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ADDITIONAL MATHEMATICS **0606/13**

Paper 1 Non-calculator **October/November 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.
- Calculators must **not** be used in this paper.
- You must show all necessary working clearly.

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. Any blank pages are indicated.

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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. $A = \pi rl$

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

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

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 ΔABC

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

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

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

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Calculators must **not** be used in this paper.

1 Solve the following inequalities.

(a) $x^2 - x - 6 \geqslant 0$ [3]

(b) $|3x - 4| < x + 2$ [4]

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2 Differentiate $x^2 e^{3x}$ with respect to x. [3]

3 In this question you may use the values in the table below.

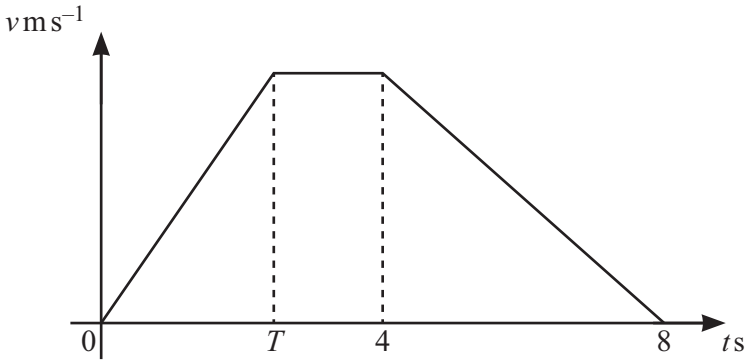
θ radians	$\sin\theta$	$\cos\theta$	$\tan\theta$
$\frac{\pi}{6}$	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{3}}{3}$
$\frac{\pi}{3}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$

Variables x and y are related by the equation $y = \sin 5x$ where $0 \leqslant x \leqslant \frac{\pi}{10}$.

Use calculus to find the approximate change in x when y increases from $\frac{\sqrt{3}}{2}$ by the small amount 0.01. [4]

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4



The velocity–time graph represents the motion of a particle moving in a straight line.
The acceleration during the first T seconds of the motion is $2\,\text{m s}^{-2}$.
The total distance travelled is 27 m.

(a) Calculate T. [4]

(b) Calculate the acceleration during the last 4 seconds of the motion. [2]

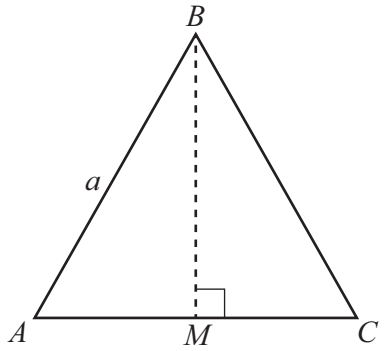
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5 The normal to the curve $y = x^3 + \frac{3}{2}x^2 - 2x + 1$ at the point where $x = 0$ cuts the curve again at two other points.

Find the x-coordinates of these two points. [8]

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6 (a)



The diagram shows an equilateral triangle ABC with side a.
M is the midpoint of AC and angle $AMB = 90°$.

Use the diagram to find $\sec 30°$. [3]

(b) Show that $\dfrac{1}{\sec x - 1} + \dfrac{1}{\sec x + 1}$ can be written as $2\,\mathrm{cosec}\,x \cot x$. [4]

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7 The point O is the origin.
Two points P and Q are such that $\overrightarrow{PQ}$ is in the same direction as $-\mathbf{i}+5\mathbf{j}$.

(a) The point R is such that $\overrightarrow{OR}$ is in the same direction as $\overrightarrow{PQ}$ and the magnitude of $\overrightarrow{OR}$ is $3\sqrt{26}$.

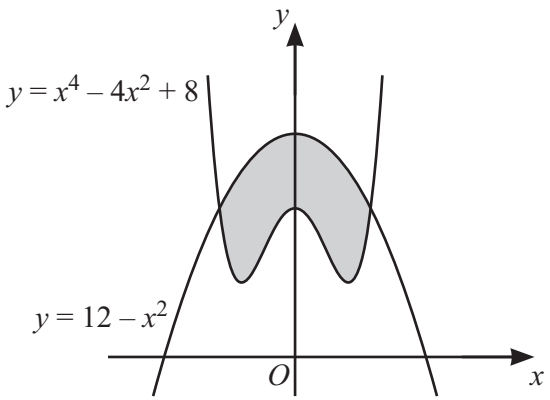
Find $\overrightarrow{OR}$. [3]

(b) $\overrightarrow{OP}$ is in the same direction as $2\mathbf{i}-3\mathbf{j}$ and $\overrightarrow{OQ}=10\mathbf{i}+6\mathbf{j}$.

Find $\overrightarrow{OP}$. [4]

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The diagram shows part of each of the curves $y = 12 - x^2$ and $y = x^4 - 4x^2 + 8$.

Find the area of the shaded region enclosed by the two curves. [7]

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9 Solve the following equations.

(a) $\log_5(5x-2) - \log_{25} x = \frac{1}{2}$ [5]

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(b) $e^{3y-7} + \frac{4}{e^3} = \frac{5}{e^{3y-1}}$ [6]

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10 (a) An arithmetic progression has first term a and common difference d.

Given that $S_{20} = 3 \times S_{10}$, find a in terms of d. [3]

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(b) A geometric progression, A, has common ratio r, where $|r| < 1$.
The terms of this progression are $a_1, a_2, a_3 \ldots$.

Another geometric progression, B, has terms $b_1, b_2, b_3 \ldots$, where

$$b_1 = a_2, \quad b_2 = a_4, \quad b_3 = a_6 \ldots .$$

The sum to infinity of A is S_A and the sum to infinity of B is S_B.

Find $\frac{S_B}{S_A}$ in terms of r.

Give your answer in its simplest form. [5]

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11 The lines $x = 0$, $x = 4$, $y = 3$ and $y = -1$ are tangents to a circle.

(a) Find the equation of the circle. [3]

The line $y = 2x + a$, where a is a constant, is also a tangent to the circle.

(b) Show that $5x^2 + 4(a-2)x + (a-1)^2 = 0$, and hence find the possible values of a. Give your answers in exact form. [4]

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12 **(a)** Write down the coefficient of x^r in the binomial expansion of $(2+x)^{59}$. [1]

(b) For this expansion, find the value of r for which the coefficient of x^r is equal to the coefficient of x^{r+1}. [4]



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