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Surname

Other names

Pearson Edexcel
International GCSE

Centre Number

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Candidate Number

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Further Pure Mathematics

Paper 1

Monday 19 January 2015 – Afternoon
Time: 2 hours

Paper Reference

4PM0/01**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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Answer all TEN questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

1 An equilateral triangle has sides of length x cm.

(a) Show that the area of the triangle is $\frac{\sqrt{3}}{4}x^2$ cm² (2)

The length of each side of the equilateral triangle is increasing at a rate of 0.1 cm/s.

(b) Find the length of each side of the triangle when the area of the triangle is increasing at a rate of $\frac{\sqrt{3}}{10}$ cm²/s. (4)

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Question 1 continued

Lined writing area for the answer to Question 1.

(Total for Question 1 is 6 marks)



P 4 4 0 2 9 A 0 3 3 2

2 A small stone is thrown vertically upwards from a point A above the ground. At time t seconds after being thrown from A , the height of the stone above the ground is s metres. Until the stone hits the ground, $s = 1.4 + 19.6t - 4.9t^2$

- (a) Write down the height of A above the ground. (1)
- (b) Find the speed with which the stone was thrown from A . (2)
- (c) Find the acceleration of the stone until it hits the ground. (1)
- (d) Find the greatest height of the stone above the ground. (3)

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Question 2 continued

A series of horizontal dotted lines for writing.

(Total for Question 2 is 7 marks)



3

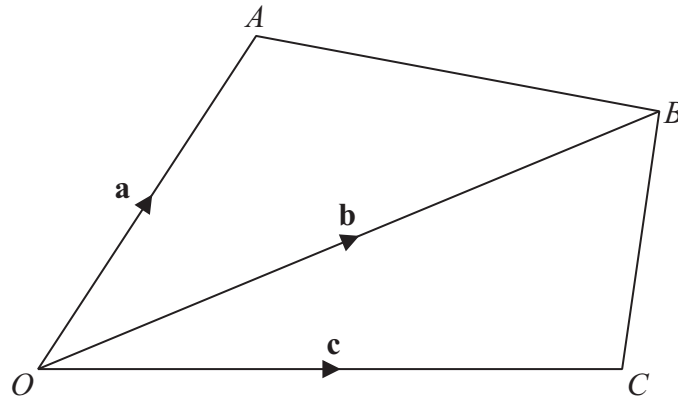


Figure 1

Figure 1 shows the quadrilateral $OABC$.

$$\vec{OA} = \mathbf{a}, \vec{OB} = \mathbf{b} \text{ and } \vec{OC} = \mathbf{c}$$

- (a) Find, in terms of \mathbf{a} and \mathbf{b} , \vec{AB} . (1)

The midpoint of OA is P and the midpoint of AB is Q .

- (b) Show that $\vec{PQ} = \mu\mathbf{b}$, where μ is a scalar, stating the value of μ . (2)

The point S lies on OC and the point R lies on BC such that $\vec{OS} = \lambda\vec{OC}$ and $\vec{BR} = \lambda\vec{BC}$.

- (c) Show that PQ is parallel to SR . (4)

Given that $\vec{PQ} = \frac{3}{2}\vec{SR}$,

- (d) find the value of λ . (2)

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Question 3 continued

Handwriting practice area consisting of 25 horizontal dotted lines.



Question 3 continued

A series of horizontal dotted lines for writing.

(Total for Question 3 is 9 marks)



4

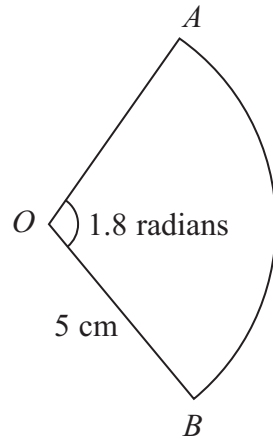


Diagram **NOT**
accurately drawn

Figure 2

Figure 2 shows the sector AOB of a circle of radius 5 cm. The centre of the circle is O and the angle AOB is 1.8 radians.

