MARKS | DO NOT WRITE IN THIS MARGIN

1. Evaluate

$$2\frac{3}{8} \div \frac{5}{16}.$$

2

2. Multiply out the brackets and collect like terms

$$(2x+3)(x^2-4x+1).$$

3

3. Two forces acting on a rocket are represented by vectors $\mathbf{u}$ and $\mathbf{v}$.

$$\mathbf{u} = \begin{pmatrix} 2 \\ -5 \\ -3 \end{pmatrix} \text{ and } \mathbf{v} = \begin{pmatrix} 7 \\ 4 \\ -1 \end{pmatrix}.$$

Calculate $|\mathbf{u} + \mathbf{v}|$, the magnitude of the resultant force.
Express your answer as a surd in its simplest form.

3

MARKS | DO NOT WRITE IN THIS MARGIN

4. Solve the equation

$$2x^2 + 7x - 15 = 0.$$

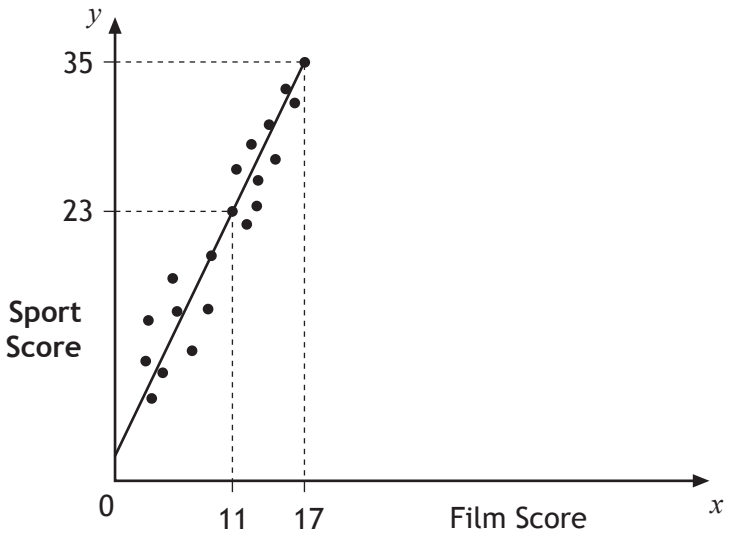
3

5. Express $\frac{4}{\sqrt{6}}$ with a rational denominator in its simplest form. **2**

MARKS | DO NOT WRITE IN THIS MARGIN

6. Teams in a quiz answer questions on film and sport.

This scattergraph shows the scores of some of the teams.



A line of best fit is drawn as shown.

(a) Find the equation of this straight line. **3**

(b) Use this equation to estimate the sports score for a team with a film score of 8. **1**

Total marks 4

MARKS | DO NOT WRITE IN THIS MARGIN

7. (a) Multiply out the brackets and simplify:

$$x^{\frac{1}{2}}\left(x^{-\frac{3}{2}}+x^{-\frac{1}{2}}\right).$$

2

(b) Find the exact value of this expression when $x = 6$. **1**

Total marks 3

8. Change the subject of the formula $p = \frac{mv^2}{2}$ to v. **3**

MARKS | DO NOT WRITE IN THIS MARGIN

9. A parabola has equation $y = x^2 - 8x + 19$.

(a) Write the equation in the form $y = (x - p)^2 + q$. **2**

(b) Sketch the graph of $y = x^2 - 8x + 19$, showing the coordinates of the turning point and the point of intersection with the y-axis. **3**

Total marks 5

MARKS | DO NOT WRITE IN THIS MARGIN

10. Brian and Bob visit a ski resort. Brian buys 3 full passes and 4 restricted passes. The total cost of his passes is £185.

