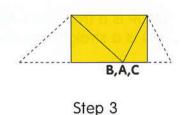
We have learnt that the sum of angles of a triangle is 180°. How can you demonstrate this property with paper folding? Follow the steps below.

- Draw a triangle on a piece of paper and cut it out.
- 2 Fold the triangle at the middle along the dotted line until A touches the base BC. Make sure the creased line is parallel to BC.
- 3 Now fold B and C towards A on the base until they touch A.

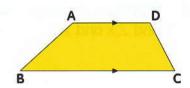
You will find that the 3 angles form a straight line.



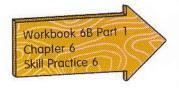




Now let us look at a trapezium. We have learnt that the sum of each pair of angles between 2 parallel sides is 180°. How can you demonstrate this property by folding a paper trapezium? Try it.



لتحميل المزيد من كتب الأطفال تابع المرح مكتبة التعليم المرح



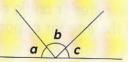




Wrap-Up!

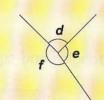
✓ The sum of angles on a straight line is 180°.

$$\angle a + \angle b + \angle c = 180^{\circ}$$



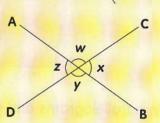
✓ The sum of angles at a point is 360°.

$$\angle d + \angle e + \angle f = 360^{\circ}$$



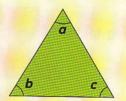
✓ Vertically opposite angles are equal.

$$\angle W = \angle y, \angle z = \angle x$$



✓ The sum of all 3 angles in a triangle is 180°.

$$\angle a + \angle b + \angle c = 180^{\circ}$$

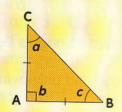


✓ A right-angled triangle has 1 right angle. The other 2 angles add up to 90°.

AB = BC

$$\angle a + \angle c = 90^{\circ}$$

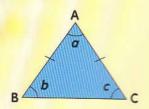
 $\angle a = \angle c = 45^{\circ}$



✓ An isosceles triangle has 2 equal sides and 2 equal angles.

$$AB = AC$$

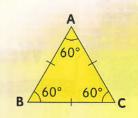
 $\angle b = \angle c$





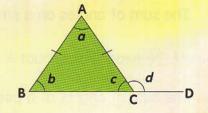
✓ An equilateral triangle has 3 equal sides and 3 equal angles. Each angle is 60°.

$$AB = BC = AC$$

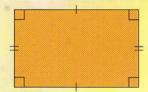


✓ The exterior angle of a triangle is equal to the sum of the interior opposite angles.

$$\angle d = \angle a + \angle b$$

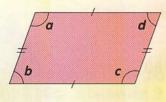


✓ In rectangles and squares, all the angles are right angles.



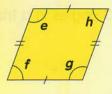


✓ In parallelograms and rhombuses, the opposite angles are equal.



$$\angle a = \angle c$$

 $\angle b = \angle d$



$$\angle e = \angle g$$

 $\angle f = \angle h$

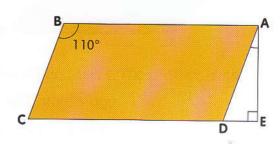
- ✓ The sum of angles between 2 parallel sides in a geometric figure is equal to 180°.
- ✓ We can find unknown angles in geometric figures by using all of the properties above.

Review E

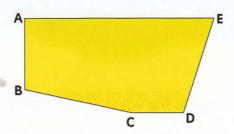
- 1. In the number 7 853 491, what is the value of the digit 8?
- 2. Express each of the following as a fraction in its simplest form:
 - (a) 60%
- (b) 0.45
- (c) 3.84
- 3. Find the missing numbers in each of the following:
 - (a) $9\ 061\ 053 = 9\ 000\ 000\ +$



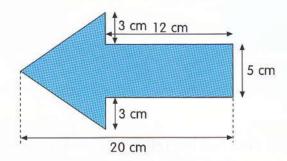
- (b) $0.75 \frac{2}{3} =$
- (c) $0.37 \times 6 = 2\frac{1}{50}$
- 4. A ribbon was cut into 3 pieces in the ratio 1 : 3 : 4. The length of the shortest piece was 3 m. What was the original length of the ribbon?
- 5. Express 330 g as a percentage of $1\frac{1}{2}$ kg.
- 6. An amount of money is divided between Jane and Mary in the ratio 5:8.
 - (a) Express Jane's money as a fraction of Mary's money.
 - (b) Express Mary's money as a fraction of the total amount of money.
- 7. The figure shows a parallelogram ABCD and a right-angled triangle ADE. CDE is a straight line. Find ∠DAE.



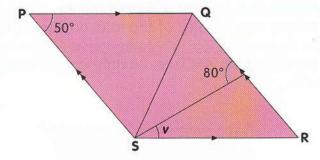
8. Name the pair of parallel lines in the figure below.



- 9. Gopal is $1\frac{5}{6}$ years older than Hamid. What is their age difference in months?
- 10. If x = 3, evaluate $\frac{5x 6}{3}$.
- 11. Find the area of the figure shown below.



- 12. The perimeter of a triangle is 84 cm. The 3 sides of the triangle are in the ratio 5:8:7. Find the length of the longest side.
- 13. PQRS is a rhombus. Find $\angle v$.



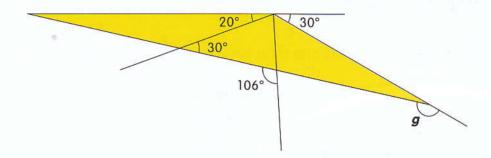
- 14. Find the value of $34\frac{1}{4} 15\frac{1}{3} + 2\frac{1}{12}$.
- 15. The cost of 6 storybooks and 10 magazines is \$46.40. The cost of 1 storybook and 1 magazine is \$6. Find the cost of 1 magazine.

16. The rates of rental for bicycles is shown in the table below.

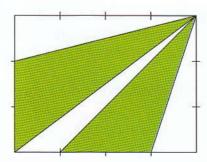
1st hour	\$2.00
Every additional $\frac{1}{2}$ hour	\$0.80

John rented a bicycle at 11.30 a.m. and returned it at 2 p.m. How much did he pay altogether?

17. Find $\angle g$ in the figure below.

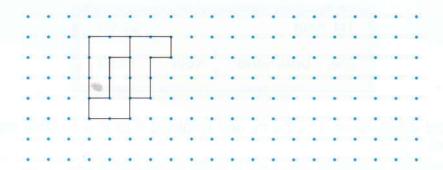


- 18. A mixture is made by mixing 3 parts of a solvent with 5 parts of water. If 40 *l* of water has been used to make the mixture, how many litres of solvent has been used?
- 19. The length and the width of the rectangle below is in the ratio 4 : 3. What fraction of the rectangle is shaded?

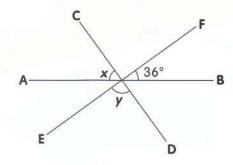


20. Meiqi's age is $\frac{1}{5}$ of her sister, Meili's. Their father is 44 years older than Meiqi. If Meili is 20 years old, find their father's age.

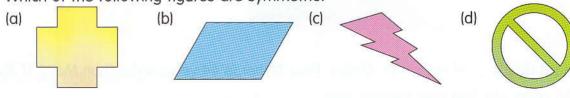
21. Extend the tessellation by drawing 6 more unit shapes.



22. AB, CD and EF are straight lines. Find the value of $\angle x + \angle y$.



- 23. There are 3 girls and 2 boys in a group. The average height of the 3 girls is 158.2 cm. Of the 2 boys, Mark's height is 160 cm. John is 10.6 cm taller than Mark.
 - (a) What is the average height of the 5 children?
 - (b) What is the difference between the average height of the boys and the average height of the girls?
- 24. The ratio of the number of green cards to the number of red cards is 3 : 8. The ratio of the number of red cards to the number of yellow cards is 2 : 3.
 - (a) Find the ratio of the number of green cards to the number of red cards to the number of yellow cards.
 - (b) If there are 45 yellow cards more than green cards, find the number of red cards.
- 25. Which of the following figures are symmetric?





You will learn to

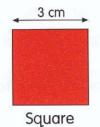
- identify and name the different parts of a circle.
- use formula to find the circumference and area of a circle, semicircle and quadrant.
- find area and perimeter of figures made up of circles, semicircles or quadrants.
- solve word problems involving area and circumference of a circle.

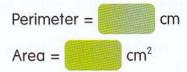


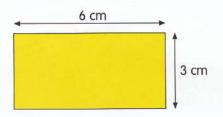


Can you find the areas and perimeters of the figures below?



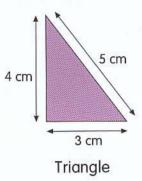




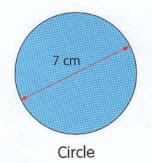


Rectangle









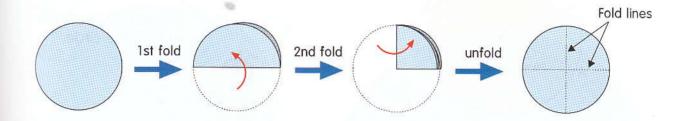
Perimeter = $\frac{1}{1}$ cm Area = $\frac{1}{1}$ cm² How can we find the area and perimeter of a circle?





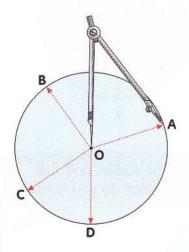
A Parts of a circle

Look at the paper circle below. We can fold it twice to get 2 fold lines as shown below.



The point where the 2 fold lines meet is called the centre of the circle.

Draw a circle using a pair of compasses. In the circle shown below, O is the centre of the circle.



Measure the lengths of OA, OB, OC and OD. What do you notice?



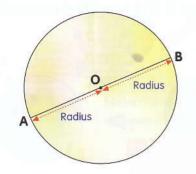
The distance between the centre of the circle and any point on the circle is always the same. This distance is known as the radius of the circle.

OA is a radius of the circle above. Can you name the other 3 radii shown?

The plural for radius is radii.



Now draw a line joining 2 points on the circle and passing through the centre of the circle. This line is known as the diameter of the circle.

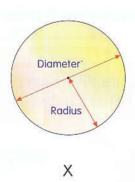


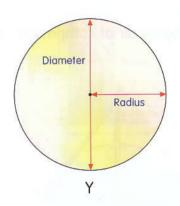
AB is a diameter of the circle.

OA and OB are both radii of the circle.



The table below shows the radius and diameter of each of the 2 circles shown below.





Measure and compare the radius and the diameter of each circle. What do you notice?

