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ADDITIONAL MATHEMATICS

0606/22

Paper 2

February/March 2025

2 hours

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a scientific calculator where appropriate.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [].

This document has **16** pages.



List of formulas

Equation of a circle with centre (a, b) and radius r .

$$(x-a)^2 + (y-b)^2 = r^2$$

Curved surface area, A , of cone of radius r , sloping edge l .

$$A = \pi r l$$

Surface area, A , of sphere of radius r .

$$A = 4\pi r^2$$

Volume, V , of pyramid or cone, base area A , height h .

$$V = \frac{1}{3}Ah$$

Volume, V , of sphere of radius r .

$$V = \frac{4}{3}\pi r^3$$

Quadratic equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \dots + \binom{n}{r}a^{n-r}b^r + \dots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

Arithmetic series

$$u_n = a + (n-1)d$$

$$S_n = \frac{1}{2}n(a+l) = \frac{1}{2}n\{2a + (n-1)d\}$$

Geometric series

$$u_n = ar^{n-1}$$

$$S_n = \frac{a(1-r^n)}{1-r} \quad (r \neq 1)$$

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

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulas for $\triangle ABC$

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2}ab \sin C$$

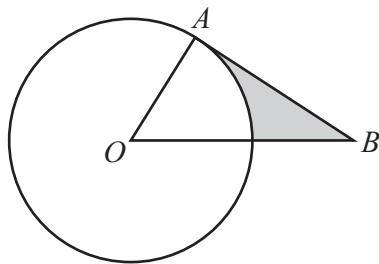


* 0000800000003 *



3

1



The diagram shows a circle with centre O and radius 5 cm.
 The point A lies on the circle.
 The point B is such that the line AB is a tangent to the circle.
 OB has length 13 cm.

(a) Find angle AOB , giving your answer in radians. [2]

(b) Find the perimeter of the shaded region. [3]

(c) Find the area of the shaded region. [3]



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4

- 2 (a) Find the x -coordinates of the stationary points on the curve $y = \frac{1}{2}(3 - 2x)(x + 2)^2$.

[4]