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

(b) Bob buys 2 full passes and 3 restricted passes.
The total cost of his passes is £130.
Write down an equation to illustrate this information. **1**

(c) Find the cost of a restricted pass and the cost of a full pass. **3**

Total marks 5

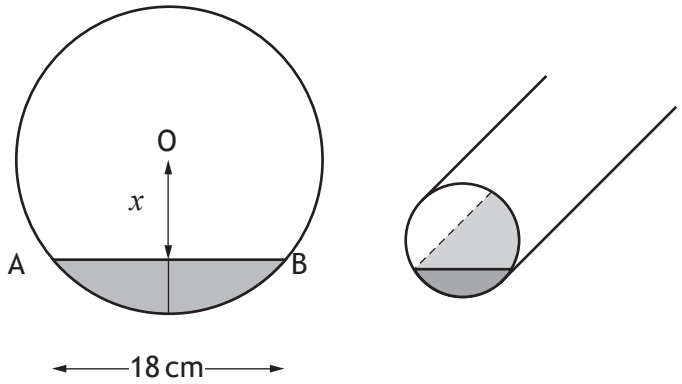
11. Express

$$\frac{4}{x+2} - \frac{3}{x-4}, \qquad x \neq -2,\ x \neq 4$$

as a single fraction in its simplest form. **3**

MARKS DO NOT WRITE IN THIS MARGIN

12. A cylindrical pipe has water in it as shown.



The depth of the water at the deepest point is 5 centimetres.

The width of the water surface, AB, is 18 centimetres.

The radius of the pipe is r centimetres.

The distance from the centre, O, of the pipe to the water surface is x centimetres.

(a) Write down an expression for x in terms of r. **1**

(b) Calculate r, the radius of the pipe. **3**

Total Marks 4

[END OF SPECIMEN QUESTION PAPER]

MARKS | DO NOT WRITE IN THIS MARGIN

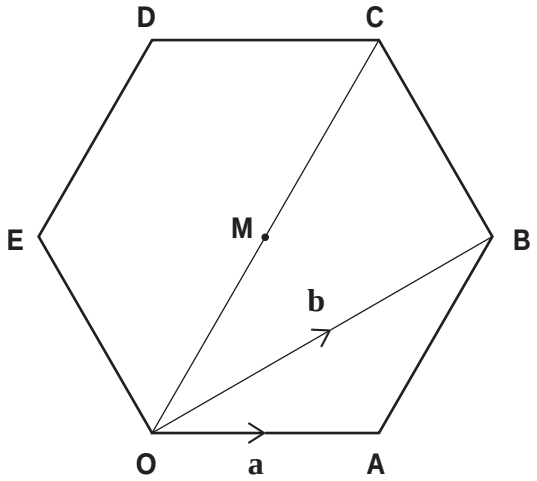
1. Beth normally cycles a total distance of 56 miles per week.
She increases her distance by 15% each week for the next three weeks.
How many miles will she cycle in the third week? **3**

2. There are 3×10^5 platelets per millilitre of blood.
On average, a person has 5·5 litres of blood.
On average, how many platelets does a person have in their blood?
Give your answer in scientific notation. **2**

MARKS | DO NOT WRITE IN THIS MARGIN

3. In the diagram, OABCDE is a regular hexagon with centre M.

Vectors **a** and **b** are represented by $\overrightarrow{OA}$ and $\overrightarrow{OB}$ respectively.

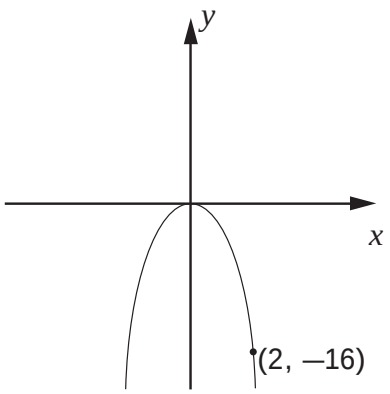


(a) Express $\overrightarrow{AB}$ in terms of **a** and **b**. **1**

(b) Express $\overrightarrow{OC}$ in terms of **a** and **b**. **1**

Total marks 2

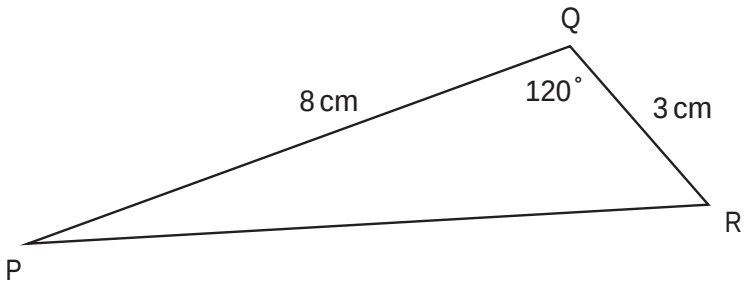
4. The graph with equation $y = kx^2$ is shown below.



