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ADDITIONAL MATHEMATICS **0606/13**

Paper 1 Non-calculator **May/June 2026**

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. Do **not** use correction fluid or tape.
- 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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1 **(a)** Write $2x^2 - 6x + 5$ in the form $a(x+b)^2 + c$, where a, b and c are constants. [3]

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(b) Hence or otherwise solve the inequality $2x^2 - 6x + 5 > 13$. [3]

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2 An arithmetic progression has first term a and common difference d, where $a \neq 0$ and $d \neq 0$.

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- The sum of the 6th and 11th terms is 0.
- The sum of the first 6 terms is -30.

Find the values of a and d. [5]

3 **(a)** Solve the equation $\log_x 9 = \log_9(x^4)$. [4]

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(b) Solve the equation $2^{2x-2} + 3(2^x) - 40 = 0$. [4]

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(c) Solve the equation $\left|x^2 + 3x - 4\right| = 6$. [4]

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4 The polynomial p is given by $\mathrm{p}(x) = 4x^3 - 5x^2 - 7x + 2$.

(a) Show that $x - 2$ is a factor of $\mathrm{p}(x)$. [1]

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(b) Write $\mathrm{p}(x)$ as a product of linear factors. [3]

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(c) Hence solve the equation $4u^6 - 5u^4 - 7u^2 + 2 = 0$. [2]

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5 **(a)** On the grid, sketch the graph of $y = \cos x + 2$ for $-360° \leqslant x \leqslant 360°$. [1]

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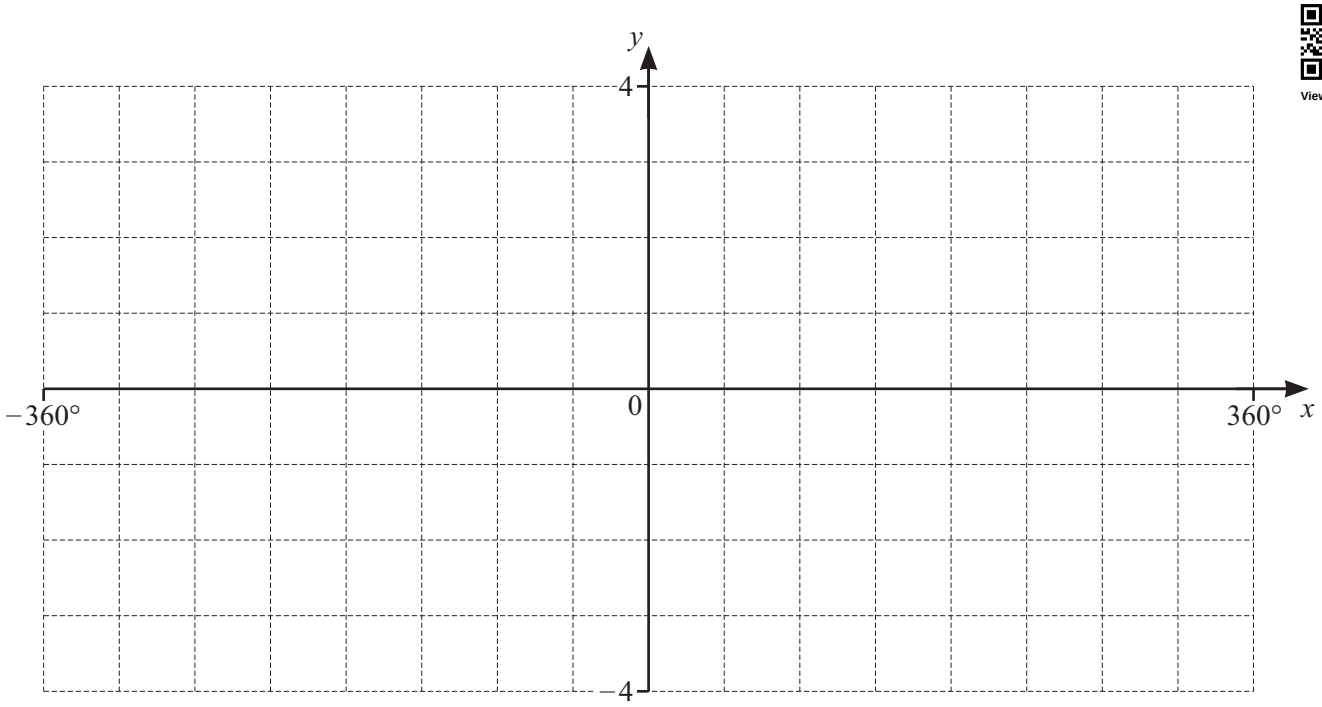

(b) On the grid, sketch the graph of $y = 4\sin 2x$ for $-180° \leqslant x \leqslant 180°$. [2]

