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Pearson Edexcel Centre Number Candidate Number

International GCSE

Further Pure Mathematics

Paper 2

Monday 22 January 2018 – Morning Time: 2 hours	Paper Reference 4PM0/02
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Calculators may be used.	Total Marks
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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 ELEVEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1

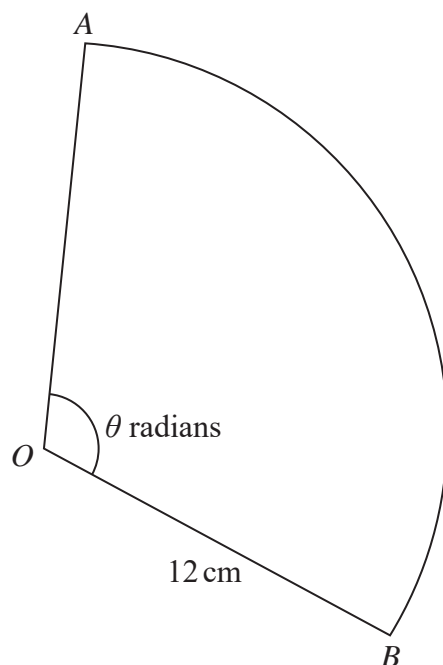


Diagram NOT
accurately drawn

Figure 1

Figure 1 shows the sector AOB of a circle with centre O and radius 12 cm . The angle AOB is θ radians and the area of the sector is 192 cm^2

Calculate

- (a) the value of θ , (2)
- (b) the length, in cm, of the arc AB . (2)

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Question 1 continued

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(Total for Question 1 is 4 marks)



2 (a) Show that $\sum_{r=1}^n (3r + 2) = \frac{n}{2} (7 + 3n)$ (2)

(b) Hence, or otherwise, evaluate $\sum_{r=10}^{20} (3r + 2)$ (3)

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Question 2 continued

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(Total for Question 2 is 5 marks)



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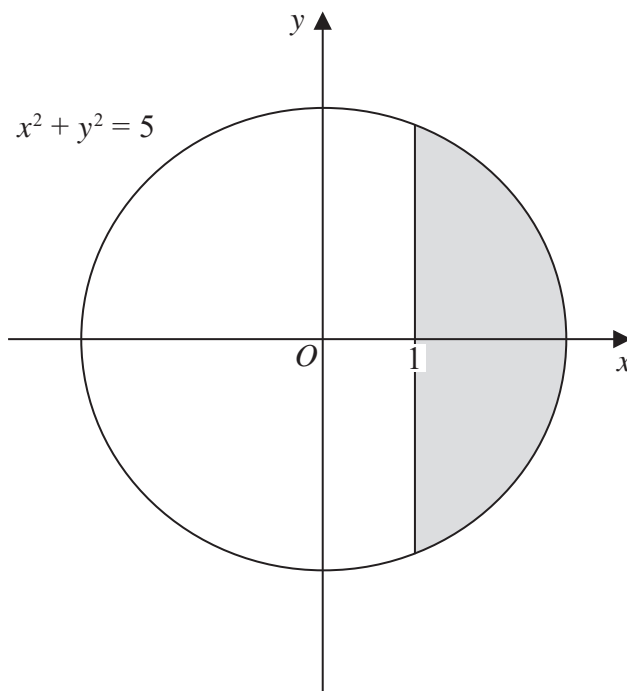
Diagram **NOT**
accurately drawn

Figure 2

The region enclosed by the circle with equation $x^2 + y^2 = 5$ and the straight line with equation $x = 1$, shown shaded in Figure 2, is rotated through 360° about the y -axis.

Use algebraic integration to find the exact volume of the solid generated.

(5)

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Question 3 continued

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(Total for Question 3 is 5 marks)



4 Here is a quadratic equation $3x^2 + px + 4 = 0$ where p is a constant.

(a) Find the set of values of p for which the equation has two real distinct roots.

(5)

(b) List all the possible integer values of p for which the equation has no real roots.

(1)

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Question 4 continued

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(Total for Question 4 is 6 marks)



5 Given that $y = 2e^x(3x^2 - 6)$

show that $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = 12e^x$

(7)

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Question 5 continued

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(Total for Question 5 is 7 marks)



6

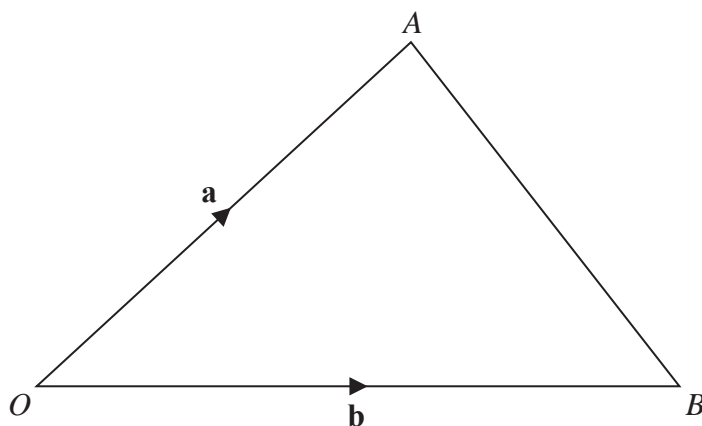
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Figure 3

Figure 3 shows the triangle OAB with $\vec{OA} = \mathbf{a}$ and $\vec{OB} = \mathbf{b}$.

