Total marks — 40

Attempt ALL questions

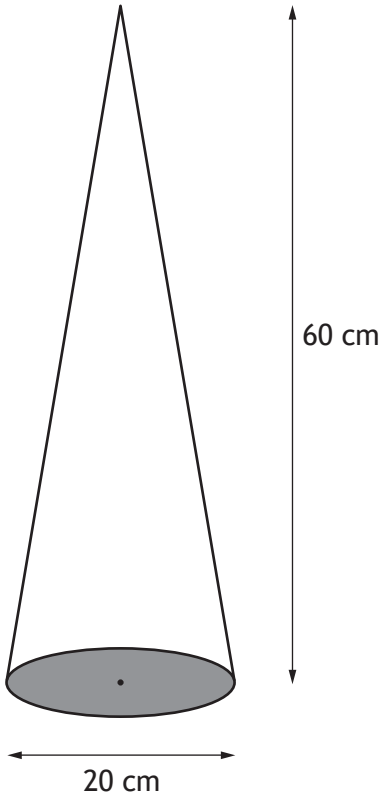
1. Evaluate

$$\frac{2}{3}\left(\frac{1}{5}+\frac{3}{4}\right).$$

Give your answer in its simplest form. **2**

2. Given that $f(x)=x^3-2$, evaluate $f(-3)$. **2**

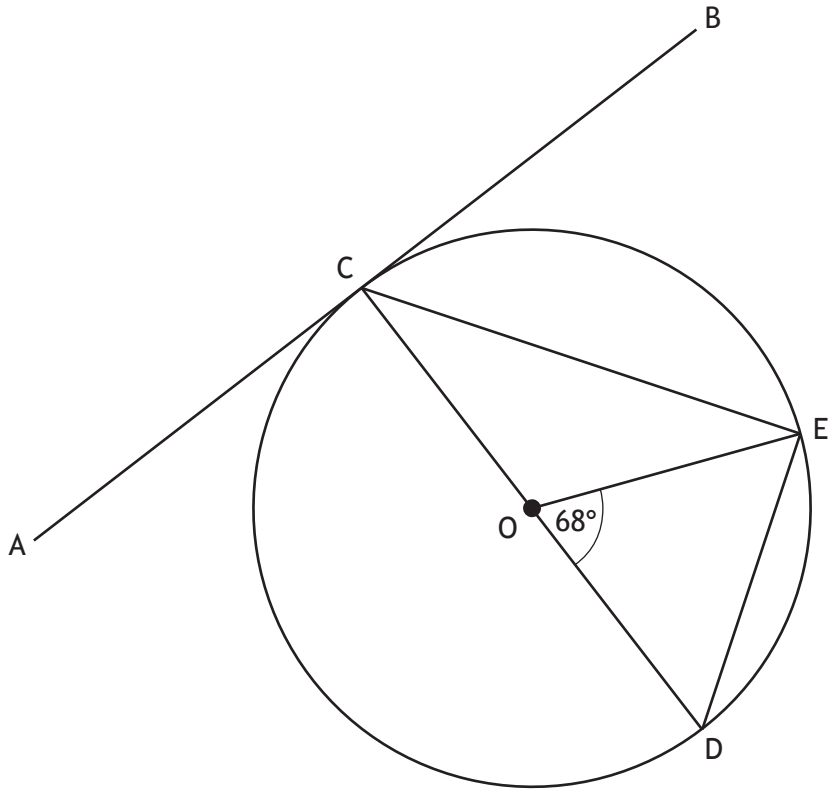
3. The diagram below shows a cone with diameter 20 centimetres and height 60 centimetres.



Calculate the volume of the cone. **2**

Take $\pi = 3.14$.

4. The diagram below shows a circle with centre O.



AB is a tangent to the circle at the point C.

CD is a diameter of the circle.

Angle EOD is 68°.

