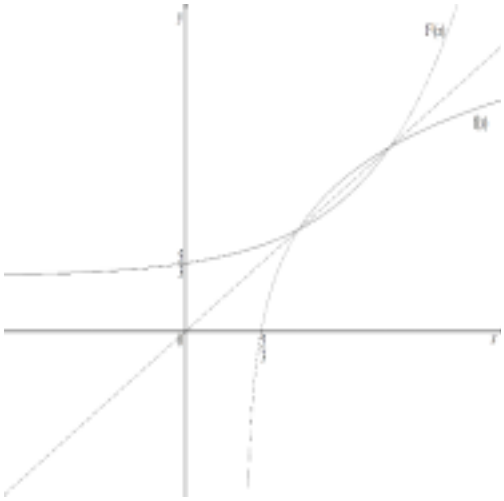
Question	Answer	Marks	Guidance
7(a)	${}^{14}C_2 \times {}^{12}C_3 \times {}^{9}C_4$ oe, soi 2 522 520	**3**	**B1** for a product of 3 combinations (ignore combinations that are equal to 1), one of which must be in the form ${}^{14}C_k$ where $k = 2,\ 3,\ 4,\ 5,\ 9,\ 10,\ 11,\ 12$ **B2** for a correct product of combinations
7(b)(i)	136 080	**B1**	
7(b)(ii)	15 120	**B1**	
7(b)(iii)	38 640	**3**	**B1** for ${}^{8}P_4$ or 1680 or $(8\times7\times6\times5)$ **B2** for $8\times {}^{8}P_4$ (13 440) oe or $15\times {}^{8}P_4$ (25 200) oe
8(a)	$(a=)\ \frac{4}{3}$ or $1.\dot{3}$	**B1**	Allow a recurring decimal Must not be an inequality in terms of a Allow $x > \frac{4}{3}$
8(b)	$f \in \mathbb{R}$ or $-\infty < f < \infty$ or $\mathbb{R}$	**B1**	Allow y or $f(x)$ but not x.
8(c)		**4**	**B1** for a correct shape for $y = f(x)$ in quadrants 1 and 4 **B1** for $\left(\frac{5}{3},\ 0\right)$, must have a correct shape in either quadrant 1 or quadrant 4 **B1** for $y = f^{-1}(x)$, must be a correct shape in quadrants 1 and 2 and intersect twice. **B1** for $\left(0,\ \frac{5}{3}\right)$, must have a reasonable shape for $y = f^{-1}(x)$ in either the first quadrant or the second quadrant
8(d)(i)	$g(g(x)) = 4x - 9$	**B1**	Must be simplified
8(d)(ii)	$fg(g(x)) = 2\ln(12x - 31)$	**M1**	allow unsimplified, using *their* answer to **(i)**
	$2\ln(12x - 31) = 4$ $x = \frac{e^2 + 31}{12}$	**2**	**Dep M1** for correct order of operations to solve *their* equation, to get as far as $x = \ldots$ Implied by decimal answer of awrt 3.2 **A1** Must be exact form.

Question	Answer	Marks	Guidance
9	$\frac{(2x+6)}{3} = 3 + \frac{4}{2x+1}$ $4x^2 - 4x - 15 (= 0)$	**2**	**M1** for equating the line and curve and obtaining a 3 term quadratic expression in terms of x.
	$x = \frac{5}{2}$	**A1**	For x-coordinate of the point of intersection.
	Either $\int \left(3 + \frac{4}{2x+1}\right) \mathrm{d}x = 3x + 2\ln(2x+1)$	**2**	**M1** for attempt to integrate with one term correct
	$\left[3x + 2\ln(2x+1)\right]_0^{\frac{5}{2}} = \frac{15}{2} + 2\ln 6$	**2**	**Dep M1** for using *their* x-coordinate of C in *their* integral. Must have a term in $\ln(2x+1)$ Allow for awrt 11.1. **A1** Must be exact but allow unsimplified
	Area of trapezium $\frac{1}{2}\left(2 + \frac{11}{3}\right) \times \frac{5}{2}$ or $\left[\frac{x^2}{3} + 2x\right]_0^{their\ \frac{5}{2}}$ or $\left[\frac{(2x+6)^2}{12}\right]_0^{their\ \frac{5}{2}} = \frac{85}{12}$	**2**	**M1** for attempt at the trapezium, must have at least one side correct. If using integration, the integral must be correct using *their* $\frac{5}{2}$
	Shaded area = $2\ln 6 + \frac{5}{12}$ or $\ln 36 + \frac{5}{12}$ or $\ln 6^2 + \frac{5}{12}$	**A1**	
	Or $\int \left\lvert 1 + \frac{4}{2x+1} - \frac{2}{3}x \right\rvert \mathrm{d}x$ $x + 2\ln(2x+1) - \frac{x^2}{3}$ or $-x - 2\ln(2x+1) + \frac{x^2}{3}$	**(5)**	**M2** for attempt to subtract and integrate with at least one term correct, allow x terms considered separately. If subtraction is reversed allow accuracy marks. Separate x terms should be considered as one term for A marks. **A1** for one term only correct **A2** for two terms only correct
	$\left[x + 2\ln(2x+1) - \frac{x^2}{3}\right]_0^{\frac{5}{2}} = \frac{5}{2} + 2\ln 6 - \frac{25}{12}$ or $\left[\frac{x^2}{3} - x - 2\ln(2x+1)\right]_0^{\frac{5}{2}} = \frac{25}{12} - \frac{5}{2} - 2\ln 6$	**(M1)**	**Dep M1** for using *their* x-coordinate of the point of intersection in *their* integral, must have a term in $\ln(2x+1)$ Allow for awrt ± 4 as appropriate