Question	Answer	Marks	Partial marks
4(a)	Correct statement for area e.g. $\frac{1}{2}r^2\alpha = 9$ or $\frac{1}{2}rs = 9$	**B1**	
	Finds an equation that can be used to eliminate α or s e.g. $\alpha = \frac{18}{r^2}$ or $r\alpha = \frac{18}{r}$ or $s = \frac{18}{r}$	**M1**	
	Correct substitution and completion to given answer e.g. $P = 2r + r \times \frac{18}{r^2} = 2r + \frac{18}{r}$	**A1**	
4(b)	Correct derivative: $2 - \frac{18}{r^2}$ oe isw	**B1**	
	$2 - \frac{18}{r^2} = 0$ and solves for r	**M1**	**FT** *their* $\frac{\mathrm{d}P}{\mathrm{d}r} = 0$ providing of the form $2 + \frac{n}{r^k}$ where n and k are non-zero integers
	$r = 3$ only soi	**A1**	
	$P = 12$ only soi	**A1**	
	[2nd derivative =] $\frac{36}{r^3}$ oe **and** which is positive for $r = 3$ →minimum **or** as $r > 0$ [2nd derivative =] > 0 →minimum **or** [2nd derivative =] $\frac{36}{3^3}$ oe →minimum OR correctly finds the values of the first derivative at $3 \pm h$ where h is small → minimum	**A1**	**dep** on $r = 3$ and no other value

Question	Answer	Marks	Partial marks
5	[When $x = 3$] $y = \frac{2}{3}$ soi	**B1**	
	Correct derivative: $\frac{x \times \frac{1}{2}(x+1)^{-\frac{1}{2}} - \sqrt{x+1}}{x^2}$ or $-x^{-2}(x+1)^{\frac{1}{2}} + x^{-1} \times \frac{1}{2}(x+1)^{-\frac{1}{2}}$	**M2**	**M1** for an attempt to differentiate using the quotient rule oe
	Gradient of tangent: $\frac{3 \times \frac{1}{2}(4)^{-\frac{1}{2}} - \sqrt{4}}{3^2}$	**M1**	**dep** on attempt at a derivative which includes $(x+1)^{-\frac{1}{2}}$
	$-\frac{5}{36}$ isw	**A1**	**dep** on having a **correct derivative**
	$y = -\frac{5}{36}x + \frac{13}{12}$ oe or $y - \frac{2}{3} = \left(-\frac{5}{36}\right)(x - 3)$ oe soi	**A1**	**FT** *their* non-zero $\frac{2}{3}$ and *their* non- zero $-\frac{5}{36}$
	$A(15, -1)$	**B2**	**B2 dep** on all previous marks awarded **B1 dep** for $x = 15$ or $y = -1$
6(a)	$\frac{2}{3}(3x+2)^{\frac{1}{2}}(+c)$ oe	**2**	**B1** for $k(3x+2)^{\frac{1}{2}}$ oe, soi where k is a constant and $k \neq 0$
6(b)	$-\frac{e^{1-2a}}{2} + \frac{1}{2}$ oe, isw	**3**	**B2** for $-\frac{1}{2}e^{(1-2x)}$ oe or **B1** for $ke^{(1-2x)}$ or $ke^{(1-2a)}$ where k is a constant, $k \neq 0$
7(a)	$x = \sqrt[3]{\frac{28}{56}}$ oe, nfww, isw	**3**	**B2** for $28x^{10}$ and $56x^{13}$ OR $[x^8](28x^2)$ and $[x^8](56x^5)$ or **B1** for $28x^{10}$ or $56x^{13}$ OR $[x^8](28x^2)$ or $[x^8](56x^5)$
7(b)(i)	$n = 10$	**2**	**B1** for the correct term in any form e.g. ${}^nC_5x^{n-5}\left(\frac{2}{x}\right)^5$ or for $n - 5 = 5$ oe, soi
7(b)(ii)	8064	**2**	**B1** for ${}^{10}C_5 \times 2^5$ oe e.g. 252×32

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