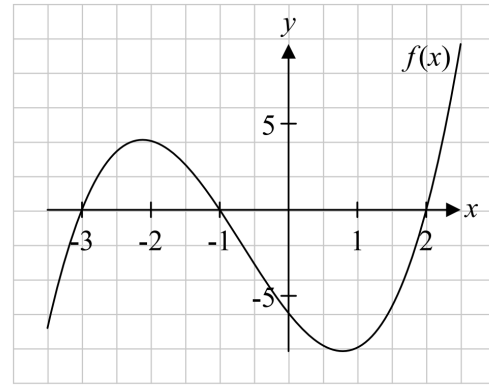


Question 1**(25 marks)**

- (a) The graph of a cubic function $f(x)$ cuts the x -axis at $x = -3$, $x = -1$ and $x = 2$, and the y -axis at $(0, -6)$, as shown.

Verify that $f(x)$ can be written as

$$f(x) = x^3 + 2x^2 - 5x - 6.$$



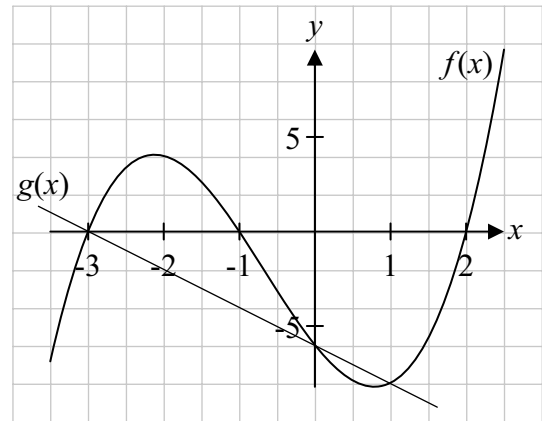
- (b) (i) The graph of the function $g(x) = -2x - 6$ intersects the graph of the function $f(x)$ above. Let $f(x) = g(x)$ and solve the resulting equation to find the co-ordinates of the points where the graphs of $f(x)$ and $g(x)$ intersect.
- (ii) Draw the graph of the function $g(x) = -2x - 6$ on the diagram above.

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$$x = -3, \quad x = -1, \quad x = 2$$

$$f(x) = (x + 3)(x + 1)(x - 2) = x^3 + 2x^2 - 5x - 6$$

OR

$$f(x) = x^3 + 2x^2 - 5x - 6$$

$$f(-3) = -27 + 18 + 15 - 6 = 0 \Rightarrow (x + 3) \text{ is a factor}$$

$$f(-1) = -1 + 2 + 5 - 6 = 0 \Rightarrow (x + 1) \text{ is a factor}$$

$$f(2) = 8 + 8 - 10 - 6 = 0 \Rightarrow (x - 2) \text{ is a factor}$$

$$f(x) = (x + 3)(x + 1)(x - 2) = x^3 + 2x^2 - 5x - 6$$

- (b) (i) The graph of the function $g(x) = -2x - 6$ intersects the graph of the function $f(x)$ above. Let $f(x) = g(x)$ and solve the resulting equation to find the co-ordinates of the points where the graphs of $f(x)$ and $g(x)$ intersect.

$$\begin{aligned}f(x) &= g(x) \\x^3 + 2x^2 - 5x - 6 &= -2x - 6 \\ \Rightarrow x^3 + 2x^2 - 3x &= 0 \\ \Rightarrow x(x^2 + 2x - 3) &= 0 \\ \Rightarrow x(x-1)(x+3) &= 0 \\ \Rightarrow x = 0, \quad x = 1, \quad x = -3 \\ \Rightarrow y = -6, \quad y = -8, \quad y = 0\end{aligned}$$

Points: $(-3, 0), (0, -6), (1, -8)$

- (ii) Draw the graph of the function $g(x) = -2x - 6$ on the diagram above.

$$\begin{aligned}g(x) &= -2x - 6 \\ g(-3) &= -2(-3) - 6 = 6 - 6 = 0 \Rightarrow (-3, 0) \\ g(0) &= -2(0) - 6 = -6 \Rightarrow (0, -6)\end{aligned}$$

Detailed marking notes

Section A

Question 1

(a) Scale 15C (0, 7, 10, 15)

Low Partial Credit:

- Only one value verified
- Recognising one factor

High Partial Credit:

- Writing $(x + 3)(x + 1)(x - 2)$
- Two relevant roots tested

(b)(i) Scale 5C (0, 3, 4, 5)

Low Partial Credit:

- Equations correct when $f(x) = g(x)$
- Cubic equation not factorised

High Partial Credit:

- Roots identified

(b)(ii) Scale 5C (0, 3, 4, 5)

Low Partial Credit:

- One point found in $g(x)$
- Only one point indicated on graph

High Partial Credit:

- Two points identified
- Two points plotted but no graph drawn