

2500/406

NATIONAL
QUALIFICATIONS
2011

WEDNESDAY, 4 MAY
2.45 PM – 4.05 PM

MATHEMATICS
STANDARD GRADE
Credit Level
Paper 2

- 1 **You may use a calculator.**
- 2 Answer as many questions as you can.
- 3 Full credit will be given only where the solution contains appropriate working.
- 4 Square-ruled paper is provided. If you make use of this, you should write your name on it clearly and put it inside your answer booklet.



FORMULAE LIST

The roots of $ax^2 + bx + c = 0$ are $x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

Sine rule: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine rule: $a^2 = b^2 + c^2 - 2bc \cos A$ or $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$

Area of a triangle: Area = $\frac{1}{2}ab \sin C$

Standard deviation: $s = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}} = \sqrt{\frac{\sum x^2 - (\sum x)^2 / n}{n-1}}$, where n is the sample size.

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1. Olga normally runs a total distance of 28 miles per week.
 She decides to increase her distance by 10% a week for the next four weeks.
 How many miles will she run in the fourth week?

2. Expand and simplify

$$(3x + 1)(x^2 - 5x + 4).$$

3. Solve the equation

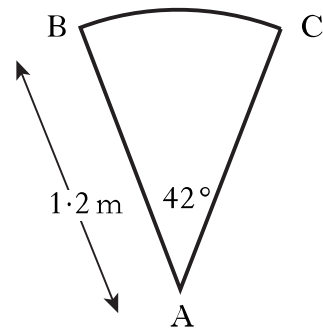
$$2x^2 + 3x - 7 = 0.$$

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

4. A car is valued at £3780.
 This is 16% less than last year's value.
 What was the value of the car last year?

[Turn over

5. A spiral staircase is being designed.



Each step is made from a sector of a circle as shown.

The radius is 1.2 metres.

Angle BAC is 42° .

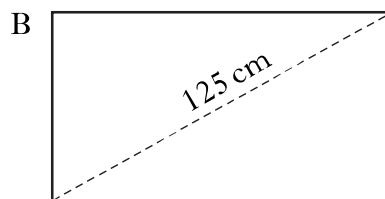
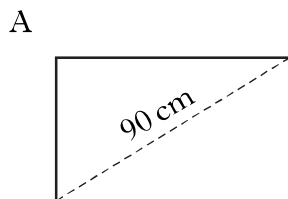
For the staircase to pass safety regulations, the arc BC must be at least 0.9 metres.

Will the staircase pass safety regulations?

4

6. Two rectangular solar panels, A and B, are mathematically similar.

Panel A has a diagonal of 90 centimetres and an area of 4020 square centimetres.



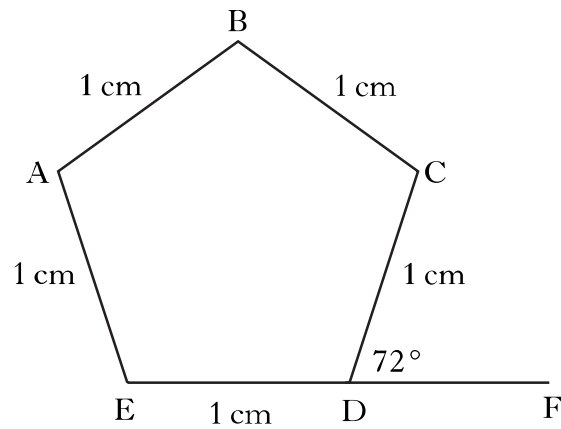
A salesman claims that panel B, with a diagonal of 125 centimetres, will be double the area of panel A.

Is this claim justified?

Show all your working.

4

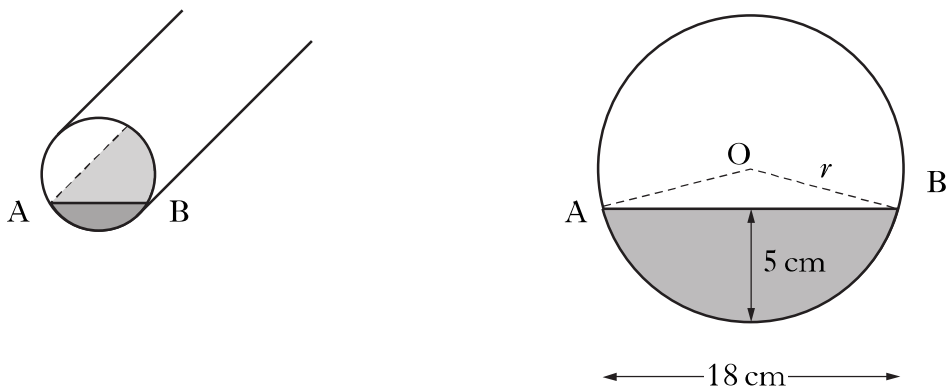
7. ABCDE is a regular pentagon with each side 1 centimetre.
 Angle CDF is 72° .
 EDF is a straight line.



- (a) Write down the size of angle ABC.
 (b) Calculate the length of AC.

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8. A pipe has water in it as shown.