Calculate the size of angle ACE. **3**

Angle ACE =

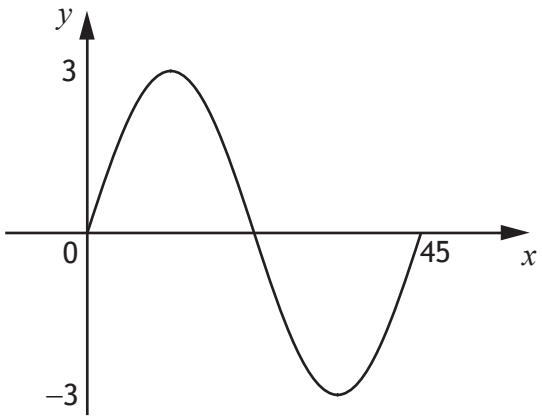
5. (a) Express $x^2 + 8x + 15$ in the form $(x + a)^2 + b$. **2**

(b) Hence, or otherwise, state the coordinates of the turning point of the graph of $f(x) = x^2 + 8x + 15$. **1**

6. Find the equation of the line passing through the points $(-3,-1)$ and $(-5,7)$.
Give the equation in its simplest form. **3**

7. Change the subject of the formula $D = \frac{B+4}{C^2}$ to B. **2**

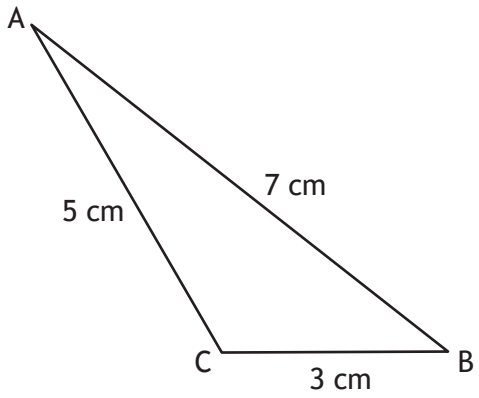
8. Part of the graph of $y = a\sin bx^\circ$ is shown in the diagram.



(a) State the value of a. **1**

(b) State the value of b. **1**

9. The diagram shows triangle ABC.



- AB = 7 centimetres
- BC = 3 centimetres
- AC = 5 centimetres

Calculate the value of cos B.

Give your answer in its simplest form. **2**

10. Tommy buys flower seeds from a website.

Tommy is given a 30% discount. He pays £16.10 for the seeds.

Calculate the cost of the flower seeds without the discount. **3**

11. Simplify $\left(m^{-2}\right)^4 \times m^{-5}$.

Give your answer with a **positive** power. **3**

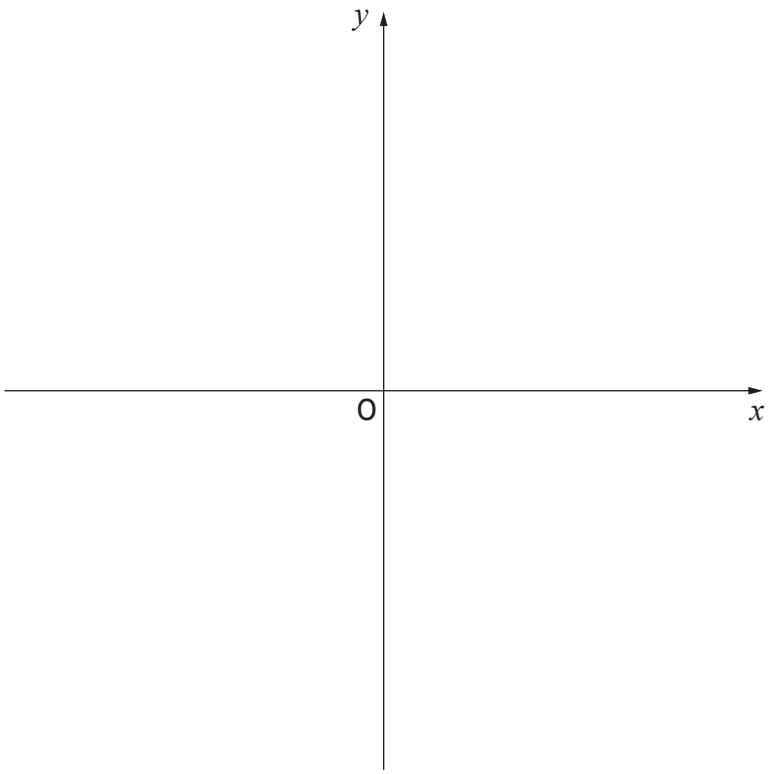
12. Express $\frac{4}{x+2} \div \frac{5}{(x+2)^2}$, $x \neq -2$ as a single fraction in its simplest form. **2**

