

National
Qualifications
MODEL PAPER 2

Mathematics Paper 2

Duration — 1 hour and 30 minutes

Total marks — 50

You may use a calculator.

Attempt ALL questions.

Use **blue** or **black** ink. Pencil may be used for graphs and diagrams only.

Write your working and answers in the spaces provided. Additional space for answers is provided at the end of this booklet. If you use this space, write clearly the number of the question you are attempting.

Square-ruled paper is provided at the back of this booklet.

Full credit will be given only to solutions which contain appropriate working.

State the units for your answer where appropriate.

Before leaving the examination room you must give this booklet to the Invigilator.

If you do not, you may lose all the marks for this paper.

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: $A = \frac{1}{2}ab \sin C$

Volume of a sphere: $V = \frac{4}{3}\pi r^3$

Volume of a cone: $V = \frac{1}{3}\pi r^2 h$

Volume of a pyramid: $V = \frac{1}{3}Ah$

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

1. $E = mc^2$.

Find the value of E when $m = 3.6 \times 10^{-2}$ and $c = 3 \times 10^8$.

Give your answer in scientific notation.

MARKS

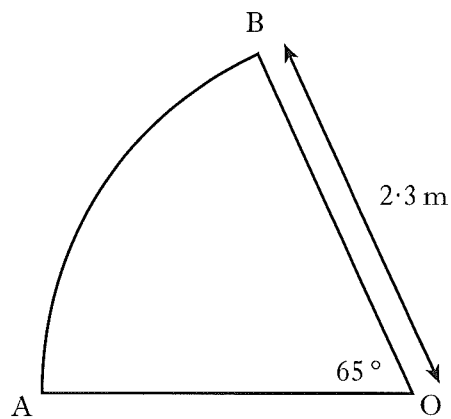
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2. Expand fully and simplify $x(x-1)^2$.

2

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



The radius of the circle is 2.3 metres.

Angle AOB is 65° .

Find the length of the arc AB.

MARKS

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4. Change the subject of the formula $p = q + 2r^2$ to r .

3

5. Solve the equation $2x^2 + 3x - 7 = 0$.

Give your answer correct to 2 significant figures.

MARKS

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6. The marks of a group of students in their October test are listed below.

41 56 68 59 43 37 70 58 61 47 75 66

(a) Calculate the median and the interquartile range.

3

The teacher arranges extra homework classes for the students before the next test in December.

In this test, the median is 67 and the interquartile range is 14.

(b) Make two appropriate comments comparing the marks in the October and December tests.

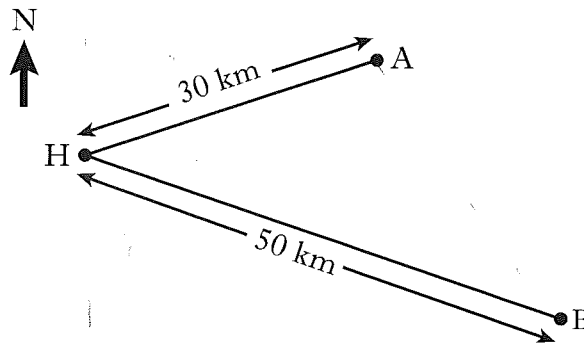
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Total marks 5

MARKS

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7. Two yachts leave from harbour H.
 Yacht A sails on a bearing of 072° for 30 kilometres and stops.
 Yacht B sails on a bearing of 140° for 50 kilometres and stops.

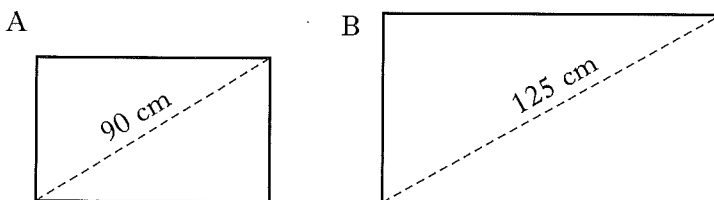


How far apart are the two yachts when they have both stopped?

Do not use a scale drawing.

4

8. 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

MARKS

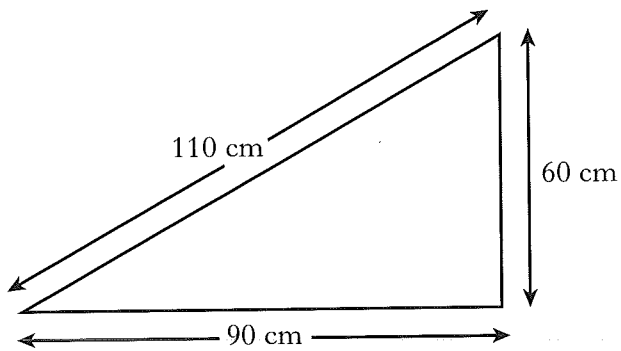
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9. Vector u has components $\begin{pmatrix} 2 \\ 0 \\ 1 \end{pmatrix}$ and vector v has components $\begin{pmatrix} 1 \\ 2 \\ -4 \end{pmatrix}$.

