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CAMBRIDGE International Education

Cambridge IGCSE™

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ADDITIONAL MATHEMATICS **0606/12**

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.

DC (SL/TC) 360545/2

[Turn over

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

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

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

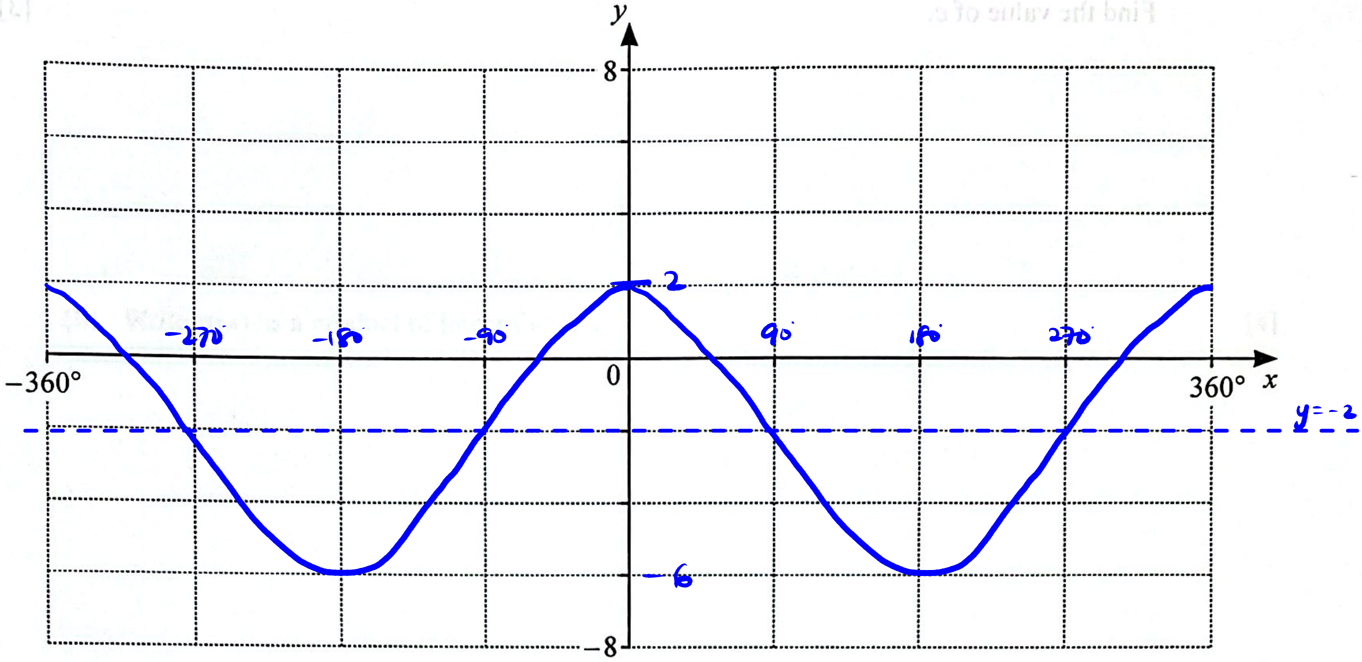
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

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

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

1 **(a)** On the axes, sketch the graph of $y = 4\cos x - 2$ for $-360° \leqslant x \leqslant 360°$. [2]



(b) Write down the amplitude of $4\cos x - 2$. [1]

4

(c) Write down the period of $4\cos x - 2$. [1]

360°

(d) Write down the set of values of the constant k for which the equation $4\cos x - 2 = k$ has at least two solutions. [1]

$-6 \leq k \leq 2$

2 Points A and B have coordinates $A(-2, 3)$ and $B(8, -3)$.

(a) The perpendicular bisector of AB passes through the point $C(0, c)$.

Find the value of c. [3]

$$m_{AB} = \frac{3-(-3)}{-2-8}$$

$$= \frac{6}{-10}$$

$$= -\frac{3}{2}$$

$$\therefore m = \frac{2}{3}$$

$$M(x,y) = \left(\frac{-2+8}{2}, \frac{3-3}{2}\right)$$

$$= (3, 0)$$

$$\therefore y = \frac{2}{3}(x-3)$$

when $x=0$, $y=c$

$$c = \frac{2}{3}(-3)$$

$$= -2$$

(b) The point D has coordinates $(2, -1)$.

The lengths of AD and BD are such that $BD = \frac{\sqrt{n}}{2}AD$ where n is an integer.