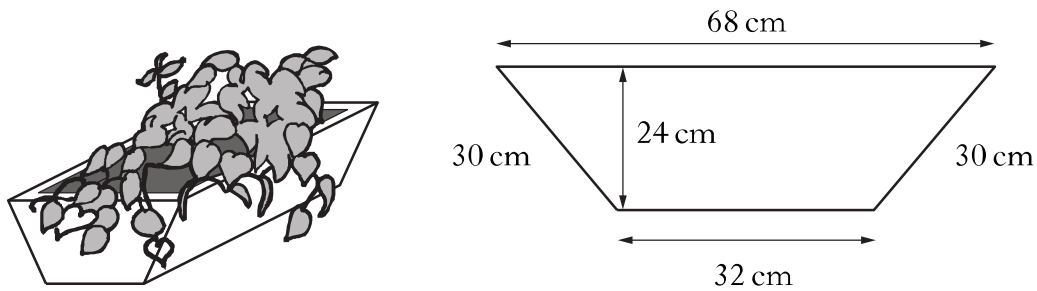


The depth of the water is 5 centimetres.
 The width of the water surface, AB, is 18 centimetres.
 Calculate r , the radius of the pipe.

3

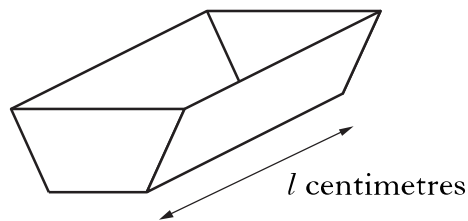
[Turn over

9. A flower planter is in the shape of a prism.
The cross-section is a trapezium with dimensions as shown.



- (a) Calculate the area of the cross-section of the planter.
(b) The volume of the planter is 156 litres.

2



Calculate the length, l centimetres, of the planter.

3

10. Tom and Samia are paid the same hourly rate.

Harry is paid $\frac{1}{3}$ more per hour than Tom.

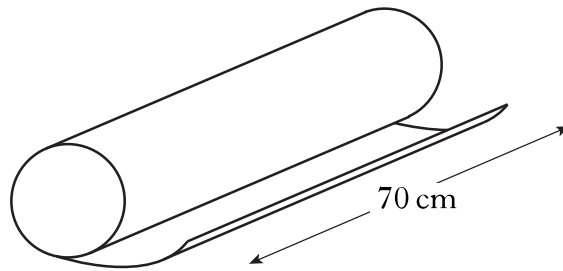
Tom worked 15 hours, Samia worked 8 hours and Harry worked 12 hours.

They were paid a total of £429.

How much was Tom paid?

3

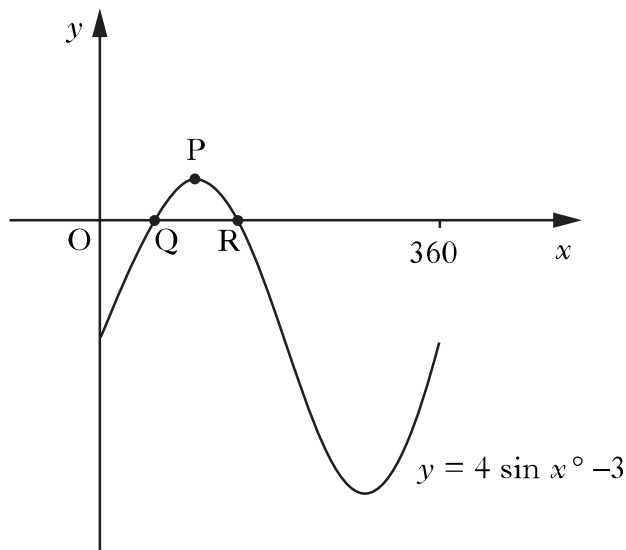
11. Paper is wrapped round a cardboard cylinder **exactly** 3 times.
The cylinder is 70 centimetres long.



The area of the paper is 3000 square centimetres.
Calculate the diameter of the cylinder.

4

12. Part of the graph of $y = 4 \sin x^\circ - 3$ is shown below.



The graph cuts the x -axis at Q and R.
P is the maximum turning point.

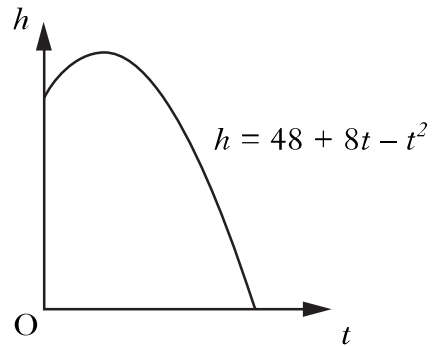
- (a) Write down the coordinates of P.
(b) Calculate the x -coordinates of Q and R.

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[Turn over for Question 13 on *Page eight*

13. The diagram shows the path of a flare after it is fired.
 The height, h metres above sea level, of the flare is given by
 $h = 48 + 8t - t^2$ where t is the number of seconds after firing.



Calculate, **algebraically**, the time taken for the flare to enter the sea.

4

[END OF QUESTION PAPER]