Question	Answer	Marks	Guidance
7(a)	$\sin AOQ = \frac{7}{10}$ $POA = \pi - AOQ$ or $14^2 = 10^2 + 10^2 - 200\cos AOB$ oe $POA = \frac{2\pi - AOB}{2}$	**M1**	Allow alternatives, but must be a complete method to find *POA*
	$POA = 2.366195157$ = 2.366 to 3 dp	**A1**	Must see an angle correct to more than 3dp used in order to justify 3 dp
7(b)	Area of sector = $\frac{1}{2}10^2(2.366)$ (118.3)	**B1**	Allow unsimplified. Also allow use of 2.37
	Area of triangle = $\frac{1}{2}10^2\sin 2.366$ (35)	**B1**	Allow unsimplified. Also allow use of 2.37
	Total area = awrt 153	**B1**	Allow greater accuracy
7(c)	Major arc *PB* = 10×2.366	**B1**	Allow unsimplified. Also allow use of 2.37
	$\sin\frac{POA}{2} = \frac{AP/2}{10}$ or $AP^2 = 10^2 + 10^2 - 200\cos POA$	**M1**	For a valid attempt to find *AP* – may be seen in **(a)** or **(b)** but *AP* must be stated in this part.
	$AP = 18.5$	**A1**	Allow awrt 18.5
	Perimeter: major arc *PB* + 20 + *their AP*	**B1**	For plan, may be implied, but must have an attempt to calculate *AP*
	Total perimeter = 62.2	**A1**	Allow awrt 62.2
8(a)	$2x^2 + 2x - 2 = x^2 + 6x - 2$ $x^2 - 4x = 0$ $x(x-4) = 0$ $x = 0,\ x = 4$	**M1**	For obtaining an equation in one variable
		M1	**Dep** for a correct attempt to obtain at least one solution
	$(0, -1)$	**A1**	nfww
	$(4, 19)$	**A1**	nfww
	Mid-point $(2, 9)$ with sufficient detail	**B1**	**AG**

Question	Answer	Marks	Guidance
8(b)	**Either** Gradient of perpendicular $= -\frac{1}{5}$	**M1**	
	$y-9=-\frac{1}{5}(x-2)$	**M1**	**Dep** on previous **M** mark for perpendicular bisector using *their* mid-point and *their* perpendicular gradient
	$7-9=-\frac{1}{5}(12-2)$ oe	**A1**	For checking by substitution, must see evidence.
	Or Alternative 1 Gradient of perpendicular $= -\frac{1}{5}$	**(M1)**	
	$y-7=-\frac{1}{5}(x-12)$	**(M1)**	**Dep** on previous **M** mark for perpendicular bisector using $(12, 7)$ and *their* perpendicular gradient
	$9-7=-\frac{1}{5}(2-12)$ oe	**(A1)**	For checking by substitution, must see evidence
	Or Alternative 2 Gradient of perpendicular $= -\frac{1}{5}$	**(M1)**	
	Gradient of line joining *their* $(2, 9)$ to $(12, 7) = = -\frac{1}{5}$	**(M1)**	
	$(2, 9)$ is a common point and gradients of perpendicular bisector and *l* are the same so *C* lies on *l*.	**(A1)**	
8(c)	$(22, 5)$	**2**	**B1** for 22 **B1** for 5
	$(-18, 13)$	**2**	**B1** for -18 **B1** for 13

Question	Answer	Marks	Guidance
9(a)	$e^{2y} = mx^2 + c$	**B1**	May be implied by later work
	Either $7.96 = 4m + c$ $3.76 = 2m + c$	**M1**	
	$m = 2.1$ oe	**A1**	
	$c = -0.44$ oe	**A1**	
	$y = \frac{1}{2}\ln\left(2.1x^2 - 0.44\right)$ oe	**A1**	Do not isw
	Or gradient = 2.1 oe	**(B1)**	
	Use of either $7.96 = 4m + c$ or $3.76 = 2m + c$	**(M1)**	For use with *their m*
	$c = -0.44$ oe	**(A1)**	
	$y = \frac{1}{2}\ln\left(2.1x^2 - 0.44\right)$ oe	**(A1)**	Must be bracketed correctly
9(b)	$y = \frac{1}{2}\ln\left(their\,2.1x^2 - their\,0.44\right)$ oe	**M1**	Must use the form $y = k\ln\left(px^2 \pm q\right)$ $p \neq 1$ and $q \neq 0$ or $e^{2y} = mx^2 + c$
	0.253	**A1**	
9(c)	$their\,2.1x^2 - their\,0.44 > 0$ or = 0 or ≥ 0 soi	**B1**	
	Correct attempt to obtain the critical value using $their\,2.1x^2 - 0.44 = 0$	**M1**	Must be from the form $y = k\ln\left(px^2 - q\right)$, $p \neq 1$ and $q > 0$
	$x > 0.458$ or $x > \sqrt{\frac{22}{105}}$ oe	**A1**	