Find the value of n. [4]

$$\frac{BD}{AD} = \frac{\sqrt{6^2+2^2}}{\sqrt{4^2+4^2}} = \frac{\sqrt{40}}{\sqrt{32}} = \sqrt{\frac{5}{4}} = \frac{\sqrt{5}}{2}$$

$$\therefore n = 5$$

3 The polynomial p is given by $p(x) = 6x^3 - x^2 - 5x + 2$.

(a) Find the remainder when $p(x)$ is divided by $x+2$. [1]

$x + 2 = 0$
$x = -2$

$p(-2) = 6(-8) - (4) - 5(-2) + 2$
$= -48 - 4 + 10 + 2$
$= -52 + 12$
$= -40$

(b) Write $p(x)$ as a product of linear factors. [4]

$p(-1) = 6(-1) - (1) - 5(-1) + 2$
$= -6 - 1 + 5 + 2$
$= 0$

hence $x+1$ is one of the factor of $p(x)$.

$$\begin{array}{r}
6x^2 - 7x + 2 \\
x+1 \,\big)\, \overline{6x^3 - x^2 - 5x + 2} \\
\underline{6x^3 + 6x^2} \quad\quad\quad \\
-7x^2 - 5x \quad \\
\underline{-7x^2 - 7x} \quad \\
2x + 2 \\
\underline{2x + 2}
\end{array}$$

$p(x) = (x+1)(6x^2 - 7x + 2)$
$= (x+1)(3x-2)(2x-1)$ #.

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

let $u^2 = x$

$6x^3 - x^2 - 5x + 2 = 0$

$(x+1)(3x-2)(2x-1) = 0$

$x_1 = -1$, $x_2 = \frac{2}{3}$, $x_3 = \frac{1}{2}$

$u^2 = -1$ rejected, $u^2 = \frac{2}{3}$, $u = \pm\sqrt{\frac{2}{3}}$, $u^2 = \frac{1}{2}$, $u = \pm\sqrt{\frac{1}{2}}$

$u_1 = -\frac{\sqrt{6}}{3}$, $u_2 = -\frac{\sqrt{2}}{2}$, $u_3 = \frac{\sqrt{2}}{2}$, $u_4 = \frac{\sqrt{6}}{3}$

4 An arithmetic progression has first term $u_1 = 400$ and common difference $d = -2$.

(a) Find the 81st term and the 100th term. [2]

81st : $u_1 + 80d = 400 + 80(-2)$

$= 400 - 160$

$= 240$

100^{th} : $u_1 + 99d = 400 + 99(-2)$

$= 400 - 198$

$= 202$

(b) Find the sum of all the terms from the 81st to the 100th, $u_{81} + u_{82} + \ldots + u_{100}$. [3]

$a = 240$, $l = 202$, $n = 20$

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

$S_{20} = 10(240 + 202)$

$= 10(442)$

$= 4420$ ※

5 Find, in exact form, the equation of the tangent to the curve $y = \ln\left((2x-4)^5\right)$ at the point where $x = 3$. [4]

$$\frac{dy}{dx} = \frac{1}{(2x-4)^5} \times 5(2x-4)^4(2)$$

$$= \frac{10}{2x-4}$$

$$= \frac{5}{x-2}$$

$$m_t = \left.\frac{dy}{dx}\right|_{x=3}$$

$$= \frac{5}{1}$$

$$= 5$$

when $x = 3$

$$y = \ln\left((2(3)-4)^5\right)$$

$$= \ln(2^5)$$

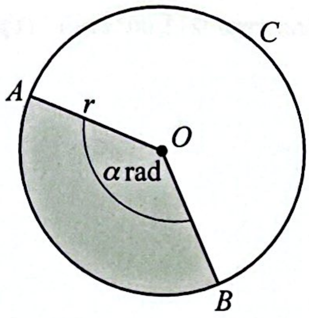
$$= \ln 32$$

equation of the tangent :

$$y - y_1 = m(x - x_1)$$

$$y - \ln 32 = 5(x-3) \quad \#$$

6 In this question lengths are in centimetres.



The diagram shows a circle with centre O and radius r.
Points A, B and C are on the circumference of the circle.
Angle $AOB = \alpha$ radians.

(a) The perimeter of the shaded sector is equal to the length of the major arc, ACB.

Find the exact value of α. [4]

$$P_{shaded} = \text{arc } ACB$$

$$2r + r\alpha = r(2\pi - \alpha)$$

$$2 + \alpha = 2\pi - \alpha$$

$$2\alpha = 2\pi - 2$$

$$\alpha = \pi - 1$$

(b) The area of the shaded sector is $18(\pi^2 - 1)$.