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

The point P is such that $\vec{OP} = \frac{3}{4}\vec{OA}$, and the point Q is the midpoint of AB .

- (b) Find \vec{PQ} as a simplified expression in terms of \mathbf{a} and \mathbf{b} . (2)

The point R is such that PQR and OBR are straight lines where

$$\vec{QR} = \mu\vec{PQ} \quad \text{and} \quad \vec{BR} = \lambda\vec{OB}$$

- (c) Express \vec{QR} in terms of (3)
- (i) \mathbf{a} , \mathbf{b} and μ
 - (ii) \mathbf{a} , \mathbf{b} and λ

- (d) Hence find the value of (4)
- (i) μ
 - (ii) λ

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Question 6 continued

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Question 6 continued

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Question 6 continued

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(Total for Question 6 is 10 marks)



7 (i) Solve the equation $\frac{(8^x)^x}{32^x} = 4$

(4)

(ii) Solve the equation $\log_x 64 + 3 \log_4 x - \log_x 4 = 5$

(7)

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Question 7 continued

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Question 7 continued

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Question 7 continued

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(Total for Question 7 is 11 marks)



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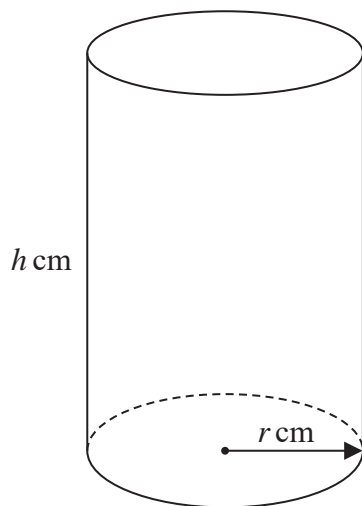


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accurately drawn

Figure 4

A solid right circular cylinder has radius r cm and height h cm, as shown in Figure 4. The cylinder has a volume of 355 cm^3 and a total surface area of $S \text{ cm}^2$

(a) Show that $S = 2\pi r^2 + \frac{710}{r}$ (4)

Given that r can vary,

(b) using calculus find, to 3 significant figures, the minimum value of S . (5)

(c) Verify that your answer to part (b) does give the minimum value of S . (2)



Question 8 continued

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Question 8 continued

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Question 8 continued

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(Total for Question 8 is 11 marks)



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9

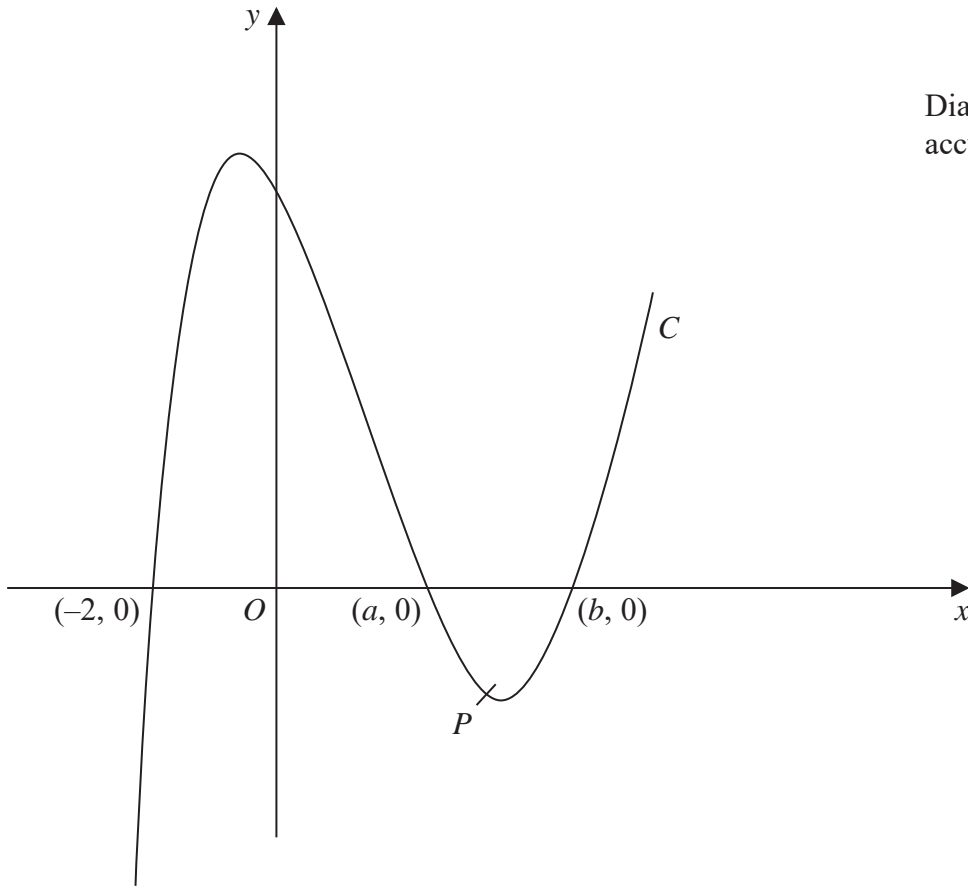


Diagram NOT accurately drawn

Figure 5

Figure 5 shows the curve C with equation $y = x^3 - 2x^2 - 5x + 6$

The curve C crosses the x -axis at the points with coordinates $(-2, 0)$, $(a, 0)$ and $(b, 0)$

