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NATIONAL QUALIFICATIONS 2008

THURSDAY, 8 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.

FORMULAE LIST

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

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

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

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

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. A local council recycles 42 000 tonnes of waste a year.

The council aims to increase the amount of waste recycled by 8% each year.

How much waste does it expect to recycle in 3 years time?

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

2. In a class, 30 pupils sat a test.

The marks are illustrated by the stem and leaf diagram below.

Test Marks

0	9
1	6 6 7 8
2	0 4 5 7 9 9 9
3	2 2 3 5 5 6 8
4	0 2 3 4 5 5 7 7 8
5	0 0

n = 30 $\qquad$ 1 | 6 = 16

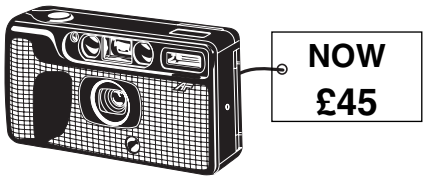
(*a*) Write down the median and the modal mark. **2**

(*b*) Find the probability that a pupil selected at random scored **at least** 40 marks. **1**

3. In a sale, all cameras are reduced by 20%.

A camera now costs £45.

Calculate the **original** cost of the camera. **3**



[Turn over

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4. Aaron saves 50 pence and 20 pence coins in his piggy bank.

Let x be the number of 50 pence coins in his bank.

Let y be the number of 20 pence coins in his bank.

(*a*) There are 60 coins in his bank.

Write down an equation in x and y to illustrate this information. **1**

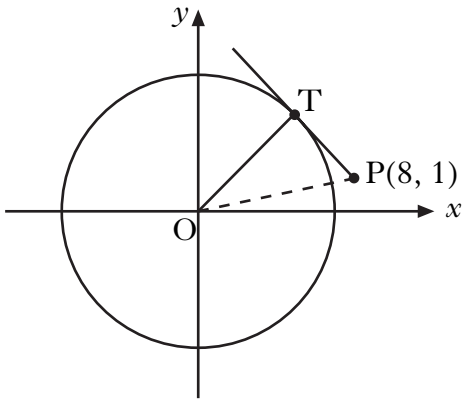
(*b*) The total value of the coins is £17·40.

Write down another equation in x and y to illustrate this information. **1**

(*c*) Hence find **algebraically** the number of 50 pence coins Aaron has in his piggy bank. **3**

5. A circle, centre the origin, is shown.

P is the point (8, 1).



(*a*) Calculate the length of OP. **2**

The diagram also shows a tangent from P which touches the circle at T.

The radius of the circle is 5 units.

(*b*) Calculate the length of PT. **2**

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6. The distance, d kilometres, to the horizon, when viewed from a cliff top, varies directly as the square root of the height, h metres, of the cliff top above sea level.

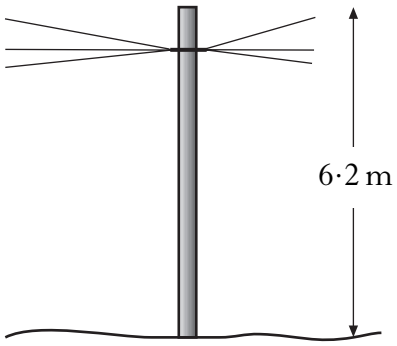
From a cliff top 16 metres above sea level, the distance to the horizon is 14 kilometres.

A boat is 20 kilometres from a cliff whose top is 40 metres above sea level.

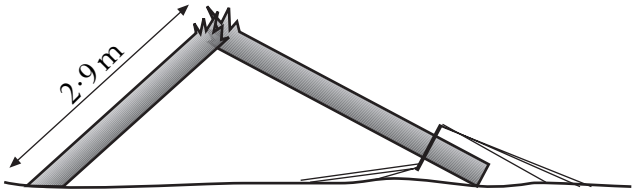
Is the boat beyond the horizon?

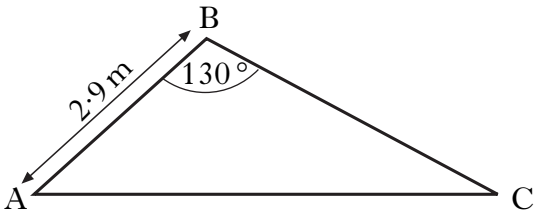
Justify your answer. **5**

7. A telegraph pole is 6·2 metres high.



The wind blows the pole over into the position as shown below.





AB is 2·9 metres and angle ABC is 130°.

