Question	Answer	Marks	Guidance
5(c)	$\log_y 2 = \dfrac{1}{\log_2 y}$ or $\log_2 y = \dfrac{1}{\log_y 2}$ or $\log_y 2 = \dfrac{\log_a 2}{\log_a y}$ **and** $\log_2 y = \dfrac{\log_a y}{\log_a 2}$	**B1**	May be implied
	$4(\log_y 2)^2 - 4(\log_y 2) + 1 = 0$ $(2\log_y 2 - 1)^2 = 0$, $\log_y 2 = \dfrac{1}{2}$ or $(\log_2 y)^2 - 4(\log_2 y) + 4 = 0$ $(\log_2 y - 2)^2 = 0$, $\log_2 y = 2$ or $(\log_a y)^2 - 4(\log_a 2)(\log_a 4)\log_a y$ $+4(\log_a 2)^2 = 0$ $(\log_a y - 2\log_a 2)^2 = 0$ $\log_a y = 2\log_a 2$	**M1**	For obtaining a 3 term quadratic equation in either $\log_y 2$ or $\log_2 y$ and solving to obtain $\log_y 2 = k$ or $\log_2 y = k$, may be implied or equivalent using an alternative base.
	$y = 4$	**A1**	nfww
6(a)	$\dfrac{dy}{dx} = 2(3+\sqrt{5})x - 8\sqrt{5}$ or $x = \dfrac{8\sqrt{5}}{2(3+\sqrt{5})}$	**M1**	Either For differentiation must have one correct term. or for use of '$b^2 - 4ac = 0$', so $x = -\dfrac{b}{2a}$ at the stationary point.
	$x = \dfrac{4\sqrt{5}}{3+\sqrt{5}} \times \dfrac{(3-\sqrt{5})}{(3-\sqrt{5})}$ oe leading to $\dfrac{12\sqrt{5}-20}{4}$ oe, this is the minimum acceptable working for this method.	**M1**	**Dep** for equating *their* $\dfrac{dy}{dx}$ to zero with attempt to solve and rationalisation using a two term factor, or rationalisation of $x = -\dfrac{b}{2a}$, using a two term factor with sufficient detail to imply no use of a calculator. Allow multiple equivalents. Allow one numerical slip or sign error.
	$x = -5 + 3\sqrt{5}$	**2**	**A1** for -5 **A1** for $3\sqrt{5}$

Question	Answer	Marks	Guidance
6(b)	$y=\left(3+\sqrt{5}\right)\left(3\sqrt{5}-5\right)^2$ $-8\sqrt{5}\left(3\sqrt{5}-5\right)+60$ $=\left(3+\sqrt{5}\right)\left(45+25-30\sqrt{5}\right)$ $-120+40\sqrt{5}+60$ $=210+70\sqrt{5}-90\sqrt{5}-150$ $-120+40\sqrt{5}+60$	**M1**	For substitution of *their x* and simplification with sufficient detail to imply no use of a calculator. Allow one numerical slip or sign error in the expansion of $\left(3+\sqrt{5}\right)\left(3\sqrt{5}-5\right)^2$ or one sign error in the other terms.
	$=20\sqrt{5}$	**2**	**A1** for all non surd terms = 0 **A1** for $20\sqrt{5}$
7(a)(i)	20160	**B1**	
7(a)(ii)	7200	**2**	**B1** for ${}^6\mathrm{P}_4$ or $6\times5\times4\times3\left(=360\right)$ for 'inner' characters or ${}^5\mathrm{P}_2$ or $4\times5\left(=20\right)$ for 'outer' characters Must be part of a product
7(a)(iii)	360	**2**	**B1** for ${}^3\mathrm{P}_3$ or 3! or 6 for arrangements of symbols or ${}^5\mathrm{P}_3$ or $5\times4\times3$ (= 60) for the digits Must be part of a product
7(b)	$\frac{n!}{(n-5)!5!}=\frac{6(n-1)!}{((n-1)-4)!4!}$	**B1**	May be implied by simplification e.g. $\frac{n!}{5!}=6\frac{(n-1)!}{4!}$ or $\frac{n(n-1)(n-2)(n-3)(n-4)}{5!}$ $=\frac{6(n-1)(n-2)(n-3)(n-4)}{4!}$
	Simplification of either the numerical factorials or the algebraic factorials	**M1**	
	$n=30$	**A1**	