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NATIONAL QUALIFICATIONS 2006

FRIDAY, 5 MAY
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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.

SCOTTISH QUALIFICATIONS AUTHORITY

FORMULAE LIST

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

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

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

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

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

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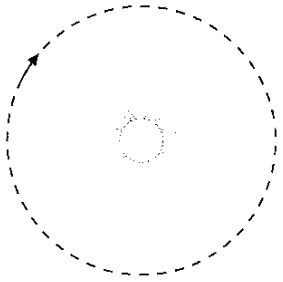
1. The orbit of a planet around a star is circular.



The radius of the orbit is $4{\cdot}96 \times 10^7$ kilometres.

Calculate the circumference of the orbit.

Give your answer **in scientific notation**. **3**

2. (*a*) The pulse rates, in beats per minute, of 6 adults in a hospital waiting area are:

68 73 86 72 82 78.

Calculate the mean and standard deviation of this data. **3**

(*b*) 6 children in the same waiting area have a mean pulse rate of 89·6 beats per minute and a standard deviation of 5·4.

Make **two** valid comparisons between the children's pulse rates and those of the adults. **2**

3. Harry bids successfully for a painting at an auction.

An "auction tax" of 8% is added to his bid price.

He pays £324 in total.

Calculate his bid price. **3**

[Turn over

KU	RE

4. (*a*) Expand and simplify

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

1

(*b*) Expand

$$m^{\frac{1}{2}}(2+m^2).$$

2

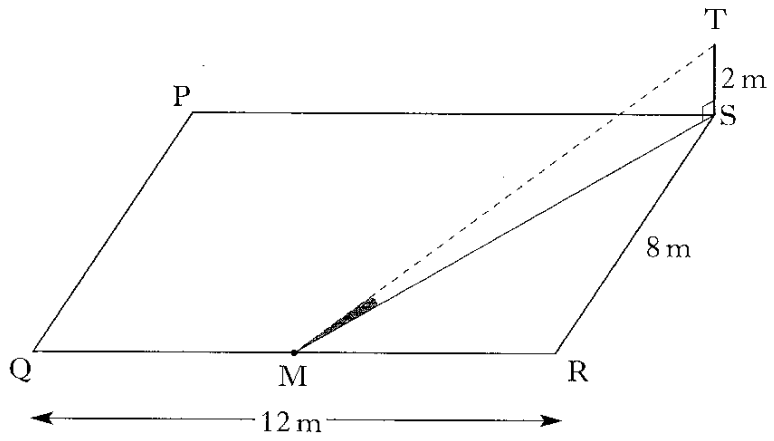
(*c*) Simplify, leaving your answer as a surd

$$2\sqrt{20}-3\sqrt{5}.$$

2

5. ST, a vertical pole 2 metres high, is situated at the corner of a rectangular garden, PQRS.

RS is 8 metres long and QR is 12 metres long.



The pole casts a shadow over the garden.

The shadow reaches M, the midpoint of QR.

Calculate the size of the shaded angle TMS.

4

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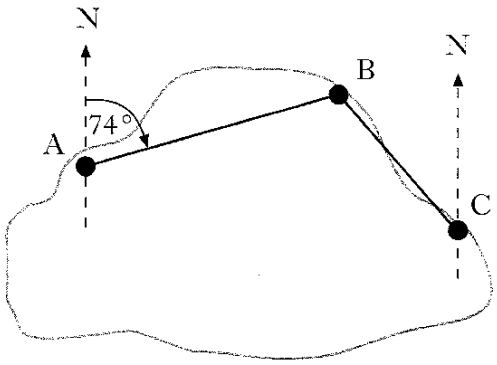
6. (*a*) There are three mooring points A, B and C on Lake Sorling.



From A, the bearing of B is 074°.

From C, the bearing of B is 310°.

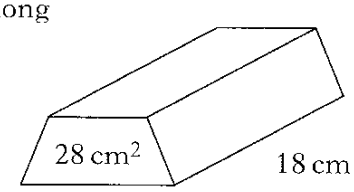
Calculate the size of angle ABC. **2**

(*b*) B is 230 metres from A and 110 metres from C.

Calculate the direct distance from A to C.

