

Please check the examination details below before entering your candidate information

Candidate surname

Other names

**Pearson Edexcel
International GCSE**

Centre Number

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Candidate Number

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Time 2 hours

Paper
reference

4PM1/01

**Further Pure Mathematics
PAPER 1**



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.*
- You must **NOT** write anything on the formulae page.
Anything you write on the formulae page will gain NO credit.

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.
- Good luck with your examination.

Turn over ►

P66026RA

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P 6 6 0 2 6 R A 0 1 3 2



Pearson

International GCSE in Further Pure Mathematics Formulae sheet

Mensuration

Surface area of sphere = $4\pi r^2$

Curved surface area of cone = $\pi r \times$ slant height

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

Series

Arithmetic series

Sum to n terms, $S_n = \frac{n}{2}[2a + (n - 1)d]$

Geometric series

Sum to n terms, $S_n = \frac{a(1 - r^n)}{(1 - r)}$

Sum to infinity, $S_\infty = \frac{a}{1 - r}$ $|r| < 1$

Binomial series

$(1 + x)^n = 1 + nx + \frac{n(n - 1)}{2!}x^2 + \dots + \frac{n(n - 1)\dots(n - r + 1)}{r!}x^r + \dots$ for $|x| < 1, n \in \mathbb{Q}$

Calculus

Quotient rule (differentiation)

$$\frac{d}{dx} \left(\frac{f(x)}{g(x)} \right) = \frac{f'(x)g(x) - f(x)g'(x)}{[g(x)]^2}$$

Trigonometry

Cosine rule

In triangle ABC : $a^2 = b^2 + c^2 - 2bc \cos A$

$\tan \theta = \frac{\sin \theta}{\cos \theta}$

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

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

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

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

$\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$

$\tan(A - B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$

Logarithms

$\log_a x = \frac{\log_b x}{\log_b a}$

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Question 2 continued

Area for writing the answer to Question 2, consisting of multiple horizontal dotted lines.

(Total for Question 2 is 5 marks)

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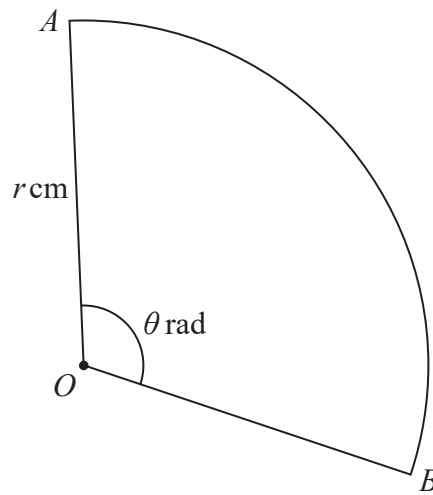


Diagram **NOT** accurately drawn

Figure 1

Figure 1 shows the sector AOB of a circle with centre O and radius r cm, where r is an integer. The size of angle AOB is θ radians.

The sector has an area of 16.8 cm^2 and a perimeter of 16.4 cm .

Calculate

- (i) the value of r
- (ii) the value of θ

(8)

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Question 3 continued

Area with horizontal dotted lines for writing.

(Total for Question 3 is 8 marks)



Question 4 continued

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

(Total for Question 4 is 5 marks)

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P 6 6 0 2 6 R A 0 9 3 2

5 Solve the equation

$$\log_3 \sqrt{x-5} + \log_9(x+3) - 1 = 0$$

Show clear algebraic working.

(7)

Area with horizontal dotted lines for working.

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Question 5 continued

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(Total for Question 5 is 7 marks)

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6 The volume of a sphere with radius r cm is increasing at a constant rate of $3 \text{ cm}^3/\text{s}$.
Find the rate, in cm^2/s , at which the surface area of the sphere is increasing when $r = 10$ (6)

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Question 6 continued

Handwriting practice area with 25 horizontal dotted lines.

(Total for Question 6 is 6 marks)

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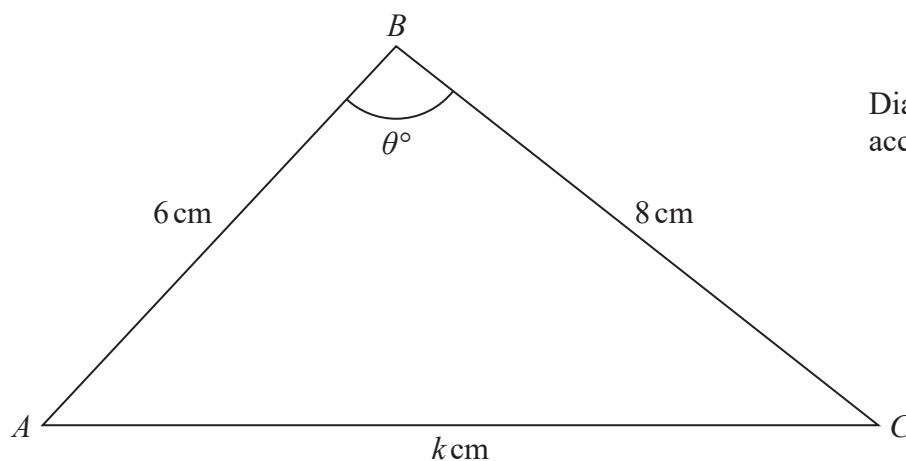


Diagram **NOT** accurately drawn

Figure 2

Figure 2 shows triangle ABC

$$AB = 6 \text{ cm} \quad BC = 8 \text{ cm} \quad AC = k \text{ cm} \quad \angle ABC = \theta^\circ$$

- (a) Show that $\cos \theta^\circ = \frac{100 - k^2}{96}$ (2)

The area of triangle ABC is $\sqrt{455} \text{ cm}^2$

- (b) Find the two possible values of k (7)



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Question 7 continued

Handwriting practice area with horizontal dotted lines.

