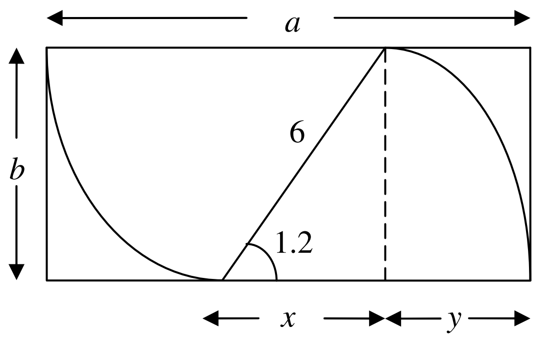
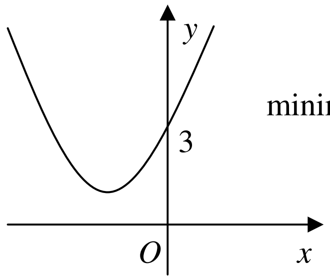
Question Number	Scheme	Marks
1.	(a) $(y=)5-2\times3=-1$ ✱ cso	B1 **(1)**
	(b) Gradient of perpendicular line is $\frac{1}{2}$	B1
	$y-(-1)=\frac{1}{2}(x-3)$ ft their $m\neq-2$	M1 A1ft
	(or substituting (3, −1) into $y=(\text{their } m)x+c$)	
	$x-2y-5=0$	A1 **(4)**
		Total 5 marks
2.	(a) $\frac{\mathrm{d}y}{\mathrm{d}x}=4x+18x^{-4}$ $x^n\mapsto x^{n-1}$	M1 A1 **(2)**
	(b) $\int(2x^2-6x^{-3})\mathrm{d}x=\frac{2}{3}x^3+3x^{-2}$ $x^n\mapsto x^{n+1}$	M1 A1
	$\left[\ldots\right]_1^3=\frac{2}{3}\times3^3+\frac{3}{9}-\left(\frac{2}{3}+3\right)$	M1
	$=14\frac{2}{3}$ $\frac{44}{3},\frac{132}{9}$ or equivalent	A1 **(4)**
		Total 6 marks
3.	(a) $\tan\theta=\frac{3}{2}$ Use of $\tan\theta=\frac{\sin\theta}{\cos\theta}$	M1
	$\theta=56.3°$ cao	A1
	$=236.3°$ ft 180° + their principle value	A1 ft **(3)**
	Maximum of one mark is lost if answers not to 1 decimal place	
	(b) $2-\cos\theta=2(1-\cos^2\theta)$ Use of $\sin^2\theta+\cos^2\theta=1$	M1
	$2\cos^2\theta-\cos\theta=0$	A1
	Allow this A1 if both $\cos\theta=0$ and $\cos\theta=\frac{1}{2}$ are given	
	$\cos\theta=0 \Rightarrow \theta=90°,270°$ M1 one solution	M1 A1
	$\cos\theta=\frac{1}{2} \Rightarrow \theta=60°,300°$ M1 one solution	M1 A1 **(6)**
		Total 9 marks

Question Number	Scheme	Marks
4.	(a) $y=0 \Rightarrow x^{\frac{1}{2}}(3-x)=0 \Rightarrow x=3$ ∗	B1 **(1)**
	or $3\sqrt{3}-3^{\frac{3}{2}}=3\sqrt{3}-3\sqrt{3}=0$	
	(b) $\frac{dy}{dx}=\frac{3}{2}x^{-\frac{1}{2}}-\frac{3}{2}x^{\frac{1}{2}}$ $x^n \mapsto x^{n-1}$	M1 A1
	$\frac{dy}{dx}=0 \Rightarrow x^{\frac{1}{2}}=x^{-\frac{1}{2}}$ Use of $\frac{dy}{dx}=0$	M1
	$\Rightarrow x=1$	A1
	A: (1, 2)	A1 **(5)**
	(c) $\int\left(3x^{\frac{1}{2}}-x^{\frac{3}{2}}\right)dx=2x^{\frac{3}{2}}-\frac{2}{5}x^{\frac{5}{2}}$ M1 $x^n \mapsto x^{n+1}$	M1 A1+A1
	Accept unsimplified expressions for As	
	Area = $[...]_0^3=2\times3\sqrt{3}-\frac{2}{5}\times9\sqrt{3}$ Use of correct limits	M1
	Area is $\frac{12}{5}\sqrt{3}$ (units^2)	A1 **(5)**
	For final A1, terms must be collected together but accept exact equivalents, e.g. $\frac{4}{5}\sqrt{27}$	
		Total 11 marks