- (a) Find the length of the arc AB . (1)

- (b) Find the area of the sector AOB . (2)

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(Total for Question 4 is 3 marks)



5 (a) On the axes opposite, draw the lines with equations

$$(i) \ y = -x - 1 \qquad (ii) \ y = 3x - 9 \qquad (iii) \ 2y = x + 7 \qquad (4)$$

(b) Show, by shading, the region R defined by the inequalities

$$y \geq -x - 1, \qquad y \geq 3x - 9 \qquad \text{and} \qquad 2y \leq x + 7 \qquad (1)$$

For all points in R , with coordinates (x, y) ,

$$P = y - 2x$$

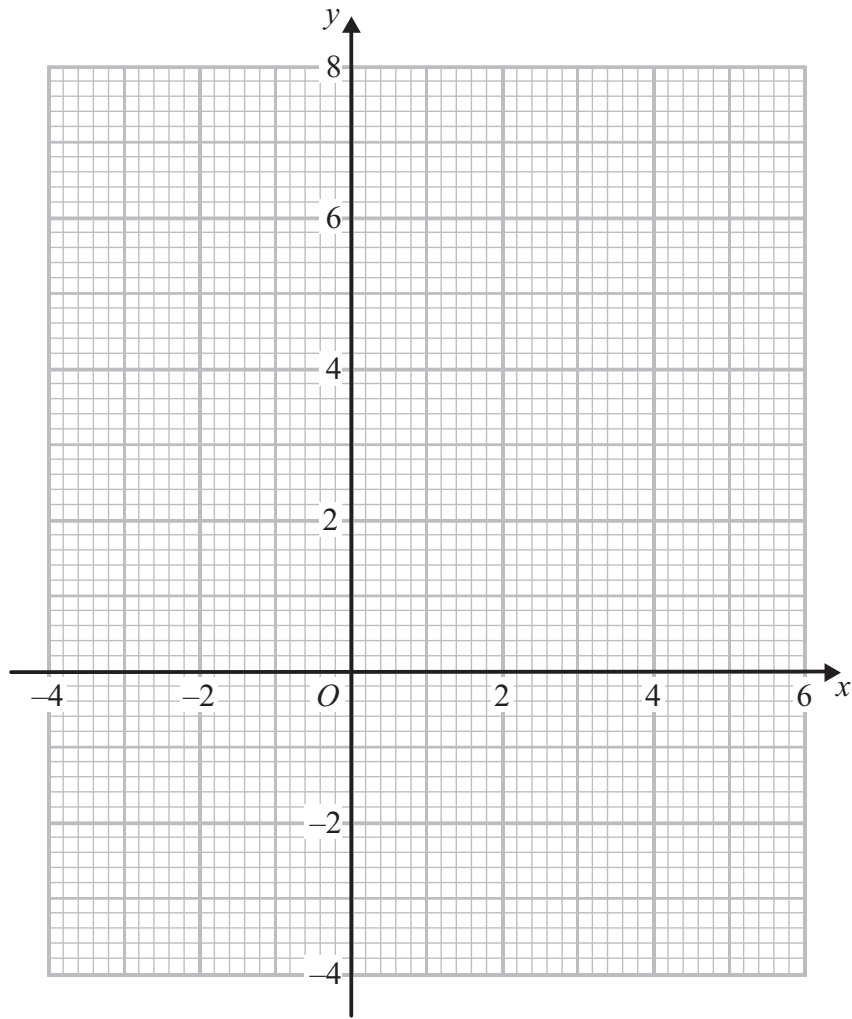
(c) Find (i) the greatest value of P ,

(ii) the least value of P .

(4)



Question 5 continued



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(Total for Question 5 is 9 marks)



6 (a) Solve, giving your answer to 3 significant figures,

$$3^z - 4 = 0 \tag{3}$$

Solve, giving your answers to 3 significant figures where appropriate,

$$(b) 9^y - 13(3^y) + 36 = 0 \tag{4}$$

$$(c) 6^x - 4(2^x) - 3^x + 4 = 0 \tag{5}$$

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Question 6 continued

A series of horizontal dotted lines for writing.



Question 6 continued

A large rectangular area with rounded corners, containing 25 horizontal dotted lines for writing.



Question 6 continued

A large area for writing, bounded by a rounded rectangle. It contains 25 horizontal dotted lines for providing an answer.