The point (2, –16) lies on the graph.

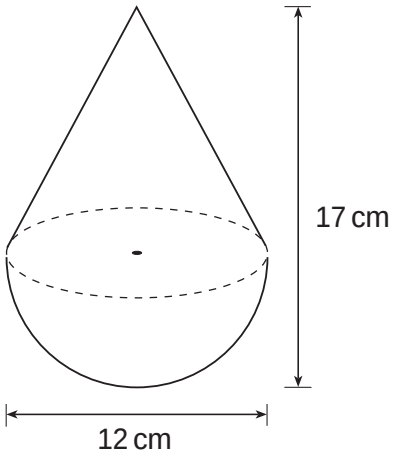
Determine the value of k. **2**

5. In triangle PQR, PQ = 8 centimetres, QR = 3 centimetres and angle PQR = 120°.



Calculate the length of PR. **3**

6. A child's toy is in the shape of a hemisphere with a cone on top, as shown in the diagram.



The toy is 12 centimetres wide and 17 centimetres high.

Calculate the volume of the toy.

Give your answer correct to 2 significant figures. **5**

7. This year Adèle paid £465 for her car insurance.

This is an increase of 20% on last year's payment.

How much did Adèle pay last year? **3**

8. A frozen food company uses machines to pack sprouts into bags.

A sample of six bags is taken from Machine A and the number of sprouts in each bag is counted.

The results are shown below.

23 19 21 20 19 24

(a) Calculate the mean and standard deviation of this sample. **3**

(b) Another sample of six bags is taken from Machine B.

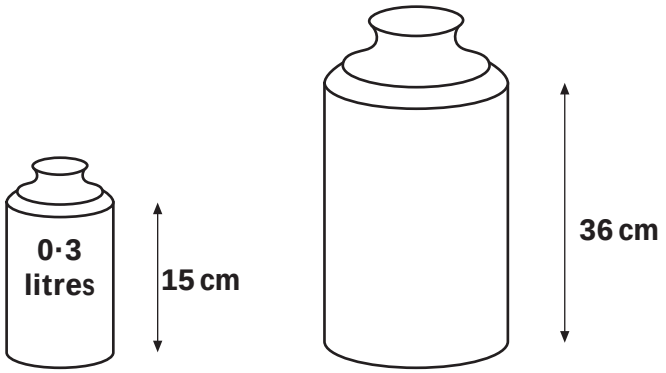
This sample has a mean of 19 and a standard deviation of 2·3.

Write down two valid comparisons between the samples. **2**

Total marks 5

MARKS | DO NOT WRITE IN THIS MARGIN

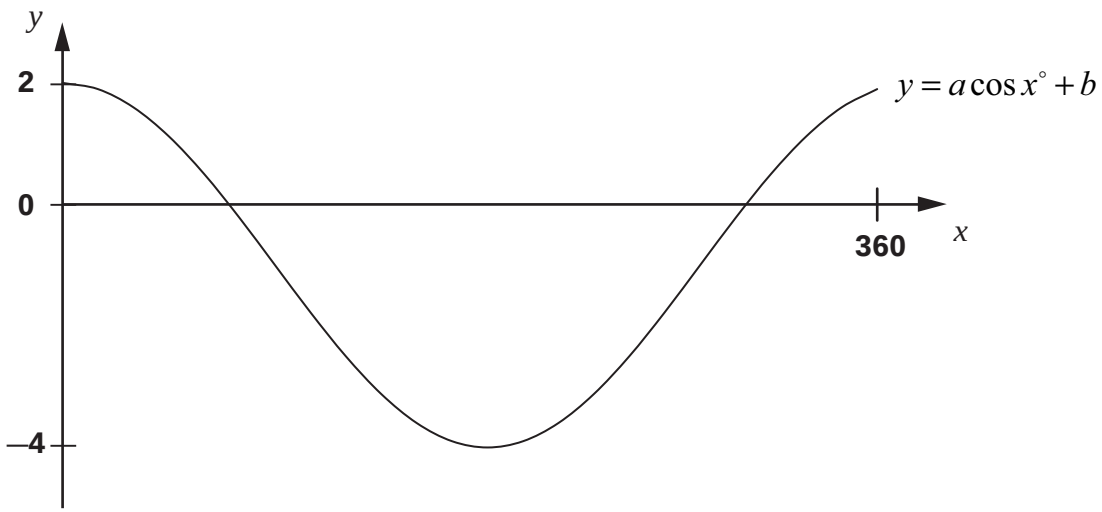
9. Screenwash is available in two different sized bottles, 'Mini' and 'Maxi'. The bottles are mathematically similar.