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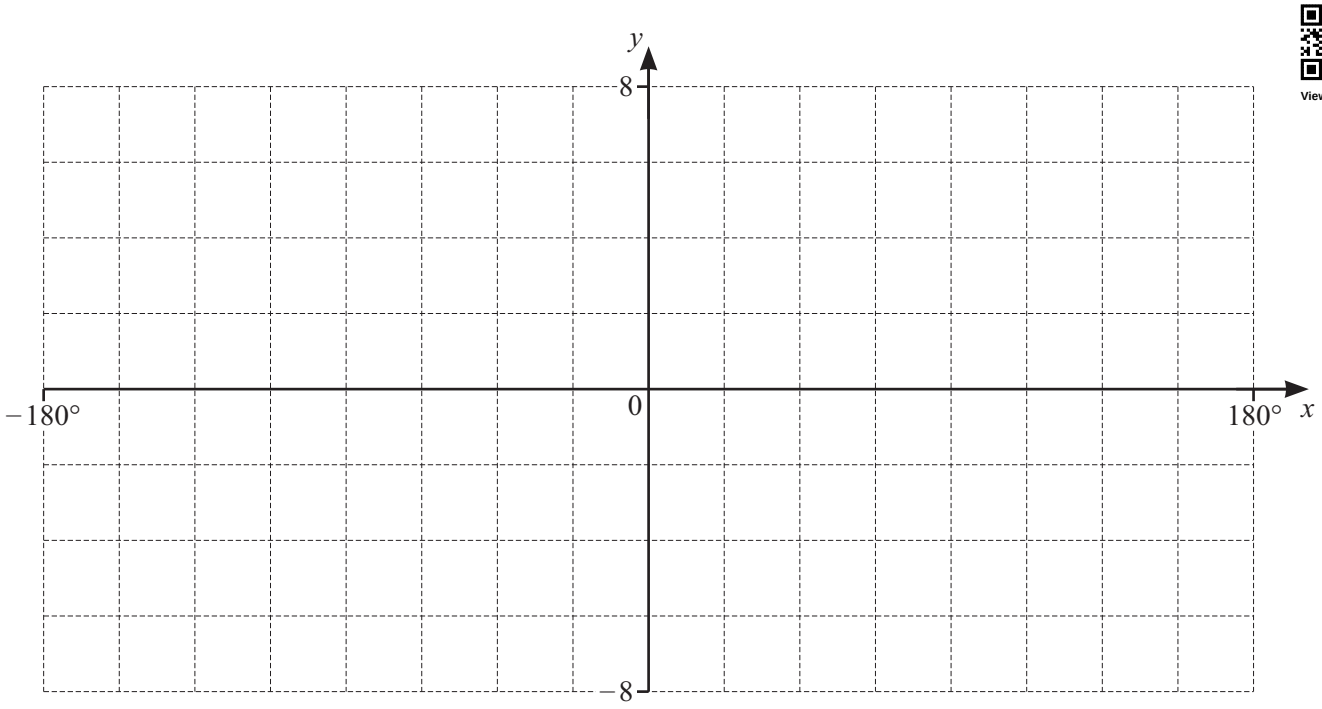

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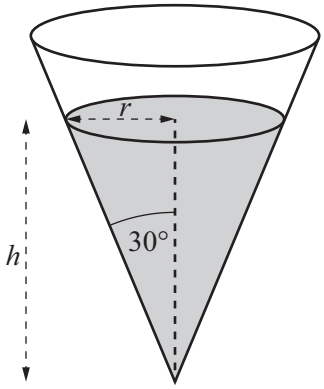
6 In this question time is in seconds and lengths are in centimetres.

You are given that $\cos 30° = \frac{\sqrt{3}}{2}$, $\sin 30° = \frac{1}{2}$ and $\tan 30° = \frac{1}{\sqrt{3}}$.

A water tank is shaped as a cone with its axis vertical.
The angle between the vertical axis and the sloping edge of the cone is 30°.



At time t the depth of the water is h, the volume of water in the tank is V, and the radius of the circle formed by the surface of the water is r.

(a) Show that $V = \frac{1}{9}\pi h^3$. [2]

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Water is flowing into the tank at a constant rate of $50\,\text{cm}^3\,\text{s}^{-1}$.

(b) Find the rate at which h is increasing at the instant when $h = 60$.
Give your answer in terms of π. [4]

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7 The number of combinations of r objects out of 20 objects is $\frac{4}{3}$ times the number of combinations of $r+1$ objects out of 20 objects.

Find the value of r. [4]

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8 A function f is defined by $f(x) = e^{2x+1}$ for $x \in \mathbb{R}$.

