Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International GCSE

Tuesday 21 May 2024

Morning (Time: 2 hours)

Paper reference **4PM1/01R**

Further Pure Mathematics
PAPER 1R

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.

Turn over ▶

R74099A

F:1/1/1/1/1/

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, $S_\infty = \frac{a}{1-r} \quad |r| < 1$

Binomial series

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

Calculus

Quotient rule (differentiation)

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

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

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

Answer all ELEVEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Without using a calculator, solve the inequality $\sqrt{50}\,x - \sqrt{18} > 6x + 5$

Give your answer in an exact form with a rationalised denominator.
Show your working clearly.

(4)

(Total for Question 1 is 4 marks)

2 Given that

$$1 - \frac{1}{3}x + \frac{5}{36}x^2 + \dots$$

is the binomial expansion, in ascending powers of x, of $(1 + Ax)^n$

where A and n are rational numbers,

(a) find the value of A and the value of n

(6)

(b) Hence find the value of the coefficient of x^3

Give your answer in the form $-\frac{p}{q}$ where p is a prime number and q is an integer.

(2)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Question 2 continued

(Total for Question 2 is 8 marks)

3

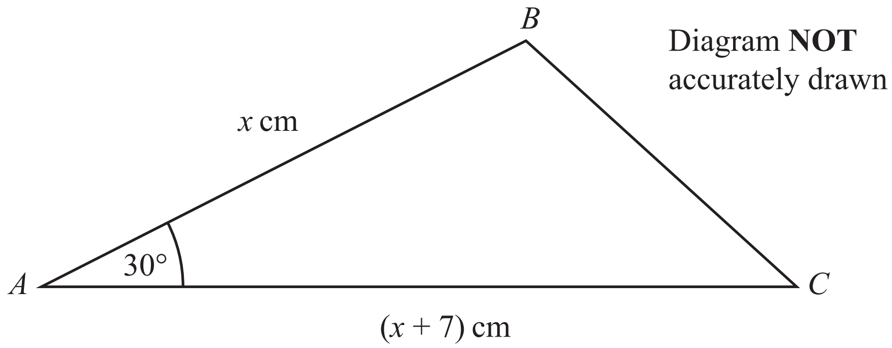


Figure 1

Figure 1 shows triangle ABC where

$AB = x$ cm $\qquad AC = (x + 7)$ cm $\qquad \angle BAC = 30^{\circ}$

The area of triangle $ABC = 36$ cm^2

(a) Show that $x = 9$

(3)

(b) Find, in cm to 3 significant figures, the length of BC

(2)

(c) Find, in degrees to one decimal place, the size of

(i) $\angle ABC$

(ii) $\angle ACB$

(3)

Question 3 continued

(Total for Question 3 is 8 marks)

4

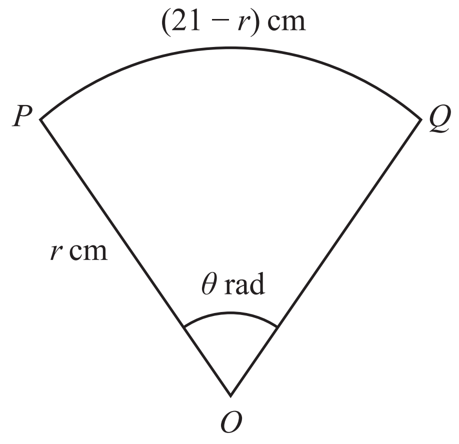


Diagram **NOT** accurately drawn

Figure 2

Figure 2 shows the sector OPQ of a circle with centre O and radius r cm.

$OP = OQ = r$ cm   arc $PQ = (21 - r)$ cm $\angle POQ = \theta$ radians

The area of the sector is A cm^2

(a) Show that $A = \frac{r}{2}(21 - r)$

(3)

The area of the sector must be greater than or equal to 27 cm^2

(b) Find the set of possible values of r

(4)

(c) Hence write down the set of possible values of θ

(2)

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

Question 4 continued

(Total for Question 4 is 9 marks)

5 The sum of the first 10 terms of an arithmetic series A is $36k + 1$ where k is a constant.

The 6th term of A is $4k + 1$

(a) (i) Find an expression in terms of k for the common difference of A

(ii) Show that the first term of A is -8

(5)

Given that the 4th term of A is 7

(b) show that $k = 4$

(2)

The sum of the first n terms of A is S_n and the nth term of A is U_n

(c) Find the value of n such that $S_n = 5U_{n+10} + 105$

(4)

Question 5 continued

Question 5 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Question 5 continued

(Total for Question 5 is 11 marks)

6 A particle P is moving in a straight line. The displacement s of P, in metres, at time t seconds, $t \geqslant 0$, is given by

$$s = e^{2t} \sin 3t + 2$$

At time $t = 0$, P is at the point A and at time $t = \dfrac{\pi}{6}$, P is at the point B