Calculate the volume of the 'Maxi' bottle. **3**

MARKS | DO NOT WRITE IN THIS MARGIN

10. Part of the graph of $y = a\cos x^\circ + b$ is shown below.



(a) Explain how you can tell from the graph that $a = 3$ and $b = -1$. **2**

(b) Calculate the x-coordinates of the points where the graph cuts the x-axis. **4**

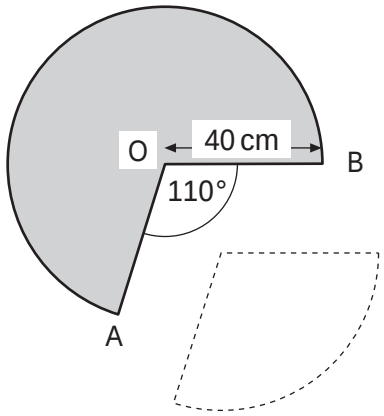
Total marks 6

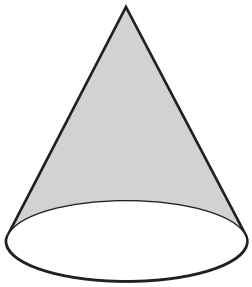
MARKS | DO NOT WRITE IN THIS MARGIN

11. A cone is formed from a paper circle with a sector removed as shown.

The radius of the paper circle is 40 centimetres.

Angle AOB is 110°.





(a) Calculate the area of the sector removed from the circle. **3**

(b) Calculate the circumference of the base of the cone. **3**

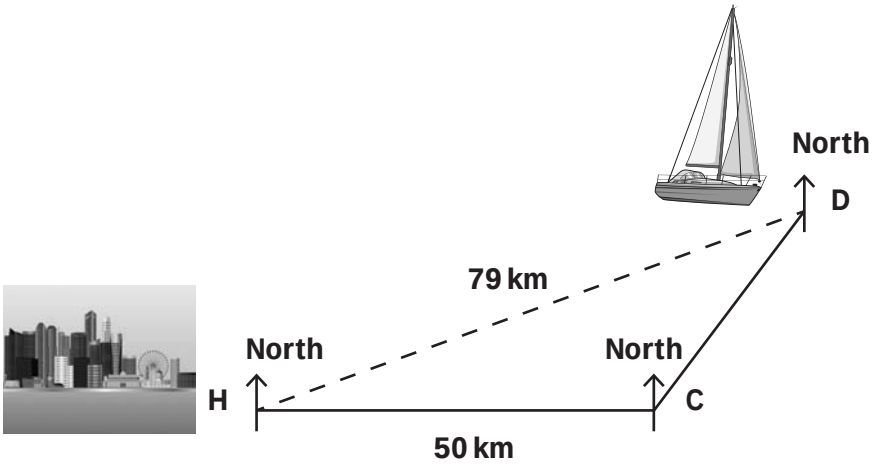
Total marks 6

MARKS | DO NOT WRITE IN THIS MARGIN

12. Find the range of values of p such that the equation $px^2 - 2x + 3 = 0,\ p \neq 0,$ has no real roots. **4**

MARKS | DO NOT WRITE IN THIS MARGIN

13. A yacht sails from a harbour H to a point C, then to a point D as shown below.



C is 50 kilometres due east of H.

D is on a bearing of 040° from C and is 79 kilometres from H.

(a) Calculate the size of angle CDH. **4**

(b) Hence, calculate the bearing on which the yacht must sail to return directly to the harbour. **2**

Total Marks 6

[END OF SPECIMEN QUESTION PAPER]