# LC 2014 (Set B): 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

Cubic = $k$(Linear)(Linear)(Linear)

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

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

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

$\therefore -6k = -6 \Rightarrow k = 1$
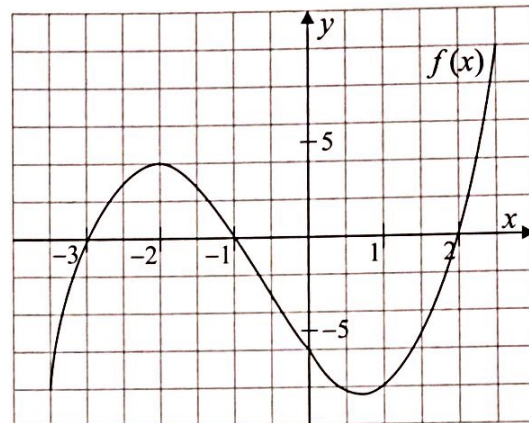
Multiply out the brackets to obtain the cubic function.

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

$\quad = (x + 3)(x^2 - x - 2)$

$\quad = x^3 - x^2 - 2x + 3x^2 - 3x - 6$

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

**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)**

$f(x) = g(x)$

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

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

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

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

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

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

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

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

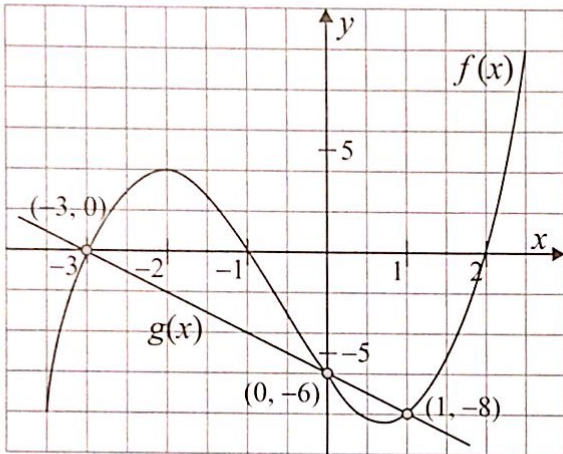$x = 0: g(0) = -2(0) - 6 = -6$

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

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

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**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

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## Question 1 (b) (ii)



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

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**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

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