Section A (36 marks)

1 **(i)** Evaluate $\left(\frac{1}{27}\right)^{\frac{2}{3}}$. **[2]**

(ii) Simplify $\dfrac{(4a^2c)^3}{32a^4c^7}$. **[3]**

2 A is the point (1, 5) and B is the point (6, −1). M is the midpoint of AB. Determine whether the line with equation $y = 2x - 5$ passes through M. **[3]**

3

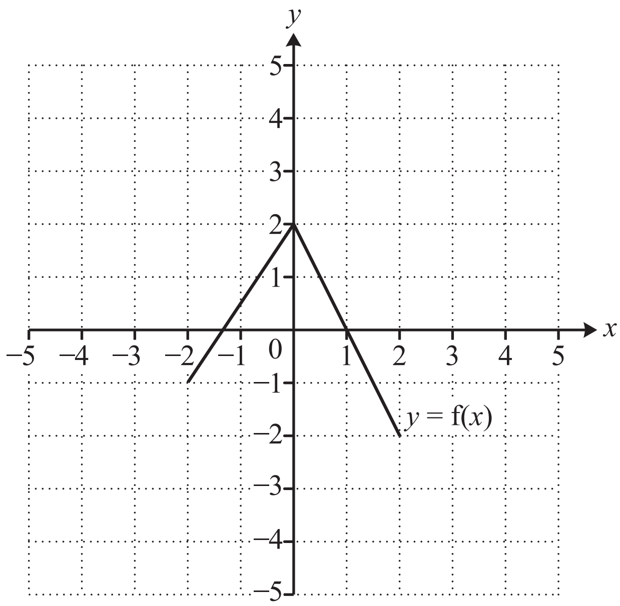

Fig. 3

Fig. 3 shows the graph of $y = \mathrm{f}(x)$. Draw the graphs of the following.

(i) $y = \mathrm{f}(x) - 2$ **[2]**

(ii) $y = \mathrm{f}(x - 3)$ **[2]**

4 **(i)** Expand and simplify $(7 - 2\sqrt{3})^2$. **[3]**

(ii) Express $\dfrac{20\sqrt{6}}{\sqrt{50}}$ in the form $a\sqrt{b}$, where a and b are integers and b is as small as possible. **[2]**

5 Make a the subject of $3(a + 4) = ac + 5f$. **[4]**

6 Solve the inequality $3x^2 + 10x + 3 > 0$. **[3]**

7 Find the coefficient of x^4 in the binomial expansion of $(5+2x)^7$. **[4]**

8 You are given that $f(x) = 4x^3 + kx + 6$, where k is a constant. When $f(x)$ is divided by $(x-2)$, the remainder is 42. Use the remainder theorem to find the value of k. Hence find a root of $f(x) = 0$. **[4]**

9 You are given that n, $n + 1$ and $n + 2$ are three consecutive integers.

(i) Expand and simplify $n^2 + (n+1)^2 + (n+2)^2$. **[2]**

(ii) For what values of n will the sum of the squares of these three consecutive integers be an even number? Give a reason for your answer. **[2]**

Section B (36 marks)

10 Fig. 10 shows a sketch of a circle with centre C(4, 2). The circle intersects the x-axis at A(1, 0) and at B.

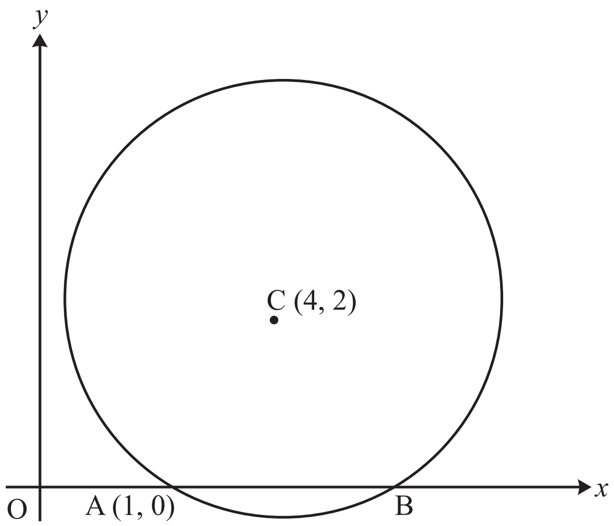

Fig. 10

(i) Write down the coordinates of B. **[1]**

(ii) Find the radius of the circle and hence write down the equation of the circle. **[4]**

(iii) AD is a diameter of the circle. Find the coordinates of D. **[2]**

(iv) Find the equation of the tangent to the circle at D. Give your answer in the form $y = ax + b$. **[4]**

