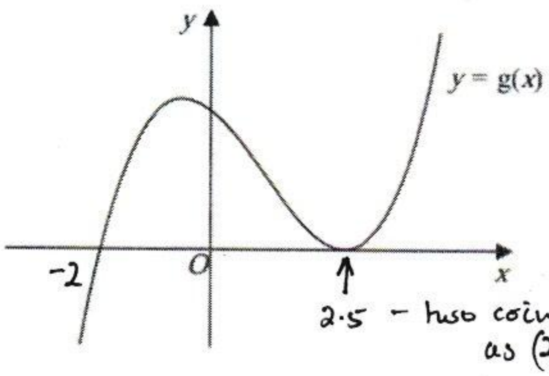
9. $$g(x) = 4x^3 - 12x^2 - 15x + 50$$

(a) Use the factor theorem to show that $(x + 2)$ is a factor of $g(x)$.

(2)

(b) Hence show that $g(x)$ can be written in the form $g(x) = (x + 2)(ax + b)^2$, where a and b are integers to be found.

(4)



– two coincident solutions as $(2x-5)^2$

Figure 2

Figure 2 shows a sketch of part of the curve with equation $y = g(x)$

(c) Use your answer to part (b), and the sketch, to deduce the values of x for which

(i) $g(x) \leqslant 0$

(ii) $g(2x) = 0$

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(3)

(a) When $x = -2$ $\quad g(x) = -32 - 48 + 30 + 50 = 0$

Hence $(x+2)$ is a factor of $g(x)$

(b) Divide by $(x+2)$ to find the remaining factor(s) of $g(x)$

$$\begin{array}{r|l} & 4x^2 - 20x + 25 \\ \hline x+2 & 4x^3 - 12x^2 - 15x + 50 \\ & 4x^3 + 8x^2 \\ \hline & \quad -20x^2 - 15x \\ & \quad -20x^2 - 40x \\ \hline & \qquad 25x + 50 \\ & \qquad 25x + 5 \\ \hline \end{array}$$

So $g(x) = (x+2)(4x^2 - 20x + 25)$

$= (x+2)(2x-5)^2$ which is of the required form

$a = 2 \quad b = -5$

(c) $g(x) = 0$ when $x = -2$ and when $x = 2.5$.

(i) Hence $g(x) \leqslant 0$ when $x \leqslant -2$ and when $x = 2.5$

(ii) $g(x) = 0$ when $x = -2$ or 2.5

So $g(2x) = 0$ when $x = -1$ or 1.25