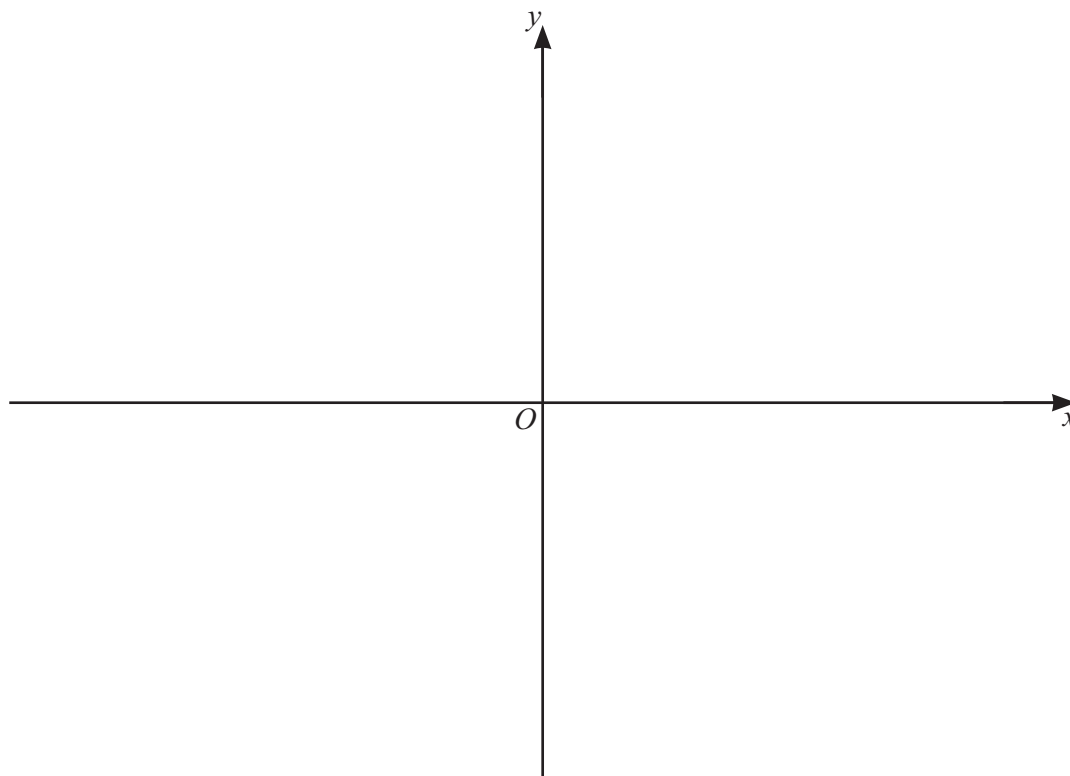


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5

- (b) On the axes, sketch the graph of $y = \frac{1}{2}(3-2x)(x+2)^2$ stating the intercepts with the coordinate axes. [3]



- (c) Find the values of k for which the equation $\frac{1}{2}(3-2x)(x+2)^2 = k$ has three real and distinct roots. [2]



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6

3 Solve the equation $6x^{\frac{3}{5}} + 1 = \frac{12}{x^{\frac{3}{5}}}$, giving your answers correct to 2 decimal places.

[4]

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7

4 (a) A team of 10 players is to be chosen from 15 players.

(i) Find the number of different teams that can be chosen if there are no restrictions.

[1]

The 15 players include 3 sisters who must **not** be separated.

(ii) Find the number of different teams that can be chosen.

[3]

(b) A 6-digit number is to be formed using the digits 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9.
The 6-digit number cannot start with 0 and all six digits must be different.

Find how many 6-digit numbers can be formed if the 6-digit number is even.

[3]



* 0000800000008 *



8

- 5 When e^y is plotted against x^2 , a straight-line graph with gradient -3 is obtained. The line passes through the point $(4.30, 5.85)$.

(a) Find y in terms of x .

[4]

(b) Find the values of x for which y exists.

[3]



* 0000800000009 *



9

6 It is given that $y = \frac{\ln(2x^2 + 1)}{x + 2}$.

(a) Find $\frac{dy}{dx}$. [3]

(b) Given that x increases from 2 to $2 + h$, where h is small, find the approximate change in y . [2]

(c) Given that y is decreasing by 0.4 units per second, find the corresponding rate of change in x when $x = 2$. [3]



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10

7 It is given that $f(x) = 2e^x + a$ for $x \geq 0$, where a is an integer

and $g(x) = \sqrt{x-1}$ for $x \geq 1$.

(a) Find the least value of a so that the function gf exists for all $x \geq 0$.

[2]

(b) In the case where $a = 5$, solve the equation $gf(x) = 3$.
Give your answer correct to 3 decimal places.

[3]



* 0000800000011 *



11

- 8 (a) Show that $\frac{\sin \theta \tan^2 \theta}{1 + \tan^2 \theta}$ can be written as $\sin^3 \theta$.

[2]

- (b) Hence solve the equation $\frac{\sin 3x \tan^2 3x}{1 + \tan^2 3x} = \frac{1}{8}$ for $-180^\circ \leq x \leq 180^\circ$.

[5]



- 9 In this question, all lengths are in metres and time is in seconds.

A particle, P , moves in a straight line such that t seconds after passing through a fixed point O its displacement, s , is given by $s = 5 \ln(2t + 1) - 5t$.

- (a) Find the value of t for which P is instantaneously at rest. [4]

- (b) Find the distance P travels between $t = 0$ and $t = 2$. [4]



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13

(c) Find an expression for the acceleration of P in terms of t .

[2]

(d) Find the acceleration when $t = 4.5$.

[1]





- 10 The expansion of $(ax-2)^4\left(1+\frac{b}{x}\right)^3$ is written in descending powers of x .

The first 3 terms of this expansion are $81x^4 + 999x^3 + cx^2$.
It is given that a , b and c are positive integers.

Find the values of a , b and c .

[10]



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15

Continuation of working space for Question 10.

Question 11 is printed on the next page.





11 Solve the equation $\cot(y + 1.5) = 3$ where y is in radians and $0 < y < 6$.

[4]

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