National Qualifications 2026

X847/76/12

Mathematics Paper 2

THURSDAY, 7 MAY

10:45 AM – 12:15 PM

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.

You will not earn marks for answers obtained by readings from scale drawings.

Write your answers clearly in the spaces provided in the answer booklet. The size of the space provided for an answer is not an indication of how much to write. You do not need to use all the space.

Additional space for answers is provided at the end of the answer booklet. If you use this space you must clearly identify the question number you are attempting.

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

You must leave your answer booklet on your desk; if you do not, you could lose all the marks for this paper.

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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 $\mathbf{a} \cdot \mathbf{b} = a_1b_1 + a_2b_2 + a_3b_3$ 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

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

MARKS

Total marks — 65

Attempt ALL questions

1. The equation $x^2 + kx + (k+3) = 0$ has equal roots.

   Find algebraically, the values of k. 3

2. Vectors $\mathbf{u}$ and $\mathbf{v}$ are defined as $\mathbf{u} = \begin{pmatrix} 3 \\ 2 \\ 6 \end{pmatrix}$ and $\mathbf{v} = \begin{pmatrix} -5 \\ -2 \\ 4 \end{pmatrix}$.

   (a) Find $\mathbf{u} \cdot \mathbf{v}$. 1

   (b) Calculate the acute angle between $\mathbf{u}$ and $\mathbf{v}$. 4

3. A function, g, is defined on $\mathbb{R}$, the set of real numbers, by

$$g(x) = \frac{1}{5}x + 6.$$

   Find the inverse function, $g^{-1}(x)$. 3

4. A circle has centre (–2,5).

   The point (3,7) lies on the circle.

   Find the equation of the circle. 2

[Turn over

MARKS

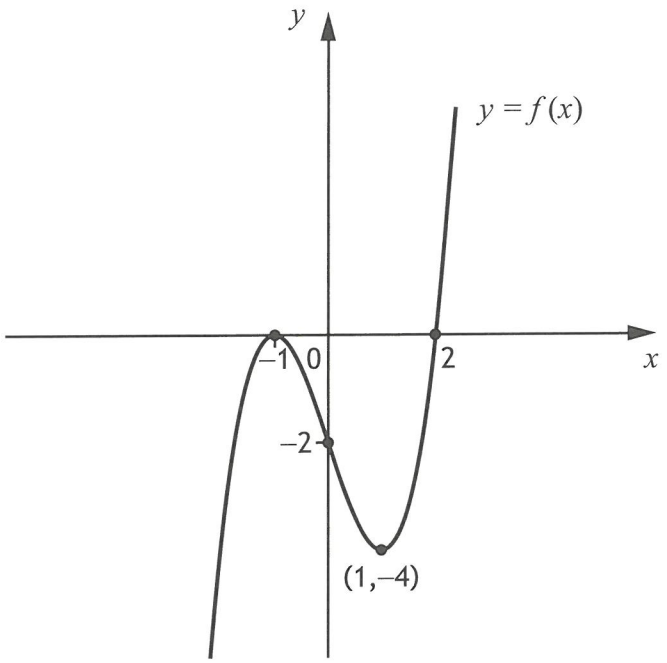
5. A sequence is defined by the recurrence relation $u_{n+1} = 1.125u_n + 5$, $u_0 = 2$.

