Question	Answer	Marks	Guidance
3(a)	4! × 3! oe	**M1**	
	144	**A1**	
3(b)	${}^4C_2 \times {}^9C_5 + {}^4C_3 \times {}^9C_4 + {}^4C_4 \times {}^9C_3$ oe	**M2**	**M1** for one correct product
	1344	**A1**	
	Alternative method		
	${}^{13}C_7 - ({}^4C_1 \times {}^9C_6 + {}^9C_7)$ oe	**(M2)**	**M1** for ${}^{13}C_7 - {}^4C_1 \times {}^9C_6$ or ${}^{13}C_7 - {}^9C_7$ oe
	1344	**(A1)**	
4(a)	$\frac{(1-\sin x)^2 + \cos^2 x}{\cos x(1-\sin x)}$ or $\frac{1-2\sin x+\sin^2 x+\cos^2 x}{\cos x(1-\sin x)}$ oe	**M1**	Common denominator
	$\frac{2-2\sin x}{\cos x(1-\sin x)}$ oe	**A1**	Use of $\cos^2 x + \sin^2 x = 1$
	$\frac{2(1-\sin x)}{\cos x(1-\sin x)}$ and correct completion to given answer, 2sec x	**A1**	Fully justified with sufficient detail
4(b)	$\cos\frac{\theta}{2} = \frac{2}{3}$ oe	**M1**	
	At least one correct half angle: 48.19[89…] or 311.8[10…]	**A1**	
	$[\theta =]$ 96.4 or 96.37[9…], 623.6 or 623.62[06…]	**A1**	and no other angles in range
5(a)	$(x-4)^2 + (y-2)^2 = 40$ oe, isw or $x^2 + y^2 - 8x - 4y - 20 = 0$ oe, isw	**B2**	**B1** for $r^2 = 40$ or $r = \sqrt{40}$ oe, soi
5(b)	$16 + (y-2)^2 = 40$ oe	**M1**	**FT** *their* equation of the circle providing it is the equation of a circle
	$(y-2)^2 = 24$ or $y^2 - 4y - 20 = 0$	**A1**	Obtain correct quadratic equation in any form
	$(0, 2 \pm \sqrt{24})$ isw or equivalent exact form	**A1**	

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Question	Answer	Marks	Guidance
6	$\ln y = mx + c$ soi	**B1**	
	Correct method to find m e.g. $m = \frac{\ln 75 - \ln 15}{2 - 1}$ oe or $-m = \ln 15 - \ln 75$ oe OR $m = \ln 5$ oe	**M1**	**FT** *their c* if necessary
	Correct method to find c e.g. $\ln 15 =$ *their*$(\ln 5)$ [1] $+ c$ oe or $\ln 75 =$ *their*$(\ln 5)$ (2) $+ c$ oe or $\ln 75 = 2(\ln 15 - c) + c$ oe OR $c = \ln 3$ oe, soi	**M1**	**FT** *their m* if necessary
	$y = 3 \times 5^x$ nfww, mark final answer	**A1**	
7	$\frac{dy}{dx} = 1 - \frac{2x+2}{x^2+2x}$	**2**	**B1** for $\frac{d(-\ln(x^2+2x))}{dx} = \frac{1}{x^2+2x} \times f(x)$ soi
	Equates *their* first derivative to 0 and simplifies as far as $2(x + 1) = x(x + 2)$ oe	**M1**	**FT** *their* $\frac{dy}{dx}$
	$x^2 - 2 = 0$ or $x^2 = 2$	**A1**	
	$x = \sqrt{2}$ $[x = -\sqrt{2}]$	**A1**	
	Justification that the negative solution should be rejected e.g. $x = -\sqrt{2}$ results in $y = 2 - \ln(2 - 2\sqrt{2})$ which is impossible	**B1**	
8(a)(i)	[Velocity:] $\frac{(2t-3)^3}{3 \times 2}$ $(+ c)$	**M1**	Allow for $k(2t - 3)^3$
	$\frac{(2 \times 3 - 3)^3}{6} + c = 6$ $[c = \frac{3}{2}]$	**M1**	Correct calculation which can be used to find c
	[Velocity at time t] $= \frac{(2t-3)^3}{6} + \frac{3}{2}$ oe	**A1**	