

Write your name here	
Surname	Other names
Edexcel	Centre Number
International GCSE	Candidate Number
Further Pure Mathematics	
Paper 2	
Thursday 22 January 2015 – Morning	Paper Reference
Time: 2 hours	4PM0/02
Calculators may be used.	Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Without sufficient working, correct answers may be awarded no marks.
- Answer the questions in the spaces provided
– *there may be more space than you need.*

Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Check your answers if you have time at the end.

Turn over ►

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PEARSON



Answer all TEN questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

1

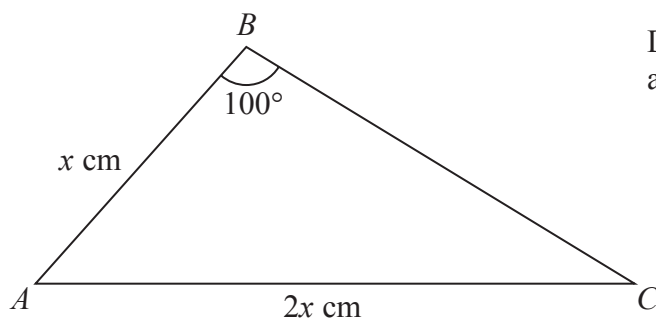


Diagram NOT accurately drawn

Figure 1

In triangle ABC , $AB = x$ cm, $AC = 2x$ cm and $\angle ABC = 100^\circ$, as shown in Figure 1.

(a) Find, in degrees to the nearest 0.1° , the size of $\angle BAC$. (4)

Given that the area of triangle ABC is 16 cm^2 ,

(b) find, to 3 significant figures, the value of x . (3)

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Question 1 continued

Dotted lines for writing.

(Total for Question 1 is 7 marks)





2 A solid right circular cylinder has height h cm and base radius r cm. The total surface area of the cylinder is S cm² and the volume of the cylinder is V cm³

(a) Show that $S = \frac{2V}{r} + 2\pi r^2$ (2)

Given that $V = 1600$

(b) find, to 3 significant figures, the minimum value of S .
Verify that the value you have found is a minimum. (7)



Question 2 continued

Handwriting practice area with 25 horizontal dotted lines for writing.



P 4 4 0 3 0 A 0 5 3 2

Question 2 continued

A series of horizontal dotted lines for writing, spanning the width of the page and filling most of the page area.

(Total for Question 2 is 9 marks)





4

$$\sin(A + B) = \sin A \cos B + \cos A \sin B$$

$$\cos(A + B) = \cos A \cos B - \sin A \sin B$$

- (a) Write down the exact value of $\sin 45^\circ$ (1)

Given that $\sin \theta = \frac{\sqrt{5}}{2\sqrt{2}}$ and $\cos \theta = \frac{\sqrt{3}}{2\sqrt{2}}$

- (b) show that $\sin(45^\circ + \theta) = \frac{\sqrt{3} + \sqrt{5}}{4}$ (2)

- (c) Find the exact value of $\cos(45^\circ + \theta)$ (2)

- (d) Show that $\sin(45^\circ + \theta) \times \cos(45^\circ + \theta) = -\frac{1}{8}$ (2)

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Question 4 continued

Dotted lines for writing.

(Total for Question 4 is 7 marks)





5 The grid opposite shows the graph of $y = 3x \sin x$ for $-1 \leq x \leq 3$, where x is measured in radians.

(a) Use the graph to estimate, to 1 decimal place, the roots of the equation

$$x \sin x = 1$$

in the interval $-1 \leq x \leq 3$

(3)

