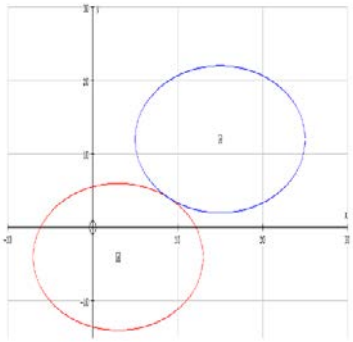
Question number		Scheme	Marks
1.	(*a*)	$f(-3) = -27 - 27 + 30 + 24 = 0 \Rightarrow (x + 3)$ is factor	M1 A1 (2)
	(*b*)	$(x + 3)(x^2 - 6x + 8)$	M1 A1
		$(x + 3)(x - 2)(x - 4)$	M1 A1 (4)
			(6 marks)
2.	(*a*)	$4x+9, \quad +12\sqrt{x}$	B1, B1 (2)
	(*b*)	$\int\left(4x+12x^{1/2}+9\right)dx = 2x^2+8x^{3/2}+9x$ (dep. on 3 terms)	M1 A1
		$\left[\ldots\ldots\right]_1^2 = \left(8+(8\times 2^{3/2})+18\right)-(2+8+9)$	M1
		$= 7+16\sqrt{2}$	M1 A1 (5)
			(6 marks)
3.		$(1 + px)^n \equiv 1 + npx, + \dfrac{n(n-1)p^2x^2}{2} + \ldots$	B1, B1
		Comparing coefficients: $np = -18$, $\dfrac{n(n-1)}{2} = 36$	M1, A1
		Solving $n(n - 1) = 72$ to give $n = 9$; $p = -2$	M1 A1; A1 ft
			(7 marks)
4.	(*a*)	Centre is at (3,-4)	B1
		radius $= \sqrt{(3^2+(-4)^2--75)} = 10$	M1 A1 (3)
	(*b*)	1st circle	B1
		2nd circle	B1
		Circles touching	B1
		At (9 , 4)	B1 (4)
			**(7 marks)**

Question number	Scheme	Marks
5. (i)	Divide: $1 + 2x^{-1}$	M1 A1
	Differentiate: $6x^2 + \frac{1}{2}x^{-\frac{1}{2}} - 2x^{-2}$	M1 A2 (1,0) **(5)**
(ii)	$\frac{x^2}{4} + \frac{x^{-1}}{-1}$	M1 A1A1
	$[\ ]^4 - [\ ]_1 = \left(4 - \frac{1}{4}\right) - \left(\frac{1}{4} - 1\right) = 4\frac{1}{2}$	M1 A1 **(5)**
		(10 marks)
6. (a)	$\frac{a}{1-r} = \frac{1200}{1-r} = 960$	M1 A1
	$960\ (1 - r) = 1200$ $\quad r = -\frac{1}{4}$ (*)	A1 (3)
(b)	$T_9 = 1200 \times (-0.25)^8$ (or T_{10})	M1
	Difference = $T_9 - T_{10} = 0.0183105\ldots - (-0.0045776\ldots)$	M1
	$= 0.023$ (or -0.023)	A1 (3)
(c)	$S_n = \frac{1200\left(1 - (-0.25)^n\right)}{1 - (-0.25)}$	M1 A1 (2)
(d)	Since n is odd, $(-0.25)^n$ is negative,	M1
	so $S_n = 960\ (1 + 0.25^n)$ (*)	A1 (2)
		(10 marks)

Question number		Scheme	Marks
7.	(a)	$\frac{\mathrm{d}C}{\mathrm{d}v} = -160v^{-2} + \frac{2v}{100}$	M1 A1
		$-160v^{-2} + \frac{2v}{100} = 0$	M1
		$v^3 = 8\,000$ $\quad v = 20$	M1 A1 (5)
	(b)	$\frac{\mathrm{d}^2C}{\mathrm{d}v^2} = 320v^{-3} + \frac{1}{50}$	M1
		> 0, therefore minimum	A1 (2)
	(c)	$v = 20 : C = \frac{160}{20} + \frac{400}{100} = 12$	B1ft
		Cost = 250 × 12 = £30	M1 A1 (3)
			(10 marks)
8.	(a)	A: $y = 1$ $\quad B$: $y = 4$	B1 (1)
	(b)	$\frac{\mathrm{d}y}{\mathrm{d}x} = \frac{2x}{25}$ $\quad = \frac{2}{5}$ where $x = 5$	M1 A1
		Tangent: $\quad y - 1 = \frac{2}{5}(x - 5)$ $\quad (5y = 2x - 5)$	M1 A1 (4)
	(c)	$x = 5y^{\frac{1}{2}}$	B1 B1 (2)
	(d)	Integrate: $\quad \frac{5y^{3/2}}{3/2}$ $\quad \left(= \frac{10y^{3/2}}{3}\right)$	M1 A1ft
		$[\ ]^4 - [\ ]_1 = \left(\frac{10 \times 4^{3/2}}{3}\right) - \left(\frac{10 \times 1^{3/2}}{3}\right)$, $\quad = \frac{70}{3}$ $\quad (23\frac{1}{3}, 23.3)$	M1 A1, A1 (5)
			(12 marks)

Question number	Scheme	Marks
9. (i)	arcsin 0.6 = 36.9° (awrt) α	B1
	$2x + 50 = 36.87$, $2x = -13.13° + 360° = 346.87°$	M1 M1
	$2x + 50 + 180 - 36.87$, $2x = 143.13° - 50° = 93.13°$	M1
	$x = 46.6,\ 173.4$	M1 A1 A1 (7)
(ii) (*a*)	$\sin 60° = \frac{\sqrt{3}}{2}$, $\frac{BC}{\left(\frac{1}{3}\right)} = \frac{18}{\sin 60°}$	B1, M1
	$BC = 6 \div \frac{\sqrt{3}}{2}$ $BC = \frac{12}{\sqrt{3}} = 4\sqrt{3}$ (*)	M1 A1 (4)
(*b*)	$\cos^2\theta = 1 - \sin^2\theta = 1 - \frac{1}{9}$	M1
	$\sin\theta = \sqrt{\frac{8}{9}}$ $\left(= \frac{\sqrt{8}}{3} = \frac{2\sqrt{2}}{3}\right)$	A1 (2)
		(13 marks)