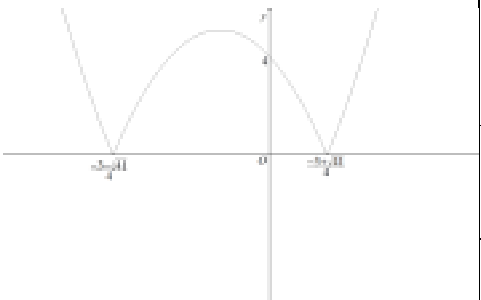
Question	Answer	Marks	Partial Marks
1(a)	$f > 3$	**B1**	Allow y but not x
	$g \in \mathbb{R}$	**B1**	Allow y but not x
1(b)	$\ln(x-3)$	**B1**	
	$\ln(x-3)=9$ $x-3=e^9$	**M1**	For attempt to equate to 9 and solve, must get rid of ln
	$x=e^9+3$	**A1**	
1(c)	$9(9x-5)-5=112$	**M1**	For correct order of operation
	$x=2$	**A1**	
2(a)	Either $2\log_4 y=\log_2 y$ Or $\log_2 x=2\log_4 x$	**B1**	
	Either $\log_2 x+\log_2 y=8$ leading to $\log_2 xy=8$ Or $2\log_4 x+2\log_4 y=8$ leading to $\log_4 xy=4$	**M1**	For use of log law
	$xy=256$	**A1**	
2(b)	$2y^2-3y+1=0$	**B1**	
	$y=\frac{1}{2},\ 1$	**M1**	For attempt to solve for y
	$x=-1$	**A1**	
	$x=0$	**A1**	
3(a)	$v=(2t+1)^{\frac{1}{2}}(+c)$	**B1**	For $v=(2t+1)^{\frac{1}{2}}$ condone absence of c
	$8=1+c,\quad c=7$	**M1**	For attempt to find c must have $k(2t+1)^{\frac{1}{2}}$
	$v=(2t+1)^{\frac{1}{2}}+7$	**A1**	

Question	Answer	Marks	Partial Marks
3(b)	$s=\frac{1}{3}(2t+1)^{\frac{3}{2}}+7t(+d)$	**B1**	For $\frac{1}{3}(2t+1)^{\frac{3}{2}}$
		M1	For attempt to integrate *their* answer to (a), must have $k(2t+1)^{\frac{1}{2}}$ in (a)
	$4=\frac{1}{3}+d$, $d=\frac{11}{3}$	**M1**	Attempt to find *d*
	$s=\frac{1}{3}(2t+1)^{\frac{3}{2}}+7t+\frac{11}{3}$	**A1**	
4(a)	$2\left(x+\frac{3}{4}\right)^2-\frac{41}{8}$	**B3**	**B1** for 2 **B1** for $\frac{3}{4}$ **B1** for $-\frac{41}{8}$
4(b)	$\left(-\frac{3}{4}, -\frac{41}{8}\right)$	**B2**	**B1** for $-\frac{3}{4}$ or **FT** on *their* $-b$ **B1** for $-\frac{41}{8}$ or **FT** on *their* c
4(c)		**B1**	For shape with max in 2[nd] quadrant
		B1	For *x*-intercepts $\frac{-3\pm\sqrt{41}}{4}$
		B1	For *y*-intercept of 4 and cusps
4(d)	$\frac{41}{8}$	**B1**	**FT** on *their c*