Question Number	Scheme	Marks
5.	(a) Arc is 6×1.2 Use of $r\theta$	M1
	Perimeter is $6\times1.2+6+6=19.2 \quad (\text{cm})$	A1 **(2)**
	(b) Area is $\frac{1}{2}\times6^2\times1.2=21.6 \quad (\text{cm}^2)$ Use of $\frac{1}{2}r^2\theta$	M1 A1 **(2)**
	(c) 	
	$b=6\sin1.2\approx5.59 \quad (\text{cm})$	B1
	$x=6\cos1.2 \quad (\approx2.174...)$	M1
	$y=6-x \quad (\approx3.825...)$	
	$a=6+y\approx9.83 \quad (\text{cm})$	M1 A1 **(4)**
		Total 8 marks

Question Number	Scheme	Marks
6.	(a) $x^2+2x+3=(x+1)^2+2$ $a=1, b=2$	B1, B1 **(2)**
	(b)  ∪ shape anywhere minimum ft their *a* and positive *b* (0, 3) marked	M1 A1ft B1 **(3)**
	(c) $\Delta=b^2-4ac=2^2-4\times3=-8$ The negative sign implies there are no real roots and, hence, the curve in (b) does not intersect (meet, cut, …) the *x*-axis. Accept equivalent statements and the statement that the whole curve is above the *x*-axis.	B1 B1 **(2)**
	(d) $\Delta=k^2-12$ $\Delta<0 \Rightarrow k^2-12<0 \quad (\text{or } k^2<12)$ $-2\sqrt{3}<k<2\sqrt{3}$ Allow $\sqrt{12}$ If just $k<2\sqrt{3}$ allow M1 A0	M1 A1 M1 A1 **(4)** **Total 11 marks**
	Alternative to (d) $\frac{dy}{dx}=0 \Rightarrow 2x+k=0 \Rightarrow x=-\frac{k}{2}$ Minimum greater than 0 implies $\frac{k^2}{4}-\frac{k^2}{2}+3>0$ $k^2<12$ Then as before.	 M1 A1

Question Number	Scheme	Marks
7.	(a) x-coordinate of P is -2, x-coordinate of Q is 2.	B1, B1 **(2)**
	(b) $y = x^3 - x^2 - 4x + 4$ Multiplying out	M1
	$\frac{dy}{dx} = 3x^2 - 2x - 4$ ∗ cso	M1 A1 **(3)**
	Alternatively	
	Using product rule $\frac{dy}{dx} = 1(x^2 - 4) + (x-1)2x$	M1
	$= 3x^2 - 2x - 4$ ∗	M1 A1
	(c) $x = -1 \Rightarrow m = 3 + 2 - 4 = 1$ Substituting $x = -1$ into (b)	M1
	$y - 6 = 1(x - (-1)) \Rightarrow y = x + 7$ ∗ cso	A1 **(2)**
	(d) $x^3 - x^2 - 4x + 4 = x + 7$ line = curve	M1
	$x^3 - x^2 - 5x - 3 = 0$	
	$(x+1)(x^2 - 2x - 3) = 0$ Obtaining linear×quadratic	M1
	$(x+1)(x+1)(x-3) = 0$ Obtaining 3 linear factors	M1
	$R: (3, 10)$	A1, A1 **(5)**
		Total 12 marks
	In (d) if the correct cubic is obtained the factors can just be written down by inspection.	
	Parts (c) and (d) can be done together. On obtaining $(x+1)^2(x-3)$, the repeated root shows that $y = x + 7$ is a tangent to the curve at $(-1, 6)$ and, if this is stated, the M1 A1 for (c) should be given at this point.	

Question Number	Scheme	Marks
8.	(a) $a+(a+d) = £\ (500 + 500 + 200) = £1200$ ∗ cso	B1 **(1)**
	(b) $a = 500, d = 200$; $u_8 = a + (8-1)d$	M1
	$= £(500 + 7 \times 200) = £1900$	A1 **(2)**
	(c) $S_8 = \frac{8}{2}(2 \times 500 + (8-1) \times 200)$	M1 A1
	$= £\ 9600$	A1 **(3)**
	(d) $\frac{n}{2}(1000 + (n-1)200) = 32\,000$	M1 A1
	$n^2 + 4n - 320 = 0$ M1 reducing to a 3 term quadratic A1 any multiple of the above	M1 A1
	$(n+20)(n-16) = 0$	M1
	$n = 16$	A1
	Age is 26	A1 **(7)**
		Total 13 marks
	In (b) if the sum is found by repeated addition, i.e. $u_1 = £500, u_2 = £700, u_3 = £900, u_4 = £1100, u_5 = £1300,$ $u_6 = £1500, u_7 = £1700, u_8 = £1900,$ allow M1 A1 at completion.	