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Question 7 continued

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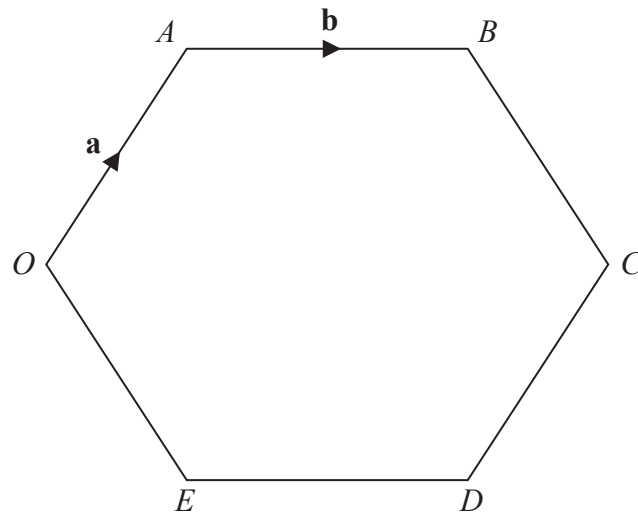


Diagram **NOT** accurately drawn

Figure 3

Figure 3 shows the regular hexagon $OABCDE$ with $\vec{OA} = \mathbf{a}$ and $\vec{AB} = \mathbf{b}$

(a) Find \vec{OB} in terms of \mathbf{a} and \mathbf{b} (1)

(b) Find \vec{BC} as a simplified expression in terms of \mathbf{a} and \mathbf{b} (3)

The point M divides BC in the ratio $2 : 1$

(c) Find \vec{OM} as a simplified expression in terms of \mathbf{a} and \mathbf{b} (2)

The point Y is such that OMY and ABY are straight lines.

(d) Use a vector method to find $AB : BY$ (5)

The area of hexagon $OABCDE$ is 60 cm^2

(e) Find the area of triangle OAY (4)

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Question 8 continued

Handwriting practice area with 20 horizontal dotted lines.

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Question 8 continued

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Question 8 continued

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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 11 marks)

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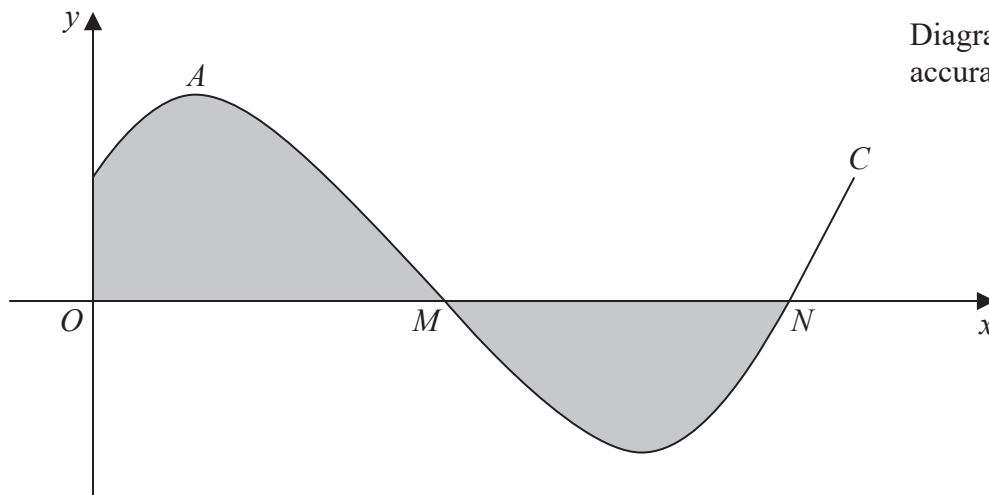


Figure 4

Figure 4 shows the curve C with equation $y = \frac{1}{2} + \sin 3x$ where $0 \leq x < \frac{2\pi}{3}$

The curve C crosses the x -axis at the points M and N

- (a) Show that the coordinates of M are $\left(\frac{7\pi}{18}, 0\right)$ and find the coordinates of N (3)

The curve C has a maximum at the point A

- (b) Find the coordinates of A (4)

- (c) Find an equation of the tangent to C at M

Give your answer in the form $ay + b\sqrt{3}x - c\sqrt{3}\pi = 0$ where a , b and c are integers to be found. (4)

The finite region, shown shaded in Figure 4, is bounded by the curve C , the y -axis and the part of the x -axis from O to N

- (d) Use algebraic integration to find, to 3 significant figures, the total area of the shaded region. (4)

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Question 10 continued

Handwriting practice area with 20 horizontal dotted lines.

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Question 10 continued

Handwriting practice area with 25 horizontal dotted lines.

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Question 10 continued

Area with horizontal dotted lines for writing.

(Total for Question 10 is 15 marks)

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11

$$f(x) = ax^2 - 14x - 10 \quad \text{where} \quad a \in \mathbb{Z}$$

Given that $(x - 4)$ is a factor of $f(x)$ and that when $f(x)$ is divided by $(x + 1)$ the remainder is 25

(a) show that $a = 6$

(6)

(b) Hence use algebra to solve the equation $f(x) = 0$

(6)

Dotted lines for writing answers.

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Question 11 continued

Handwriting practice area with 20 horizontal dotted lines.

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Question 11 continued

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(Total for Question 11 is 12 marks)

TOTAL FOR PAPER IS 100 MARKS