(a) Find the exact distance AB

(2)

(b) Find the exact velocity of P when $t = \dfrac{\pi}{3}$

(4)

Question 6 continued

(Total for Question 6 is 6 marks)

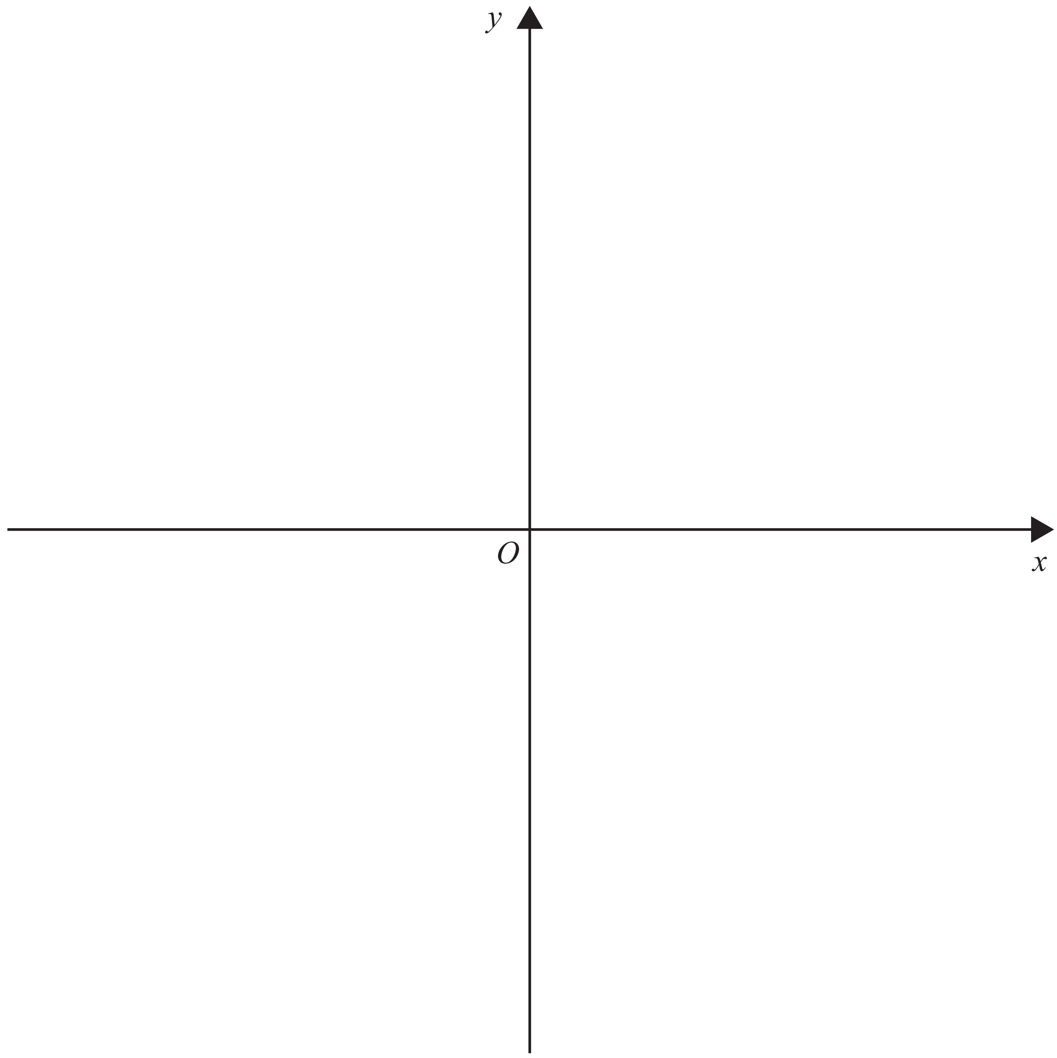
7 The curve C has equation $y = -\log_4(x + 4)$

(a) Using the axes below, sketch the graph of C.
Label the coordinates of the points of intersection of C with the coordinate axes and the equation of any asymptote to C.

(4)

(b) Solve the equation $\log_{(x+4)} 256 - \log_4(x + 4) = 0$

(5)



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Question 7 continued

(Total for Question 7 is 9 marks)

