



Essential Skills
Higher
Mathematics
Practice Exam 2026

Paper 2 (Calculator)

Time 1 hour and 30 minutes

Total marks – 65

Attempt ALL questions.

You may use a calculator.

To earn full marks, you must show your working in your answers.

State the units for your answer where appropriate.

Use **blue** or **black** ink.

Marks available are harsh but I wanted as much course coverage as possible.

FORMULAE LIST

Circle

The equation $x^2 + y^2 + 2gx + 2fy + c = 0$ represents a circle centre $(-g, -f)$ and radius $\sqrt{g^2 + f^2 - c}$.

The equation $(x - a)^2 + (y - b)^2 = r^2$ represents a circle centre (a, b) and radius r .

Scalar product

$\mathbf{a} \cdot \mathbf{b} = |\mathbf{a}||\mathbf{b}| \cos \theta$, where θ is the angle between $\mathbf{a}$ and $\mathbf{b}$

or $\mathbf{a} \cdot \mathbf{b} = a_1 b_1 + a_2 b_2 + a_3 b_3$, where $\mathbf{a} = \begin{pmatrix} a_1 \\ a_2 \\ a_3 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} b_1 \\ b_2 \\ b_3 \end{pmatrix}$.

Trigonometric formulae

$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$

$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$

$$\sin 2A = 2 \sin A \cos A$$

$$\cos 2A = \cos^2 A - \sin^2 A$$

$$= 2 \cos^2 A - 1$$

$$= 1 - 2 \sin^2 A$$

Table of standard derivatives

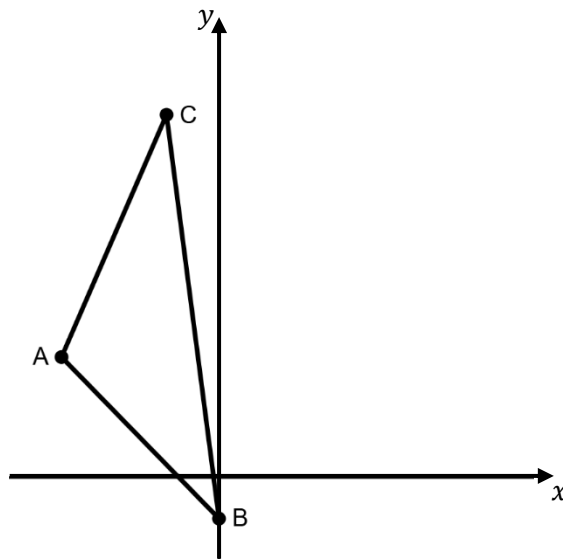
$f(x)$	$f'(x)$
$\sin ax$	$a \cos ax$
$\cos ax$	$-a \sin ax$

Table of standard integrals

$f(x)$	$\int f(x) dx$
$\sin ax$	$-\frac{1}{a} \cos ax + C$
$\cos ax$	$\frac{1}{a} \sin ax + C$

Attempt ALL questions
Total marks – 65

1. The vertices of a triangle are A(-6, 3), B(0, -1) and C(-2, 9) as shown.



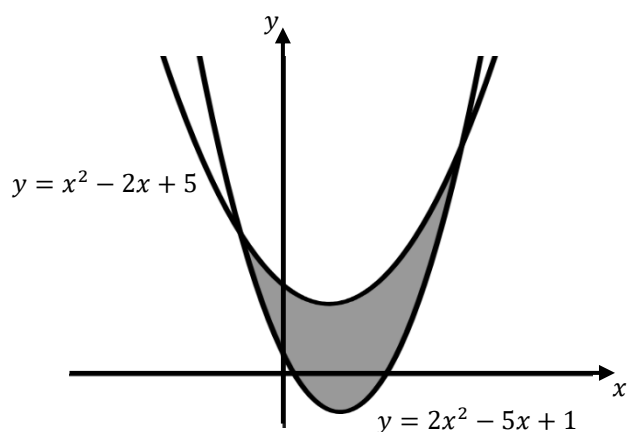
- (a) Find the equation of the perpendicular bisector of AB. 4
- (b) Determine the coordinates of the point where the perpendicular bisector of AB intersects side BC. 4
2. The curve $y = f(x)$ is such that $\frac{dy}{dx} = 6x - 4x^2$.
The curve passes through the point (2,5).
Express y in terms of x . 4
3. (a) Given $A(2, -1, 4)$, $B(6, 3, 1)$ and $C(-1, 5, 7)$,
express $\overrightarrow{AB}$ and $\overrightarrow{AC}$ in component form. 2
- (b) Calculate the size of the angle BAC . 4
4. Show that $x^2 + (m + 3)x + (m - 5) = 0$ has real roots for all values of m . 4

5. Solve $\log_3 x + \log_3(x - 8) = \log_7 49$, where $x > 8$ 4

6. A function, f , is defined by $f(x) = x^4 - 4x^3 + 5$.
Find the x -coordinates of the stationary points of f and determine their nature. 5

7. Functions f and g are given by $f(x) = 11 - 8\cos x$ and $g(x) = 2x$, $x \in \mathbb{R}$.
(a) Find expressions for:
(i) $f(g(x))$ 1
(ii) $g(f(x))$ 1
(b) Determine the values of x for which $f(g(x)) = g(f(x))$, where $0 \leq x \leq 360$. 5

8. The graphs of $y = x^2 - 2x + 5$ and $y = 2x^2 - 5x + 1$ are shown below.



Calculate the shaded area. 6

9. Show that $\frac{1 - \cos 2x}{\sin 2x} = \tan x$, where $0 < x < \frac{\pi}{2}$. 3

10. A cylindrical tin of Mintos has a surface area given by

$$A(r) = 2\pi r^2 + \frac{1200}{r}$$

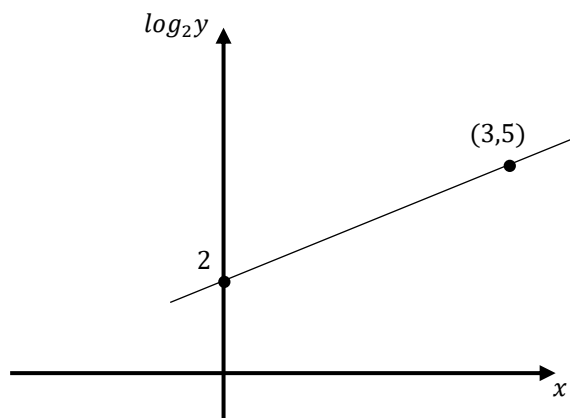


Determine the value of r that will minimise the surface area.

5

11. Two variables x and y are connected by the equation $y = ab^x$.

The graph of $\log_2 y$ against x is a straight line passing through $(0,2)$ and $(3,5)$.



Find the values a and b .

5

12. The circle C_1 has equation $(x - 1)^2 + (y - 2)^2 = 100$.

A circle, C_2 , with equation $x^2 + y^2 - 2x + 4y + k = 0$ is drawn inside C_1 .

The circles have no point of contact.

Find the range of values for k .

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[END OF QUESTION PAPER]