

# 2500/31/01

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NATIONAL  
QUALIFICATIONS  
2012

WEDNESDAY, 2 MAY  
1.30 PM – 2.25 PM

MATHEMATICS  
STANDARD GRADE  
Credit Level  
Paper 1  
(Non-calculator)

- 1 You may NOT 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:**  $\text{Area} = \frac{1}{2} ab \sin C$

**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.

1. Evaluate

$$7 \cdot 2 - 0 \cdot 161 \times 30.$$

2

2. Expand and simplify

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

3

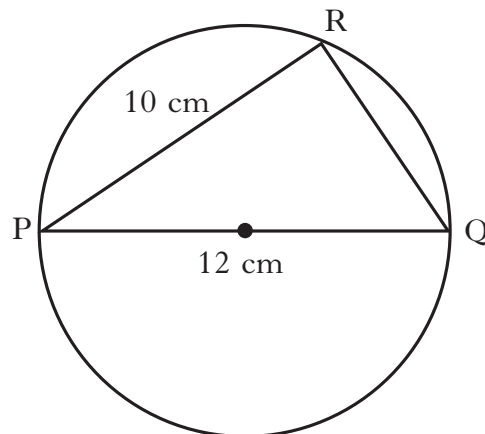
3. Change the subject of the formula to  $m$ .

$$L = \frac{\sqrt{m}}{k}$$

2

4. In the diagram,

- PQ is the diameter of the circle
- PQ = 12 centimetres
- PR = 10 centimetres.



Calculate the length of QR.

**Give your answer as a surd in its simplest form.**

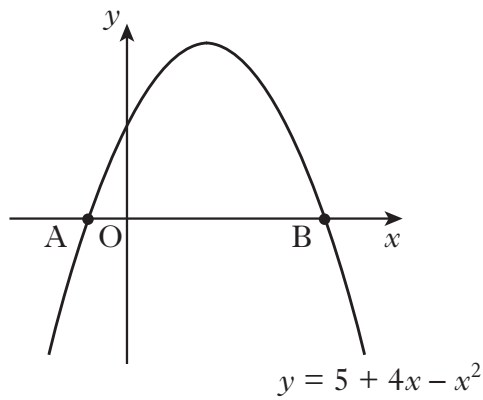
4

**[Turn over**

5. Mike is practising his penalty kicks.  
Last week, Mike scored 18 out of 30.  
This week, he scored 16 out of 25.  
Has his scoring rate improved?  
**Give a reason for your answer.**



6. The diagram shows part of the graph of  $y = 5 + 4x - x^2$ .



A is the point  $(-1, 0)$ .  
B is the point  $(5, 0)$ .

- (a) State the equation of the axis of symmetry of the graph.  
(b) Hence, find the maximum value of  $y = 5 + 4x - x^2$ .

3

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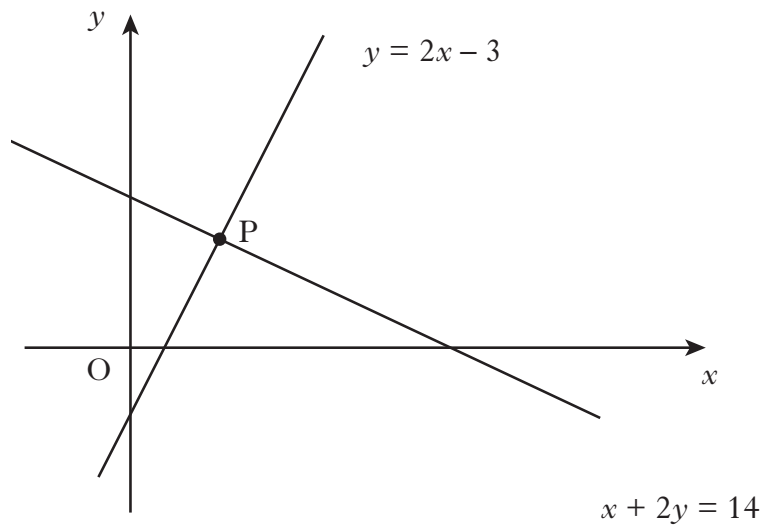
2

7. Given  $2x^2 - 2x - 1 = 0$ , show that

$$x = \frac{1 \pm \sqrt{3}}{2}$$

8. The graph below shows two straight lines.

- $y = 2x - 3$
- $x + 2y = 14$



The lines intersect at the point P.

Find, **algebraically**, the coordinates of P.

