# Edexcel GCE

## Core Mathematics C1

## Advanced Subsidiary

## Monday 10 January 2005 – Afternoon

## Time: 1 hour 30 minutes

**1.** (*a*) Write down the value of $16^{\frac{1}{2}}$.

**(1)**

(*b*) Find the value of $16^{-\frac{3}{2}}$.

**(2)**

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**2.** (i) Given that $y = 5x^3 + 7x + 3$, find

(*a*) $\dfrac{\mathrm{d}y}{\mathrm{d}x}$,

**(3)**

(*b*) $\dfrac{\mathrm{d}^2 y}{\mathrm{d}x^2}$.

**(1)**

(ii) Find $\displaystyle\int \left(1 + 3\sqrt{x} - \frac{1}{x^2}\right) \mathrm{d}x$.

**(4)**

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**3.** Given that the equation $kx^2 + 12x + k = 0$, where $k$ is a positive constant, has equal roots, find the value of $k$.

**(4)**

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**4.** Solve the simultaneous equations

$$x + y = 2$$

$$x^2 + 2y = 12.$$

**(6)**

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**5.** The $r$th term of an arithmetic series is $(2r - 5)$.

($a$) Write down the first three terms of this series.

**(2)**

($b$) State the value of the common difference.

**(1)**

($c$) Show that $\sum_{r=1}^{n}(2r-5) = n(n-4)$.

**(3)**

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**6.**

**Figure 1**

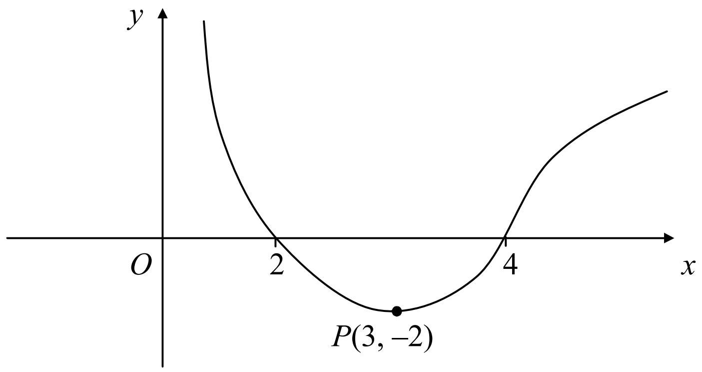


Figure 1 shows a sketch of the curve with equation $y = f(x)$. The curve crosses the $x$-axis at the points (2, 0) and (4, 0). The minimum point on the curve is $P(3, -2)$.

In separate diagrams sketch the curve with equation

($a$) $y = -f(x)$,

**(3)**

($b$) $y = f(2x)$.

**(3)**

On each diagram, give the coordinates of the points at which the curve crosses the $x$-axis, and the coordinates of the image of $P$ under the given transformation.

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**7.** The curve $C$ has equation $y = 4x^2 + \dfrac{5-x}{x}$, $x \neq 0$. The point $P$ on $C$ has $x$-coordinate 1.

($a$) Show that the value of $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ at $P$ is 3.

**(5)**

($b$) Find an equation of the tangent to $C$ at $P$.

**(3)**

This tangent meets the $x$-axis at the point $(k, 0)$.

($c$) Find the value of $k$.

**(2)**

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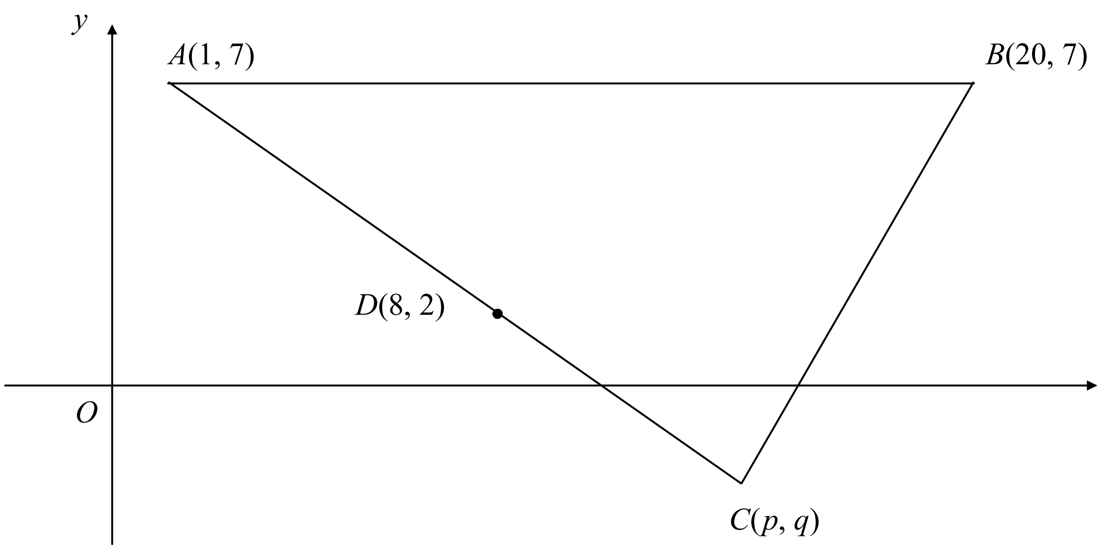
**8.** **Figure 2**




The points $A(1, 7)$, $B(20, 7)$ and $C(p, q)$ form the vertices of a triangle $ABC$, as shown in Figure 2. The point $D(8, 2)$ is the mid-point of $AC$.

($a$) Find the value of $p$ and the value of $q$.

**(2)**

The line $l$, which passes through $D$ and is perpendicular to $AC$, intersects $AB$ at $E$.

($b$) Find an equation for $l$, in the form $ax + by + c = 0$, where $a$, $b$ and $c$ are integers.

**(5)**

($c$) Find the exact $x$-coordinate of $E$.

**(2)**

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**9.** The gradient of the curve $C$ is given by

$$\frac{\mathrm{d}y}{\mathrm{d}x} = (3x - 1)^2.$$

The point $P(1, 4)$ lies on $C$.

($a$) Find an equation of the normal to $C$ at $P$.

**(4)**

($b$) Find an equation for the curve $C$ in the form $y = \mathrm{f}(x)$.

**(5)**

($c$) Using $\frac{\mathrm{d}y}{\mathrm{d}x} = (3x - 1)^2$, show that there is no point on $C$ at which the tangent is parallel to the line $y = 1 - 2x$.

**(2)**

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**10.** Given that

$$\mathrm{f}(x) = x^2 - 6x + 18, \quad x \geq 0,$$

($a$) express $\mathrm{f}(x)$ in the form $(x - a)^2 + b$, where $a$ and $b$ are integers.

**(3)**

The curve $C$ with equation $y = \mathrm{f}(x)$, $x \geq 0$, meets the $y$-axis at $P$ and has a minimum point at $Q$.

($b$) Sketch the graph of $C$, showing the coordinates of $P$ and $Q$.

**(4)**

The line $y = 41$ meets $C$ at the point $R$.

($c$) Find the $x$-coordinate of $R$, giving your answer in the form $p + q\sqrt{2}$, where $p$ and $q$ are integers.

**(5)**

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**TOTAL FOR PAPER: 75 MARKS**

**END**