Question	Answer	Marks	Partial Marks
5(a)	$\mathrm{p}(3)$: $162+9a+36+b=11$ $\mathrm{p}(-1)$: $-6+a-12+b=-21$	**M1**	For attempt at $\mathrm{p}(3)$ and $\mathrm{p}(-1)$
	$9a+b+187=0$ $a+b+3=0$	**A1**	for both, may be implied by correct work later
	$a=-23$, $b=20$	**M1**	attempt to solve simultaneous equations
		A1	For both
	$\mathrm{p}(x)=(x-2)(6x^2-11x-10)$	**M1**	For attempt to factorise or use algebraic long division
		A1	For $(6x^2-11x-10)$
5(b)	$\mathrm{p}(x)=(x-2)(3x+2)(2x-5)$	**M1**	For attempt to factorise or use quadratic formula – must be seen
	$2,\ -\frac{2}{3},\ \frac{5}{2}$	**A1**	For all three solutions
6(a)	$\frac{1}{13}\begin{pmatrix}5\\-12\end{pmatrix}$	**B1**	
6(b)	$4-2k=-10r$ $1+3k=5r$	**M1**	equating like vectors to obtain 2 equations
	$r=-\frac{7}{10},\ k=-\frac{3}{2}$	**M1**	Dep on previous M mark, for attempt to solve simultaneously
		A1	
6(c)(i)	$3\mathbf{q}-2\mathbf{p}$	**B1**	
6(c)(ii)	$9\mathbf{q}-6\mathbf{p}$	**B1**	
6(c)(iii)	A common point of A and the same direction vector	**B1**	
6(c)(iv)	1:2	**B1**	
7(a)	$\frac{1}{2}\times10^2\times\theta=35$ so $\theta=0.7$	**B1**	

Question	Answer	Marks	Partial Marks
7(b)	Arc length *CD*: 7	**B1**	
	$\sin(0.35) = \frac{AB/2}{12}$	**M1**	For a complete method to find *AB*, could be using cosine rule
	$AB = 8.23(0)$	**A1**	
	Perimeter = $7 + 4 + 8.23 = 19.2$	**A1**	
7(c)	Area of triangle $= \frac{1}{2}12^2 \sin 0.7$	**M1**	For complete attempt at triangle area, may use equivalent method
	Area of triangle $= 46.4$	**A1**	
	Shaded area $= 11.4$	**A1**	Follow through on *their* area of the triangle
8(a)	$\frac{n}{2}(14 + (n-1)0.4)$	**B1**	
	$\frac{n}{2}(14 + (n-1)0.4) > 300$ $0.4n^2 + 13.6n - 600 > 0$	**M1**	Attempt to form a 3 term inequality and find the positive critical value
	Positive critical value 25.29	**A1**	
	26 terms	**A1**	
8(b)	$a + ar = 9$	**B1**	
	$\frac{a}{1-r} = 36$	**B1**	
	$36(1+r)(1-r) = 9$	**M1**	attempt at solution of simultaneous equations
	$r = \frac{\sqrt{3}}{2}$	**A1**	

Question	Answer	Marks	Partial Marks
9	$x(5x-3)=2$ $5x^2-3x-2=0$	M1	attempt at a 3-term quadratic equation in one variable with solution
	$x=1,\ x=-\frac{2}{5}$	A1	Allow if $x=-\frac{2}{5}$ not seen
	$A\ \ (1,\ 2)$	A1	
	$B\ \left(\frac{3}{5},\ 0\right)$	B1	
	Area of triangle $=\frac{2}{5}$	M1	Using *their A* and *B*
	Area under curve: $\int_1^3 \frac{2}{x}\,dx=\left[2\ln x\right]_1^3$	B1	For $\left[2\ln x\right]_1^3$
	$=2\ln 3$	M1	For use of limits
	Total area $=\frac{2}{5}+\ln 9$	A1	
10(a)	$\frac{dy}{dx}=\frac{1}{2}x(x+2)^{-\frac{1}{2}}+(x+2)^{\frac{1}{2}}$	B1	For $\frac{1}{2}(x+2)^{-\frac{1}{2}}$
		M1	For differentiation of a product
		A1	
	$\frac{dy}{dx}=\frac{1}{2}(x+2)^{-\frac{1}{2}}\left[x+2(x+2)\right]$	M1	For attempt to simplify
	$\frac{dy}{dx}=\frac{3x+4}{2\sqrt{x+2}}$	A1	
10(b)	$3x+4=0$	M1	For setting *their* numerator in (a) to zero and attempt to solve
	$x=-\frac{4}{3}$	A1	
	$y=-\frac{4\sqrt{6}}{9}$ oe	A1	
10(c)	Using the gradient method or inspection of y-coordinates either side of stationary point. Allow use of second derivative	M1	complete method
	Minimum	A1	Must be from correct work