Circle	Radius (cm)	Diameter (cm)
Х	1.5	3
Y	2	4

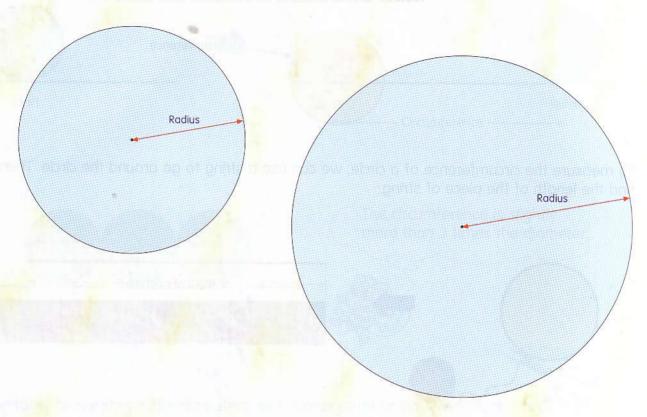


In any circle, the diameter is twice the length of the radius. Diameter = $2 \times \text{Radius}$ Radius = Diameter $\div 2$

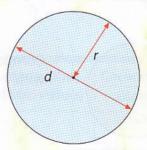




1. Measure the radius and diameter of each of these circles.



2. Let r represent the radius and d represent the diameter of a circle.



(a)
$$r = 6$$
 cm, $d = \frac{1}{100}$ cm

(b)
$$r = 3.5$$
 m, $d = 100$ m

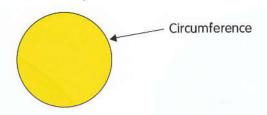
(c)
$$r =$$
 cm, $d = 18$ cm

(d)
$$r = m, d = 11 \text{ m}$$

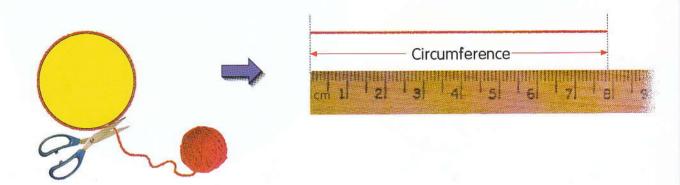


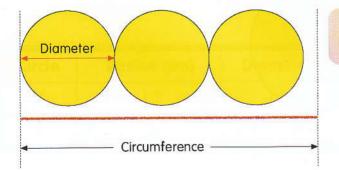
B Finding circumference

The perimeter of a circle is also known as the circumference of the circle.



To measure the circumference of a circle, we can use a string to go around the circle. Then, find the length of the piece of string.





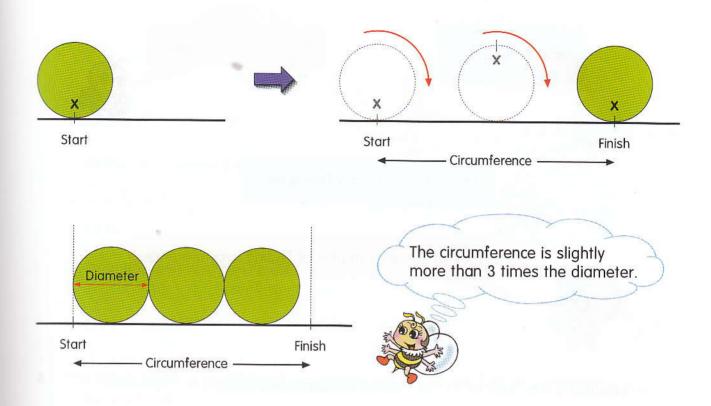
Compare the circumference of the circle with its diameter. What do you notice?



From the above diagram, we can see that the circumference of a circle is slightly more than 3 times its diameter.



Here is another way to show the relationship between the circumference and the diameter of a circle.



The table below shows the diameters and approximate circumferences of 3 circles. Find the value of the $\frac{\text{Circumference}}{\text{Diameter}}$ for each circle. What do you notice?

Circle	Diameter (cm)	Circumference (cm) (Approximate value)	Circumference Diameter
А	7	22	3.14
В	10	31.4	3.14
С	14	44	3.14



22 divided by 7 gives 3.14 (correct to 2 decimal places).



The value of the $\frac{\text{Circumference}}{\text{Diameter}}$ is the same for all circles. It is always about 3.14 or $\frac{22}{7}$ times of the diameter. We can represent this value with the Greek letter π .

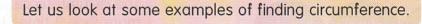
$$\pi = 3.14 \text{ or } \frac{22}{7}$$

We read π as pi (pie).



Since
$$\frac{\text{Circumference}}{\text{Diameter}} = \pi$$
,

Circumference = $\pi \times Diameter$



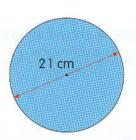


1. A circle has a diameter of 21 cm. Find its circumference. (Take $\pi = \frac{22}{7}$)

Circumference =
$$\pi \times \text{Diameter}$$

= $\frac{22}{7} \times 21$
= 66 cm

Its circumference is 66 cm.



2. The radius of a circular plate is 11 cm. Find the circumference of the plate. (Take $\pi=3.14$)

Diameter =
$$2 \times \text{Radius}$$

= 2×11
= 22 cm

Circumference =
$$3.14 \times 22$$

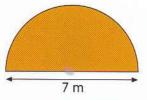
= 69.08 cm

The circumference of the plate is 69.08 cm.





3. The figure below is formed by a semicircle and a straight line. What is its perimeter? (Take $\pi = \frac{22}{7}$)

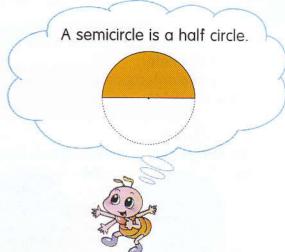


Diameter of circle = 7 m

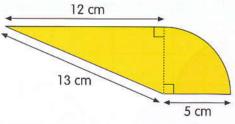
$$\frac{1}{2}$$
 of the circumference of a circle
$$= \frac{1}{2} \times \frac{22}{7} \times 7$$

$$= 11 \text{ m}$$

Its perimeter is 18 m.



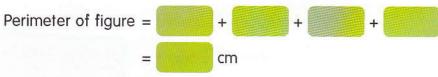
4. The figure below is made up of a quadrant and a triangle. Find its perimeter. (Take $\pi=3.14$)



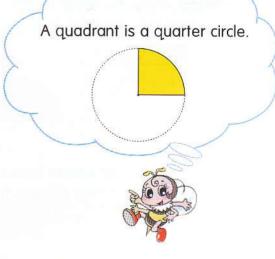
Diameter of circle = $2 \times 5 = 10$ cm

$$\frac{1}{4}$$
 of the circumference of a circle
$$= \frac{1}{4} \times 3.14 \times 10$$

$$= \frac{1}{4} \cos \theta$$



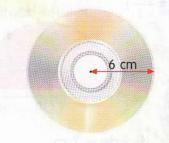
Its perimeter is ____ cm.





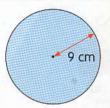
- 1. The radius of a CD-ROM is 6 cm. Find
 - (a) its diameter.
 - (b) its circumference.

 $(Take \pi = 3.14)$

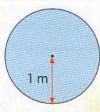


2. The circles below are not drawn to scale. Find their circumferences. (Take $\pi = 3.14$)

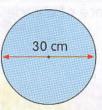
(a)



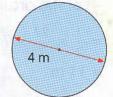
(b)



(c)



(d)

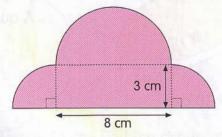


3. When a wheel turns 1 complete round, we say that it makes 1 revolution. If the diameter of the wheel is 14 cm, find the distance the wheel moves in 2 revolutions.

 $(\text{Take } \pi = \frac{22}{7})$

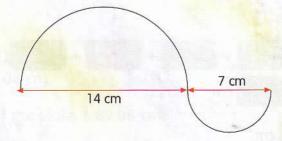


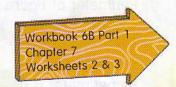
4. The figure below is made up of a rectangle, a semicircle and 2 quadrants. Find its perimeter. (Take $\pi = 3.14$)



5. Raju bent a piece of wire to form the curve shown below. The diameters of the 2 semicircles are shown. What is the total length of the piece of wire?

 $(\text{Take } \pi = \frac{22}{7})$





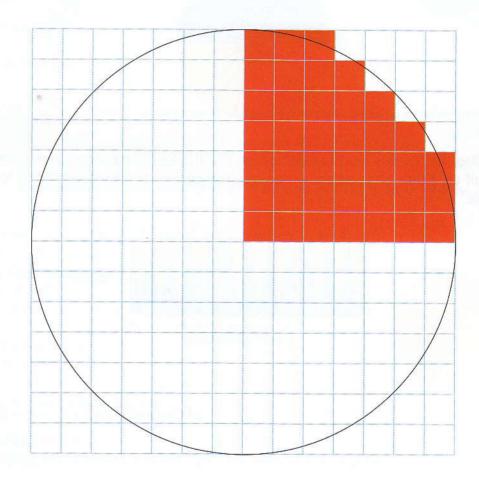




We can use a square grid to help us find the approximate area of a circle.



I have placed a circle on a square grid. Count the number of squares covered by the quadrant.



Area of each small square is 1 cm².

Number of grid squares covered by quadrant ≈ 39

Area of quadrant $\approx 39 \times 1 \text{ cm}^2 = 39 \text{ cm}^2$

Area of circle $\approx 39 \text{ cm}^2 \times 4 = 156 \text{ cm}^2$

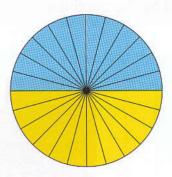




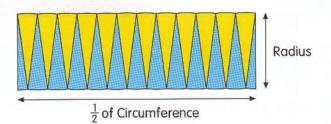


Let us look at a more accurate way of finding the area of a circle.

1. Cut a circle into 24 equal pieces.



2. Place 23 of the pieces next to each other. Cut the last piece into 2 halves and place each half on either ends as shown below. The circle has now been made to look like a rectangle.



$$\frac{1}{2}$$
 of Circumference = $\frac{1}{2} \times \pi \times \text{Diameter}$
= $\pi \times \text{Radius}$

Area of circle = Area of rectangle
$$= \frac{1}{2} \text{ of circumference} \times \text{Radius}$$
$$= \pi \times \text{Radius} \times \text{Radius}$$



Area of circle = $\pi \times \text{Radius} \times \text{Radius}$





Let us look at some examples of finding area.