Calculate the length of AC. **4**

[Turn over

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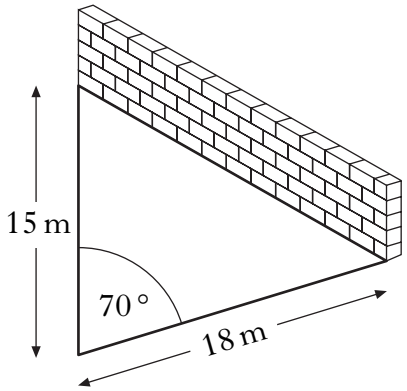
8. A farmer builds a sheep-pen using two lengths of fencing and a wall.



The two lengths of fencing are 15 metres and 18 metres long.

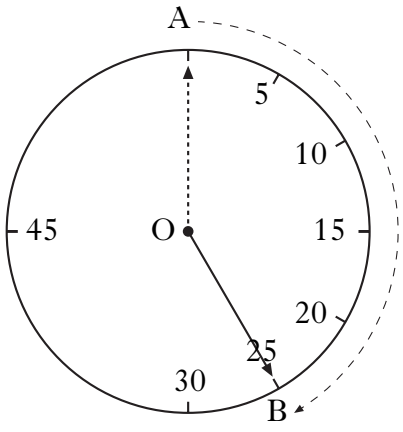
(*a*) Calculate the area of the sheep-pen, when the angle between the fencing is 70 °. **3**

(*b*) What angle between the fencing would give the farmer the largest possible area? **1**

9. Contestants in a quiz have 25 seconds to answer a question.

This time is indicated on the clock.

The tip of the clock hand moves through the arc AB as shown.



(*a*) Calculate the size of angle AOB. **1**

(*b*) The length of arc AB is 120 centimetres.

Calculate the length of the clock hand. **4**

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10. To hire a car costs £25 per day plus a mileage charge.

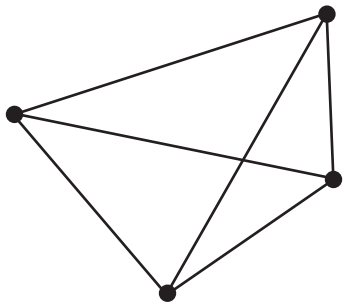
The first 200 miles are free with each additional mile charged at 12 pence.

(*a*) Calculate the cost of hiring a car for 4 days when the mileage is 640 miles. **1**

(*b*) A car is hired for d days and the mileage is m miles where $m > 200$.

Write down a formula for the cost £C of hiring the car. **3**

11. The minimum number of roads joining 4 towns to each other is 6 as shown.



The minimum number of roads, r, joining n towns to each other is given by the formula

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

(*a*) State the minimum number of roads needed to join 7 towns to each other. **1**

(*b*) When $r = 55$, show that $n^2 - n - 110 = 0$. **2**

(*c*) Hence find **algebraically** the value of n. **3**

[Turn over for Question 12 on *Page eight*

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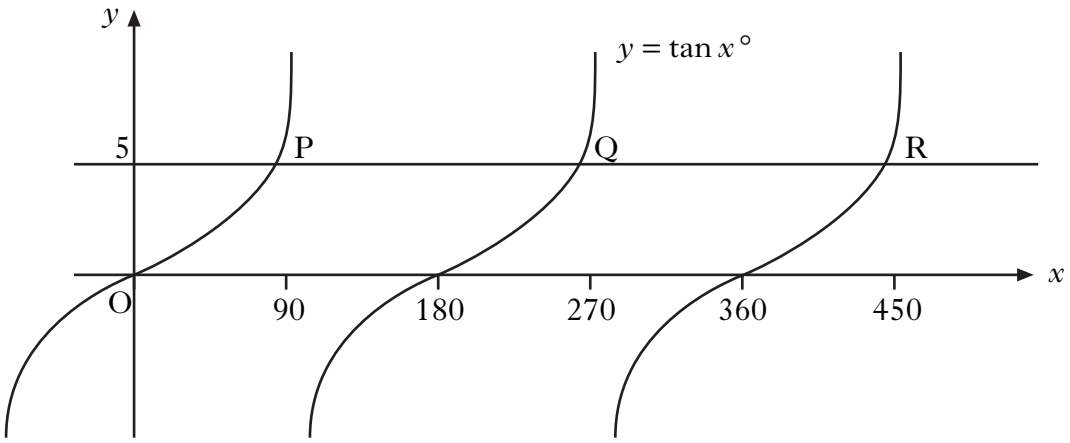
12. The diagram shows part of the graph of $y = \tan x°$.

The line $y = 5$ is drawn and intersects the graph of $y = \tan x°$ at P and Q.



(*a*) Find the x-coordinates of P and Q. **3**

(*b*) Write down the x-coordinate of the point R, where the line $y = 5$ next intersects the graph of $y = \tan x°$. **1**

[*END OF QUESTION PAPER*]