13. Expand and simplify $\sqrt{10}\left(\sqrt{10}-\sqrt{2}\right)+8\sqrt{5}$. **3**

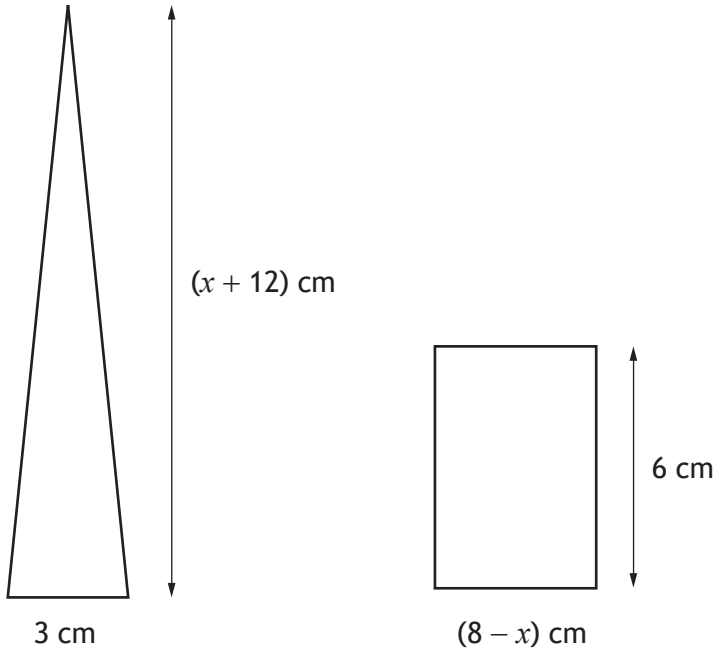
14. Sketch the graph of $y = (x+1)(x-3)$ using the axes provided below.

On your sketch, show clearly the points of intersection with the x-axis and the y-axis, and the coordinates of the turning point. **3**

(Additional axes, if required, can be found on *page 14*.)



15. A triangle and rectangle are shown in the diagram.



(a) Find an expression for the area of the triangle. **1**

15. (continued)

(b) Given that the area of the triangle is equal to the area of the rectangle, find algebraically the value of x. **4**

[END OF QUESTION PAPER]

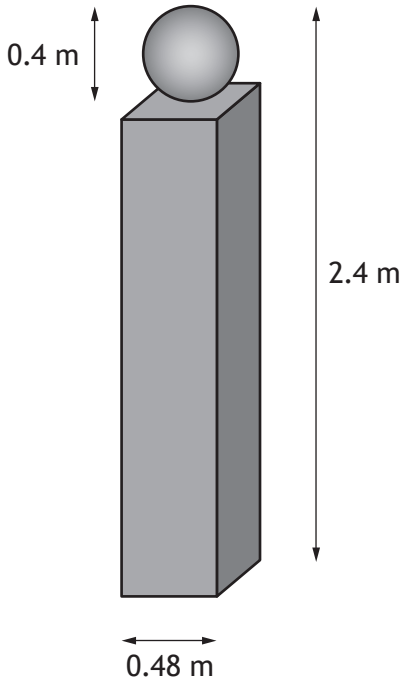
Total marks — 50

Attempt ALL questions

1. Expand and simplify $(3x-2)(2x^2+5x-1)$. **3**

2. A company's annual profit at the end of 2021 was £215,000.
The profit is expected to increase by 3% each year.
Calculate the company's expected annual profit by the end of 2025.
Give your answer correct to the nearest thousand pounds. **3**