Calculate the magnitude of $2u - v$.

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10. A triangular paving slab has measurements as shown.



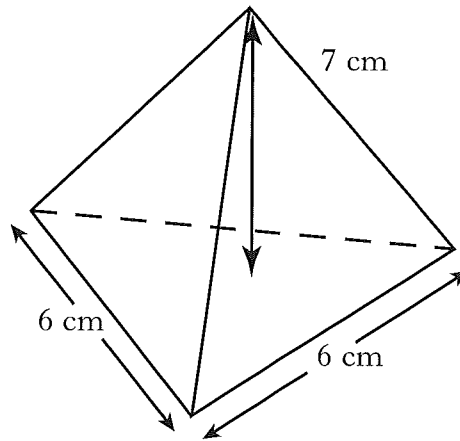
Is the slab in the shape of a right-angled triangle?
Show all your working.

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MARKS

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11. The diagram below shows a pyramid.



The base of the pyramid is an equilateral triangle of side 6 centimetres.

The height of the pyramid is 7 centimetres.

Calculate the volume of the pyramid.

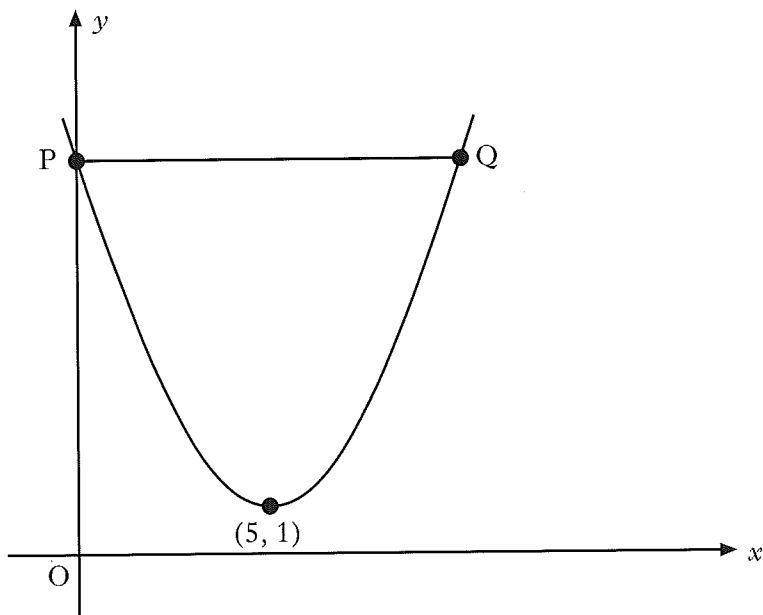
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MARKS

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12. The graph below shows part of a parabola with equation of the form

$$y = (x + a)^2 + b.$$



- (a) State the values of a and b .

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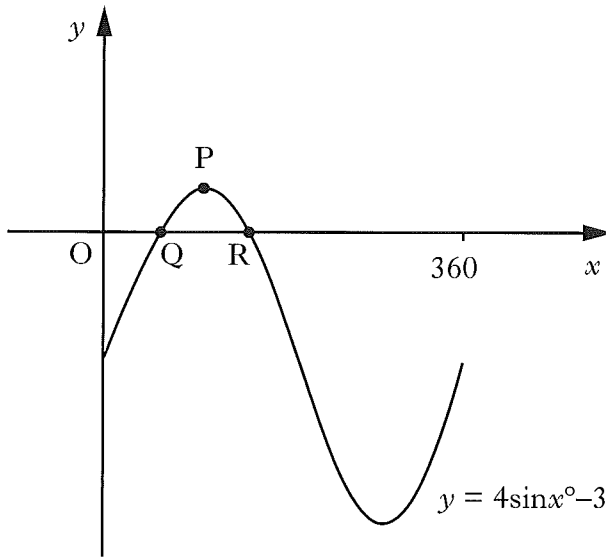
- (b) The line PQ is parallel to the x -axis.
Find the coordinates of points P and Q.

3

Total marks 5

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13. 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.

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(b) Calculate the x -coordinates of Q and R.

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Total marks 5

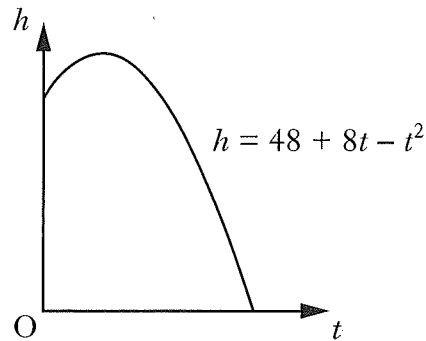
MARKS

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14. 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 MODEL PRACTICE PAPER]

ADDITIONAL SPACE FOR ANSWERS