(Total for Question 6 is 12 marks)



7 The curve C has equation $y = x^2 + 3$

The point A with coordinates $(0, 3)$ and the point B with coordinates $(4, 19)$ lie on C , as shown below in Figure 3.

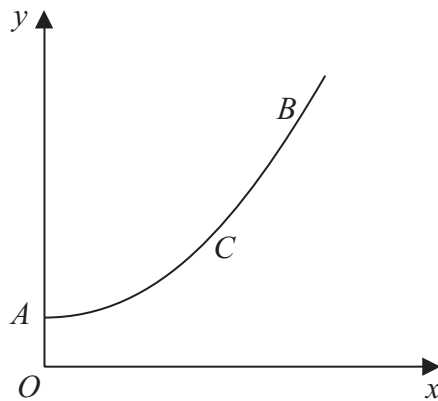


Figure 3

The finite area enclosed by the arc AB of curve C , the axes and the line with equation $x = 4$ is rotated through 360° about the x -axis.

(a) Using algebraic integration, calculate, to 1 decimal place, the volume of the solid generated.

(6)

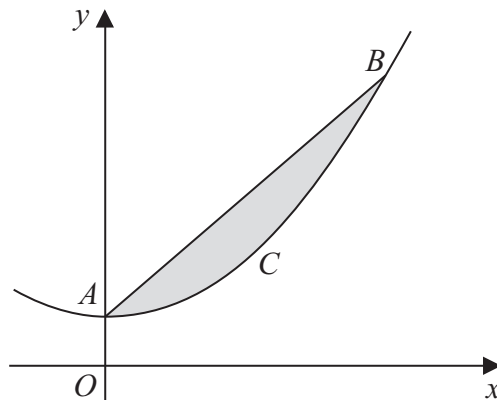


Figure 4

(b) Using algebraic integration, calculate the area of the region between the chord AB and the arc AB of C , shown shaded in Figure 4.

(6)

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Question 7 continued

Handwriting practice area consisting of 25 horizontal dotted lines.



Question 7 continued

A large rectangular area with rounded corners, containing 25 horizontal dotted lines for writing.



Question 7 continued

Dotted lines for writing.

(Total for Question 7 is 12 marks)



Question 8 continued

A series of horizontal dotted lines for writing.



Question 8 continued

A series of horizontal dotted lines for writing.



Question 8 continued

[Large area with horizontal dotted lines for writing]

(Total for Question 8 is 12 marks)



9

$$f(x) = 2x^3 + ax^2 + bx + 15 \quad \text{where } a \text{ and } b \text{ are constants.}$$

The remainder when $f(x)$ is divided by $(x - 1)$ is -12

The remainder when $f(x)$ is divided by $(x + 1)$ is 48

(a) Find the value of a and the value of b . (6)

(b) Show that $f\left(\frac{1}{2}\right) = 0$ (1)

(c) Express $f(x)$ as a product of linear factors. (4)

(d) Solve the equation $f(x) = 0$ (1)

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Question 9 continued

A series of horizontal dotted lines for writing.



Question 9 continued

A large rectangular area with rounded corners, containing 25 horizontal dotted lines for writing.



Question 9 continued

A large area of the page is filled with horizontal dotted lines, intended for the student to write their answer to Question 9.

(Total for Question 9 is 12 marks)



10 The points A , B and C have coordinates $(-2, 3)$, $(2, 5)$ and $(4, 1)$ respectively.

(a) Show, by calculation, that AB is perpendicular to BC . (3)

(b) Show that the length of $AB =$ the length of BC . (3)

The midpoint of AC is M .

(c) Find the coordinates of M . (1)

(d) Find the exact length of the radius of the circle which passes through the points A , B and C . (3)

The point P lies on BM such that $BP : PM = 2 : 1$

(e) Find the coordinates of P . (2)

The point Q lies on AP produced such that $AP : PQ = 2 : 1$

(f) Find the coordinates of Q . (3)

(g) Show that Q lies on BC . (3)

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Question 10 continued

A large rectangular area with rounded corners, containing 25 horizontal dotted lines for writing.



Question 10 continued

A large rectangular area with rounded corners, containing 25 horizontal dotted lines for writing.



Question 10 continued

A large rectangular area with rounded corners, containing 25 horizontal dotted lines for writing.