1. A circle has a radius of 7 cm. Find its area. (Take $\pi = \frac{22}{7}$)

Area =
$$\pi \times \text{Radius} \times \text{Radius}$$

= $\frac{22}{7} \times 7 \times 7$
= 154 cm²



Its area is 154 cm².



THINK

Compare the answer above with the one on page 31. (Is the one on page 31 a good estimate?



2. Find the area of a circle of diameter 10 m. (Take $\pi = 3.14$)

Radius = Diameter
$$\div$$
 2
= $10 \div 2$
= 5 m

Area =
$$3.14 \times 5 \times 5$$

= 78.5 m^2

10 m

The area of the circle is 78.5 m^2 .

3. The diameter of a coaster is 8 cm. Find the area of the coaster. (Take $\pi=3.14$)



The area of the coaster is

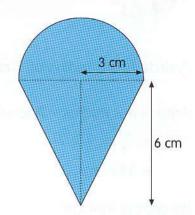


4. The figure is made up of a semicircle and a triangle. Find the area of the figure. (Take $\pi=3.14$)

Area of semicircle =
$$\frac{1}{2}$$
 × Area of circle
= $\frac{1}{2}$ × 3.14 × 3 × 3
= 14.13 cm²

Area of triangle =
$$\frac{1}{2} \times \text{Base} \times \text{Height}$$

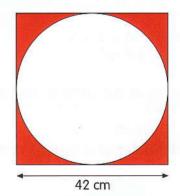
= $\frac{1}{2} \times 6 \times 6$
= 18 cm^2



The area of the figure is cm².

لتحميل المزيد من كتب الأطفال تابع مكتبة التعليم المرح

5. Mr Lim used a laser beam to cut out a circular piece from a square piece of metal sheet as shown below. What was the area of the remaining piece of metal sheet? (Take $\pi = \frac{22}{7}$)



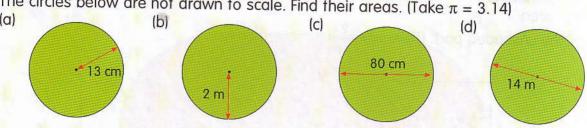
Area of remaining piece of metal sheet =
$$-$$
 = $-$ cm²

The area of the remaining piece of metal sheet was cm².

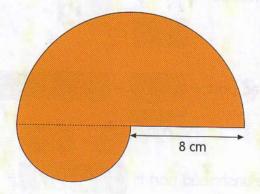




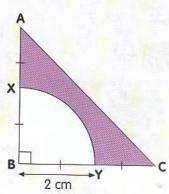
The circles below are not drawn to scale. Find their areas. (Take $\pi = 3.14$)



- A pizza of diameter 28 cm is cut into 6 equal slices. Find the area of each slice of pizza. $(Take \pi = \frac{22}{7})$
- Linda joined 2 semicircular pieces of cardboard of different sizes to make a logo design for her art project. The radius of the larger semicircle was 8 cm. What was the area of the design? (Take $\pi = 3.14$)



4. Triangle ABC is a right-angled isosceles triangle. Point X cuts AB into half and point Y cuts BC into half. Find the area of the shaded part. (Take $\pi = \frac{22}{7}$)

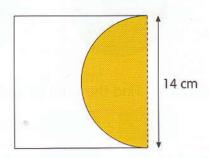


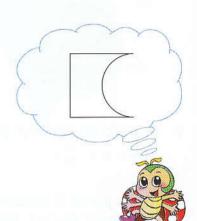


D More on area and perimeter

- 1. The shaded part in the square below is a semicircle. Find the
 - (a) perimeter
 - (b) area

of the unshaded part. (Take $\pi = \frac{22}{7}$)





(a) Circumference of semicircle =
$$\frac{1}{2} \times \frac{22}{7} \times 14$$

= cm

The perimeter of the unshaded part is _____ cm.

(b) Area of square =
$$\times$$
 = \times = \times cm²

Area of semicircle =
$$\frac{1}{2} \times \frac{22}{7} \times 7 \times 7$$

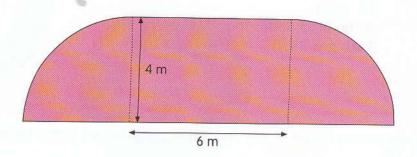
= cm^2

The area of the unshaded part is _____ cm².



- 2. The floor of a swimming pool is formed by 2 quadrants and a rectangle. Find
 - (a) the floor area of the swimming pool.
 - (b) the cost of tiling if the tiling costs \$38 per square metre. Round off your answer to the nearest dollar.

(Take $\pi = 3.14$)



(a) Floor area = Area of 2 quadrants + Area of rectangle

Area of each quadrant =
$$\frac{1}{4} \times 3.14 \times 4 \times 4$$

= m^2

Area of rectangle =
$$6 \times 4^{\circ}$$

= m^2

The floor area of the swimming pool is m^2 .

(b)
$$1 \text{ m}^2 \rightarrow \$38$$

$$m^2 \rightarrow \$38$$

$$= \$ \qquad \approx \$$$

Mr Jones needs to pay about \$ for the tiling.



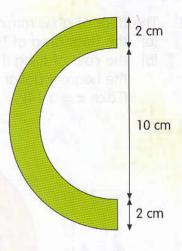
John wrote the letter C in large block letter on a banner. He did this by drawing a large semicircle, a smaller semicircle and 2 lines of length 2 cm each.

Find the

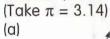
- (a) perimeter
- (b) area

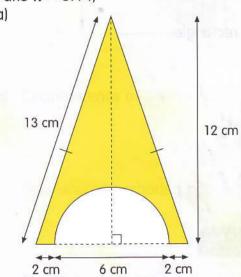
of the block letter that he wrote.

 $(Take \pi = 3.14)$

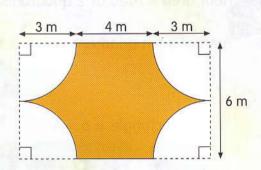


Find the perimeter and area of the shaded regions shown in the figures below.

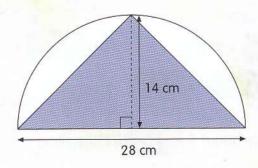








A triangle is drawn inside a semicircle of diameter 28 cm. If the height of the triangle is 3. 14 cm, what fraction of the semicircle is the triangle? Reduce your fraction to its simplest form. (Take $\pi = \frac{22}{7}$)









1 Draw 2 circles with the same centre O as shown in Figure 1. The inner circle has a radius of 7 cm and the outer circle has a radius of 14 cm.

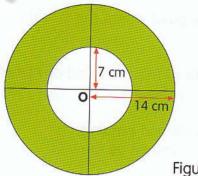
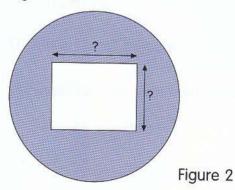


Figure 1

- 2 Using $\pi = \frac{22}{7}$, find the area of the shaded region.
- 3 Now replace the inner circle with a rectangle so that the shaded region outside the rectangle has the same area as in 2. Draw this new figure and write down the length and breadth of the rectangle. (Note: Make sure that your rectangle does not go beyond the circumference of the big circle.)

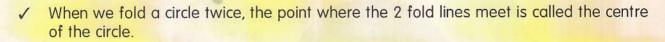




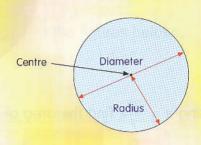




Wrap-Up!



- ✓ The distance between the centre of the circle and any point on the circle is known as the radius of the circle.
- ✓ A line joining 2 points on the circle and passing through the centre of the circle is known as the diameter of the circle.



✓ In any circle, the diameter is twice the length of the radius.

Diameter = 2 × Radius

Radius = Diameter ÷ 2

- ✓ The perimeter of a circle is also known as the circumference of the circle.
- The value of the $\frac{\text{Circumference}}{\text{Diameter}}$ is the same for all circles. The circumference is always about 3.14 or $\frac{22}{7}$ times of the diameter. We can represent this value with the Greek letter π .

$$\pi \approx \frac{22}{7}$$
 or 3.14

- \checkmark Circumference of a circle = $\pi \times$ Diameter
- \checkmark Area of circle = $\pi \times \text{Radius} \times \text{Radius}$
- ✓ A semicircle is a half circle. A quadrant is a quarter circle.

You will learn to

- read and interpret pie charts.
- solve problems using data in pie charts.



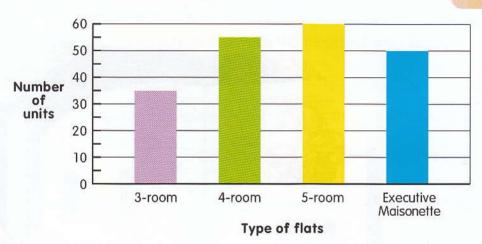




You have learnt how to represent data in tables, bar graphs and line graphs. Look at the data given in the table below.

Type of flats	Number of units
3-room	35
4-room	55
5-room	60
Executive Maisonette	50

I can present the data above using a bar graph.

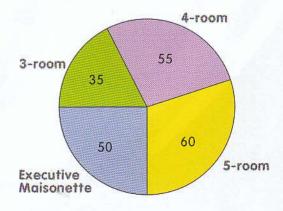




What fraction of the total number of flats are 5-room flats? What percentage of the total number of flats are executive maisonettes?

I can also present the data in this way. Look at the figure shown on the right. Do you know what it is called? Can you use it to answer the 2 questions above?







A Reading and interpreting pie charts

Type of sales	Monthly sales
Storybooks	\$500
Textbooks	\$600
Stationery	\$300
Magazines	\$600
Total sales	\$2000



I can present the data in the table using a pie chart.

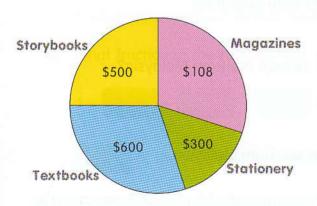
Storybooks sales =
$$\frac{500}{2000} = \frac{1}{4}$$

Stationery sales =
$$\frac{300}{2000} = \frac{3}{20}$$

Textbooks sales =
$$\frac{600}{2000} = \frac{3}{10}$$

Magazines sales =
$$\frac{600}{2000} = \frac{3}{10}$$

The pie chart is divided into 4 parts, namely the sales of storybooks, textbooks, stationery and magazines. The size of each part is determined by the fractions above.



A pie chart is a circle graph.

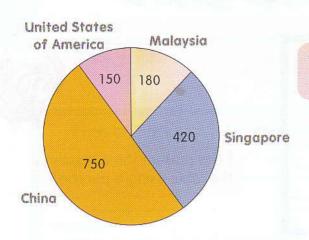


THINK

What answer do you get when all the 4 fractions are added. Why is this so?