4

[Turn over for Questions 9, 10 and 11 on *Page six*

KU	RE
1	
	1
	3
1	
	1
	1
	1
	2

9. Each day, Marissa drives 40 kilometres to work.
- (a) On Monday, she drives at a speed of  $x$  kilometres per hour.  
Find the time taken, in terms of  $x$ , for her journey.
- (b) On Tuesday, she drives 5 kilometres per hour **faster**.  
Find the time taken, in terms of  $x$ , for this journey.
- (c) Hence find an expression, in terms of  $x$ , for the difference in times of the two journeys.  
Give this expression **in its simplest form**.

10. (a) Evaluate  $(2^3)^2$ .
- (b) Hence find  $n$ , when  $(2^3)^n = \frac{1}{64}$ .

11. The sum of consecutive even numbers can be calculated using the following number pattern:

$$2 + 4 + 6 = 3 \times 4 = 12$$

$$2 + 4 + 6 + 8 = 4 \times 5 = 20$$

$$2 + 4 + 6 + 8 + 10 = 5 \times 6 = 30$$

- (a) Calculate  $2 + 4 + \dots + 20$ .
- (b) Write down an expression for  $2 + 4 + \dots + n$ .
- (c) Hence or otherwise calculate  $10 + 12 + \dots + 100$ .

[END OF QUESTION PAPER]

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## 2500/31/02

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NATIONAL  
QUALIFICATIONS  
2012

WEDNESDAY, 2 MAY  
2.45 PM – 4.05 PM

MATHEMATICS  
STANDARD GRADE  
Credit Level  
Paper 2

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1. There are 2.69 million vehicles in Scotland.

It is estimated that this number will increase at a rate of 4% each year.

If this estimate is correct, how many vehicles will there be in 3 years' time?

Give your answer **correct to 3 significant figures**.

4

2. Before training, athletes were tested on how many sit-ups they could do in one minute.

The following information was obtained:

lower quartile ( $Q_1$ )      23

median ( $Q_2$ )              39

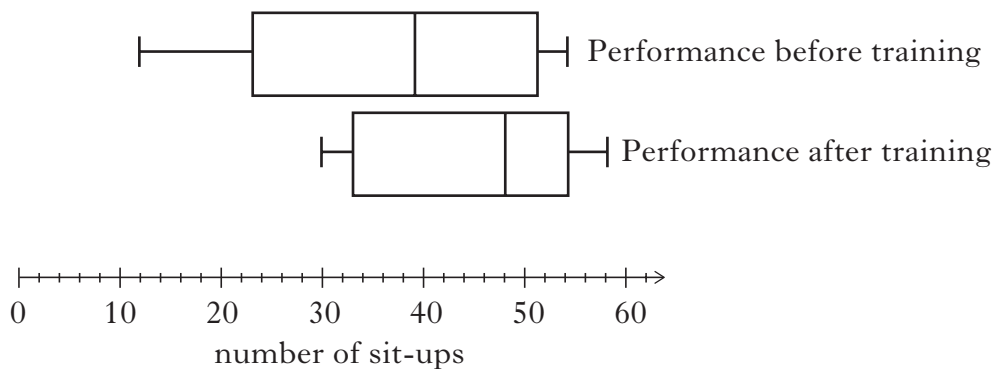
upper quartile ( $Q_3$ )      51

- (a) Calculate the semi-interquartile range.

1

After training, the athletes were tested again.

**Both** sets of data are displayed as boxplots.



- (b) Make **two** valid statements to compare the performances before and after training.

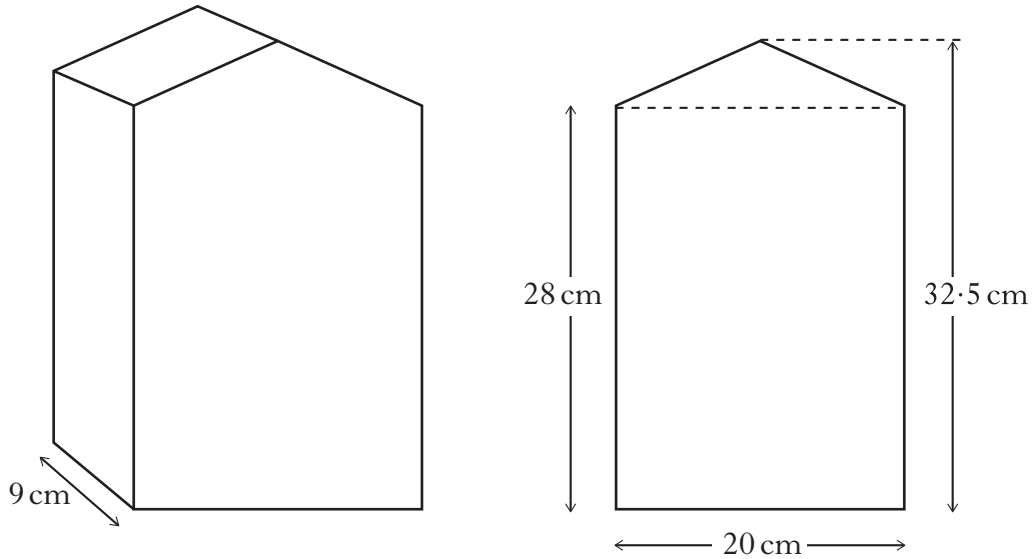
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[Turn over

3. A container for oil is in the shape of a prism.

The width of the container is 9 centimetres.