8

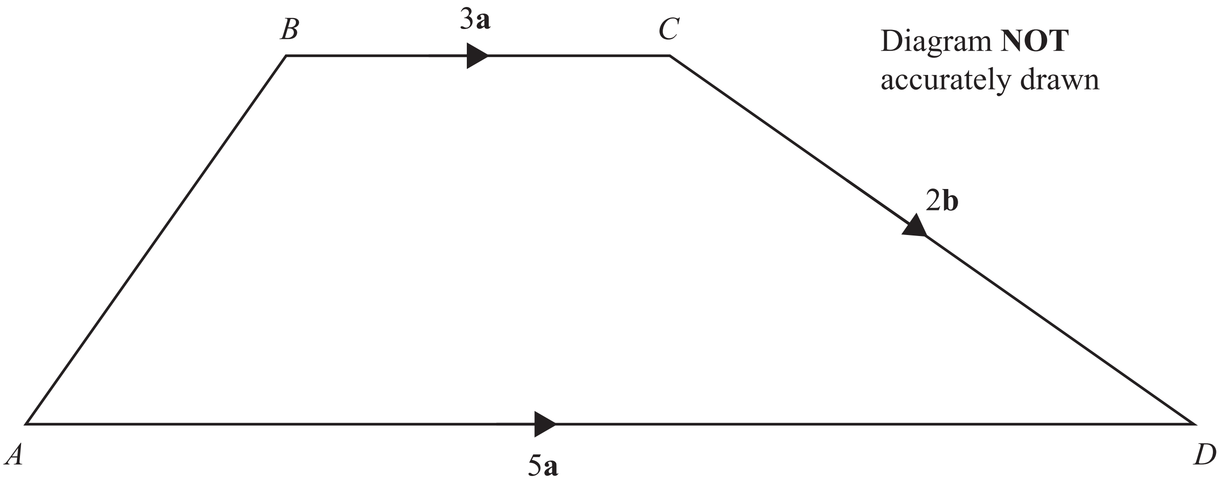


Figure 3

Figure 3 shows a trapezium $ABCD$

$$\overrightarrow{BC} = 3\mathbf{a} \qquad \overrightarrow{AD} = 5\mathbf{a} \qquad \overrightarrow{CD} = 2\mathbf{b}$$

(a) Find $\overrightarrow{AB}$ as a simplified expression in terms of **a** and **b**

(1)

The diagonals BD and AC intersect at point X where $\overrightarrow{BX} = k\,\overrightarrow{BD}$

(b) Using a vector method, find the value of k

(5)

(c) Find the ratio of the area of triangle CXD : area of the trapezium $ABCD$

(4)

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

Question 8 continued

Question 8 continued

Question 8 continued

(Total for Question 8 is 10 marks)

9 The point A has coordinates $(-4, 3)$ and the point B has coordinates $(6, 8)$
The points A and B lie on the line k

(a) Find an equation of k

(2)

The point C, on k, is such that $AC : CB = 4:1$

(b) Find the coordinates of point C

(2)

The point D with coordinates (p, q), where $p < 0$, lies on the line l through C that is perpendicular to k

The length of CD is $8\sqrt{5}$

(c) Find the coordinates of D

(6)

(d) Find the area of triangle ACD

(2)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Question 9 continued

Question 9 continued

Question 9 continued

(Total for Question 9 is 12 marks)

10 The quadratic equation $2x^2 + kx + 4 = 0$ has roots α and β such that

$$k < 0 \text{ and } \alpha > \beta$$

Given that $\alpha^2 - \beta^2 = \frac{7\sqrt{17}}{4}$

(a) show that $k = -7$

(8)

(b) Hence form a quadratic equation that has roots

$$(\alpha - \beta) \text{ and } (\alpha + \beta)$$

(4)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Question 10 continued

Question 10 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Question 10 continued

(Total for Question 10 is 12 marks)

11 $$f(\theta) = (2\cos\theta - \sin\theta)(2\sin\theta + \cos\theta)$$

(a) Show that $f(\theta) = \frac{3}{2}\sin 2\theta + 2\cos 2\theta$

(3)

Diagram **NOT** accurately drawn

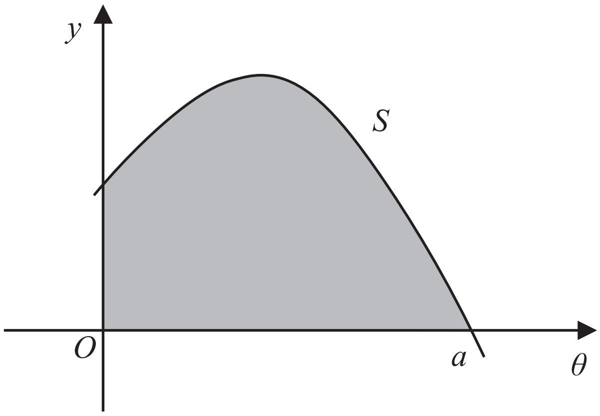


Figure 4

Figure 4 shows part of the curve S with equation $y = f(\theta) + 2$

Given that S intersects with the θ-axis at the point with coordinates $(a, 0)$

(b) using $\sin^2\theta + \cos^2\theta = 1$, or otherwise, show that $a = \frac{\pi}{2}$

(5)

(c) Using algebraic integration, find the exact area bounded by S, the positive θ-axis and the positive y-axis shown shaded in Figure 4

(3)

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

Question 11 continued

Question 11 continued

(Total for Question 11 is 11 marks)

TOTAL FOR PAPER IS 100 MARKS