1. The pie chart below shows 1500 stamps collected by Sally from 4 different countries.



We can display quantities in a pie chart.



(a) Which country are most of Sally's stamps from?

The largest part of the pie chart represents stamps from China. So, most of Sally's stamps are from China.

(b) What fraction of the total number of stamps are from Singapore?

$$\frac{420}{1500} = \frac{}{}$$

Reduce the fraction to its simplest form.



of the total number of stamps are from Singapore.

(c) What percentage of the total number of stamps are from Malaysia?

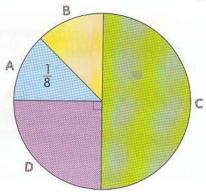
$$\frac{180}{1500} \times 100\% = \frac{1}{1}\%$$

% of the total number of stamps are from Malaysia.

(d) Find the ratio of the number of stamps from the United States of America to the number of stamps from China.



2. The pie chart below shows the number of votes cast by a group of viewers for the 4 contestants A, B, C and D taking part in the Singapore Idol contest.



We can display fractions in a pie chart.



(a) What fraction of the total number of votes went to contestant D? The part representing votes for contestant D is $\frac{1}{4}$ of the whole pie chart. So, $\frac{1}{4}$ of the total number of votes went to contestant D.

(b) What percentage of the total number of votes went to contestant C? The part representing votes for contestant C is $\frac{1}{2}$ of the whole pie chart.

$$\frac{1}{2} \times 100\% = 50\%$$

Whole pie chart represents 100%.

Contestant C received 50% of the total number of votes.

(c) What fraction of the total number of votes went to contestant B?

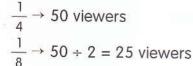




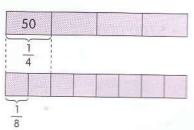
of the votes went to contestant B.

Whole pie chart represents 1 whole.

(d) If 50 viewers voted for contestant D, how many viewers voted for contestant A?

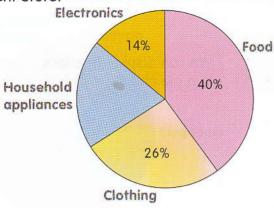


25 viewers voted for contestant A.





3. The pie chart below shows the annual sales for last year from 4 different sections of a department store.



We can display percentages in a pie chart.



(a) What percentage of the annual sales came from the 'Household appliances' section?

$$100\% - 14\% - 40\% - 26\% = 20\%$$

Whole pie chart represents 100%.

20% of the annual sales came from the 'Household appliances' section.

(b) Which section had the highest sales?



The part representating the 'Food' section is the largest among the 4 parts. So, the 'Food' section had the highest sales.

(c) What fraction of the annual sales came from the 'Electronics' section?

$$14\% = \frac{14}{100}$$

$$= \frac{14}{100}$$
 (in simplest form)

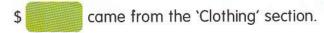


(d) If the total annual sales from these 4 sections was \$700 000, how much of this amount came from the 'Clothing' section?

$$100\% \rightarrow \$700\ 000$$

$$1\% \rightarrow \frac{\$700\ 000}{100} = \$7000$$

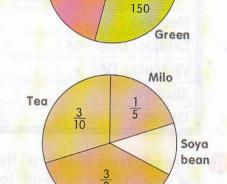
$$26\% \rightarrow \$$$







- 1. A group of 500 children was asked to choose their favourite colour. The pie chart represents their choices.
 - (a) How many children chose red?
 - (b) What fraction of the children chose green?
 - (c) What percentage of the children chose yellow?
 - (d) What is the ratio of the number of children who chose blue to those who chose yellow?
- The pie chart shows the different types of drinks sold at a drinks stall.
 - (a) Which was the most popular drink?
 - (b) What fraction of the drinks sold was soya bean?
 - (c) What percentage of the drinks sold was milo?
 - (d) If 80 cups of milo were sold, how many cups of tea were sold?



Red

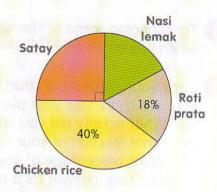
Blue

40

Yellow

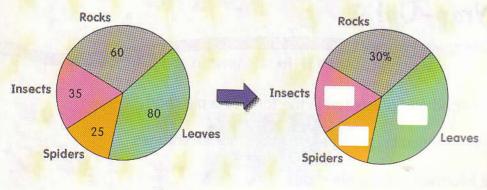
80

- A group of tourists was asked to choose their favourite local food in Singapore. The pie chart shows their choices.
 - (a) What percentage of tourists chose satay?
 - (b) What fraction of tourists chose chicken rice?
 - (c) What percentage of the tourists chose nasi lemak?
 - (d) If the total number of tourists was 3000, how many of them chose roti prata?



Coffee

4. A group of students collected 200 items during a nature walk. The type of items collected are shown in the pie chart below. Find the percentage for each item collected. (Express your answer as a decimal.) How can you check your answer?



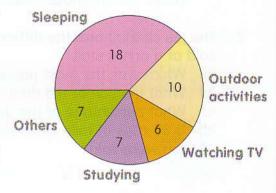




- 1) Keep track of how you spend your time during a weekend (Saturday and Sunday). You may choose to divide your time into the following 5 categories: Sleeping, Outdoor activities, Watching TV, Studying and Others.
- 2 Record your data in a table using a spreadsheet software. An example is shown below.

Activity	Number of hours (Total = 48 hours)	
Sleeping	18	
Outdoor activities	10	
Watching TV	6	
Studying	7	
Others	7	

3 After you have filled in all the cells of the table, use the spreadsheet software to generate a pie chart. An example is shown on the right. (Your teacher will show you how to do this step.)



- 4 Try changing some of the values in the table. Watch what happens to the pie chart when you do that.
- 5 Copy your original pie chart over to a word processing software and add some text to your pie chart. Use your pie chart to answer the following questions:
 - (a) What activity did you spend the most time on?
 - (b) What fraction of your time did you spend watching television?
 - (c) What percentage of your time was spent studying? (Express your answer as a mixed number.)





Wrap-Up!

- ✓ Data can be summarised and presented in the form of a pie chart.
- ✓ Pie charts display information in quantities, fractions or percentages.
- ✓ We can get useful information from pie charts.



Review F

- 1. Write the following in numerals.
 - (a) Twenty-four thousand, nine hundred and five
 - (b) Three million, fifty-five thousand and seven
 - (c) One million and fifty-two thousand
- 2. Find the missing numbers in the following:

(a)
$$91.234 = 9 \times 10 + 1 + \frac{2}{10} + \frac{3}{1000}$$

(b)
$$0.247 = \frac{6}{25} + \frac{7}{25}$$

(c)
$$\frac{28}{35} = \frac{28}{35}$$

3. Leena is *p* years old. Nancy is 6 years older than Leena. Which one of the following will be Nancy's age in 10 years' time?

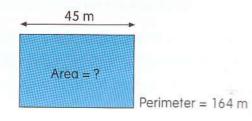
$$(p+10)$$
, $(p+16)$, $(p-16)$, $(p+4)$

- 4. Express 70 as a percentage of 56.
- 5. How many square faces are there in the net of a cube?
- 6. Evaluate the following expressions.

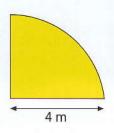
(a)
$$8\frac{3}{5} - 2\frac{1}{3}$$

(b)
$$14\frac{1}{4} - 9.41$$

7. A rectangular field has a perimeter of 164 m. Its length is 45 m. Find its area.



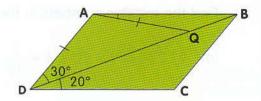
8. Find the perimeter of the following quadrant. (Take $\pi = \frac{22}{7}$)



9. Which of the following fractions is less than $\frac{1}{5}$?

$$\frac{5}{12}$$
, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{7}{40}$

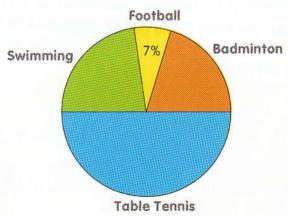
 ABCD is a parallelogram. AD = AQ. DQB is a straight line. Find ∠QAB.



11. Find the missing number in

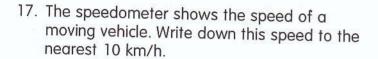
$$64\frac{13}{15} = 60 + 4\frac{1}{5} +$$

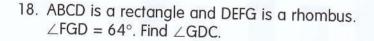
- 12. Find the value of $684 \div 3 + 27 \times 5$.
- 13. Find the average of 3.5, 10.13 and $1\frac{1}{4}$.
- 14. The pie chart shows the types of sports preferred by a group of students who was surveyed.

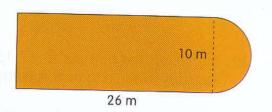


- (a) If the number of students who preferred football was $\frac{1}{3}$ of those who preferred swimming, what was the percentage of the students who preferred swimming?
- (b) If the number of students who preferred football was 14, what was the total number of students surveyed?

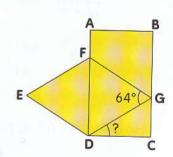
- 15. $\frac{1}{6}$ of an apple pie was eaten by Huili and $\frac{2}{5}$ of it was eaten by Anne. Mrs Tan took home $\frac{1}{3}$ of the remaining pie. What fraction of the pie was still left?
- 16. The figure on the right is made up of a rectangle and a semicircle.
 - (a) Find the perimeter of the figure.
 - (b) Find the area of the figure. (Take $\pi = 3.14$)









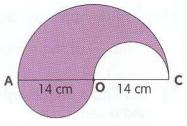


- 19. The number of white balls to the number of red balls in a bag was in the ratio 4 : 9. After $\frac{1}{3}$ of the red balls were taken out of the bag, there were 18 more red balls than white balls in the bag.
 - (a) What was the total number of balls in the bag initially?
 - (b) How many red balls were removed from the bag?
- 20. A buffet lunch is charged according to the price list below:

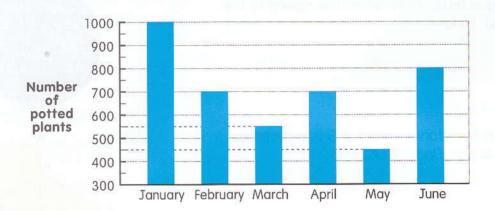
Adult	\$16.80
Senior citizen (above 55)	\$ 8.40
Child (below 12)	\$10.40

A family of 5 members comprising Mr and Mrs Lin, their father (aged 65) and 2 children (both below 12), went for the buffet lunch. How much did they pay altogether?