(a) Calculate the value of u_1. **1**

(b) Explain why this sequence does not approach a limit as $n \to \infty$. **1**

(c) Determine the smallest value of n for which $u_n > 30$. **2**

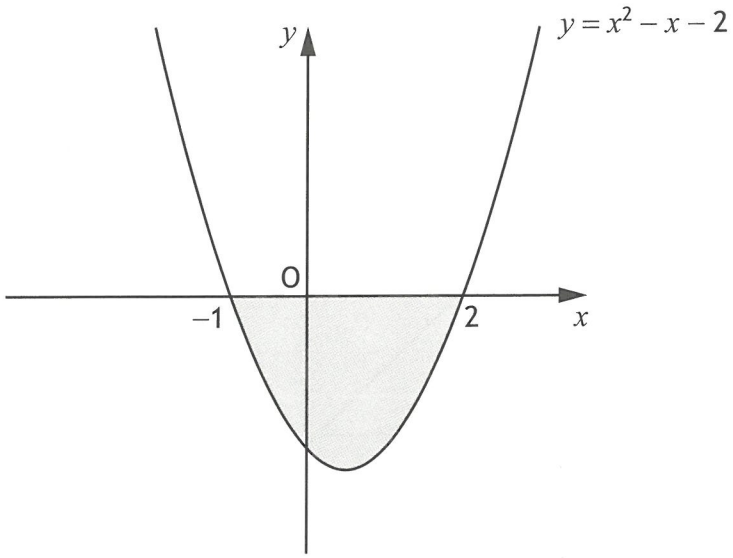
6. The diagram shows the graph of a cubic function $y = f(x)$ with stationary points at (–1,0) and (1,–4).



On the diagram in your answer booklet, sketch the graph of $y = -f(x) + 1$. **3**

MARKS

7. The diagram shows the curve with equation $y = x^2 - x - 2$.

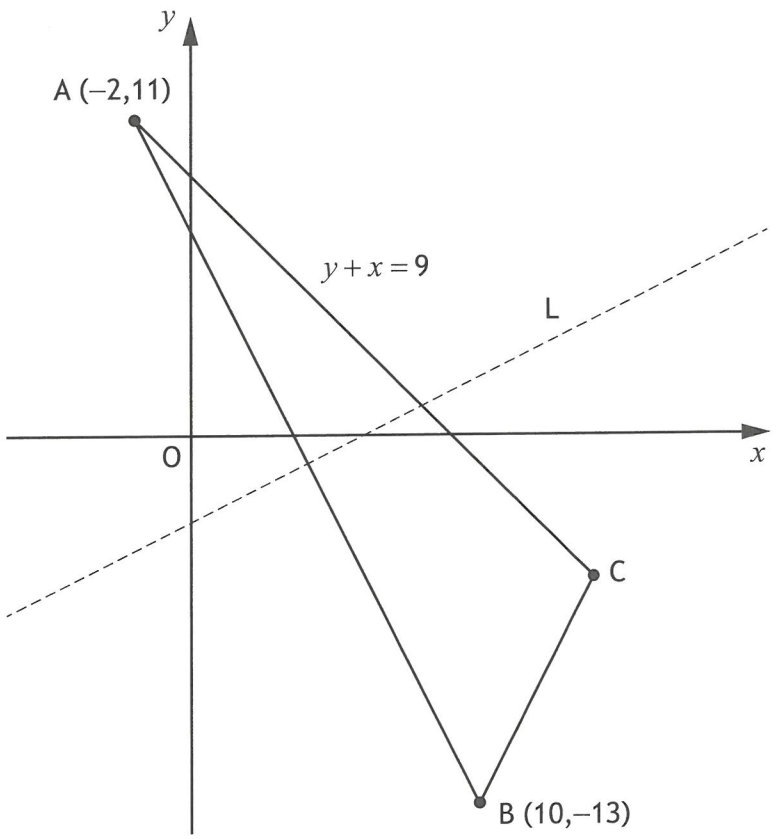


Calculate the shaded area. 4

[Turn over

MARKS

8. A and B are the points (–2,11) and (10,–13).



(a) Find the equation of L, the perpendicular bisector of AB. 4

The equation of AC is $y+x=9$.