- (a) (i) Show that $a = 1$
- (ii) Find the value of b . (4)

The point P on C has x coordinate 2 and the line l is the tangent to C at P .

- (b) Show that l crosses the x -axis at the point with coordinates $(-2, 0)$ (6)
- (c) Use algebraic integration to find the exact area of the finite region bounded by C and l . (4)

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Question 9 continued

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Question 9 continued

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Question 9 continued

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(Total for Question 9 is 14 marks)



P 5 3 2 9 2 A 0 2 7 3 6

10 The point A has coordinates $(-6, -4)$ and the point B has coordinates $(4, 1)$
The line l passes through the point A and the point B .

(a) Find an equation of l . (2)

The point P lies on l such that $AP:PB = 3:2$

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

The point Q with coordinates (m, n) lies on the line through P that is perpendicular to l .

Given that $m < 0$ and that the length of PQ is $3\sqrt{5}$

(c) find the coordinates of Q . (5)

The point R has coordinates $(-13, 0)$

(d) Show that

(i) AB and RQ are equal in length,

(ii) AB and RQ are parallel. (4)

(e) Find the area of the quadrilateral $ABQR$. (2)

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Question 10 continued

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Question 10 continued

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Question 10 continued

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(Total for Question 10 is 15 marks)



11

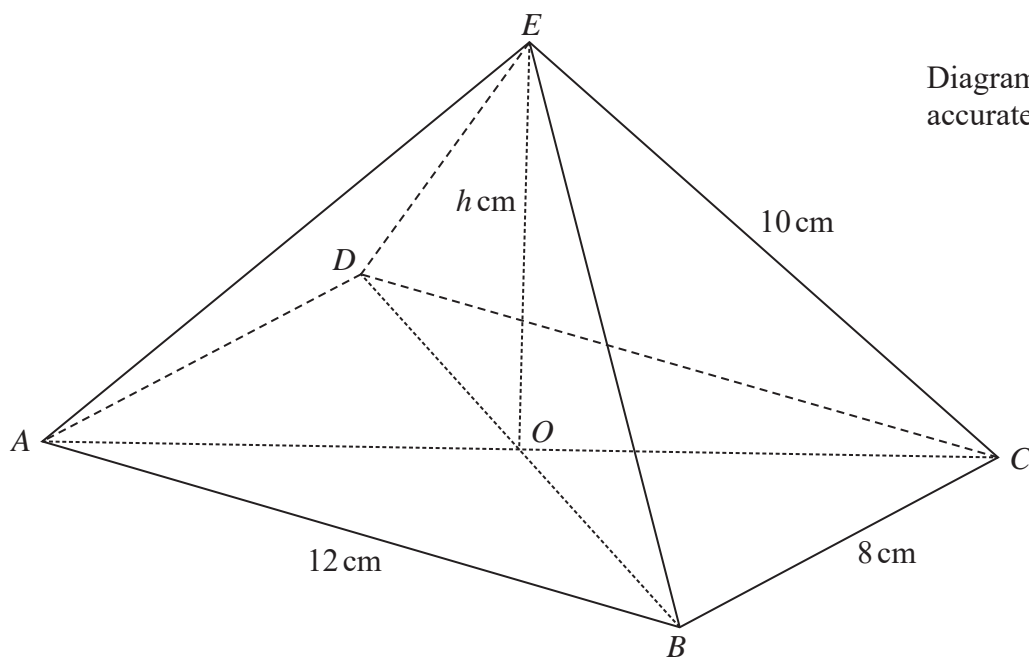
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Figure 6

A pyramid with a rectangular base $ABCD$ and vertex E is shown in Figure 6.

The rectangular base is horizontal with $AB = 12$ cm and $BC = 8$ cm.

The diagonals of the base intersect at the point O .

The vertex E of the pyramid is vertically above O .

The height of the pyramid is h cm and $AE = BE = CE = DE = 10$ cm.

(a) Show that $h = 4\sqrt{3}$ (3)

(b) Find, in degrees to 1 decimal place, the size of angle OCE . (2)

The angle between OE and the plane CBE is θ°

(c) Show that $\cos \theta^\circ = \frac{2\sqrt{7}}{7}$ (3)

The point P is the midpoint of BE and the point Q is the midpoint of CE .

(d) Find, in degrees to 1 decimal place, the size of the angle between the plane OPQ and the plane EPQ . (4)



Question 11 continued

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Question 11 continued

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(Total for Question 11 is 12 marks)

TOTAL FOR PAPER IS 100 MARKS

