

# 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 ( $A$ ) =  $\pi r^2$

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  $\pi$  represents the number pi.

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

## Trapeziums

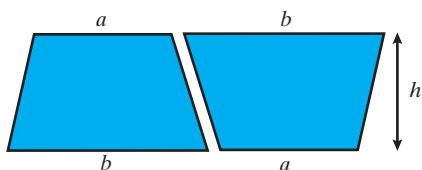
LEARN

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

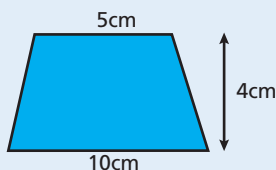
- This formula can be proved:



- 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.

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



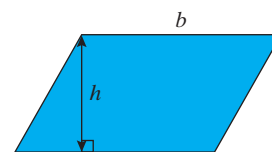
### Key Point

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

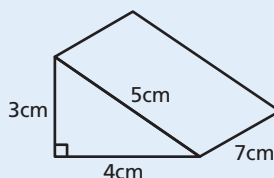
- A right prism is a 3D shape that has the same **cross-section** running all the way through it.

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 =  $2\pi r h + 2\pi r^2$

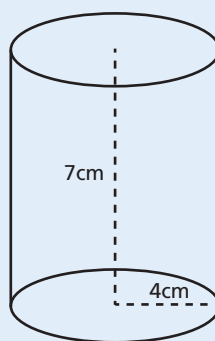
Work out the volume and the surface area of the cylinder. Give your answers in terms of  $\pi$ .

### Volume

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

### Surface Area

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

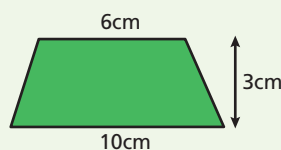


### Key Point

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

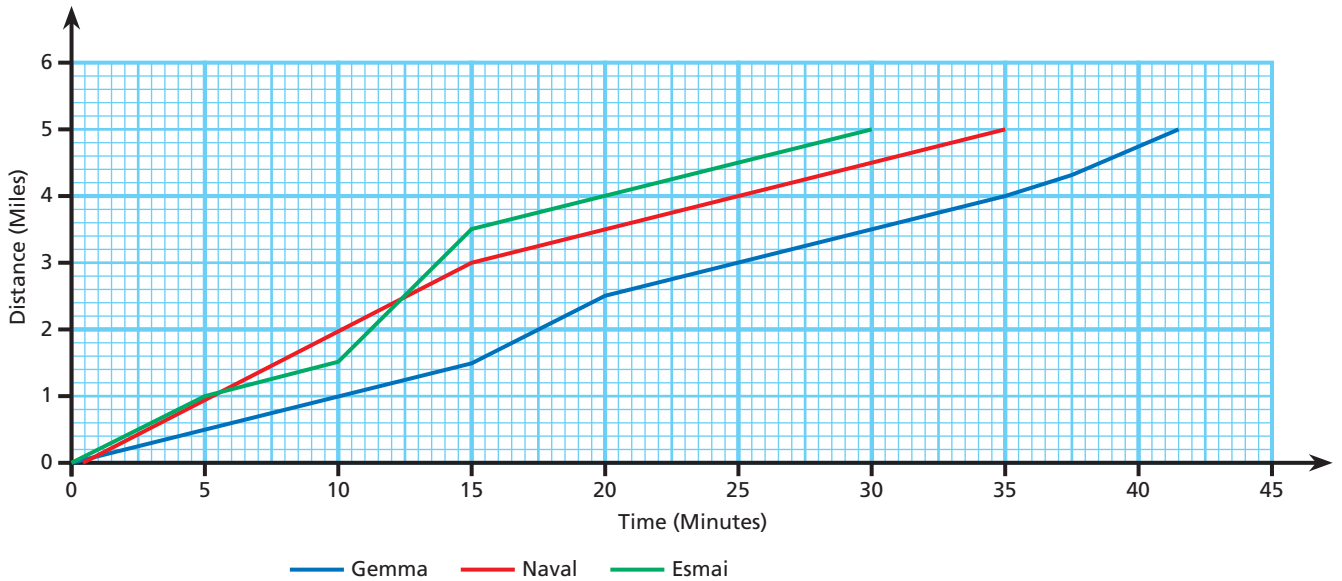
## Uses of Graphs & Other Graphs

- 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]

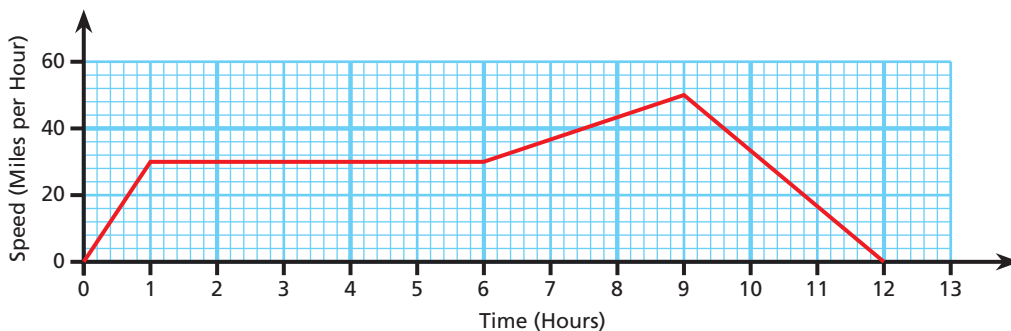
- b) What speed was Naval travelling at for the last 20 minutes before he finished?  
Give your answer in miles per hour. [2]

