

Area and Volume 2

You must be able to:

- Recall and use the formulae for the circumference and area of a circle
- Recall and use the formula for the area of a trapezium
- Recall and use the formulae for the volume and surface area of a prism
- Recall and use the formulae for the volume and surface area of a cylinder.

Circles

LEARN

Circumference of a Circle (C) = $2\pi r$ or $C = \pi d$

Area of a Circle (A) = πr^2

Work out the circumference and area of a circle with radius 9cm. Give your answers to 1 decimal place.

Circumference

$$\begin{aligned} C &= 2 \times \pi \times 9 \\ &= 18 \times \pi \\ &= 56.5\text{cm (to 1 d.p.)} \end{aligned}$$

Area

$$\begin{aligned} A &= \pi \times 9^2 \\ &= \pi \times 81 \\ &= 254.5\text{cm}^2 \text{ (to 1 d.p.)} \end{aligned}$$

Key Point

The symbol π represents the number pi.

π can be approximated by 3.14 or $\frac{22}{7}$.

Trapeziums

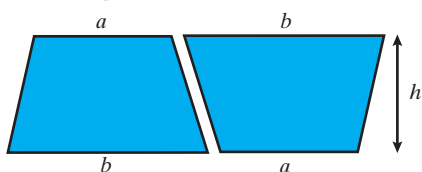
LEARN

The area of a **trapezium** is:

$$A = \frac{1}{2}(a + b)h$$

where a and b are the **parallel** sides and h is the **perpendicular** height

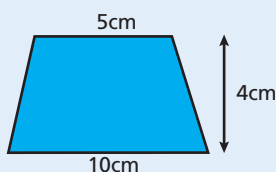
- This formula can be proved:



- Two identical trapeziums fit together to make a parallelogram with base $a + b$ and height h
- The area of the parallelogram is $(a + b)h$
- Therefore, the area of each trapezium is $\frac{1}{2}(a + b)h$.

Work out the area of the trapezium.

$$\begin{aligned} A &= \frac{1}{2} \times (5 + 10) \times 4 \\ &= 30\text{cm}^2 \end{aligned}$$



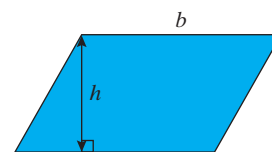
Key Point

Perpendicular means 'at right angles'.

Parallel means 'in the same direction and always the same distance apart'.

Key Point

The area of a parallelogram is: $A = bh$



Prisms

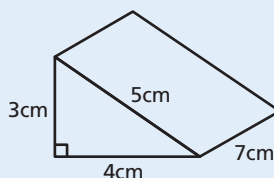
- A right prism is a 3D shape that has the same **cross-section** running all the way through it.

LEARN

Volume of a Prism = Area of Cross-Section \times Length

- The surface area is the sum of the areas of all the **faces**.

Work out the volume and surface area of the triangular prism.



Volume

$$\begin{aligned} \text{Area of the cross-section} &= \frac{1}{2} \times 3 \times 4 = 6\text{cm}^2 \\ \text{Volume} &= 6 \times 7 \\ &= 42\text{cm}^3 \end{aligned}$$

Surface Area

Five faces:

$$\begin{aligned} \text{Two triangular faces} &= 6 + 6 = 12 \\ \text{Base} &= 4 \times 7 = 28 \\ \text{Side} &= 3 \times 7 = 21 \\ \text{Slanted side} &= 5 \times 7 = 35 \\ \text{Total surface area} &= \\ &12 + 28 + 21 + 35 = 96\text{cm}^2 \end{aligned}$$

Cylinders

LEARN

Volume of a Cylinder = $\pi r^2 h$

Surface Area of a Cylinder = $2\pi r h + 2\pi r^2$

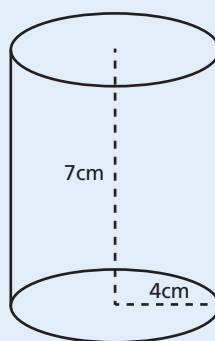
Work out the volume and the surface area of the cylinder. Give your answers in terms of π .

Volume

$$\begin{aligned} V &= \pi \times 4^2 \times 7 \\ &= 112\pi\text{cm}^3 \end{aligned}$$

Surface Area

$$\begin{aligned} SA &= 2 \times \pi \times 4 \times 7 + 2 \times \pi \times 4^2 \\ &= 56\pi + 32\pi \\ &= 88\pi\text{cm}^2 \end{aligned}$$

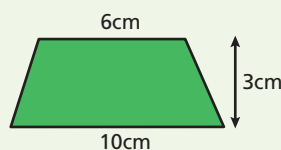


Key Point

A cylinder is just like any other right prism. To find the volume, you multiply the area of the cross-section (circular face) by the length of the cylinder.