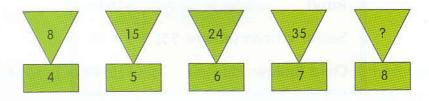
21. The figure consists of a big semicircle with centre O and 2 smaller semicircles with diameters AO and OC of 14 cm each. Find the area of the shaded region. (Take $\pi = \frac{22}{7}$)



- 22. A ship left the harbour at 17 15 on Sunday and returned to the harbour at 08 40 on Tuesday. How long was it away from the harbour? (Give your answer in h and min.)
- 23. The bar graph below shows the number of potted plants sold at a nursery for the first 6 months of the year.



- (a) How many potted plants were sold from April to June?
- (b) What was the decrease in percentage of the number of potted plants from January to February?
- (c) What was the average number of potted plants sold each month over the 6-month period?
- 24. David left Singapore for Kuala Lumpur at 8.00 a.m and drove at an average speed of 100 km/h. Arnold started for Kuala Lumpur from the same place 1 hour 45 minutes later. David arrived in Kuala Lumpur at 11.30 a.m. while Arnold arrived at 1.45 p.m. What was Arnold's average speed?
- 25. Examine the pattern closely and find the missing number.



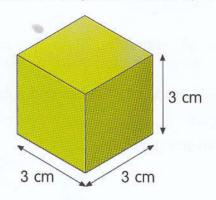
You will learn to

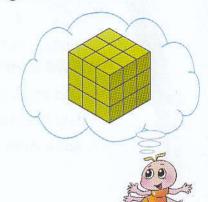
- find the volume of solids made up of cubes and cuboids.
- find the volume of liquids.
- solve word problems involving volume.





1. How many 1-cm cubes are required to build up a cube of edge 3 cm?



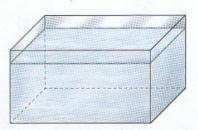




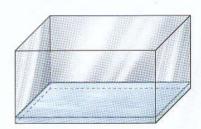
What is the volume of the 3-cm cube above?

- 2. Express the volume of water in the 2 containers shown below in
 - (a) litres.

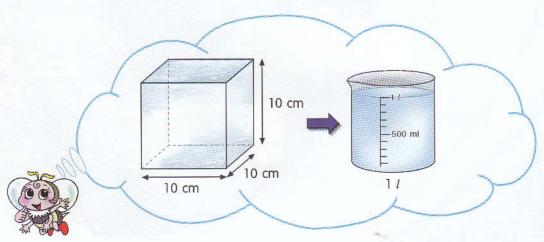




Volume = 3000 cm^3



Volume = 282 cm^3





A Volume of solids made up of cubes and cuboids

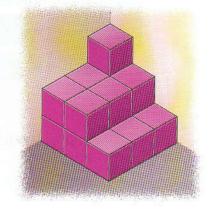
1. The solid figure shown on the right is made up of 1-cm cubes. Find its volume.

Volume of each 1-cm cube =
$$1 \times 1 \times 1$$

= 1 cm^3

Number of cubes in the solid = 1 + 6 + 9 = 16

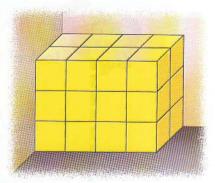
Volume of the solid figure = $16 \times 1 \text{ cm}^3$ = 16 cm^3



2. The cuboid shown on the right is made up of 1-cm cubes. Find the volume of the cuboid.

Volume of cuboid =
$$\times 1 \text{ cm}^3$$

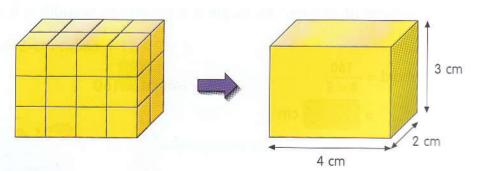
= cm^3





We can also use the following formula to find the volume of a cuboid.

Volume of cuboid = Length \times Breadth \times Height

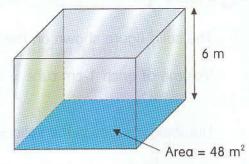


Volume of the cuboid =
$$4 \times 2 \times 3$$

= cm^3

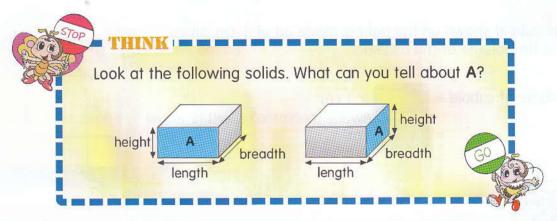
3. A glass cuboid has a base area of 48 m² and a height of 6 m. Find its volume.





Area = Length \times Breadth





To find one dimension of a cuboid, we divide its volume by the other 2 dimensions.

4. A cuboid has a volume of 160 cm³. Its length is 8 cm and its breadth is 5 cm. Find its height.

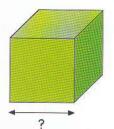
Height of the cuboid =
$$\frac{160}{8 \times 5}$$
 = $\frac{160}{8 \times 5}$ cm $\frac{8 \times 5}{5 \times 4}$ = $\frac{160}{5 \times 5}$ = $\frac{8 \times 5}{5 \times 4}$ = $\frac{160}{5 \times 5}$ =



5. The volume of a cube is 216 m³. What is the length of one edge of the cube?

All the edges of a cube have the same length.







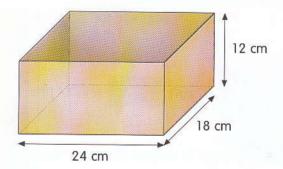




Length of one edge of the cube =



6. How many cubes of side 2 cm can fill up an empty rectangular box measuring 24 cm by 18 cm by 12 cm?



$$\frac{24}{2} = 12$$

$$\frac{18}{2} = 9$$

$$\frac{12}{2} = 6$$

Number of 2-cm cubes = $12 \times 9 \times 6$





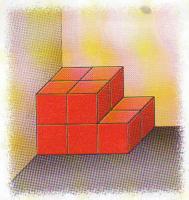
THINK

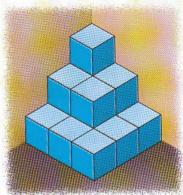
Can you think of another way of finding the answer to Question 6?



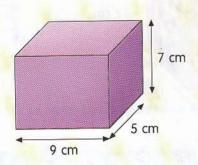


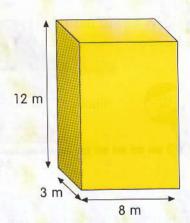
1. The following solids consist of 1-cm cubes. Find the volume of each solid.
(a) (b)





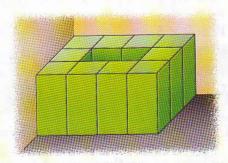
2. Find the volume of the following cuboids.





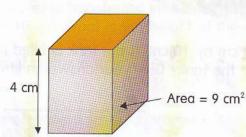
3. The solid shown below is made up of cuboids each measuring 2 cm by 1 cm by 1 cm. Find its volume.

(b)

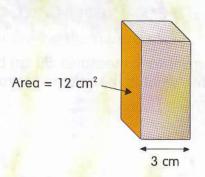


4. Find the volume of the following cuboids.

(a)

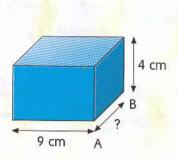


(b)

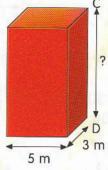


5. Find the unknown edge of each cuboid.

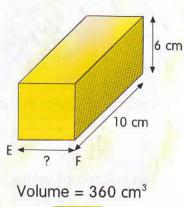
(a)



(b)



(c)

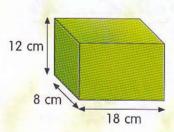


 $Volume = 216 cm^3$

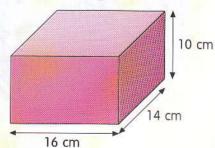
Volume = 135 m³

- 6. The volume of a cube is 729 cm³. Find the length of one edge of the cube.
- 7. How many cubes of side 2 cm are needed to fill up the following cuboids?

(a)



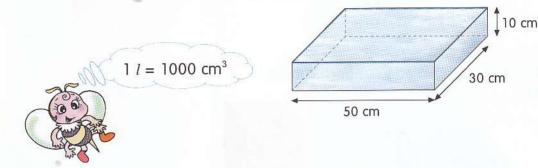
(b)



8. Thirty-six 2-cm cubes will fill up an empty rectangular box 12 cm long and 4 cm high. What is the breadth of the box?

B Volume of liquid in cuboids

 A rectangular tank measures 50 cm by 30 cm by 10 cm. If the tank is filled to the brim with water, what is the volume of water in the tank? Give your answer in litres.

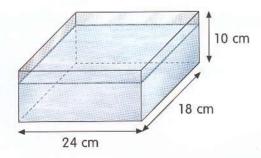


Volume of water in the tank =
$$50 \times 30 \times 10$$

= $15\ 000\ \text{cm}^3$
= $15\ l$

The volume of water in the tank is 15 l.

2. A rectangular container, 24 cm by 18 cm by 10 cm, is $\frac{3}{4}$ filled with water. Find the volume of water in the container in litres.



Capacity is the amount of space in a container.

Volume of water in the container =
$$\frac{3}{4} \times$$
 Capacity of container = $\frac{3}{4} \times 24 \times 18 \times 10$ = 3240 cm³





3. A rectangular tray measuring 15 cm by 15 cm by 2 cm is filled with water to its brim. All the water is transferred into an empty cubic container where the length of each edge is 10 cm. What is the height of the water level in the cubic container?

Volume of water in tray =
$$15 \times 15 \times 2$$

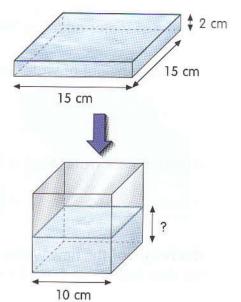
= 450 cm^3

Volume of water in cubic container = 450 cm³

$$450 = 10 \times 10 \times \text{Height}$$

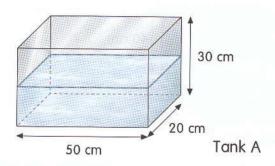
$$Height = \frac{450}{10 \times 10}$$
$$= cm$$

The height of the water level in the cubic container is _____ cm.

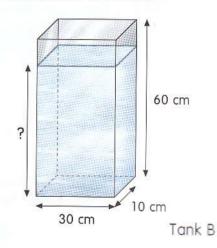


4. Kenny pours the same amount of water into 2 empty tanks A and B as shown below. Tank A is half-filled with water. What is the height of the water level in Tank B?

cm.