3. A concrete gatepost is made in the shape of a cuboid with a sphere on top.



The sphere has diameter 0.4 metres.

The cuboid has a square base of length 0.48 metres.

The total height of the gatepost is 2.4 metres.

Calculate the volume of concrete needed to make a gatepost. **3**

4. Moira buys 4 mangoes and 3 apples at a fruit shop.
The total cost is £4.25.

(a) Write down an equation to illustrate this information. **1**

Sami buys 5 mangoes and 2 apples in the same fruit shop.
The total cost is £4.70.

(b) Write down an equation to illustrate this information. **1**

(c) Calculate, algebraically, the cost of a mango and the cost of an apple. **4**

5. A school netball team recorded the number of sit-ups each player completed in a minute.

The numbers for the seven players were:

29 27 24 31 22 19 30

(a) Calculate the mean and standard deviation of the numbers of sit-ups. **4**

5. (continued)

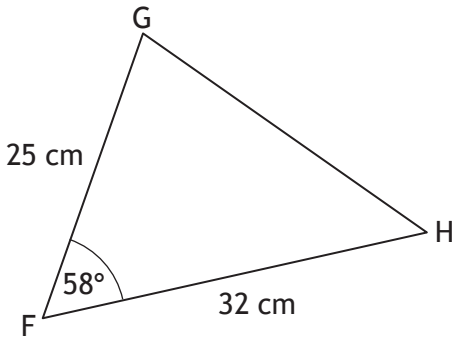
Some players in the school's hockey team also recorded the number of sit-ups they completed in a minute.

Their numbers gave a mean of 29 and a standard deviation of 3.2.

(b) Make two valid comments comparing the numbers of sit-ups of the players in the netball team and the hockey team. **2**

6. The diagram shows triangle FGH.

- FG = 25 centimetres
- FH = 32 centimetres
- Angle GFH = 58°

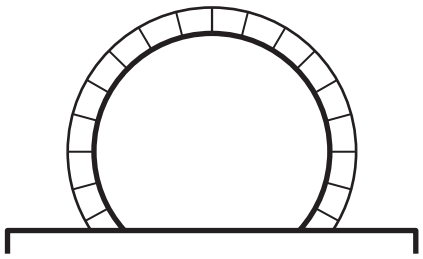


Calculate the area of triangle FGH. **2**

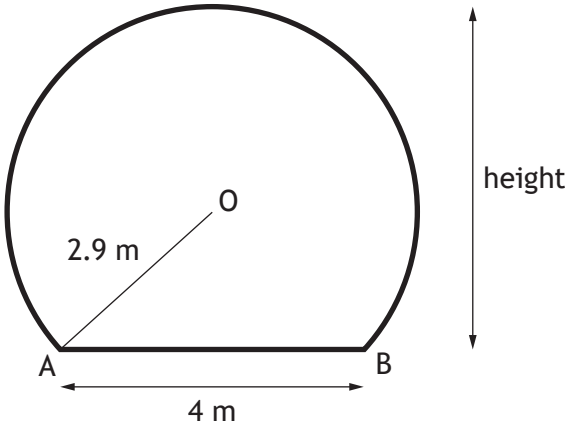
7. Solve the equation $4x^2 + 2x - 7 = 0$.

Give your answers correct to 2 significant figures. **4**

8. A train tunnel has a circular cross-section with a horizontal floor.



A diagram of the cross-section is shown below.



