**1.** $f(x) = (\sqrt{x} + 3)^2 + (1 - 3\sqrt{x})^2$.

Show that $f(x)$ can be written in the form $ax + b$ where $a$ and $b$ are integers to be found. **(3)**

---

**2.** The curve $C$ has the equation

$$y = x^2 + ax + b,$$

where $a$ and $b$ are constants.

Given that the minimum point of $C$ has coordinates $(-2, 5)$, find the values of $a$ and $b$. **(4)**

---

**3.** The sequence $u_1, u_2, u_3, \ldots$ is defined by

$$u_n = 2^n + kn,$$

where $k$ is a constant.

Given that $u_1 = u_3$,

*(a)* find the value of $k$, **(3)**

*(b)* find the value of $u_5$. **(2)**

---

**4.** Given that

$$\frac{dy}{dx} = 2x^3 + 1,$$

and that $y = 3$ when $x = 0$, find the value of $y$ when $x = 2$. **(6)**

---

**5.** $f(x) = 4x - 3x^2 - x^3$.

*(a)* Fully factorise $4x - 3x^2 - x^3$. **(3)**

*(b)* Sketch the curve $y = f(x)$, showing the coordinates of any points of intersection with the coordinate axes. **(3)**

---

**6.** The straight line $l$ has the equation $x - 2y = 12$ and meets the coordinate axes at the points $A$ and $B$.

Find the distance of the mid-point of $AB$ from the origin, giving your answer in the form $k\sqrt{5}$. **(6)**

---

**7.** *(a)* Given that $y = 2^x$, find expressions in terms of $y$ for

*(i)* $2^{x+2}$,

*(ii)* $2^{3-x}$. **(4)**

*(b)* Show that using the substitution $y = 2^x$, the equation

$$2^{x+2} + 2^{3-x} = 33$$

can be rewritten as

$$4y^2 - 33y + 8 = 0. \quad \textbf{(2)}$$

*(c)* Hence solve the equation

$$2^{x+2} + 2^{3-x} = 33. \quad \textbf{(4)}$$

---

**8.** Given that

$$y = 2x^{\frac{3}{2}} - 1,$$

*(a)* find $\dfrac{\mathrm{d}^2y}{\mathrm{d}x^2}$, **(3)**

*(b)* show that

$$4x^2\frac{\mathrm{d}^2y}{\mathrm{d}x^2} - 3y = k,$$

where $k$ is an integer to be found, **(2)**

*(c)* find

$$\int y^2 \, \mathrm{d}x. \quad \textbf{(6)}$$

---

***Turn over***

**9.** The second and fifth terms of an arithmetic series are 26 and 41 repectively.

*(a)* Show that the common difference of the series is 5. **(4)**

*(b)* Find the 12th term of the series. **(3)**

Another arithmetic series has first term −12 and common difference 7.

Given that the sums of the first $n$ terms of these two series are equal,

*(c)* find the value of $n$. **(4)**

---

**10.**

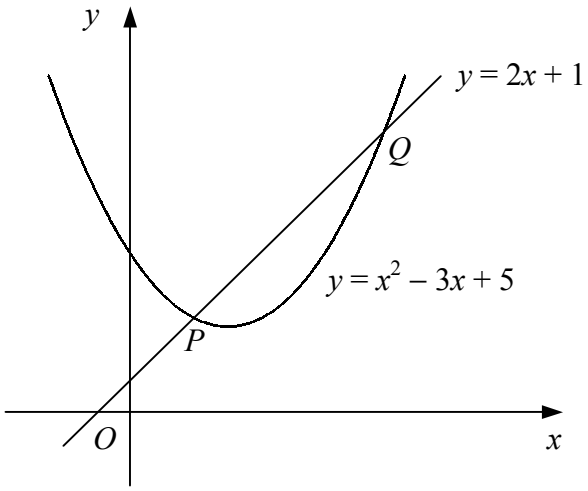



**Figure 1**

Figure 1 shows the curve $y = x^2 - 3x + 5$ and the straight line $y = 2x + 1$.
The curve and line intersect at the points $P$ and $Q$.

*(a)* Using algebra, show that $P$ has coordinates (1, 3) and find the coordinates of $Q$. **(4)**

*(b)* Find an equation for the tangent to the curve at $P$. **(4)**

*(c)* Show that the tangent to the curve at $Q$ has the equation $y = 5x - 11$. **(2)**

*(d)* Find the coordinates of the point where the tangent to the curve at $P$ intersects the tangent to the curve at $Q$. **(3)**

---

**END**

# C1 Paper B – Marking Guide

**1.** $f(x) = x + 6\sqrt{x} + 9 + 1 - 6\sqrt{x} + 9x$ — M1 A1
$= 10x + 10, \quad a = 10, b = 10$ — A1 **(3)**

---

**2.** quadratic, coeff of $x^2 = 1$, minimum $(-2, 5)$
$\therefore\ y = (x + 2)^2 + 5$ — M1 A1
$= x^2 + 4x + 9, \quad a = 4, b = 9$ — M1 A1 **(4)**