Volume of water in Tank B = Volume of water in Tank A $= \frac{1}{2} \times 50 \times 20 \times 30$ $= 15\ 000\ cm^3$



$$15 000 = 30 \times 10 \times \text{Height}$$

$$\text{Height} = \frac{15 000}{30 \times 10}$$

$$= \text{cm}$$

The height of the water level in Tank B is



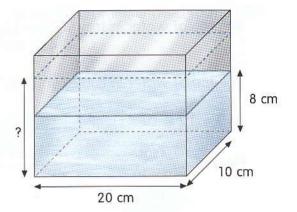
5. A rectangular tank, 20 cm long and 10 cm wide, is filled with water up to a height of 8 cm. If 1 l of water is added into the tank, what will be the height of the new water level?

cm

Volume of water added = $1 l = 1000 cm^3$

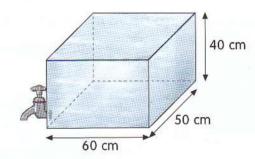
Increase in height of water level = $\frac{1000}{20 \times 10}$

Height of new water level = 8 + cm



The height of the new water level will be _____ cm.

6. A rectangular container, measuring 60 cm by 50 cm by 40 cm, is filled with water to its brim. Water is emptied from a tap at a rate of 24 litres per minute. How long will it take to empty the container completely?



Volume of water in the container = $60 \times 50 \times 40$ = $120\ 000\ \text{cm}^3$ = $120\ l$

24 l of water $\rightarrow 1$ min

1 *l* of water $\rightarrow \frac{1}{24}$ min

120 l of water $\rightarrow \frac{1}{24} \min \times 120$

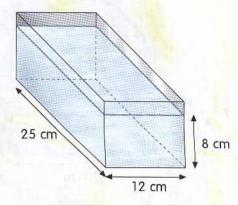
It will take minutes to empty the container completely.



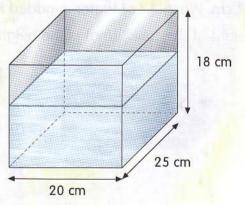


1. Find the volume of water in each of these tanks in litres.

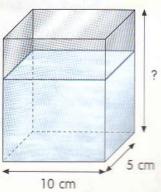
12 cm 9 cm



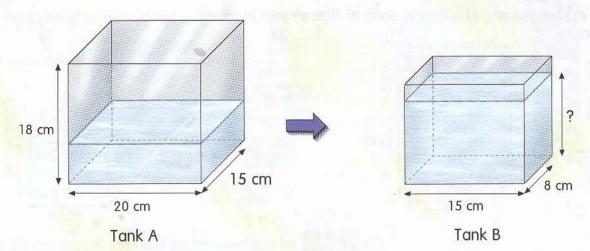
2. A rectangular tank has dimensions 20 cm by 25 cm by 18 cm. It is $\frac{3}{5}$ filled with water. Find the volume of the water in litres.



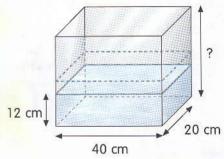
3. A rectangular container is 10 cm long and 5 cm wide. It contains 400 ml of water when it is $\frac{2}{3}$ full. Find the height of the tank.



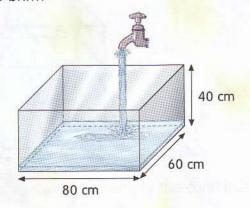
4. Tank A, measuring 20 cm by 15 cm by 18 cm, is $\frac{1}{3}$ filled with water. All of this water is poured into an empty Tank B, measuring 15 cm long and 8 cm wide. Find the height of the water level in Tank B.



5. A rectangular tank, 40 cm long and 20 cm wide, is filled with water up to a height of 12 cm. When 4 l of water is added into the tank, the water level rises to $\frac{1}{2}$ of the height of the tank. What is the height of the tank?



6. An empty rectangular container measures 80 cm by 60 cm by 40 cm. Water is poured into the container at a rate of 12 litres per minute. How long will it take to fill the container to the brim?







C More word problems

1. The length of a cuboid is twice its breadth and thrice its height. If the length is 18 cm, find the volume of the cuboid.

Length of cuboid = 18 cm

Breadth of cuboid = $\frac{18}{2}$ = 9 cm

Height of cuboid = $\frac{18}{3}$ = 6 cm

Volume of cuboid =

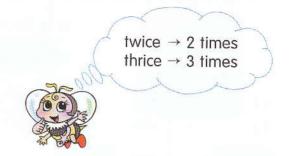


cm³

The volume of the cuboid is



cm³.



40 cm

2. Mr Tan has a rectangular block of wood measuring 40 cm by 30 cm by 20 cm. He uses a machine to cut as many 3-cm cubes as possible from this block of wood. How many such cubes can he cut?

$$40 \div 3 = 13 \frac{1}{3}$$

Number of possible cubes along the length = 13

$$30 \div 3 = 10$$

Number of possible cubes along the breadth = 10

$$20 \div 3 = 6\frac{2}{3}$$

Number of possible cubes along the height = 6

Number of total possible 3-cm cubes = $13 \times 6 \times 10$



He can cut



3-cm cubes from the block of wood.

THINK

Can you find the answer to the question above by using the following method?

Number of possible 3-cm cubes = Volume of block of wood Volume of 3-cm cube

Why?



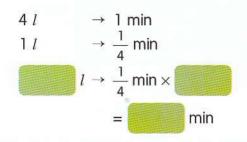
20 cm

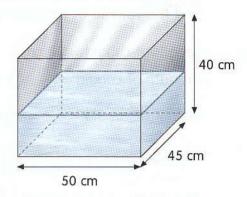
30 cm

3. A rectangular tank, measuring 50 cm by 45 cm by 40 cm, was $\frac{2}{5}$ filled with water. If the water was emptied from the tank at a rate of 4 litres per minute, how long did it take to empty the tank completely?

Volume of water in the tank =
$$\frac{2}{5} \times 50 \times 45 \times 40$$

= 36 000 cm³
= l

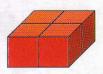




It took ____ minutes to empty the tank completely.

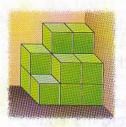


- The height of a cuboid is thrice its breadth and twice its length. If the height is 12 cm long, find its volume.
- 2. A cuboid consists of 4 cubes. The volume of the cuboid is 1372 cm³. Find the length of each edge of the cube.

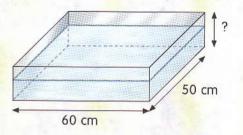


- 3. A machine cuts a cube with sides 10 cm into smaller 2-cm cubes. How many smaller cubes are obtained?
- 4. Find the maximum number of 2-cm cubes that can be fitted into a 13-cm cubical container.

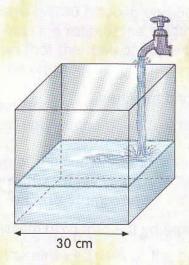
- 5. Seventy-two 4-cm cubes will completely fill up an empty rectangular box of breadth 12 cm and length 32 cm. What is the height of the box?
- 6. The solid shown on the right is made up of 1-cm cubes. It is placed at a corner of a room. How many more 1-cm cubes are needed to build up a 3-cm cube?



7. A rectangular tank of length 60 cm and breadth 50 cm is $\frac{3}{5}$ filled with water. When 18 l of water is added into the tank, the water level rises to the brim of the tank. What is the height of the tank?



8. A cubical tank with sides 30 cm is $\frac{1}{3}$ filled with water. If water is poured into a tank at a rate of 2 litres per minute, how long will it take to fill up the tank?

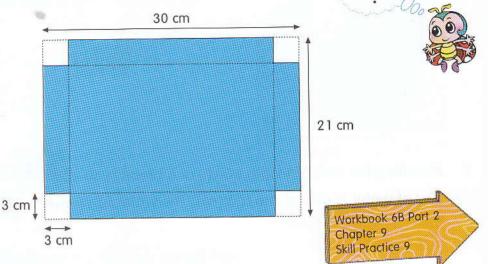








- 1 Take a sheet measuring 30 cm by 21 cm.
- 2 Cut out the square corners of the sheet of sides 3 cm.
- Fold it into a rectangular solid.
- 4 Fasten the joints of 4 edges with sticky tape.
- 5 Measure and record the length, breadth and height of the solid.
- 6 Find its volume.





Wrap-Up!

- ✓ The volume of a solid is the amount of space it occupies.
- ✓ Volume of a cuboid = Length \times Breadth \times Height
- ✓ The volume of liquid is usually measured in litres and millilitres.
- $1 l = 1000 \text{ cm}^3$ $1 \text{ ml} = 1 \text{ cm}^3$
- ✓ All the edges of a cube have the same length.
- ✓ To find a dimension of a cuboid, we divide its volume by the other 2 dimensions.

$$Length = \frac{Volume}{Breadth \times Height}$$

$$\frac{\text{Breadth}}{\text{Breadth}} = \frac{\text{Volume}}{\text{Length} \times \text{Height}}$$

$$Height = \frac{Volume}{\frac{Length \times Breadth}{}}$$



Review G

1. Find the values of the following expressions.

(a)
$$32 \times 15 - 264 \div 8$$

(b)
$$60 \div (2 + 3) \times 4$$

(c)
$$(45 + 3) \times 6 \div 4$$

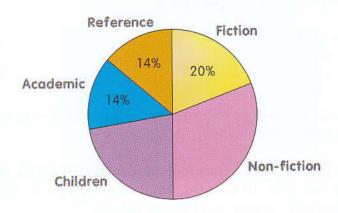
- 2. 4 bags have a mass of 3p kg, (p + 7) kg, (9p 5) kg and (3 p) kg. If p = 2, find the average mass of the 4 bags.
- 3. A tap was used to fill an empty water tank measuring 50 cm by 30 cm by 40 cm. If the water tank became full after 12 minutes, what was the rate of flow of water from the tap to the tank? Give your answer in litres per minute.
- 4. Convert the following quantities.

(a)
$$2.73 \text{ kg} = 900 \text{ g}$$

(c)
$$\frac{2}{5}$$
 m = cm

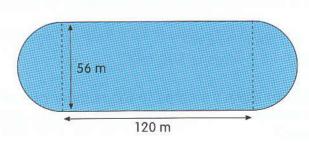
- 5. A rectangle is 100 cm long and 60 cm wide.
 - (a) What is the ratio of the length to the breadth?
 - (b) Given that the ratio of the length to the breadth of another rectangle is the same as the original one, find its breadth when its length is 125 cm.
- 6. (a) What fraction of 8.8 km is 176 m?
 - (b) What percentage of 12.5 litres is 500 ml?
- 7. The ratio of the number of Kevin's stamps to the number of Carl's stamps is 3 : 5. If Carl gives 30% of his stamps to Kevin, what is the new ratio of the number of Kevin's stamps to Carl's stamps?
- 8. A school has 2000 students. 45% of the students are girls and the rest are boys. 20% of the girls and 70% of the boys wear glasses. What percentage of the students do not wear glasses?