Quick Test

- Calculate the volume and surface area of a cylinder with radius 4cm and height 6cm.
- Work out the area of the trapezium.
- Calculate the circumference and area of a circle, diameter 7cm.



Key Words

trapezium
parallel
perpendicular
cross-section
face

Practice Questions

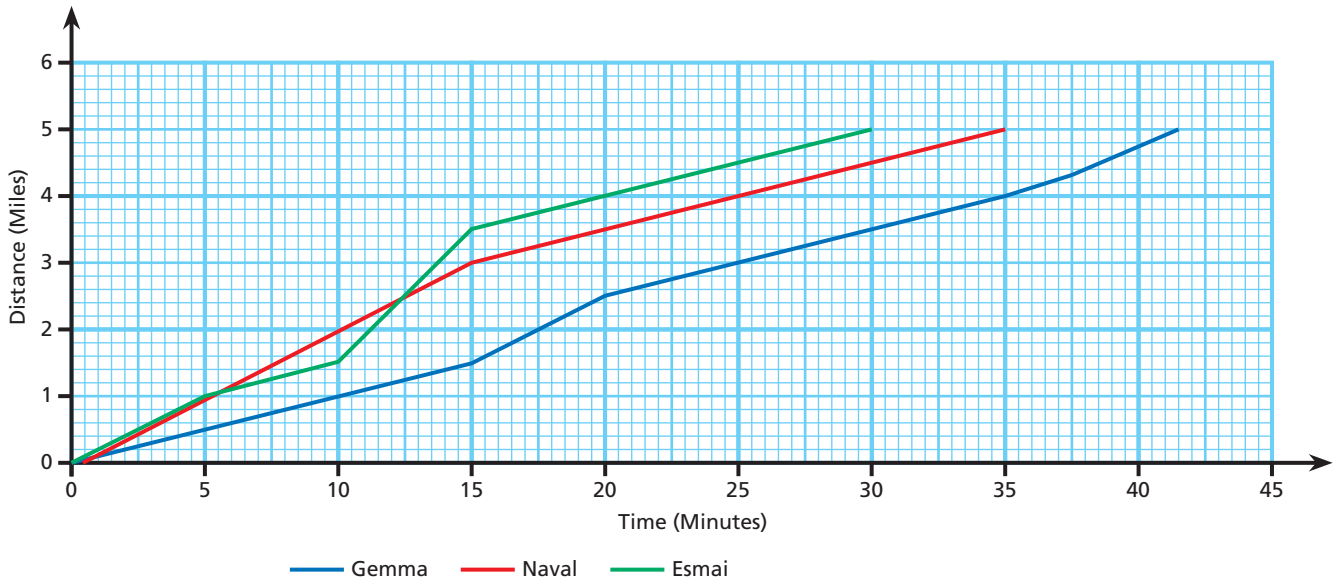
Uses of Graphs & Other Graphs

- 1 A line is parallel to the line of equation $y = 3x - 2$ and goes through the point $(1, 5)$.

Work out the equation of the line.

[3]

- 2 Gemma, Naval and Esmail entered a five-mile cycling race. The graph below shows the race.



- a) Who won the race? [1]

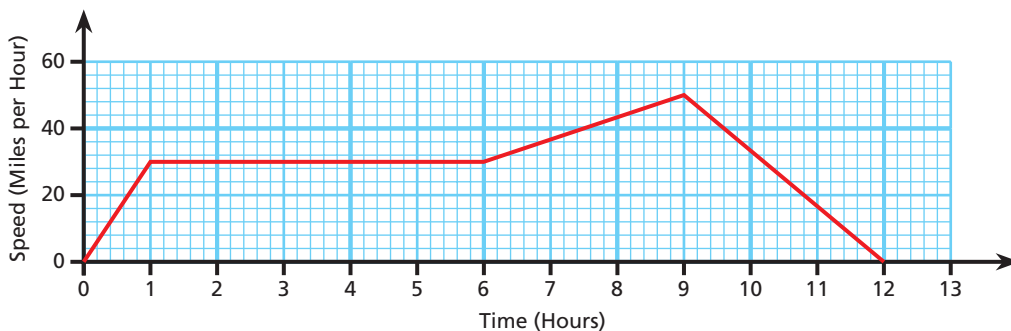
- b) What speed was Naval travelling at for the last 20 minutes before he finished?
Give your answer in miles per hour. [2]

- c) Between what times was Gemma travelling her fastest?
Give a reason for your answer. [2]

- d) How many minutes after the race started did the winner move into the lead? [1]

- e) Describe the race. [3]

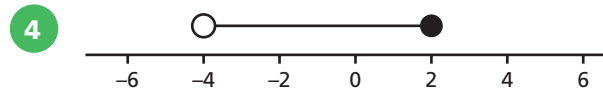
- 3 The graph below shows the journey of a train. Work out the total distance travelled. [3]