- 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]

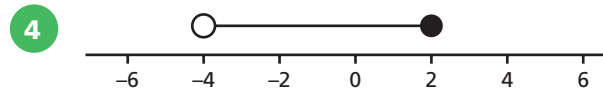
- 3 The graph below shows the journey of a train. Work out the total distance travelled. [3]



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]

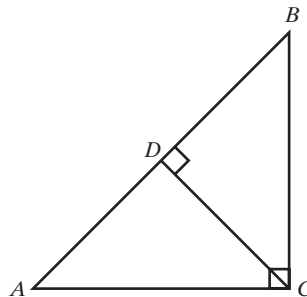


Write down the inequality represented by the number line. [2]

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 ...

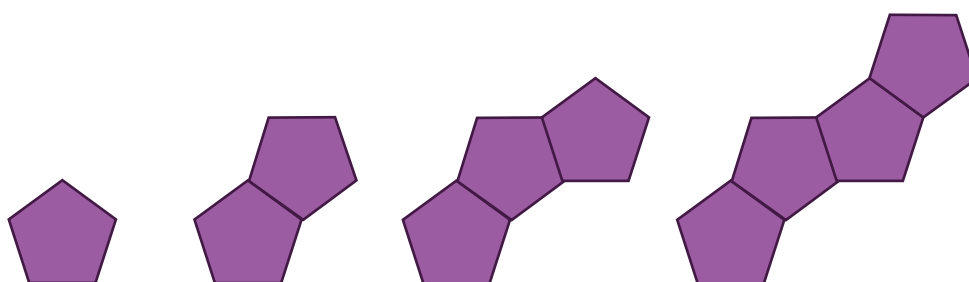
1, 5, 9, 13, 17 ...

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]

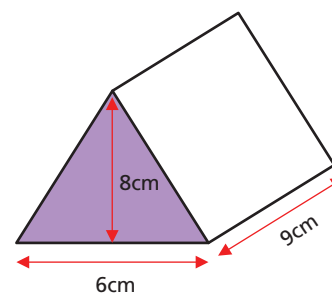
Total Marks ..... / 10

## 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.

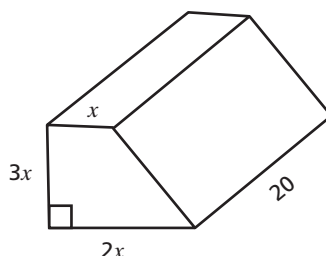
Work out the radius of this circle.

[2]

3 The volume of the trapezoid is  $900\text{cm}^3$ .

All measurements are in centimetres.

Work out the value of  $x$ .



[4]

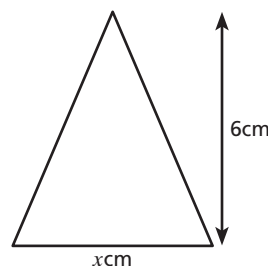
4 The surface area of a sphere is  $75\text{cm}^2$ . Work out the length of the radius.

[3]

5 Here is a triangle.

The area of the triangle is  $7.5\text{cm}^2$ .

Work out the value of  $x$ .

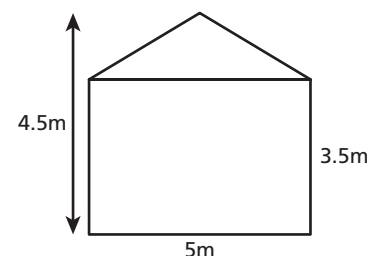


[3]

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  $11\text{m}^2$ , 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  $25\text{cm}^2$ .

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.

Answer \_\_\_\_\_ [2]

- 12 Circle the largest number.

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><b>Dave's Dongles</b></p> <p>£12 a month</p> <p>+</p> <p>5p a minute</p> <p>10% discount on first 6 months</p>
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<p><b>Ian's Internet</b></p> <p>£10 a month</p> <p>+</p> <p>6p a minute</p> <p>15% discount on first 4 months</p>
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On average Mandeep uses 120 minutes per month.

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

Answer \_\_\_\_\_ [5]

- 17** a) Circle the calculation that is equivalent to  $97 \times 1452$  

$9.7 \times 14520$        $9.7 \times 145.2$        $970 \times 14520$        $0.97 \times 145.2$       [1]

- b)  $97 \times 1452 = 140844$  

Use this information to write down the value of  $9.7 \times 145.2$

Answer \_\_\_\_\_ [1]