(b) By drawing a suitable straight line on the grid, obtain estimates, to 1 decimal place, of the roots of the equation

$$2x \sin x - x = 1$$

in the interval $-1 \leq x \leq 3$

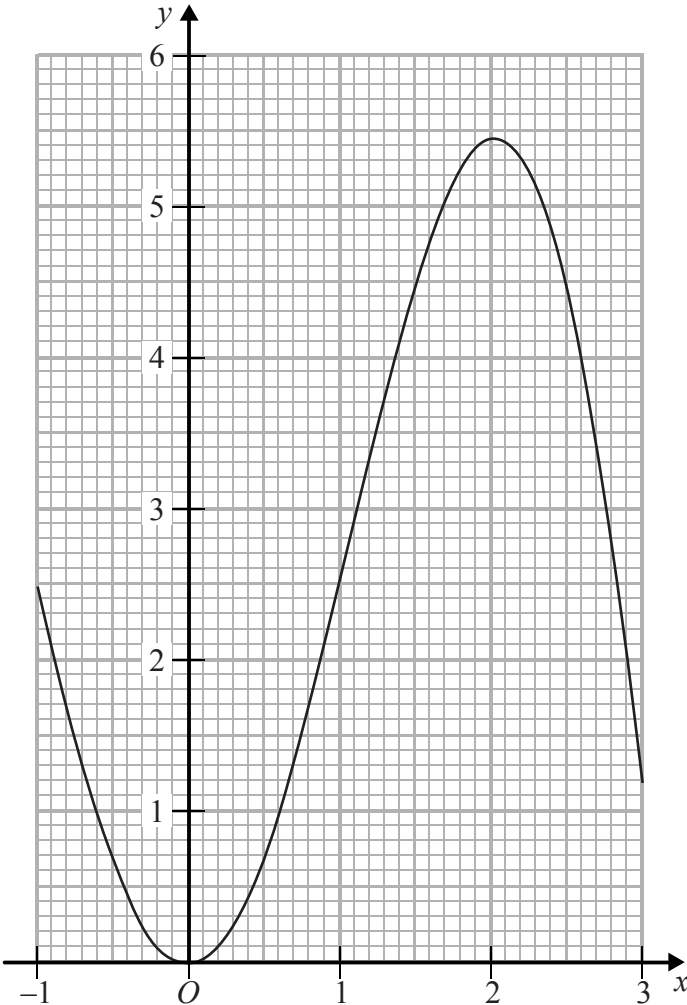
(5)

A series of horizontal dotted lines for drawing a straight line and estimating roots.



Question 5 continued

Graph for Question 5



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(Total for Question 5 is 8 marks)





6 The equation $2x^2 + px - 3 = 0$, where p is a constant, has roots α and β .

(a) Find the value of

(i) $\alpha\beta$

(ii) $\left(\alpha + \frac{1}{\beta}\right)\left(\beta + \frac{1}{\alpha}\right)$ (4)

(b) Find, in terms of p ,

(i) $\alpha + \beta$

(ii) $\left(\alpha + \frac{1}{\beta}\right) + \left(\beta + \frac{1}{\alpha}\right)$ (4)

Given that $\left(\alpha + \frac{1}{\beta}\right) + \left(\beta + \frac{1}{\alpha}\right) = 2\left(\alpha + \frac{1}{\beta}\right)\left(\beta + \frac{1}{\alpha}\right)$

(c) find the value of p .

(1)

(d) Using the value of p found in part (c), find a quadratic equation, with integer

coefficients, which has roots $\left(\alpha + \frac{1}{\beta}\right)$ and $\left(\beta + \frac{1}{\alpha}\right)$. (2)

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Question 6 continued

Ruled area for writing the answer to Question 6.





Question 6 continued

Area for writing answers, consisting of multiple horizontal dotted lines.



Question 7 continued

Lined area for writing the answer to Question 7.





Question 7 continued

Handwriting practice area with 25 horizontal dotted lines.



Question 7 continued

Ruled area for writing the answer to Question 7.

(Total for Question 7 is 10 marks)





- 8 (a) Find the full binomial expansion of $(1 - 2x)^5$, giving each coefficient as an integer. (3)
- (b) Expand $(1 + 2x)^{-5}$ in ascending powers of x up to and including the term in x^3 , giving each coefficient as an integer. (3)
- (c) Write down the range of values of x for which this expansion is valid. (1)
- (d) Expand $\left(\frac{1 - 2x}{1 + 2x}\right)^5$ in ascending powers of x up to and including the term in x^2 , giving each coefficient as an integer. (3)
- (e) Find the gradient of the curve with equation $y = \left(\frac{1 - 2x}{1 + 2x}\right)^5$ at the point $(0, 1)$. (2)

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Question 8 continued

Dotted lines for writing.