---

**3.** *(a)* $u_1 = 2 + k$
$u_3 = 8 + 3k$ — B1
$u_1 = u_3 \ \therefore 2 + k = 8 + 3k$ — M1
$k = -3$ — A1

*(b)* $u_5 = 2^5 - 3(5) = 32 - 15 = 17$ — M1 A1 **(5)**

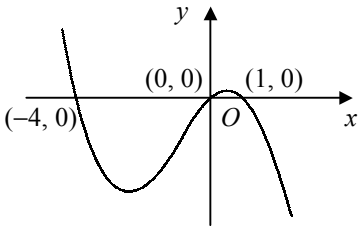
---

**4.** $y = \int (2x^3 + 1)\ dx$
$y = \frac{1}{2}x^4 + x + c$ — M1 A2
$x = 0, y = 3 \ \therefore\ c = 3$ — B1
$y = \frac{1}{2}x^4 + x + 3$
when $x = 2, \quad y = 8 + 2 + 3 = 13$ — M1 A1 **(6)**

---

**5.** *(a)* $= x(4 - 3x - x^2)$ — M1
$= x(1 - x)(4 + x)$ — M1 A1

*(b)*




B3 **(6)**

---

**6.** $x = 0 \Rightarrow y = -6 \quad \therefore (0, -6)$
$y = 0 \Rightarrow x = 12 \quad \therefore (12, 0)$ — B1
mid-point $= \left(\frac{0+12}{2}, \frac{-6+0}{2}\right) = (6, -3)$ — M1 A1
dist. from $O = \sqrt{6^2 + (-3)^2} = \sqrt{36+9} = \sqrt{45}$ — M1
$= \sqrt{9 \times 5} = 3\sqrt{5}$ — M1 A1 **(6)**

---

**7.** *(a)* *(i)* $2^{x+2} = 2^2 \times 2^x = 4y$ — M1 A1
*(ii)* $2^{3-x} = \frac{2^3}{2^x} = \frac{8}{y}$ — M1 A1

*(b)* $2^{x+2} + 2^{3-x} = 33 \Rightarrow 4y + \frac{8}{y} = 33$
$4y^2 + 8 = 33y$ — M1
$4y^2 - 33y + 8 = 0$ — A1

*(c)* $(4y - 1)(y - 8) = 0$ — M1
$y = \frac{1}{4}, 8$ — A1
$2^x = \frac{1}{4}, 8$
$x = -2, 3$ — A2 **(10)**

---

**8.** *(a)* $\frac{dy}{dx} = 3x^{\frac{1}{2}}$ M1 A1

$\frac{d^2y}{dx^2} = \frac{3}{2}x^{-\frac{1}{2}}$ A1

*(b)* LHS $= 4x^2(\frac{3}{2}x^{-\frac{1}{2}}) - 3(2x^{\frac{3}{2}} - 1)$

$= 6x^{\frac{3}{2}} - 6x^{\frac{3}{2}} + 3$ M1

$= 3 \quad [k = 3]$ A1

*(c)* $= \int (2x^{\frac{3}{2}} - 1)^2 \, dx$

$= \int (4x^3 - 4x^{\frac{3}{2}} + 1) \, dx$ M1 A1

$= x^4 - \frac{8}{5}x^{\frac{5}{2}} + x + c$ M1 A3 **(11)**

---

**9.** *(a)* $a + d = 26$

$a + 4d = 41$ A1

subtracting, $3d = 15$ M1

$d = 5$ A1

*(b)* $a = 21$ B1

$u_{12} = 21 + (11 \times 5) = 76$ M1 A1

*(c)* $\frac{n}{2}[42 + 5(n - 1)] = \frac{n}{2}[-24 + 7(n - 1)]$ M1 A1

$n(5n + 37) = n(7n - 31)$

$2n(n - 34) = 0$ M1

$n > 0 \ \therefore n = 34$ A1 **(11)**

---

**10.** *(a)* $x^2 - 3x + 5 = 2x + 1$

$x^2 - 5x + 4 = 0$ M1

$(x - 1)(x - 4) = 0$ M1

$x = 1, 4$ A1

when $x = 1, \ y = 2(1) + 1 = 3$

$\therefore \ P(1, 3), Q(4, 9)$ A1

*(b)* $\frac{dy}{dx} = 2x - 3$ M1

grad $= -1$ A1

$\therefore \ y - 3 = -(x - 1) \quad [y = 4 - x]$ M1 A1

*(c)* grad $= 5$

$\therefore \ y - 9 = 5(x - 4)$ M1

$y - 9 = 5x - 20$

$y = 5x - 11$ A1

*(d)* $4 - x = 5x - 11$ M1

$x = \frac{5}{2}$ A1

$\therefore \ (\frac{5}{2}, \frac{3}{2})$ A1 **(13)**

---

Total **(75)**

# Performance Record – C1 Paper B

| Question no. | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Topic(s) | algebra | compl. square | sequence | integr. | curve sketch | straight line | indices | diff., integr. | AP | diff., tangents | |
| Marks | 3 | 4 | 5 | 6 | 6 | 6 | 10 | 11 | 11 | 13 | 75 |
| Student | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |