

LC 2014: PAPER 1

QUESTION 1 (25 MARKS)

Question 1 (a)

$x = -3$ is a root $\Rightarrow (x + 3)$ is a factor

$x = -1$ is a root $\Rightarrow (x + 1)$ is a factor

$x = 2$ is a root $\Rightarrow (x - 2)$ is a factor

$$\text{Cubic} = k(\text{Linear})(\text{Linear})(\text{Linear})$$

You can find the value of k as the y -intercept $(0, -6)$ is given.

$$y = f(x) = k(x + 3)(x + 1)(x - 2)$$

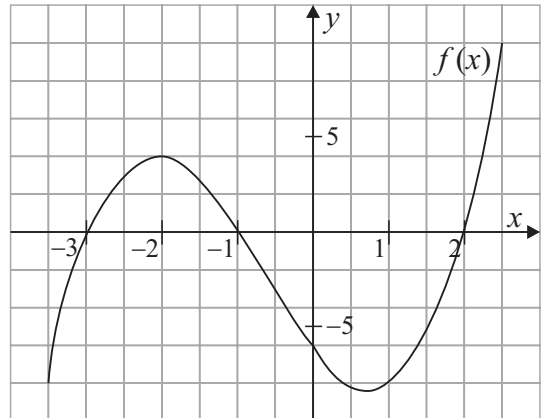
$$x = 0, y = -6: f(0) = k(3)(1)(-2) = -6$$

$$\therefore -6k = -6 \Rightarrow k = 1$$

Multiply out the brackets to obtain the cubic function.

$$\begin{aligned} f(x) &= 1(x + 3)(x + 1)(x - 2) \\ &= (x + 3)(x^2 - x - 2) \\ &= x^3 - x^2 - 2x + 3x^2 - 3x - 6 \\ &= x^3 + 2x^2 - 5x - 6 \end{aligned}$$

AUTHOR'S NOTE: The official marking scheme completely ignores the step to find k . Because $k = 1$, they got away with this omission. However, the technique shown is the proper method for finding the expression for a function.



MARKING SCHEME NOTES

Question 1 (a) [Scale 15C (0, 7, 10, 15)]

7: • Only one value verified

• Recognising one factor

10: • Writing $(x + 3)(x + 1)(x - 2)$

• Two relevant roots tested

Question 1 (b) (i)

$$f(x) = g(x)$$

$$x^3 + 2x^2 - 5x - 6 = -2x - 6$$

$$x^3 + 2x^2 - 3x = 0 \leftarrow \text{Bring all terms to one side}$$

$$x(x^2 + 2x - 3) = 0 \leftarrow \text{Take out } x \text{ in common}$$

$$x(x - 1)(x + 3) = 0 \leftarrow \text{Factorise the quadratic}$$

$$\therefore x = -3, 0, 1$$

Substitute the x values into either function to obtain the y co-ordinates.

$$g(x) = -2x - 6$$

$$x = -3: g(-3) = -2(-3) - 6 = 0$$

$$x = 0: g(0) = -2(0) - 6 = -6$$

$$x = 1: g(1) = -2(1) - 6 = -8$$

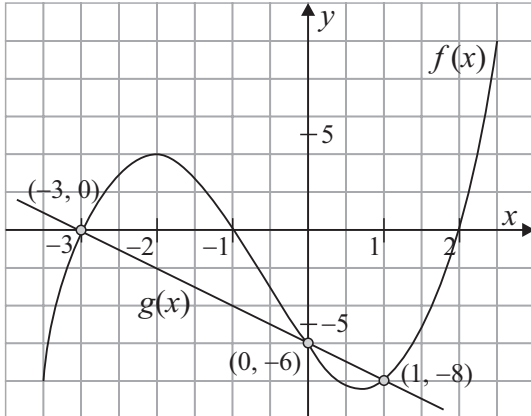
Therefore, $(-3, 0)$, $(0, -6)$ and $(1, -8)$ are the points of intersection of the two functions.

MARKING SCHEME NOTES

Question 1 (b) (i) [Scale 5C (0, 3, 4, 5)]

- 3: • Equations correct when $f(x) = g(x)$
 • Cubic equation not factorised
- 4: • Roots identified

Question 1 (b) (ii)



Use any 2 (or all 3) of the points of intersection to draw the graph of the linear function $g(x) = -2x - 6$.

MARKING SCHEME NOTES

Question 1 (b) (ii) [Scale 5C (0, 3, 4, 5)]

- 3: • One point found in $g(x)$
 • Only one point indicated on graph
- 4: • Two points identified
 • Two points plotted but no graph drawn