H

National Qualifications 2025

X847/76/11

Mathematics
Paper 1 (Non-calculator)

MONDAY, 12 MAY

9:00 AM – 10:15 AM

Total marks — 55

Attempt ALL questions.

You must NOT 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.

Before leaving the examination room you must give your answer booklet to the Invigilator; if you do not, you may 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

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

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

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

$$\begin{aligned} \cos 2A &= \cos^2 A - \sin^2 A \\ &= 2\cos^2 A - 1 \\ &= 1 - 2\sin^2 A \end{aligned}$$

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 — 55 marks

Attempt ALL questions

1. A curve has equation $y = x^3 - 2x^2 + 5$.

Find the equation of the tangent to this curve at the point where $x = 2$. **4**

2. Find the equation of the perpendicular bisector of the line joining A$(1, 4)$ and B$(9, 10)$. **4**

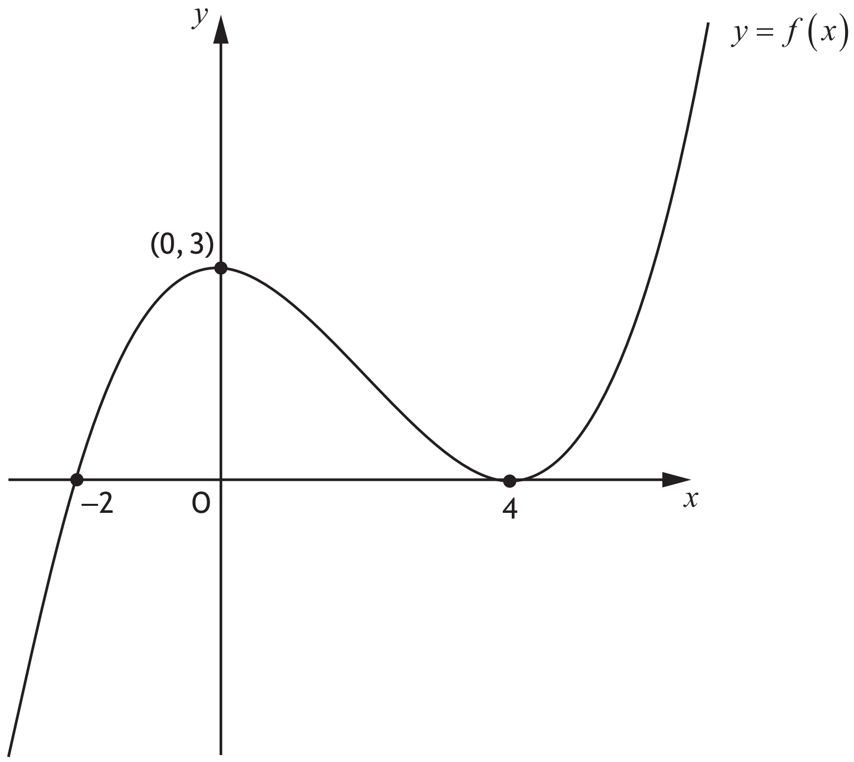
3. Find $\int \left(\frac{12}{x^2} + x^{\frac{1}{2}} \right) dx,\ x > 0$. **4**

4. Evaluate $3\log_3 2 + \log_3 \frac{1}{24}$. **3**

[Turn over

MARKS

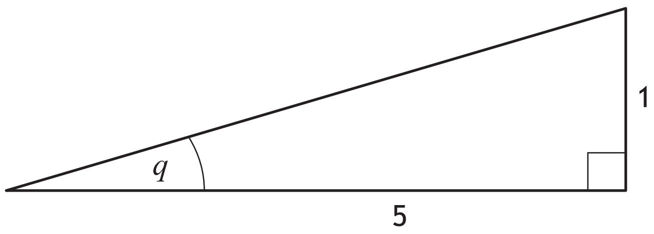
5. The diagram shows the graph of $y = f(x)$, with stationary points at (0, 3) and (4, 0).



On the diagram in your answer booklet, sketch the graph of $y = f(-x) + 3$. **2**

MARKS

6. The diagram shows a right-angled triangle with angle q.

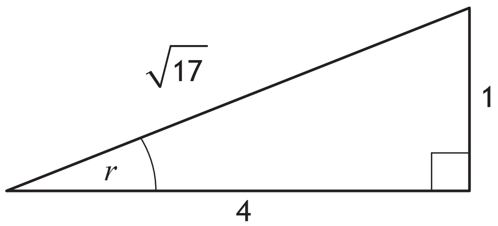


(a) Determine the value of:

(i) $\sin 2q$ **3**

(ii) $\cos 2q$. **1**

A second right-angled triangle has angle r as shown.



(b) Find the value of $\sin(2q - r)$. **3**

7. (a) Show that $(x+3)$ is a factor of $5x^3 + 16x^2 - x - 12$. **2**

(b) Hence, or otherwise, solve $5x^3 + 16x^2 - x - 12 = 0$. **3**

8. Given that $\log_a 75 = 2 + \log_a 3$, $a > 0$, find the value of a. **3**

[Turn over

MARKS

9. Find the coordinates of the points of intersection of the line with equation $y = x + 1$ and the circle with equation $x^2 + y^2 - 2x + 6y - 15 = 0$. **4**

10. The vectors $\mathbf{u}$ and $\mathbf{v}$ are such that:

- $\mathbf{u} = \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix}$
- $\mathbf{v} = \begin{pmatrix} 1 \\ 3 \\ k \end{pmatrix}$
- the angle between $\mathbf{u}$ and $\mathbf{v}$ is 45°.

Find the value of k, where $k > 0$. **5**

11. The equation $9x^2 + 3kx + k = 0$ has two real and distinct roots.

Determine the range of values for k.

Justify your answer. **4**

12. Given that:

- $\dfrac{dy}{dx} = 6\cos x + 8\sin 2x$, and
- $y = 4$ when $x = \dfrac{\pi}{6}$,

express y in terms of x. **4**

MARKS

13. A function, f, is defined on the set of real numbers.

The derivative of f is $f'(x) = (x+5)(2-x)$.

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

It is known that:

- f is a cubic function
- $f(0) < 0$
- the equation $f(x) = 0$ has exactly one solution. The solution lies between –10 and 10.

(b) Draw a sketch of a possible graph of $y = f(x)$ on the diagram in your answer booklet. **3**

[END OF QUESTION PAPER]

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