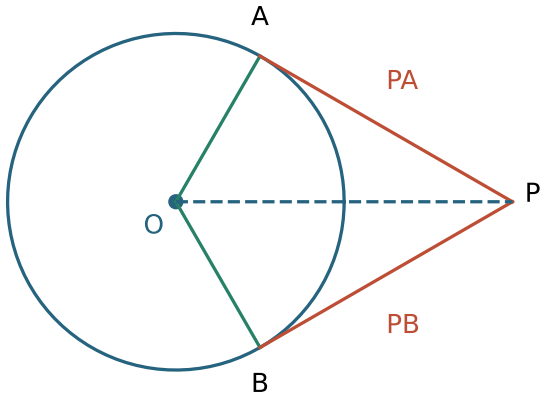
Exercise walk-through

# 4.2 Perimeter, area and volume, including circles (G14–G17, G19)

AQA · GCSE · Mathematics

# Figure: Congruence, similarity and circles (4)

Shared OP and equal radii → RHS → PA = PB




- Equal radii, shared OP and right angles give congruent triangles (RHS), so PA = PB
- Match each part of the diagram to the text.

# Perimeter, area and volume

- Triangle: $\frac{1}{2} \times b \times h$, where $h$ is the **perpendicular height** .
- Parallelogram: $b \times h$.
- Trapezium: $\frac{1}{2}(a+b)h$, where $a$ and $b$ are the parallel sides.
- Circle: $A = \pi r^2$, and the **circumference** is $C = 2\pi r = \pi d$.

$$\text{arc length} = \frac{\theta}{360} \times 2\pi r \qquad \text{sector area} = \frac{\theta}{360} \times \pi r^2$$

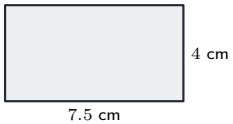
# Pythagoras and trigonometry

- **Pythagoras' theorem.** In a right-angled triangle, $a^2 + b^2 = c^2$, where $c$ is the **hypotenuse**, the longest side, opposite the right angle.
- A ladder whose foot is 3 m from a wall and whose top is 4 m up the wall is $\sqrt{9+16} = 5$ m long.
- **Trigonometric ratios.** Label the sides from the angle $\theta$: opposite, **adjacent** (next to the angle) and **hypotenuse**.
- **Worked example 12.** In a right-angled triangle the hypotenuse is 23.7 cm and $x$ is the side **adjacent** to an angle of $52°$.

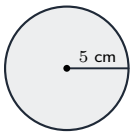
$$\sin\theta = \frac{\text{opp}}{\text{hyp}} \qquad \cos\theta = \frac{\text{adj}}{\text{hyp}} \qquad \tan\theta = \frac{\text{opp}}{\text{adj}}$$

# Exercises 2.1·2.2

**2.1** Work out the perimeter and the area of the rectangle. [2]

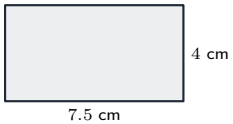



**2.2** A circle has a radius of 5 cm. Work out its circumference and its area. Give your answers to 1 decimal place. [2]



# Exercises 2.1·2.2

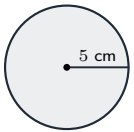
**2.1** Work out the perimeter and the area of the rectangle. [2]




**2.1**

- perimeter **23** cm
- area **30** $\text{cm}^2$

**2.2** A circle has a radius of 5 cm. Work out its circumference and its area. Give your answers to 1 decimal place. [2]

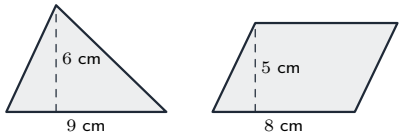



**2.2**

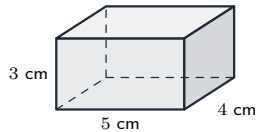
- $C = 10\pi = \mathbf{31.4}$ cm
- $A = 25\pi = \mathbf{78.5}$ $\text{cm}^2$

# Exercises 2.3·2.4

**2.3** Work out the area of the triangle and the area of the parallelogram. [2]

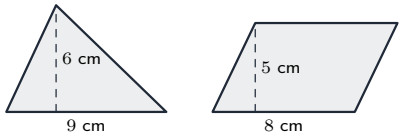



**2.4** Work out the volume and the surface area of the cuboid. [2]



# Exercises 2.3·2.4

**2.3** Work out the area of the triangle and the area of the parallelogram. [2]

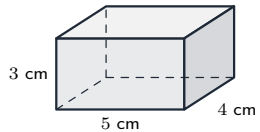



**2.3**

- triangle $\frac{1}{2} \times 9 \times 6 = \mathbf{27}$ cm$^2$
- parallelogram $8 \times 5 = \mathbf{40}$ cm$^2$