- The centre of the circle is O.
- Chord AB is 4 metres.
- The radius OA is 2.9 metres.

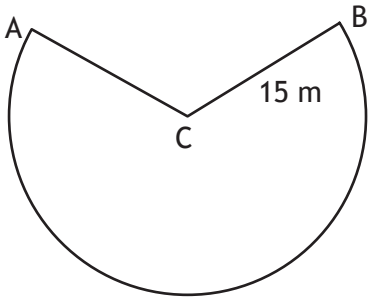
Calculate the height of the tunnel. **4**

MARKS | DO NOT WRITE IN THIS MARGIN

9. Solve the equation $3\sin x^\circ + 4 = 6$, for $0 \leq x \leq 360$. **3**

10. An attraction at a theme park has a carriage attached to an arm.

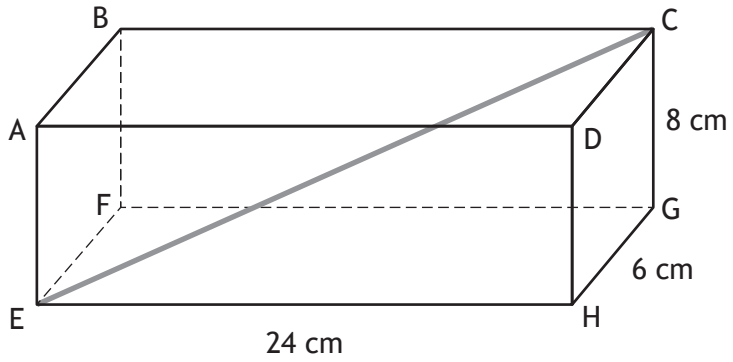
The arm swings from A to B along the arc of a circle, centre C, as shown in the diagram below.



- The length of the arm, CB, is 15 metres.
- The length of the major arc, AB, is 69.4 metres.

Calculate the size of the reflex angle ACB. **3**

11. The diagram shows a cuboid, ABCDEFGH.



- The length of the cuboid, EH, is 24 centimetres.
- The breadth of the cuboid, HG, is 6 centimetres.
- The height of the cuboid, CG, is 8 centimetres.

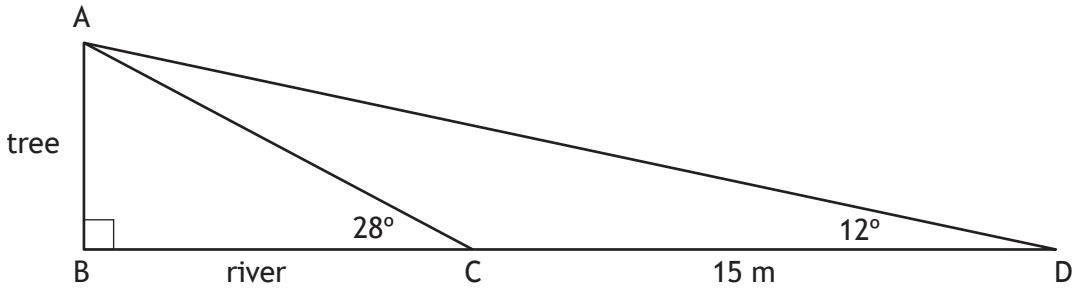
Calculate the length of EC, the space diagonal of the cuboid. **3**

12. Simplify $\frac{2ab+6a}{b^2-9}$. **3**

13. Simplify $\frac{\sin x^\circ + 2\cos x^\circ}{\cos x^\circ}$. **2**

14. The width of a river is represented by BC in the diagram below.

AB represents a tree on the river bank.



- From C, the angle of elevation to A is 28°.
- From D, the angle of elevation to A is 12°.
- The distance from C to D is 15 metres.
- BCD is a straight line.

Calculate BC, the width of the river. **5**

[END OF QUESTION PAPER]