Give your answer **to 3 significant figures**. **4**

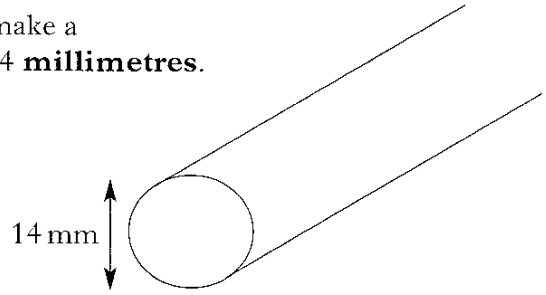
7. (*a*) A block of copper 18 centimetres long is prism shaped as shown.



The area of its cross section is 28 square centimetres.

Find the volume of the block. **1**

(*b*) The block is melted down to make a cylindrical cable of diameter 14 **millimetres**.



Calculate the length of the cable. **4**

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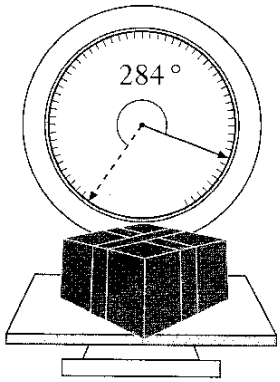
8. A set of scales has a circular dial.

The pointer is 9 centimetres long.

The tip of the pointer moves through an arc of 2 centimetres for each 100 grams of weight on the scales.



A parcel, placed on the scales, moves the pointer through an angle of 284°.

Calculate the weight of the parcel. **4**

9. The number of diagonals, d, in a polygon of n sides is given by the formula

$$d = \tfrac{1}{2}n(n-3).$$

(*a*) How many diagonals does a polygon of 7 sides have? **2**

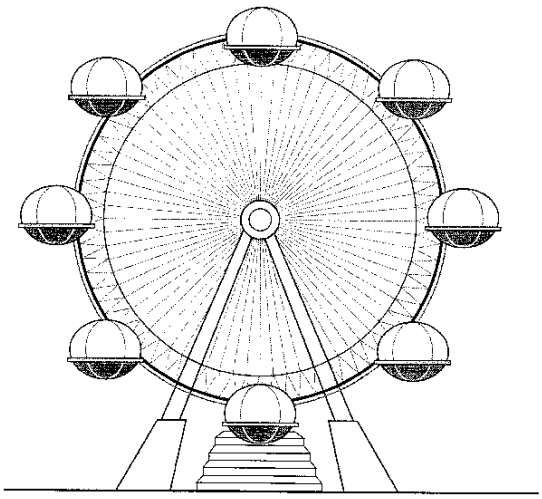
(*b*) A polygon has 65 diagonals.

Show that for this polygon, $n^2 - 3n - 130 = 0$. **2**

(*c*) Hence find the number of sides in this polygon. **3**

	KU	RE

10. Emma goes on the "Big Eye".



Her height, h metres, above the ground is given by the formula

$$h = -31 \cos t° + 33$$

where t is the number of seconds after the start.

(*a*) Calculate Emma's height above the ground 20 seconds after the start. **2**

(*b*) When will Emma first reach a height of 60 metres above the ground? **3**

(*c*) When will she next be at a height of 60 metres above the ground? **1**

[Turn over for Question 11 on *Page eight*

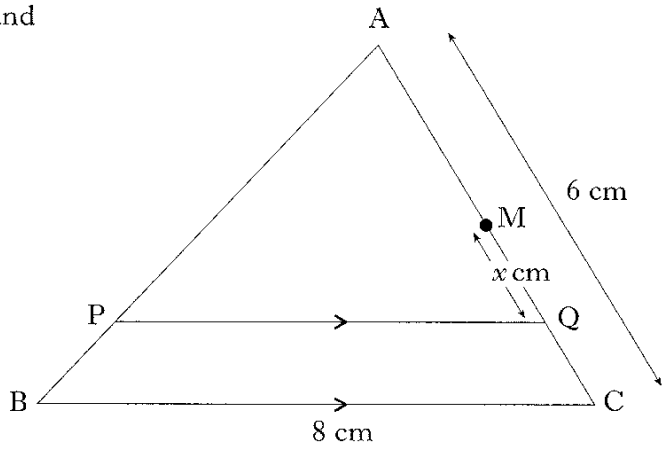
KU	RE

11. In triangle ABC,

BC = 8 centimetres,

AC = 6 centimetres and

PQ is parallel to BC.



M is the midpoint of AC.

Q lies on AC, x centimetres from M, as shown on the diagram.

(*a*) Write down an expression for the length of AQ. **1**

(*b*) Show that PQ = $(4 + \frac{4}{3}x)$ centimetres. **3**

[END OF QUESTION PAPER]