Find the exact value of r.
Simplify your answer. [4]

$$A_{shaded} = \frac{1}{2} r^2 \alpha$$

$$18(\pi^2 - 1) = \frac{1}{2} r^2 (\pi - 1)$$

$$r^2 = \frac{36(\pi^2 - 1)}{\pi - 1}$$

$$r^2 = \frac{36(\pi + 1)\cancel{(\pi - 1)}}{\cancel{\pi - 1}}$$

$$\therefore r = 6\sqrt{\pi + 1} \text{ cm } \#$$

7 Show that $\operatorname{cosec} x - \sin x$ can be written as $\dfrac{\cos x}{\tan x}$. [3]

$$\frac{1}{\sin x} - \frac{\sin x}{1} \times \frac{\sin x}{\sin x}$$

$$\frac{1}{\sin x} - \frac{\sin^2 x}{\sin x}$$

$$\frac{\cos^2 x}{\sin x}$$

$$\frac{\frac{\cos^2 x}{\cos x}}{\frac{\sin x}{\cos x}}$$

$$\frac{\cos x}{\tan x} \rightarrow \text{R.H.S, shown! \#}$$

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8 Variables x and y are related by the equation $y = \dfrac{5x+1}{x-2}$.

Using calculus, find the approximate change in x when y increases from 4 by the small amount h. [5]

$$\frac{dy}{dx} = \frac{(x-2)(5) - (5x+1)(1)}{(x-2)^2}$$

$$= \frac{5x - 10 - 5x - 1}{(x-2)^2}$$

$$= -\frac{11}{(x-2)^2}$$

when $y = 4$, $\quad 4 = \dfrac{5x+1}{x-2}$

$$4x - 8 = 5x + 1$$

$$-9 = x$$

$$\left.\frac{dy}{dx}\right|_{x=-9} = -\frac{11}{(-9-2)^2}$$

$$= -\frac{1}{11}$$

$$\therefore \quad \delta x = \frac{dx}{dy} \times \delta y$$

$$= -11h \quad \#$$

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9 (a) Write $\frac{1}{\log_x e} - \ln(x-1)$ as a single logarithm to base e. [2]

$$\frac{1}{\frac{\ln e}{\ln x}} - \ln(x-1)$$

$$\ln x - \ln(x-1)$$

$$\ln\left(\frac{x}{x-1}\right)$$

(b) Solve the equation $2\log_5 2x = 1 + \log_5(9x-10)$. [5]

$$\log_5 4x^2 - \log_5(9x-10) = 1$$

$$\log_5\left(\frac{4x^2}{9x-10}\right) = 1$$

$$\frac{4x^2}{9x-10} = 5$$

$$4x^2 = 45x - 50$$

$$4x^2 - 45x + 50 = 0$$

$$(4x-5)(x-10) = 0$$

$$x_1 = \frac{5}{4} \qquad x_2 = 10$$

10 It is given that a geometric progression has the following terms.

2nd term	$11x-1$
3rd term	$x+5$
4th term	$x-1$

(a) Given that $x > 0$, find the common ratio and first term of the progression. [6]

$$\frac{x+5}{11x-1} = \frac{x-1}{x+5}$$

$$x^2+10x+25 = 11x^2-12x+1$$

$$0 = 10x^2-22x-24$$

$$0 = 5x^2-11x-12$$

$$0 = (5x+4)(x-3)$$

$$x_1 = -\frac{4}{5} \qquad x_2 = 3$$

rejected

$$\therefore r = \frac{x+5}{11x-1} = \frac{3+5}{11(3)-1} = \frac{8}{32} = \frac{1}{4} \qquad a = \frac{11x-1}{3} = \frac{32}{3} \#$$

(b) The sum to infinity of this progression is $\frac{k}{3}$ where k is an integer.

Find the value of k. [2]

$$S_\infty = \frac{a}{1-r}$$

$$= \frac{32/3}{3/4}$$

$$= \frac{32 \times 4}{3 \times 3}$$

$$= \frac{128}{6} = \frac{64}{3} \qquad \therefore k = 64 \#$$

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11 The position vectors of points A and B relative to an origin O are

$$\overrightarrow{OA} = \begin{pmatrix} 4 \\ -2 \end{pmatrix} \text{ and } \overrightarrow{OB} = \begin{pmatrix} -4 \\ 6 \end{pmatrix}.$$

The point C lies on AB and is such that $AC : CB = 3 : 1$.

The point D lies on OA such that $\overrightarrow{OD} = \lambda\overrightarrow{OA}$ and $\overrightarrow{CD} = \begin{pmatrix} 5 \\ -5.5 \end{pmatrix}$.