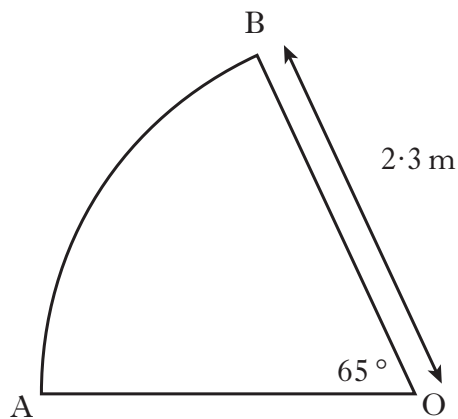
The uniform cross section of the container consists of a rectangle and a triangle with dimensions as shown.



Calculate the volume of the container, **correct to the nearest litre.**

4

4. A sector of a circle, centre O, is shown below.



The radius of the circle is 2.3 metres.

Angle AOB is  $65^\circ$ .

Find the length of the arc AB.

3

5. The depth,  $d$ , of water in a tank, varies directly as the volume,  $v$ , of water in the tank and inversely as the square of the radius,  $r$ , of the tank.

When the volume of water is  $60\,000\text{ cm}^3$ , the depth of water is 50 cm and the radius of the tank is 20 cm.

Calculate the depth of the water, when the volume of water is  $75\,000\text{ cm}^3$  and the radius of the tank is 25 cm.

4

6. The price for Paul's summer holiday is £894.40.

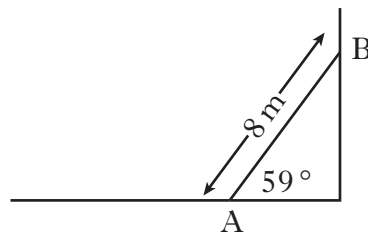
The price includes a 4% booking fee.

What is the price of his holiday without the booking fee?

3

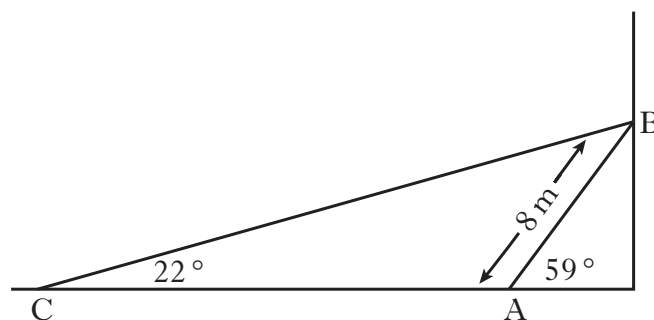
7. A heavy metal beam, AB, rests against a vertical wall as shown.

The length of the beam is 8 metres and it makes an angle of  $59^\circ$  with the ground.



A cable, CB, is fixed to the ground at C and is attached to the top of the beam at B.

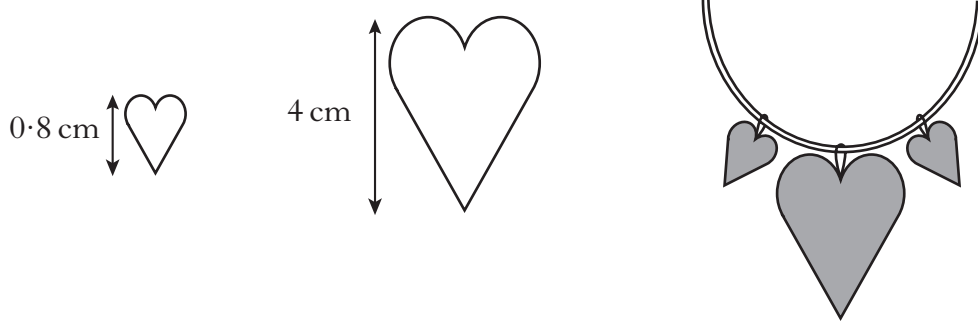
The cable makes an angle of  $22^\circ$  with the ground.



Calculate the length of cable CB.

4

8. A necklace is made of beads which are mathematically similar.



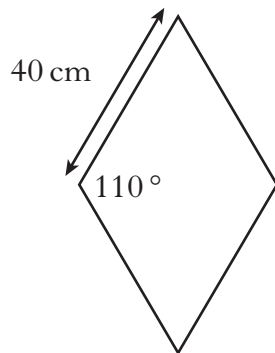
The height of the smaller bead is 0.8 centimetres and its area is 0.6 square centimetres.

The height of the larger bead is 4 centimetres.

Find the area of the larger bead.

3

9. Paving stones are in the shape of a rhombus.



The side of each rhombus is 40 centimetres long.

The obtuse angle is  $110^\circ$ .

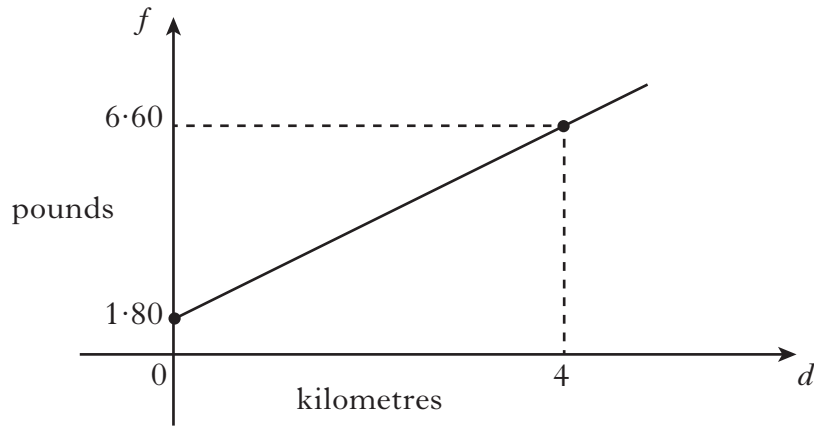
Find the area of one paving stone.

4

10. A taxi fare consists of a call-out charge of £1.80 **plus** a fixed cost per kilometre.

A journey of 4 kilometres costs £6.60.

The straight line graph shows the fare,  $f$  pounds, for a journey of  $d$  kilometres.

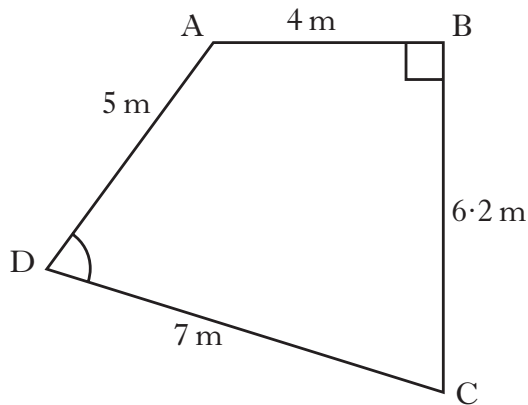


- Find the equation of the straight line.
- Calculate the fare for a journey of 7 kilometres.

3

2

11. Quadrilateral ABCD with angle  $ABC = 90^\circ$  is shown below.



- $AB = 4$  metres
- $BC = 6.2$  metres
- $CD = 7$  metres
- $AD = 5$  metres

- Calculate the length of AC.
- Calculate the size of angle ADC.

2

4

[Turn over for Questions 12 and 13 on *Page eight*

12.  $f(x) = 3 \sin x^\circ$ ,  $0 \leq x < 360$

(a) Find  $f(270)$ .

(b)  $f(t) = 0.6$ .

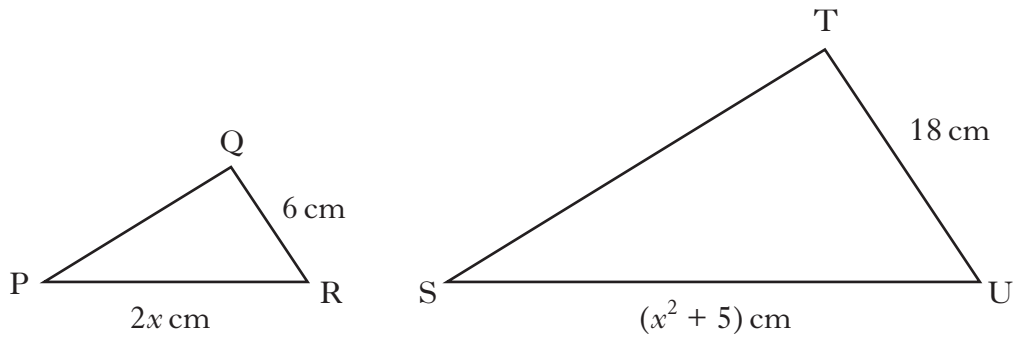
Find the two possible values of  $t$ .

1

4

13. Triangles PQR and STU are mathematically similar.

The scale factor is 3 and PR corresponds to SU.



(a) Show that  $x^2 - 6x + 5 = 0$ .

(b) Given QR is the shortest side of triangle PQR, find the value of  $x$ .

2

3

[END OF QUESTION PAPER]