11

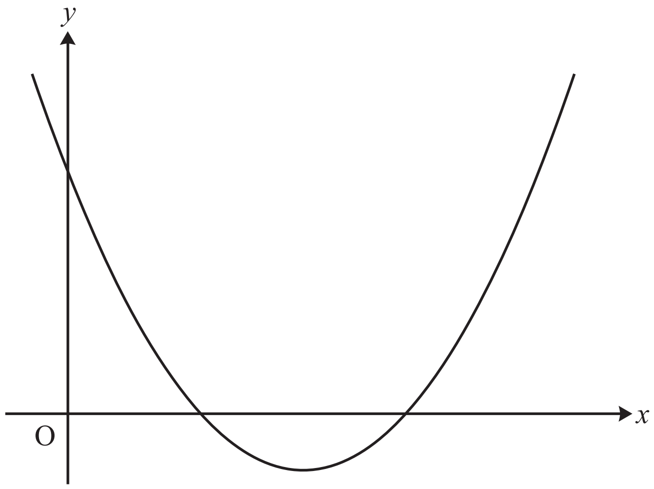

Fig. 11

Fig. 11 shows a sketch of the curve with equation $y = (x-4)^2 - 3$.

(i) Write down the equation of the line of symmetry of the curve and the coordinates of the minimum point. **[2]**

(ii) Find the coordinates of the points of intersection of the curve with the x-axis and the y-axis, using surds where necessary. **[4]**

(iii) The curve is translated by $\begin{pmatrix} 2 \\ 0 \end{pmatrix}$. Show that the equation of the translated curve may be written as $y = x^2 - 12x + 33$. **[2]**

(iv) Show that the line $y = 8 - 2x$ meets the curve $y = x^2 - 12x + 33$ at just one point, and find the coordinates of this point. **[5]**

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12

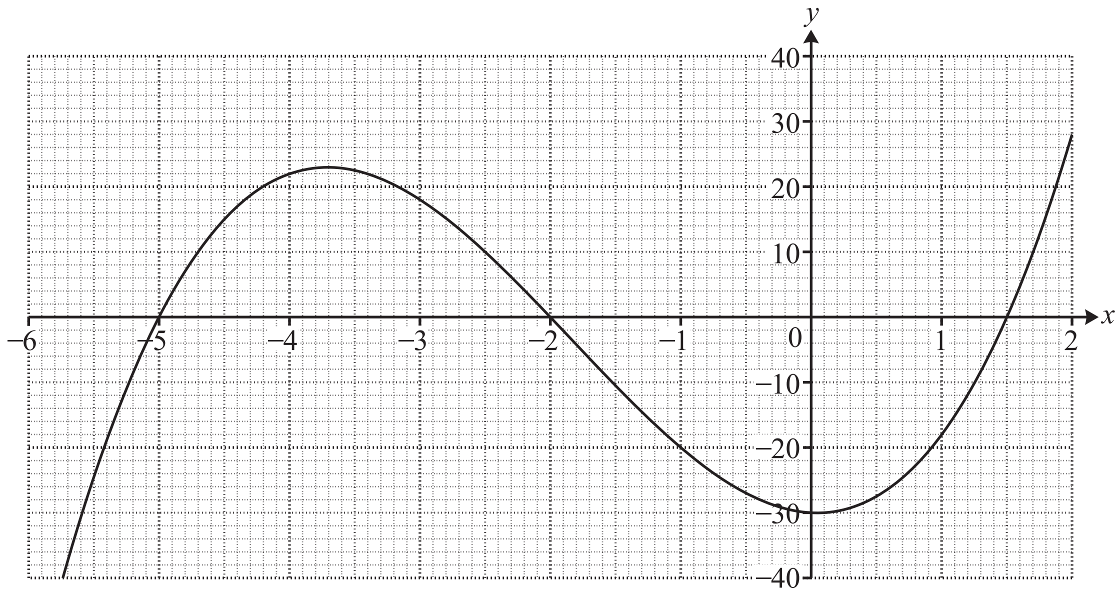

Fig. 12

Fig. 12 shows the graph of a cubic curve. It intersects the axes at (–5, 0), (–2, 0), (1.5, 0) and (0, –30).

(i) Use the intersections with both axes to express the equation of the curve in a factorised form. **[2]**

(ii) Hence show that the equation of the curve may be written as $y = 2x^3 + 11x^2 - x - 30$. **[2]**

(iii) Draw the line $y = 5x + 10$ accurately on the graph. The curve and this line intersect at (–2, 0); find graphically the x-coordinates of the other points of intersection. **[3]**

(iv) Show algebraically that the x-coordinates of the other points of intersection satisfy the equation

$$2x^2 + 7x - 20 = 0.$$

Hence find the exact values of the x-coordinates of the other points of intersection. **[5]**

END OF QUESTION PAPER