Total Marks / 15

Inequalities

- 1 Write down all the integer values for m that satisfy $-1 \leq m < 4$. [1]
- 2 Solve $2x - 6 > 2$ [2]
- 3 Write down all the possible integer values for y if $12 \leq 3y \leq 36$. [2]

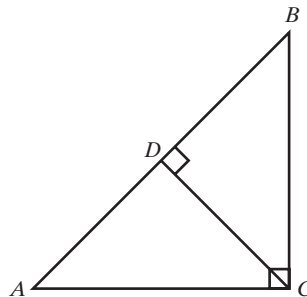


Write down the inequality represented by the number line. [2]

Total Marks / 7

Congruence and Geometrical Problems

- 1 Prove that triangle ABC and triangle BCD are similar. [3]



- 2 Lisa has a 10cm by 8cm photograph of her pet dog. She wants a smaller copy to fit into her handbag and a larger copy for her office.
- a) What will the length of the smaller copy be, if the width is 4cm? [1]
- b) What will the width of the larger copy be, if the length is 25cm? [2]

Total Marks / 6

Review Questions

Number Patterns and Sequences 1 & 2

- 1 The first term that the following two sequences have in common is 17.

8, 11, 14, 17, 20 ...

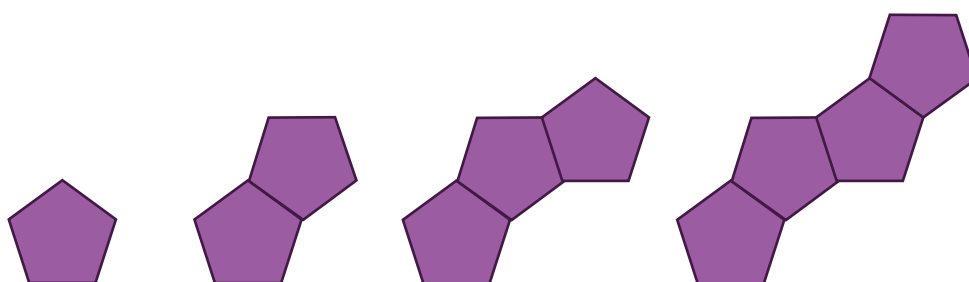
1, 5, 9, 13, 17 ...

Work out the next term that the two sequences have in common.

You must show your working.

[2]

- 2 Regular pentagons of side length 1cm are joined together to make a pattern.



- a) Use the patterns to complete the table below.

Pattern Number	Perimeter (cm)
1	
2	
3	
4	
60	
n	

[2]

- b) What is the maximum number of pentagons that could be used to give a perimeter less than 1500cm?

[2]

- 3 Write down the first three terms in the sequence with the n th term $n^2 - 6$.

[2]

- 4 Write down the next two terms in the sequence below:

4, 6, 10, 18, 34 ...

[2]

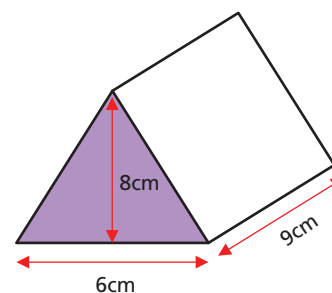
Total Marks / 10

Area and Volume 1, 2 & 3

1 a) Work out the volume of the triangular prism.

b) A cube has the same volume as the triangular prism.

Work out the total length of all the edges of the cube.



[2]

[3]

2 The numerical values of the area and circumference of a circle are equal.

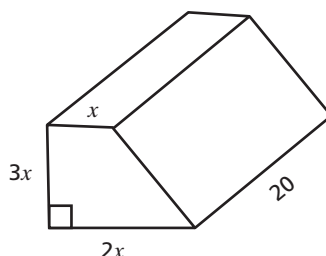
Work out the radius of this circle.

[2]

3 The volume of the trapezoid is 900cm^3 .

All measurements are in centimetres.

Work out the value of x .



[4]

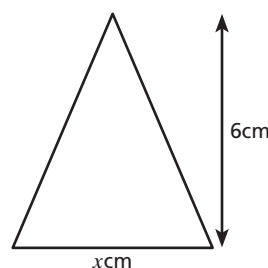
4 The surface area of a sphere is 75cm^2 . Work out the length of the radius.

[3]

5 Here is a triangle.

The area of the triangle is 7.5cm^2 .

Work out the value of x .

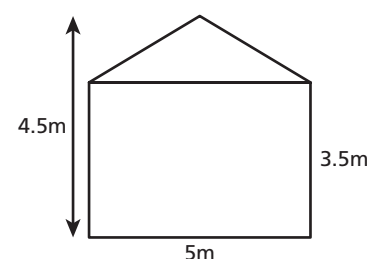


[3]

6 John is planning to paint the front of his house. He needs to estimate how much paint he should buy. He does this by calculating the area of the front of the house, including all windows and doors.