Question 8 continued

A large rectangular area containing 25 horizontal dotted lines for writing.



Question 8 continued

A series of horizontal dotted lines providing space for the student's answer to Question 8.

(Total for Question 8 is 12 marks)



9

Diagram NOT accurately drawn

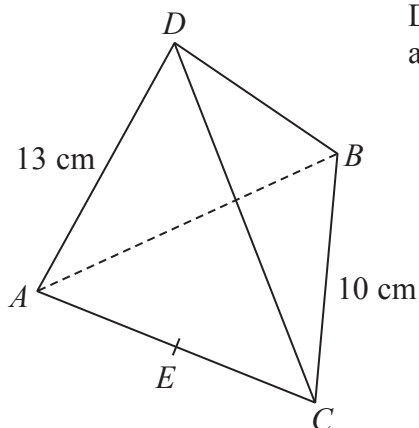


Figure 2

Figure 2 shows a triangular pyramid $ABCD$.
 $AB = BC = CA = 10$ cm and $DA = DB = DC = 13$ cm.
 The point E is the midpoint of AC .

- (a) Find the exact length of
 - (i) DE
 - (ii) BE(4)

- (b) Find, in degrees to 1 decimal place, the size of the angle between the line BD and the line DE .
(3)

- (c) Find, in degrees to 1 decimal place, the size of the angle between the line BD and the plane ABC .
(3)

- (d) Find, in degrees to 1 decimal place, the size of the angle between the plane ADC and the plane ABC .
(2)

- (e) Find, to 3 significant figures, the volume of the pyramid $ABCD$.
(3)

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Question 9 continued

A large rectangular area containing 25 horizontal dotted lines for writing.





Question 9 continued

Ruled writing area with horizontal dotted lines.



Question 9 continued

A series of horizontal dotted lines for writing the answer to Question 9 continued.

(Total for Question 9 is 15 marks)



10

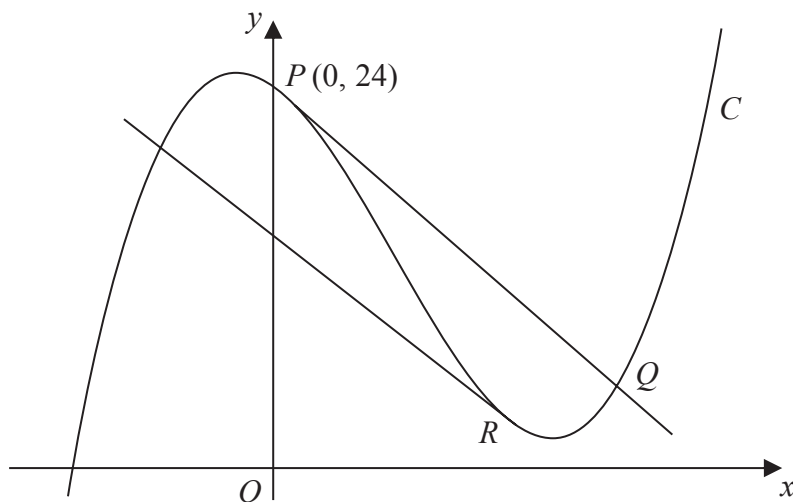


Diagram **NOT** accurately drawn

Figure 3

Figure 3 shows the curve C with equation $y = 9x^3 - 18x^2 - 8x + 24$

The curve cuts the y -axis at the point P with coordinates $(0, 24)$.

The point Q lies on C and the line PQ is the tangent to C at P .

(a) Find an equation of PQ . (4)

(b) Find the coordinates of Q . (5)

The point R lies on C and S is the point such that $PQRS$ is a parallelogram.
Given that RS is the tangent to C at R ,

(c) find the coordinates of R , (4)

(d) find the coordinates of S . (2)

(e) Show that S lies on C . (2)

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Question 10 continued

Dotted lines for writing.





Question 10 continued

Dotted lines for writing.



Question 10 continued

Ruled writing area consisting of 20 horizontal dotted lines.





Question 10 continued

Area with horizontal dotted lines for writing.

(Total for Question 10 is 17 marks)

TOTAL FOR PAPER IS 100 MARKS