---

**2.4** Work out the volume and the surface area of the cuboid. [2]

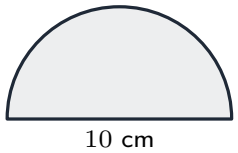



**2.4**

- $V = \mathbf{60}$ cm$^3$
- $2(20 + 15 + 12) = \mathbf{94}$ cm$^2$

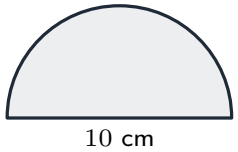
# Exercise 3.1

**3.1** The shape is a semicircle with a diameter of 10 cm. Work out its perimeter and its area. Give your answers to 1 decimal place. [3]



# Exercise 3.1

**3.1** The shape is a semicircle with a diameter of 10 cm. Work out its perimeter and its area. Give your answers to 1 decimal place. [3]




**3.1**

- arc $\frac{1}{2} \times 10\pi = 15.7$
- perimeter $15.7 + 10 = \mathbf{25.7}$ cm
- area $\frac{1}{2} \times \pi \times 5^2 = \mathbf{39.3}$ cm$^2$

# Exercise 3.2 (a)

**3.2** A garden is a rectangle 12 m by 8 m. It has a round pond with a radius of 1.5 m. The rest of the garden is lawn.

(a) Work out the area of the lawn. [2]

# Exercise 3.2 (a)

**3.2** A garden is a rectangle 12 m by 8 m. It has a round pond with a radius of 1.5 m. The rest of the garden is lawn.

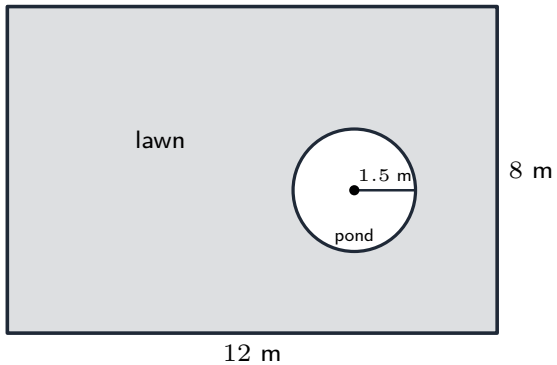
(a) Work out the area of the lawn. [2]

(a) $96 - \pi \times 1.5^2 = \mathbf{88.9}$ m$^2$

# Exercise 3.2 (b)

**3.2** A garden is a rectangle 12 m by 8 m. It has a round pond with a radius of 1.5 m. The rest of the garden is lawn.

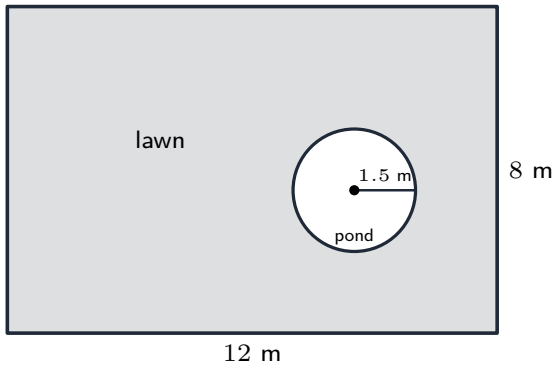
(b) One box of grass seed covers 20 $m^2$ and costs £4.50. Work out the cost of the seed for the lawn. [3]



# Exercise 3.2 (b)

**3.2** A garden is a rectangle 12 m by 8 m. It has a round pond with a radius of 1.5 m. The rest of the garden is lawn.

(b) One box of grass seed covers 20 $m^2$ and costs £4.50. Work out the cost of the seed for the lawn. [3]




(b) $88.9 \div 20 = 4.45$; **5** boxes; £**22.50**

# Exercise 3.2 (c)

**3.2** A garden is a rectangle 12 m by 8 m. It has a round pond with a radius of 1.5 m. The rest of the garden is lawn.

(c) A fence goes all round the edge of the garden and all round the pond. Fencing is sold in 2 m panels at £18 each. Work out the cost of the fencing. [4]

# Exercise 3.2 (c)

**3.2** A garden is a rectangle 12 m by 8 m. It has a round pond with a radius of 1.5 m. The rest of the garden is lawn.

(c) A fence goes all round the edge of the garden and all round the pond. Fencing is sold in 2 m panels at £18 each. Work out the cost of the fencing. [4]

(c) $40 + 2\pi \times 1.5 = 49.4$ m; $49.4 \div 2 = 24.7$, so 25 panels; £**450**

# Exercise 3.2 (d)

**3.2** A garden is a rectangle 12 m by 8 m. It has a round pond with a radius of 1.5 m. The rest of the garden is lawn.

(d) The pond is a cylinder 0.6 m deep. A hose fills it at 12 litres per minute. How long does it take to fill the pond? Give your answer in hours and minutes. [5]

# Exercise 3.2 (d)

**3.2** A garden is a rectangle 12 m by 8 m. It has a round pond with a radius of 1.5 m. The rest of the garden is lawn.

(d) The pond is a cylinder 0.6 m deep. A hose fills it at 12 litres per minute. How long does it take to fill the pond? Give your answer in hours and minutes. [5]

(d) $\pi \times 1.5^2 \times 0.6 = 4.24$ m$^3$; 4241 litres; $4241 \div 12 = 353$ minutes $= 5$ **hours** 53 **minutes**