(a) State the range of f^{-1}. [1]

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(b) Find the domain of f^{-1}. [1]

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(c) Find an expression for $f^{-1}(x)$. [2]

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(d) On the axes, sketch the graph of $y = \mathrm{f}(x)$ and hence sketch the graph of $y = \mathrm{f}^{-1}(x)$. State the exact coordinates of any intercepts with the axes. [4]

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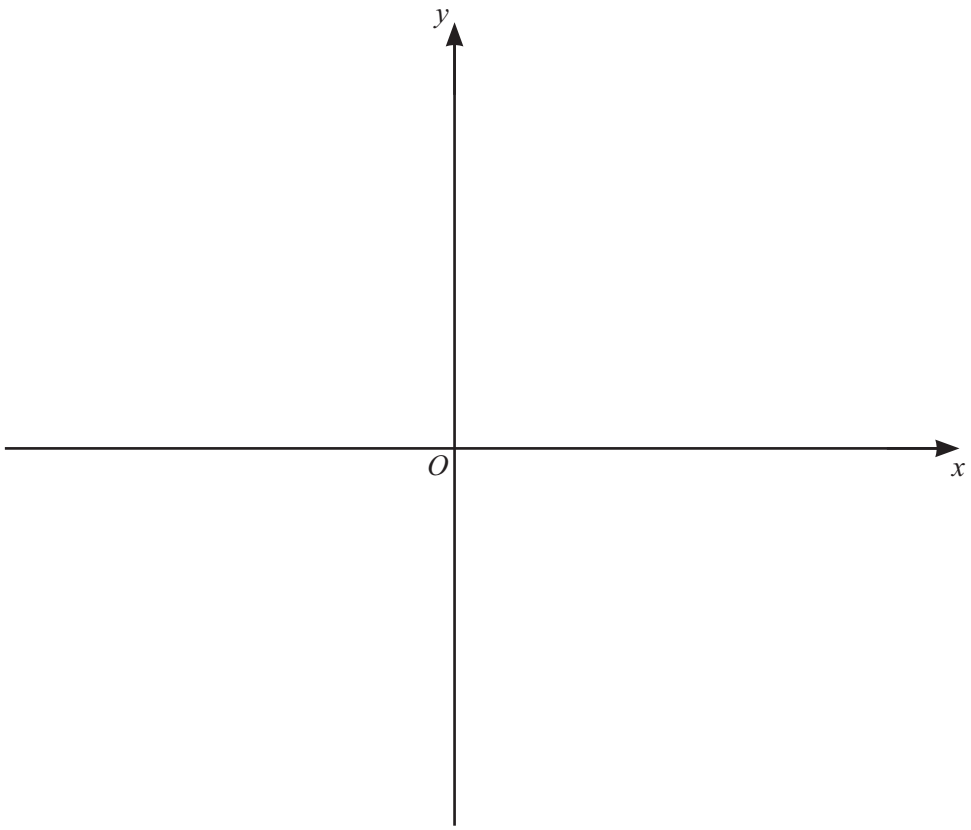

9 A circle has centre (3, 1) and radius 1.
A line has equation $2y + x = c$, where c is a constant.

(a) Given that the line is a tangent to the circle, find the two possible values of c. [7]

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(b) When c takes a value between the two values found in **9(a)**, state the relationship between the line and the circle. [1]

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10 The parallelogram $OABC$ is such that $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.
The point D lies on OB such that $OD : OB = 1 : 3$.
The point E lies on AC such that $AE : AC = 2 : 3$.

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Show that $\overrightarrow{DE}$ is parallel to $\overrightarrow{AB}$. [5]

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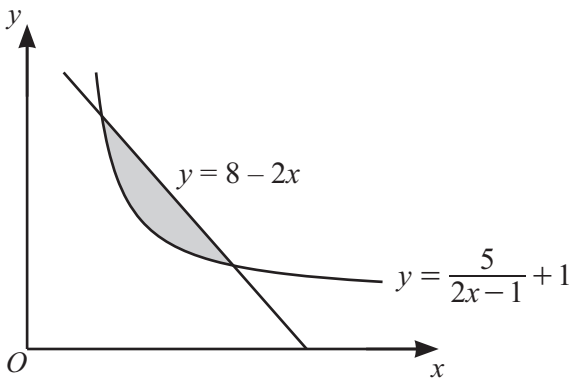

The diagram shows part of the curve $y = \frac{5}{2x-1} + 1$ and part of the line $y = 8 - 2x$.

Find the exact area of the shaded region enclosed by the curve and the line. [10]

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12 A curve has equation $y = e^{\frac{2a}{x}}$ where a is a positive constant.

(a) Find $\frac{dy}{dx}$ in terms of a. [2]

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The normal to the curve at the point where $x = a$ passes through the origin.

(b) Find the value of a. [5]

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