(b) Calculate the size of the obtuse angle between L and AC. 2

9. Determine the range of values of x for which the function $f(x)=4x^3-12x^2+7$ is strictly decreasing.

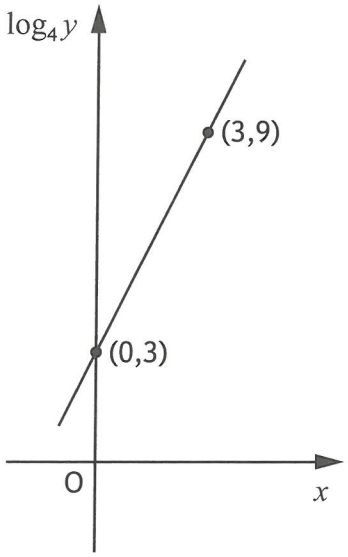
Justify your answer. 4

10. Solve the equation $3\cos 2x° + 10\cos x° = 1$ for $0 \leq x < 360$. 5

MARKS

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

The graph of $\log_4 y$ against x is a straight line as shown.



Find the values of a and b. **5**

12. A function f is defined on the set of real numbers by

$$f(x) = x^3 + 2x^2 - 4x + 1.$$

(a) Find the x-coordinates of the stationary points on the curve with equation $y = f(x)$. **3**

(b) Hence, determine the maximum and minimum values of $f(x)$ in the interval $-1 \leq x \leq 1$. **3**

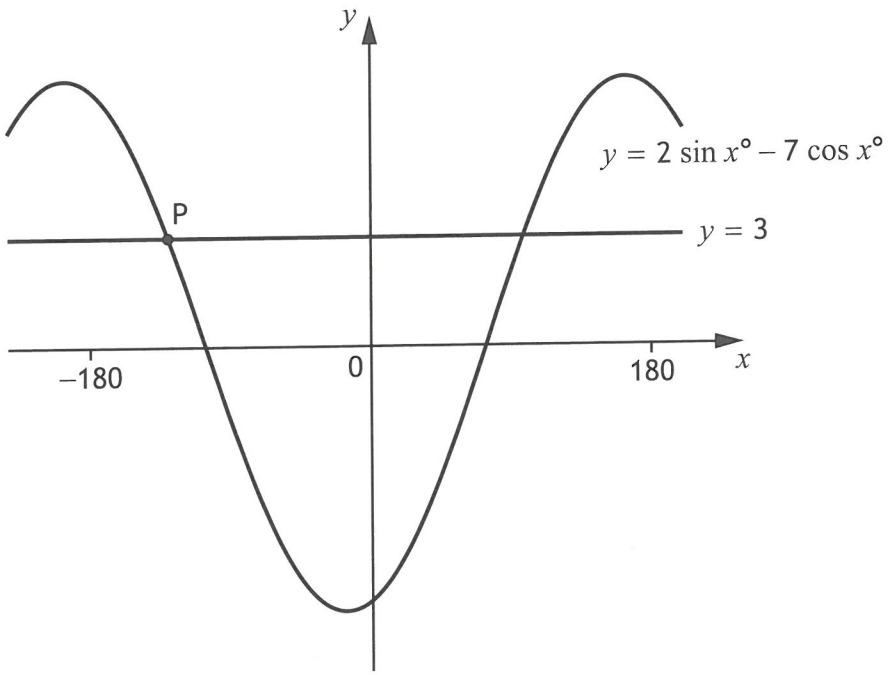
[Turn over

MARKS

13. (a) Express $2\sin x° - 7\cos x°$ in the form $k\sin(x-a)°$, where $k > 0$ and $0 < a < 360$. 4

The diagram shows part of the curve with equation $y = 2\sin x° - 7\cos x°$ and the line with equation $y = 3$.

The curve and the line intersect at the point P.



(b) Find the x-coordinate of P. 3

MARKS

14. During a metal-working process a heated steel rod is cooled by dropping it into a container of oil.

The temperature of the rod is given by

$$T = 800e^{-0.124t} + 25,$$

where T is the temperature of the rod, in degrees Celsius, t seconds after it is dropped into the oil.

(a) Determine the temperature of the rod as it is dropped into the oil. 1

(b) Calculate the time taken for the temperature of the rod to cool to 150 °C. 4

15. Express $(3\sin\theta + \cos\theta)(\sin\theta + 3\cos\theta)$ in the form $a + b\sin c\theta$, where a, b and c are integers. 3

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