FOR OCR

GCE Examinations

Advanced / Advanced Subsidiary

# Core Mathematics C1

Paper E

Time: 1 hour 30 minutes

**INSTRUCTIONS TO CANDIDATES**

- Answer **all** the questions.
- Give non-exact numerical answers correct to 3 significant figures, unless a different degree of accuracy is specified in the question or is clearly appropriate.
- **You are not permitted to use a calculator in this paper.**

**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is 72.
- **You are reminded of the need for clear presentation in your answers.**

*Written by Shaun Armstrong*

**1.** *(i)* Express $\frac{21}{\sqrt{7}}$ in the form $k\sqrt{7}$. [2]

*(ii)* Express $8^{-\frac{1}{3}}$ as an exact fraction in its simplest form. [2]

**2.** Find $\frac{\mathrm{d}y}{\mathrm{d}x}$ when

*(i)* $y = x - 2x^2$, [2]

*(ii)* $y = \frac{3}{x^2}$. [2]

**3.** *(a)* Express $x^2 - 10x + 27$ in the form $(x + p)^2 + q$. [3]

*(b)* Sketch the curve with equation $y = x^2 - 10x + 27$, showing on your sketch

*(i)* the coordinates of the vertex of the curve,

*(ii)* the coordinates of any points where the curve meets the coordinate axes. [3]

**4.** The straight line $l_1$ has gradient 2 and passes through the point with coordinates (4, −5).

*(i)* Find an equation for $l_1$ in the form $y = mx + c$. [2]

The straight line $l_2$ is perpendicular to the line with equation $3x - y = 4$ and passes through the point with coordinates (3, 0).

*(ii)* Find an equation for $l_2$. [3]

*(iii)* Find the coordinates of the point where $l_1$ and $l_2$ intersect. [3]

**5.** Given that the equation

$$4x^2 - kx + k - 3 = 0,$$

where $k$ is a constant, has real roots,

*(i)* show that

$$k^2 - 16k + 48 \geq 0,$$ [2]

*(ii)* find the set of possible values of $k$, [3]

*(iii)* state the smallest value of $k$ for which the roots are equal and solve the equation when $k$ takes this value. [3]

**6.** The points $P$ and $Q$ have coordinates $(-2, 6)$ and $(4, -1)$ respectively.

Given that $PQ$ is a diameter of circle $C$,

*(i)* find the coordinates of the centre of $C$, [2]

*(ii)* show that $C$ has the equation

$$x^2 + y^2 - 2x - 5y - 14 = 0.$$ [5]

The point $R$ has coordinates $(2, 7)$.

*(iii)* Show that $R$ lies on $C$ and hence, state the size of $\angle PRQ$ in degrees. [2]

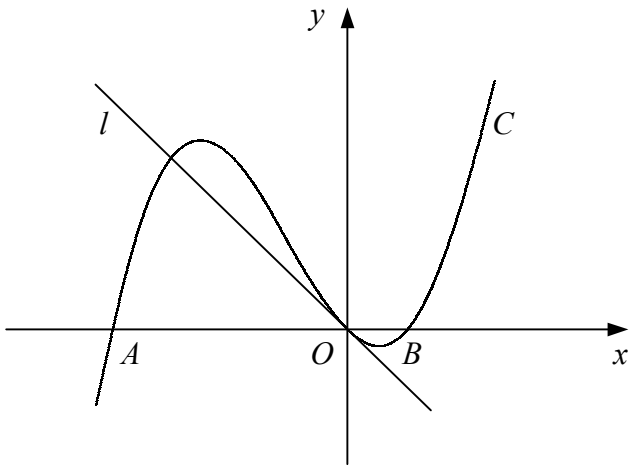
**7.** *(i)* Describe fully the single transformation that maps the graph of $y = \mathrm{f}(x)$ onto the graph of $y = \mathrm{f}(x - 1)$. [2]

*(ii)* Showing the coordinates of any points of intersection with the coordinate axes and the equations of any asymptotes, sketch the graph of $y = \dfrac{1}{x-1}$. [3]

*(iii)* Find the $x$-coordinates of any points where the graph of $y = \dfrac{1}{x-1}$ intersects the graph of $y = 2 + \dfrac{1}{x}$. Give your answers in the form $a + b\sqrt{3}$, where $a$ and $b$ are rational. [5]

***Turn over***

**8.**




The diagram shows the curve $C$ with the equation $y = x^3 + 3x^2 - 4x$ and the straight line $l$.

The curve $C$ crosses the $x$-axis at the origin, $O$, and at the points $A$ and $B$.

*(i)* Find the coordinates of $A$ and $B$. [3]

The line $l$ is the tangent to $C$ at $O$.

*(ii)* Find an equation for $l$. [4]

*(iii)* Find the coordinates of the point where $l$ intersects $C$ again. [4]

**9.** The curve with equation $y = 2x^{\frac{3}{2}} - 8x^{\frac{1}{2}}$ has a minimum at the point $A$.

*(i)* Find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$. [3]

*(ii)* Find the $x$-coordinate of $A$. [3]

The point $B$ on the curve has $x$-coordinate 2.

*(iii)* Find an equation for the tangent to the curve at $B$ in the form $y = mx + c$. [6]