(a) Find $\overrightarrow{OD}$. [5]

$\overrightarrow{AC} = \frac{3}{4}\overrightarrow{AB}$

$\overrightarrow{AO} + \overrightarrow{OC} = \frac{3}{4}\begin{pmatrix} -8 \\ 8 \end{pmatrix}$

$\overrightarrow{OC} = \begin{pmatrix} -6 \\ 6 \end{pmatrix} + \overrightarrow{OA}$

$\overrightarrow{OC} = \begin{pmatrix} -2 \\ 4 \end{pmatrix}$

$\overrightarrow{CD} = \begin{pmatrix} 5 \\ -5.5 \end{pmatrix}$

$\overrightarrow{OD} = \begin{pmatrix} 5 \\ -5.5 \end{pmatrix} + \overrightarrow{OC}$

$= \begin{pmatrix} 3 \\ -1.5 \end{pmatrix}$

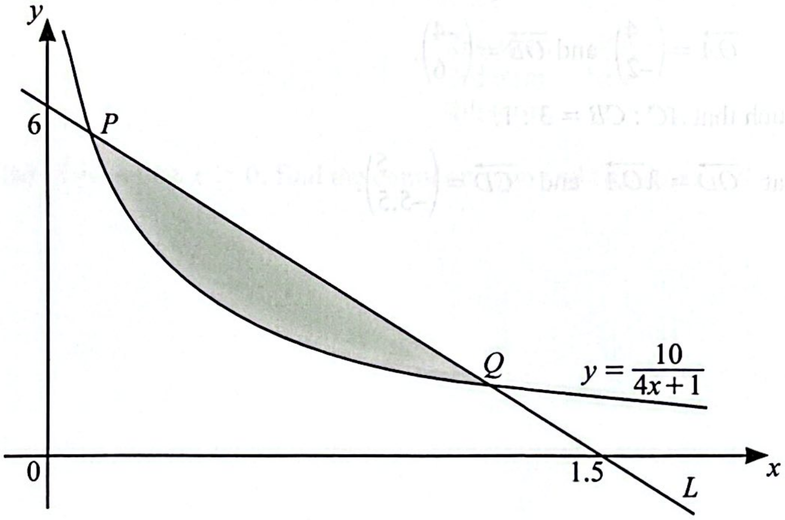
(b) Hence find the value of λ. [1]

$\begin{pmatrix} 3 \\ -1.5 \end{pmatrix} = \lambda \begin{pmatrix} 4 \\ -2 \end{pmatrix}$

$\frac{3}{2}\cancel{\begin{pmatrix} 2 \\ -1 \end{pmatrix}} = \lambda \left[2 \cancel{\begin{pmatrix} 2 \\ -1 \end{pmatrix}} \right]$

$\therefore \lambda = \frac{3}{4}$ *

12



The diagram shows part of the curve $y = \dfrac{10}{4x+1}$ and the line L.

L passes through the points (0, 6) and (1.5, 0).
The curve and L intersect at the points P and Q.

Find the exact area of the shaded region. [11]

$L: \quad \dfrac{x}{3/2} + \dfrac{y}{6} = 1$

$4x + y = 6$

$y = -4x + 6$

intersect: $\quad -4x + 6 = \dfrac{10}{4x+1}$

$(4x-6)(4x+1) = -10$

$16x^2 - 20x - 6 + 10 = 0$

$4x^2 - 5x + 1 = 0$

$(4x-1)(x-1) = 0$

$x_P = \frac{1}{4} \qquad x_Q = 1$

Continuation of working space for Question 12.

$$A_{\text{shaded}} = \int_{1/4}^{1} (6-4x)\,dx - \int_{1/4}^{1} \left(\frac{10}{4x+1}\right) dx$$

$$= \left[6x - 2x^2\right]_{1/4}^{1} - \left[\frac{5}{2}\ln(4x+1)\right]_{1/4}^{1}$$

$$= \left[(6-2) - \left(\frac{3^{\times 4}}{2^{\times 4}} - \frac{1}{8}\right)\right] - \left[\frac{5}{2}\ln\left(\frac{5}{2}\right)\right]$$

$$= 4 - \frac{11}{8} - \frac{5}{2}\ln\frac{5}{2}$$

$$= \frac{21}{8} - \frac{5}{2}\ln\frac{5}{2} \quad \#$$

Question 13 is on the back page.

13 Show that, for all values of $n \geqslant 3$, $\quad {}^{n+2}C_3 - {}^{n}C_3 = n^2$. [4]

L.H.S: $\dfrac{(n+2)!}{(n-1)!\,3!} - \dfrac{n!}{(n-3)!\,3!}$

$\dfrac{(n+2)(n+1)n\cancel{(n-1)!}}{\cancel{(n-1)!} \times 6} - \dfrac{n(n-1)(n-2)\cancel{(n-3)!}}{\cancel{(n-3)!} \times 6}$

$\dfrac{n}{6}\left(n^2+3n+2 - (n^2-3n+2)\right)$

$\dfrac{n}{\cancel{6}}(\cancel{6}n)$

$n^2 \rightarrow$ R.H.S, shown!