Question	Scheme	Marks	AOs
1	$w = 2x - 1 \Rightarrow x = \dfrac{w+1}{2}$	B1	3.1a
	$3\left(\dfrac{w+1}{2}\right)^3 + 5\left(\dfrac{w+1}{2}\right)^2 - 2\left(\dfrac{w+1}{2}\right) + 6 = 0$	M1	3.1a
	$\dfrac{3}{8}(w^3 + 3w^2 + 3w + 1) + \dfrac{5}{4}(w^2 + 2w + 1) - 2\dfrac{(w+1)}{2} + 6 = 0$	M1 A1 A1	1.1b 1.1b 1.1b
		(5)	
ALT	$\alpha + \beta + \gamma = -\dfrac{5}{3}, \alpha\beta + \beta\gamma + \alpha\gamma = -\dfrac{2}{3}, \alpha\beta\gamma = -2$	B1	3.1a
	New sum = $2(\alpha + \beta + \gamma) - 3 = -\frac{19}{3}$ New pair sum $4(\alpha\beta + \beta\gamma + \gamma\alpha) - 4(\alpha + \beta + \gamma) + 3 = 7$ New product$8\alpha\beta\gamma - 4(\alpha\beta + \beta\gamma + \gamma\alpha) + 2(\alpha + \beta + \gamma) - 1 = -\frac{53}{3}$	M1	3.1a
	$w^3 + 19w^2 + 21w + 53 = 0$	M1 A1 A1	1.1b 1.1b 1.1b
		(5)	
			(5 marks)

Notes

B1: Selects the method of making a connection between *x* and *w* by writing $x = \frac{w+1}{2}$

M1 Applies the process of substituting $x = \frac{w\pm1}{2}$ into $3x^3 + 5x^2 - 2x + 6 = 0$

M1: Manipulates their equation into the form $w^3 + pw^2 + qw + r(= 0)$ having substituted their *x* in terms of *w*. Note that the "= 0" can be missing for this mark.

A1: At least two of *p*, *q*, *r* correct. Note that the "= 0" can be missing for this mark.

A1: Fully correct equation including "= 0"

The first 4 marks are available if another letter is used instead of *w* but the final answer must be in terms of *w*.

Alternative

B1: Selects the method of giving three correct equations containing α, β and γ.

M1: Applies the process of finding the new sum, new pair sum, new product.

M1: Applies $w^3 - (\text{newsum})w^2 + (\text{newpairsum})w - (\text{newproduct})(= 0)$

or identifies *p* as – (new sum), *q* as (new pair sum) and *r* as – (new product)

A1: At least two of *p*, *q*, *r* correct.

A1: Fully correct equation including "= 0"

The first 4 marks are available if another letter is used instead of *w* but the final answer must be in terms of *w*.