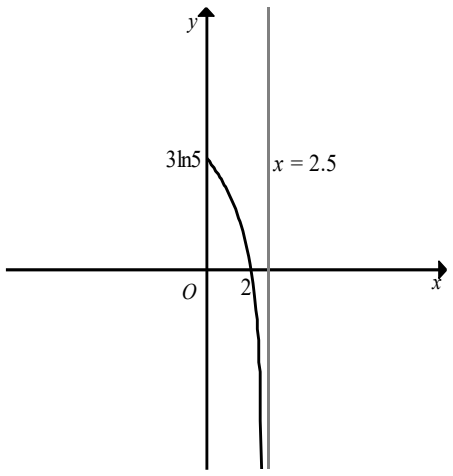
Question	Answer	Marks	Partial Marks
5(a)	Centre $(5, 12)$ soi	**B1**	
	Gradient of radius = $\frac{12-4}{5-11}$ $\left(=-\frac{4}{3}\right)$	**M1**	
	Equation of normal: $y-4=\frac{3}{4}(x-11)$	**M1**	Must be using *their* perpendicular gradient and the correct point
	$3x-4y=17$	**A1**	
5(b)	Distance between centres = 13 Sum of radii = 12	**M1**	For both
	$13>12$ so no intersection	**A1**	
6	$8(\ln x)^2-10\ln x+3$ $(=0)$	**2**	**M1** for elimination of y and re-arrangement to a 3 term quadratic in terms of $\ln x$
	$\ln x=0.75,\quad \ln x=0.5$	**2**	**Dep** on previous **M** mark for correct method of solution
	$x=e^{0.75},\quad x=e^{0.5}$	**A1**	For both
7(a)	$\frac{1}{2}\times 6\times 6\times\sin\theta=9$ oe	**M1**	
	$\sin\theta=\frac{1}{2}$	**A1**	
7(b)	$\frac{1}{2}(36)(\theta-their\sin\theta)=15\pi-9$ oe	**M1**	
	$\theta=\frac{5\pi}{6}$	**A1**	
	5π	**2**	**M1** for $6\times their\frac{5\pi}{6}$, but not $\frac{\pi}{6}$
8(a)	$\frac{5}{2}$, 1	**B1**	

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Question	Answer	Marks	Partial Marks
8(b)	Area of trapezium = $\frac{7}{4}$	**B1**	**FT** on *their y* coordinates
	Area under curve = $\int_1^2\left(\frac{3}{x+1}-1+\frac{2}{x}\right)\mathrm{d}x$	**B1**	Condone omission of limits here
	$3\ln(x+1)-x+2\ln x$	**2**	**M1** for at least one correct log term
	$(3\ln 3-2-2\ln 2)-(3\ln 2-1)$	**M1**	**Dep** on previous **M** mark
	$\ln\frac{27}{2}-1$	**M1**	**Dep** on previous **M** mark for simplification using log rules correctly
	$\frac{11}{4}-\ln\left(\frac{27}{2}\right)$	**A1**	
9(a)(i)	$\frac{1}{8}-2\left(x-\frac{9}{4}\right)^2$	**3**	**B2** for $a-2\left(x-\frac{9}{4}\right)^2$ or **B1** for $a+b\left(x-\frac{9}{4}\right)^2$ **B1** for $a=\frac{1}{8}$ oe
9(a)(ii)	Turning point $\left(\frac{9}{4},\ \frac{1}{8}\right)$	**B1**	FT on *their a* and *c*
	f^{-1} does not exist as given domain includes the turning point. oe	**B1**	**Dep** on previous **B** mark, turning point must be correct
9(b)(i)		**3**	**B1** for correct shape ; may not be over correct domain but must have positive *y*-intercept and appear to tend to a vertical asymptote in the 4th quadrant **B1** for (0, 3 ln 5) and (2, 0) stated or marked on graph; must have attempted correct shape **B1** for asymptote at $x = 2.5$

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