The diagram shows John's house.

If each tin of paint will cover 11m^2 , work out an estimate of the number of tins that John needs to buy.



[4]

Total Marks / 21

Mixed Exam-Style Questions

- 11 The formula used to calculate the area of a circle is $A = \pi r^2$.


A circle has an area of 25cm^2 .

Ethan thinks the radius of the circle is $\frac{5}{\sqrt{\pi}}$

Guy thinks the radius is $\frac{\sqrt{\pi}}{5}$

Who is correct? Write down a calculation to support your answer.

[2]

- 12 Put the following numbers in order. 

6.77

6.767

6.677

6.8

[1]

- 13 a) Write 45 as a product of prime factors.


Answer _____ [2]

- b) Write 105 as a product of prime factors.

Answer _____ [1]

- c) Use your answers to parts a) and b) to work out the highest common factor of 45 and 105.

Answer _____ [2]

- 14 Work out $5\frac{1}{6} - 2\frac{1}{3}$ 

Answer _____ [3]

- 15** $P = xy$
 x is increased by 10%.
 y is increased by 10%.

Work out the percentage increase in P .


Answer _____ [2]

- 16** Mandeep is looking for a new 12-month phone contract.


<p>Dave's Dongles</p> <p>£12 a month</p> <p>+</p> <p>5p a minute</p> <p>10% discount on first 6 months</p>

<p>Ian's Internet</p> <p>£10 a month</p> <p>+</p> <p>6p a minute</p> <p>15% discount on first 4 months</p>

On average Mandeep uses 120 minutes per month.

Which phone contract is cheaper for Mandeep? 
 You must show your working.

Answer _____ [5]

- 17** $97 \times 1452 = 140844$ 

a) Use this information to write down the value of 9.7×145.2

Answer _____ [1]

b) Use this information to write down the value of 0.97×1.452

Answer _____ [1]

Ratio and Proportion

1 If $\frac{2}{7}$ of the pupils in a class are girls, what is the ratio of boys to girls?

Answer _____ [1]

2 a) A coach uses 11 litres of fuel to travel 161.7km. How far can it travel on 13 litres of fuel?

Answer _____ [2]

b) A large sack of dog biscuits feeds three dogs for 15 days.

For how many days would the same sized sack feed five dogs at the same rate?

Answer _____ [2]

3 £700 is divided between Sarah, John and James in the ratio 1 : 3 : 4.

How much more money than Sarah does John receive?

Answer _____ [3]

4 Simplify 15 millilitres : 3 litres

Answer _____ [1]

5 The formula $d = kt^2$ represents what happens when an apple falls from a tree.

d = distance (that the apple falls)

t = time

k = constant of proportionality

If $d = 20$ when $t = 2$, work out the constant of proportionality.

Answer _____ [2]

Total Marks / 11

Variation and Compound Measures

1 Petra inherits £3000. She puts the money into a savings account that pays 2% compound interest each year.

a) How much interest will Petra earn in the first year?

Answer _____ [2]

b) How much interest will she have earned at the end of three years?

Answer _____ [3]

2 A greyhound runs 77.8 metres in eight seconds.

Write down the greyhound's average speed in:

a) Metres per second (to 3 decimal places).

Answer _____ [1]

b) Metres per hour (to 2 decimal places).

Answer _____ [2]

3 A silver ring weighing 2g has a density of 10.49g/cm^3 .

Work out the volume of silver in the ring.

Give your answer to an appropriate degree of accuracy.

Answer _____ [2]

Total Marks / 10

Practice Exam Paper 2

- 1 A survey was carried out to collect data about how often people visited the theatre. It was conducted by asking people who were leaving a theatre to answer a few questions. A section of the questionnaire is shown below.

(i) How old are you?

20 to 30 30 to 40 40 to 50 50 to 60 Over 60

(ii) How many times do you visit the theatre?

Not often Sometimes Many times

- (a) Explain why the data collected will be biased.

[1]

- (b) Write an improved version of each question.

(i) _____

[1]

(ii) _____

[1]

- 2 A train leaves Smithrington Station at 10.43 am. It travels 98 km to Bingham Station and the journey takes 1.75 hours.

Calculate:

- (a) The train's arrival time at Bingham Station.

Answer _____ [2]

- (b) The average speed of the train for the journey.

Answer _____ [2]

- 3 In Yishkon, Canada, the temperature outside a house is -15°C . Inside the house, the temperature is 18°C .

- (a) How much higher is the temperature inside the house than outside?

Answer _____ [2]

- (b) The formula to convert degrees Celsius (C) to degrees Fahrenheit (F) is:

$$F = \frac{9}{5} \times C + 32$$

Use the formula to calculate the temperature inside the house in degrees Fahrenheit.

Answer _____ [2]

Turn Over