Question	Answer	Marks	Partial Marks
1	$x^2 - 18x + 45$ (= 0)	**B1**	Expand and simplify to three terms.
	$(x - 15)(x - 3)(= 0)$ or $x = \frac{18 \pm \sqrt{18^2 - 4 \times 45}}{2}$ or $(x - 9)^2 = -45 + 81$	**M1**	Factorise or use formula on *their* 3 term quadratic or complete the square
	$x = 15$ and $x = 3$	**A1**	
	$x < 3$ or $x > 15$ or $(-\infty, 3) \cup (15, \infty)$	**A1**	oe Do not accept 'and'. Do not accept $3 > x > 15$. Mark final answer.
2	$\frac{2^{(2x+2)}}{2^{(x-1)}} = 2^{\frac{5x}{3}} \times 2^1$	**M1**	Convert all to powers of 2 – allow one error**.**
	$2^{(x+3)} = 2^{\left(\frac{5x}{3}+1\right)}$	**M1**	Use $\frac{2^x}{2^y}$ and $2^{(x-y)}$ correctly on *their* expression. Allow one arithmetic slip.
	$x + 3 = \frac{5x}{3} + 1$	**M1**	**Dep** on previous M1. Forms linear equation using *their* powers correctly.
	$x = 3$	**A1**	
3(a)	Gradient of line $\frac{3-1}{4-12} = \left(-\frac{1}{4}\right)$	**B1**	
	Gradient of perpendicular = 4	**M1**	$\frac{-1}{\textit{their}\text{ grad line}}$
	Mid-point is (8, 2)	**B1**	
	Equation: $\frac{y-2}{x-8} = 4$	**M1**	Using *their* perpendicular gradient and mid-point
	$y = 4x - 30$	**A1**	
3(b)	$x = 0 \rightarrow (y) = -30$	**B1**	**FT** equation must have 3 terms
	$y = 0 \rightarrow (x) = 7.5$	**B1**	**FT** equation must have 3 terms
	$AB = \sqrt{30^2 + 7.5^2} = 30.9$ or better	**B1**	nfww Accept exact answer of $\frac{15\sqrt{17}}{2}$

Question	Answer	Marks	Partial Marks
4	$x + y = 9$	**B1**	
	$(x + 1)^2 = y + 2$	**B1**	
	$x + (x + 1)^2 - 2 = 9$ or $(10 - y)^2 = y + 2$	**M1**	Replace y or x. Allow unsimplified using *their* three term expressions both containing x and y terms. Condone one sign or arithmetic error. Result must be a quadratic function.
	$x^2 + 3x - 10$ (= 0) or $y^2 - 21y + 98$ (= 0)	**A1**	Correct 3 term quadratic
	$x = -5$ and $x = 2$ or $y = 7$ and $y = 14$ or $(x + 5)(x - 2)$ or $(y - 7)(y - 14)$	**M1**	**Dep** on correct method to solve their quadratic
	$x = 2$ and $y = 7$ **only**	**A1**	Reject $x = -5$, $y = 14$ as log –4 is not appropriate
5(a)	$x = 1 \rightarrow y = 8$	**B1**	
	$\frac{dy}{dx} = 3x^2 - 12x + 3$	**M1**	Attempt to differentiate. Powers reduced by 1 in all four terms.
	$x = 1 \rightarrow \frac{dy}{dx} = -6$	**A1**	
	$\frac{y-8}{x-1} = -6 \rightarrow y = -6x + 14$	**A1**	Either form. isw
5(b)	$x^3 - 6x^2 + 9x - 4 = 0$ $(x - 1)(x^2 - 5x + 4) = 0$ or $(x - 4)(x^2 - 2x + 1) = 0$	**2**	**M1** for equating *their* tangent to curve and simplifying to 4 term cubic. **M1Dep** for finding a factor or stating that $(x - 1)$ is a factor or makes at least 3 attempts to find a factor.
	$(x - 1)(x - 1)(x - 4) = 0$	**2**	**A1** for $(x - 1)$ or $x = 1$ can be implied. nfww **A1** for $(x - 4)$ or $x = 4$ not repeated. nfww
	$x = 4 \rightarrow y = -10$ only	**A1**	nfww

Question	Answer	Marks	Partial Marks
6	$\frac{(x+1)^2}{x^2}=\frac{x^2+2x+1}{x^2}=1+\frac{2}{x}+\frac{1}{x^2}$	**2**	**B1** for expanding numerator seen anywhere. **M1** for attempt to divide *their* three term numerator by x^2.
	$\int 1+\frac{2}{x}+\frac{1}{x^2}\,dx=x+2\ln x-\frac{1}{x}+(c)$	**2**	**A2/1/0** minus 1 each error or omission.
	$\left[4-2\ln 4-\frac{1}{4}\right]-\left[2+2\ln 2-\frac{1}{2}\right]$	**M1**	**Dep** insert 4 and 2 into *their* three or two term integrand and subtract correctly.
	$=\frac{9}{4}+2\ln 2$	**A1**	oe must be exact two terms. isw
7 (a)	$a=3 \quad r=\frac{2.4}{3}=0.8$	**B1**	
	$S_8=\frac{3(1-0.8^8)}{(1-0.8)}$	**M1**	Inserts *their* a and r into S_8
	= 12.48 awrt or 12.5	**A1**	
7(b)	$S_\infty=\frac{3}{(1-0.8)}=15$	**B1**	
7(c)	$S_n = 15(1-0.8^n) > 0.95\times 15$	**M1**	*their* correctly produced $S_n > 0.95S_\infty$
	$0.8^n < 0.05$	**A1**	oe
	$n < \frac{\log 0.05}{\log 0.8}$ or $n<\log_{0.8}0.05$	**M1**	**Dep** takes logs correctly of *their* expression with power of n.
	$n = 14$	**A1**	nfww
8(a)	$\frac{1}{2}(2\sqrt{3}+1)AC\sin 30° = \frac{11}{2}$	**M1**	Correct use of area of a triangle
	$(2\sqrt{3}+1)AC = 22$	**A1**	oe
	$AC=\frac{22}{(2\sqrt{3}+1)}\times\frac{(2\sqrt{3}-1)}{(2\sqrt{3}-1)}$	**M1**	Multiply by *their* $(2\sqrt{3}+1)$
	$AC = 4\sqrt{3}-2$	**A1**	