- 9. The average of 3 numbers is 14. The 3 numbers are also in the ratio 1:2:4. Find the 3 numbers.
- 10. On a certain day, a clock ran faster by 5 seconds for every 10 minutes after 8.00 a.m. What was the actual time when it showed 10.00 a.m. on that day?
- 11. The pie chart summarises the types of books in a private library.

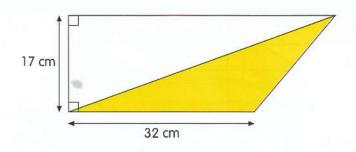


- (a) What percentage of the books are non-fiction?
- (b) If there are 490 academic books, what is the number of non-fiction books?
- 12. A motorist completed $\frac{3}{5}$ of a journey in 2 hours. He completed the rest of the journey in 1 hour at an average speed of 90 km/h.
 - (a) What was the distance of the whole journey?
 - (b) What was the average speed of the whole journey?
- 13. The figure shown below is made up of a rectangle and 2 semicircles.
 - Find (a) the perimeter of the figure, and
 - (b) the area of the figure.

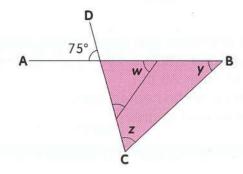
(Take
$$\pi = \frac{22}{7}$$
)



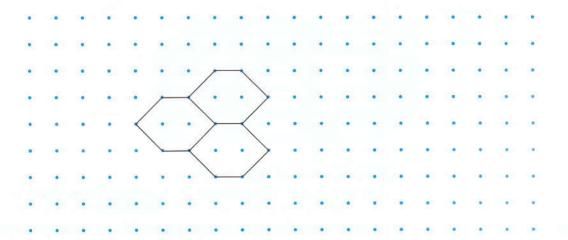
14. Find the area of the shaded part in the figure below.



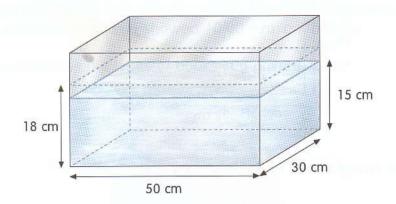
15. AB and CD are straight lines. Find $\angle w + \angle x + \angle y + \angle z$.



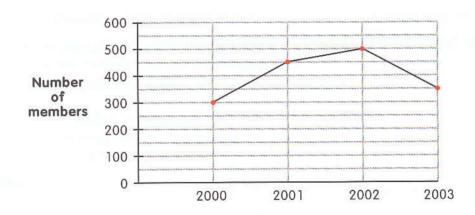
16. Extend the tessellation by drawing 6 more unit shapes.



17. When more water was added into the container, the water level rose to 18 cm. How much water was added into the container? Give your answer in litres and millilitres.



- 18. With the help of a ruler, a protractor and a set square, draw a parallelogram ABCD, with AB = 10 cm, BC = 6 cm and \angle BCD = 130°. Then draw a perpendicular line from the point C to the line AB to meet AB at E.
 - (a) Measure the length of ED to the nearest mm.
 - (b) Measure ∠CED to the nearest degree.
- 19. The line graph below shows the number of members in a club for the past 4 years.

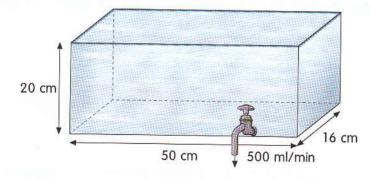


- (a) Which year had the highest number of members?
- (b) What was the percentage increase in the number of members from 2000 to 2001?
- 20. An empty container is 18 cm long, 9 cm wide and 9 cm high. If each cuboid measures 6 cm by 3 cm, how many cuboids are needed to fill the container completely?

21. Look at the pattern below closely. What are the digits in the boxes?

Row	Product	Digit in the ones place
1	19	9
2	19 × 19	1
3	19 × 19 × 19	9
4	19 × 19 × 19 × 19	1
7	$19 \times 19 \times 19 \times 19 \times 19 \times 19 \times 19$	
		STATEMENT P
50	19 × 19 × × 19 (50 times)	

22. A rectangular tank measuring 50 cm by 16 cm by 20 cm is filled with water to the brim. When a tap at the bottom of the tank is turned on, water flows out at a rate of 500 ml/min. How long does it take before the tank is emptied?



- 23. Lyn bought some spoons and ladles for \$45 altogether. Each spoon cost \$1.20 and each ladle cost \$1.40 more than a spoon. If she bought half as many ladles as spoons, find the number of spoons and the number of ladles she bought.
- 24. 180 picture cards were shared among 4 boys and 3 girls. The girls received 2 times as many picture cards as the boys. The girls divided their share in the ratio 1:2:3.
 - (a) How many picture cards did the girl who had the largest share receive?
 - (b) If the boys shared their cards equally, how many cards did each boy receive?



25. Observe the pattern and find the missing numbers.



Problem-Solving Strategies

لتحميل المزيد من كتب الأطفال تابع المرح المرح

In this chapter, you will be introduced to 7 problem-solving strategies as shown below.



What is a strategy?



A strategy is a plan we make use of when we want to solve problems.

When solving a problem, it is useful to list the information given and analyse the problem before deciding which strategy to use. Sometimes, a problem may require the use of more than one strategy.



Are there only 7 strategies altogether?

There are many strategies you can use when solving a problem. The 7 strategies listed above are some of the more common ones.

Let us learn about the various strategies through some examples.





Make a List

3 coloured balls are to fit into the 3 holes of a wooden block as shown in the figure below. In how many ways can this be done?



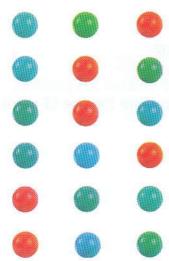
List the information

To fit 3 coloured balls into 3 holes.

Analyse the problem

Since any of the coloured balls can be in the first, second or third hole, we can make a list to help us find all the possible ways.

List all the possible ways



Do you see that each colour appears exactly twice in every vertical column?



Thus, there are 6 ways of arranging the 3 balls.

Let's Try

In how many ways can you fit 4 coloured balls into a wooden block with 4 holes?



Make a Table

Jane received a 50¢ commission for every book she sold and a bonus of \$12 for every 30 books sold. If she made a total of \$61.50, how many books did she sell?

List the information

50¢ commission for each book sold Bonus of \$12 for every 30 books sold Total amount made: \$61.50 First, write down all the information given in the question.



Analyse the problem

1 book
$$\rightarrow$$
 \$0.50
30 books \rightarrow (\$0.50 × 30) + \$12
= \$27



Include the bonus of \$12.

Looking at the total amount that she made, Jane must have sold more than 30 books.

Construct a table

We now make a table as shown below.

Number of books sold	Amount paid to Jane
30	\$27
60	$$27 \times 2 = 54
90	\$27 × 3 = \$81

From the table above, we see that Jane must have sold more than 60 books but less than 90 books.

$$750 \div 50 = 15$$

$$60 + 15 = 75$$

Jane sold 75 books altogether.





Guess and Check

Jill has \$4 in the form of 20-cent and 10-cent coins. There are seven more 10-cent coins than 20-cent coins. How many coins of each type does she have?

List the information

Coins: 10-cent and 20-cent coins only

Total amount: \$4

Number of coins: Seven 10-cent coins more than 20-cent coins

Analyse the problem

We make a guess to find the number of 10-cent coins and 20-cent coins that will add up to give a total of \$4 such that there are seven more 10-cent coins than 20-cent coins.

First guess

Ten 20-cent coins Seventeen 10-cent coins



Make a reasonable guess. Do not worry if it is not correct.

Check

$$10 \times 200 = 2.00$$

$$17 \times 100 = 1.70$$

The guess is wrong. Let us try again.

Revise the guess

Eleven 20-cent coins Eighteen 10-cent coins

Check

$$\begin{array}{c}
 11 \times 200 = \$2.20 \\
 18 \times 100 = \$1.80
 \end{array}
 \right} \$4.00$$

The guess is correct.

Jill has eleven 20-cent coins and eighteen 10-cent coins.

Use a Diagram/Model

There is a stack of 4 books: Mathematics, Science, English and Chinese. The English book (E) is placed below the Chinese book (C). The Mathematics book (M) is placed between the English and the Chinese books. The English book is placed above the Science book (S). How are the 4 books arranged in the stack?



List the information

- There are 4 books M, S, E and C
- · E is below C
- M is between E and C
- E is above S

Analyse the problem

We draw simple diagrams to help us visualise the 4 pieces of information above.

Draw a first diagram to represent part of the information

Draw a diagram using the second and third points above.

Draw a second diagram to add in the rest of the information

After drawing the diagram of how the first 3 books are placed in the stack, place the last book in the stack as shown in the diagram below.



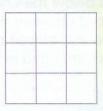
The diagram above shows how the 4 books are stacked.

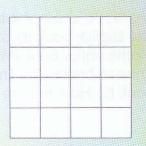
The Chinese book is on the top of the stack, followed by the Mathematics and the English books in a top-down order. The Science book is at the bottom of the stack.

Look for a Pattern

How many squares, small and big, are there in a

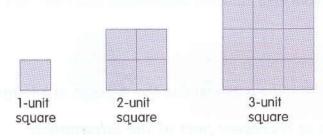
- (a) 3×3 square grid?
- (b) 4×4 square grid?





(a) Analyse the problem

These are squares of different unit lengths.



Make a table to find a pattern

Number of 1-unit squares	Number of 2-unit squares	Number of 3-unit squares
$3 \times 3 = 9$	$2 \times 2 = 4$	1 × 1 = 1

9 + 4 + 1 = 14

There are 14 squares altogether in a 3×3 square grid.

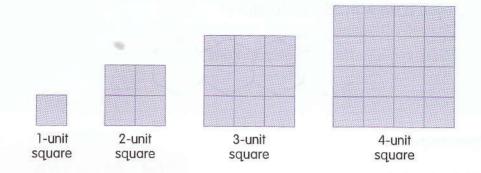
Can you see a pattern?





(b) Use the pattern

These are squares of different unit lengths.



Type of squares	Number of squares
1-unit square	$4 \times 4 = 16$
2-unit square	$3 \times 3 = 9$
3-unit square	$3 \times 2 = 4$
4-unit square	1 × 1 = 1

We can use the pattern from (a) to do this.



$$16 + 9 + 4 + 1 = 30$$

There are 30 squares altogether in a 4×4 square grid.

Let's Try	
Can you figure out the num	nber of squares in a 5 × 5 square grid?

Simplify the Problem

Matchsticks are used to form hexagons as shown in the diagram below. How many hexagons can you build with 391 matchsticks?



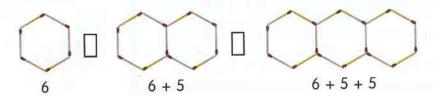
List the information

There are 391 matchsticks.

There are too many matchsticks to work on!

Simplify the problem

Let us look at how to form 3 hexagons first.



The 1st hexagon uses 6 matchsticks. The 2nd hexagon uses 5 more matchsticks. The 3rd hexagon uses 5 more matchsticks.

Solve the original problem

The 1st hexagon uses 6 sticks.

Every additional new hexagon on the right uses 5 more matchsticks.

Number of hexagons =
$$385 \div 5$$

= 77

Total number of hexagons =
$$1 + 77$$

= 78

I can build 78 hexagons with 391 matchsticks.



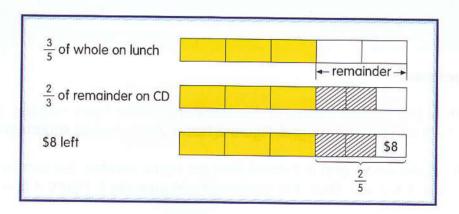
Work Backwards

Mother gave Sumei some money for her birthday. She spent $\frac{3}{5}$ of the money on lunch with her friend. She spent $\frac{2}{3}$ of the remainder buying for herself a new CD and was left with \$8. How much money did her mother give her at the beginning?

List the information

- She spent $\frac{3}{5}$ of the money.
- She spent $\frac{2}{3}$ of the remainder.
- \$8 left.

Draw models



Work backwards to get from the known to the unknown

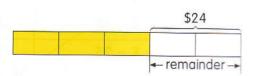
$$\$8 \times 3 = \$24$$

The remainder was \$24.

1 unit =
$$\frac{$24}{2}$$
 = \$12

$$5 \text{ units} = \$12 \times 5 = \$60$$

Mother gave her \$60 at the beginning.



Let us look at some more examples of solving problems using the stategies that you have just learnt.



Example 1

Study the pattern of a series of square grids. Determine the number of unshaded unit squares in Figure 6.

Figure 1 Figure 2 Figure 3 Figure 4 ... Figure 6

Number of unshaded squares?

Analyse the problem

The edge length of the shaded square grid is the same as the figure number. For example, Figure 2 has a 2×2 shaded square grid, Figure 3 has a 3×3 shaded square grid and so on.

The edge length of the whole grid is 2 more than the figure number. For example, the edge length of Figure 4 is 4 + 2 = 6. Thus, the number of unit squares in Figure 4 is $6 \times 6 = 36$.

Make a table & Look for a pattern

Figure	No. of unit squares (whole grid)	N <mark>o.</mark> of u <mark>nit squares</mark> (shaded grid)	No. of unit squares (unshaded grid)
1	$3 \times 3 = 9$	$1 \times 1 = 1$	9 - 1 = 8
2	4 × 4 = 16	$2 \times 2 = 4$	16 - 4 = 12
3	$5 \times 5 = 25$	$3 \times 3 = 9$	25 - 9 = 16
4	$6 \times 6 = 36$	$4 \times 4 = 16$	36 - 16 = 20
5	$7 \times 7 = 49$	$5 \times 5 = 25$	49 - 25 = 24
6	8 × 8 = 64	$6 \times 6 = 36$	64 - 36 = 28

There are 28 unshaded unit squares in Figure 6.



Let's Try

Can you apply the 'Look for a pattern' strategy to the last column? How many unshaded unit squares will there be in Figure 10?

Example 2

The diagram below shows 6 tiles with different number of dots each. How many pairs of values are there such that their values when added together give a sum greater than 6?



Make a list

[1, 6], {2, 5} and {3, 4} are pairs of values that give a sum greater than 6.



List out all the pairs of numbers.

{1, 2}, {1, 3}, {1, 4}, {1, 5}, {1, 6}, {2, 3}, {2, 4}, {2, 5}, {2, 6}, {3, 4} {3, 5}, {3, 6}, {4, 5}, {4, 6}, {5, 6}

Identify the relevant pairs

There are 9 pairs of values from the above list whose sum is greater than 6: {1, 6}, {2, 5}, {2, 6}, {3, 4}, {3, 5}, {3, 6}, {4, 5}, {4, 6}, {5, 6}



There are 14 chickens and cows altogether on the farm. There are 46 legs in all. How many chickens and how many cows are there on the farm?



Analyse the problem

Each chicken has 2 legs. Each cow has 4 legs.

Guess and check & Make a table

Number of chickens	Number of chicken legs		Number of cow legs	Total number of legs
7	$7 \times 2 = 14$	7	$7\times 4=28$	14 + 28 = 42

The total number of legs is 42.

The guess is wrong. Let us try again.

Revise the guess

Number of chickens	Number of chicken legs	Number of cows	Number of cow legs	Total number of legs
6	6 × 2 = 12	8	8 × 4 = 32	12 + 32 = 44
5	5 × 2 = 10	9	9 × 4 = 36	10 + 36 = 46

x too few

✓ correct

We revised our guess 2 times to get the correct answer.

There are 5 chickens and 9 cows on the farm.



Each letter in the grid shown on the right stands for a number. The total sum for the numbers in each row and each column is shown next to it. What numbers are represented by A, B and C?

	Α	В	С	12
-	Α	С	В	12
	Α	В	Α	11
-	9	14	12	

Analyse the problem

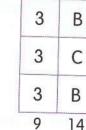
Looking at the first column, we get $\rightarrow A = 3$.



Use a diagram/model

Use the picture provided as a diagram to work on.

Α	В	С	12
Α	С	В	12
Α	В	Α	11
9	14	12	1





Replace each A with 3.

Look at the third row, we get \rightarrow 3 + B + 3 = 11 6 + B = 11B = 5

لتحميل المزيد من كتب الأطفال تابع مكتبة التعليم المرح

-	3	5	С	12
-	3	С	5	12
-	-3	5	3	11
_	9	14	12	J



Replace each B with 5.

Looking at the first column, we get \rightarrow 3 + 5 + C = 12

$$8 + C = 12$$

 $C = 4$

C

B

3

12

12

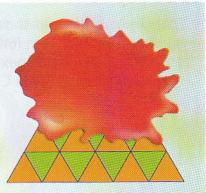
12

11

We get A = 3, B = 5 and C = 4.

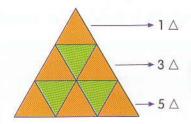


A large equilateral triangle is made up of small equilateral triangles. Some red paint has been accidentally splashed on the large triangle, covering part of it. Can you figure out the total number of small equilateral triangles in the diagram shown on the right?



Simplify the problem & Look for a pattern

Look at the large triangle on the left.



It has 3 rows of small equilateral triangles. Number of small triangles = 5 + 3 + 1= 9

We have added all the odd numbers from 5 to 1 to get the total number of small equilateral triangles.

Solve the original problem

We see from the figure in the question that there are 9 small equilateral triangles in the bottom row.

As in the triangle above, the top row will also have 1 small triangle.

We add all the odd numbers from 9 to 1 to find the total number of small equilateral triangles.

$$9 + 7 + 5 + 3 + 1 = 25$$

Hence, there are 25 small equilateral triangles.



Since 5 odd numbers have been added, we say that there are 5 rows of small triangles in the large triangle.



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Linda bought 6 floormats and 4 towels of the same type for \$132. A towel cost 4 times as much as a floormat. Find the cost of a floormat.

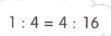
List the information

- Bought 6 towels and 4 floormats
- Paid a total of \$132
- Cost of 1 towel is 4 times the cost of 1 floormat

Analyse the problem

The cost of 1 towel is 4 times the cost of 1 floormat.

The cost of 4 towels is 16 times the cost of 1 floormat.



Simplify the problem

Since 4 towels cost as much as 16 more floormats, the cost of 6 floormats and 4 towels is the same as the cost of 22 floormats.

22 floormats
$$\rightarrow$$
 \$132
1 floormat \rightarrow $\frac{$132}{22}$
= \$6

The cost of 1 floormat is \$6.



Let's Thy

The total cost of 3 radios and 5 walkmans of the same type is \$770. The cost of each radio is 3 times the cost of each walkman. Find the cost of each radio.



Let us summarise the problem-solving process.

- Read the question carefully and identify all the information.
- List the information and analyse the problem.
- Choose one or more strategies to try out.
- Solve the problem using your chosen strategies.
- Check against the question to make sure that your answer is reasonable.

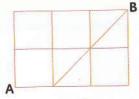


- 1. In a 2-person relay, the first runner completed half of the total distance and $\frac{1}{2}$ km before passing the baton to the second runner. The second runner ran $\frac{1}{3}$ of the remaining distance and $\frac{1}{3}$ km to the finishing line. What was the total distance of the race?
- 2. In a group of 50 children, 2 apples were given to every boy and 1 apple was given to every girl. In total, the boys got 7 apples more than the girls. How many boys and girls were there in the group?
- 3. Tom is shorter than Ken. Ron's height is somewhere between Ken's and Wayne's heights. Wayne is taller than Ken. Arrange these 4 boys from the shortest to the tallest.
- If a man can only walk diagonally upwards (if there is a diagonal path), eastwards and northwards, how many routes can he take to get from point A to point B in each of the following scenarios.

(a)



(b)





- 5. A boy makes \$2 for every game set he sold. He will also get a bonus of \$14 for every 25 game sets sold. If he wants to make \$200, how many game sets must he sell?
- 6. Mr Jones is required to arrive at the airport 1 hour 30 minutes before his flight takes off. It takes 45 minutes to travel from his house to the airport. For this trip, he needs to detour to pick up his sister from the airport which will take up another $\frac{1}{3}$ of the travel time from his house to the airport. He adds in another $\frac{1}{3}$ of the total travel (including detour) time on the road for any possible traffic jam. If his flight is scheduled to take off at 7.50 p.m., what time must he leave his house?
- 7. Using only 10¢, 20¢ and 50¢ coins, how many different ways can you put them together to make
 - (a) \$0.80?
 - (b) \$1?
 - (c) \$1.50?

You need not use all the three denominations of the coins and there is no restriction on the number of coin for each denomination available.

8. At an ice cream shop, customers can choose one of five flavours of ice cream. They may also select one of six toppings to go with their ice cream. How many ways can you combine the flavour with the topping?

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