Question	Answer	Marks	Partial Marks
8(b)	$BC^2 = \left(2\sqrt{3}+1\right)^2 + \left(4\sqrt{3}-2\right) - 2\left(2\sqrt{3}+1\right)\left(4\sqrt{3}-2\right)\cos 30$	**M1**	Correct use of cosine rule with *their AC*.
	$BC^2 = \left[13+4\sqrt{3}\right] + \left[52-16\sqrt{3}\right] + \left[-22\sqrt{3}\right]$	**A2**	**A1** for one correct expanded bracket **A1** for the other two correct expanded brackets
	$BC^2 = 65-34\sqrt{3}$	**A1**	
9(a)	$2\mathbf{b}+\mathbf{a}$	**B1**	
9(b)	$2\mathbf{a}-2\mathbf{b}$	**B1**	
9(c)	$2\mathbf{b}+\mathbf{a}+\mu(2\mathbf{a}-2\mathbf{b})$	**B1**	**FT** on *their* $\overrightarrow{OQ}$ and $\overrightarrow{QR}$ isw
9(d)	$\lambda\left(3\mathbf{a}+\mathbf{b}\right)$	**B1**	$\lambda 3\mathbf{a}+\mathbf{b}$ is B0
9(e)	$3\lambda = 1+2\mu$ $\lambda = 2-2\mu$ $\lambda = \frac{3}{4}$, $\mu = \frac{5}{8}$	**3**	**M1** for forming two simultaneous equations equating correct terms. Each equation must have 3 terms. **M1Dep** for attempting to solve by removing μ or λ to $\lambda =$ or $\mu =$ **A1** for both
9(f)	$\frac{QX}{XS} = \frac{5}{3}$	**B1**	**FT** Must be positive from $\mu < 1$
9(g)	$\frac{OR}{OX} = \frac{4}{3}$	**B1**	**FT** Must be positive from $\lambda < 1$
10(a)	$P+Q = 500$ and $P+Q\mathrm{e}^2 = 600$	**B1**	
	$Q = \frac{100}{(\mathrm{e}^2-1)} = 15.7$ or 15.6	**2**	**M1** for attempt to solve by removing P from two equations both containing 3 terms **A1** awrt
	$P = 484$ or 485	**A1**	awrt
10(b)	$B = 484.3+15.65\mathrm{e}^4 = 1338$	**B1**	Integer value rounded down from 1338… if seen.

Question	Answer	Marks	Partial Marks
10(c)	$e^{2t} = \frac{1000000 - 484.3}{15.65}$	**M1**	Make e^{2t} the subject
	$2t = \ln\left(\frac{1000000 - 484.3}{15.65}\right)$	**M1**	Take logs correctly where $e^{2t} > 0$ or $e^n > 0$
	$\left[t = 5.5(3) \text{ or } t = 5.5\ldots.\right] \rightarrow$ 6th week.	**A1**	nfww
11(a)	$\text{LHS} = \frac{\sin x \times \frac{\sin x}{\cos x}}{1 - \cos x}$	**M1**	Uses $\tan x = \frac{\sin x}{\cos x}$
	$= \frac{1 - \cos^2 x}{\cos x(1 - \cos x)}$	**M1**	**Dep** Uses $\sin^2 x = 1 - \cos^2 x$ to eliminate $\sin x$
	$\frac{(1 - \cos x)(1 + \cos x)}{\cos x(1 - \cos x)} = \frac{1 + \cos x}{\cos x} = \sec x + 1$	**2**	**M1Dep** Factorise correctly and cancel correctly. **A1** Uses $\frac{1}{\cos x} = \sec x$
11(b)	$5\frac{\sin x}{\cos x} - 3\frac{\cos x}{\sin x} = \frac{2}{\cos x}$	**B1**	Change tan *x*, cot *x* and sec *x* into sin *x* and cos *x* correctly.
	$5\sin^2 x - 3(1 - \sin^2 x) = 2\sin x$	**M1**	Multiply correctly by $\sin x \cos x$ and use $\cos^2 x + \sin^2 x = 1$
	$8\sin^2 x - 2\sin x - 3 = 0$	**A1**	Three term quadratic.
	$(2\sin x + 1)(4\sin x - 3) = 0$	**M1**	Factorise or use formula on *their* quadratic
	$\sin x = -\frac{1}{2} \rightarrow x = 210°, 330°$	**A1**	
	$\sin x = \frac{3}{4} \rightarrow x = 48.6°, 131.4°$	**A1**	