Question	Mark Scheme	Marks
1. (a)	$f(-2) = (-2)^3 - (19 \times -2) - 30$ M: Evaluate f (–2) or f (2)	M1
	$f(-2) = 0$, so $(x + 2)$ is a factor	A1 (2)
	Alternative: $(x^3 - 19x - 30) \div (x+2) = (x^2 + ax + b)$, $a \neq 0, b \neq 0$ [M1]	
	$= (x^2 - 2x - 15)$, so $(x + 2)$ is a factor [A1]	
(b)	$(x^3 - 19x - 30) = (x+2)(x^2 - 2x - 15)$	M1 A1
	$= (x + 2)(x + 3)(x - 5)$	M1 A1 (4)
		(6)
2. (a)	$\frac{1}{2}r^2\theta = \frac{1}{2} \times 6.5^2 \times 0.8 = 16.9$ (a.w.r.t. if changed to degrees)	M1 A1 (2)
(b)	$\sin 0.4 = \frac{x}{6.5}$, $x = 6.5 \sin 0.4$, (where x is half of AB)	M1, A1
	(n.b. 0.8 rad = 45.8°)	
	$AB = 2x = 5.06$ (a.w.r.t.) (*)	A1 (3)
	Alternative: $AB^2 = 6.5^2 + 6.5^2 - 2 \times 6.5 \times 6.5 \cos 0.8$ [M1]	
	$AB = \sqrt{6.5^2 + 6.5^2 - 2 \times 6.5 \times 6.5 \cos 0.8}$ [A1]	
	$AB = 5.06$ [A1]	
(c)	$r\theta + 5.06 = (6.5 \times 0.8) + 5.06 = 10.26$ (a.w.r.t) (or 10.3)	M1 A1 (2)
		(7)
3.(a)	$(5p - 8) - p = (3p + 8) - (5p - 8)$	M1
	Solve, showing steps, to get $p = 4$, or verify that $p = 4$. (*)	A1 c.s.o. (2)
	Alternative: Using $p = 4$, finding terms (4, 12, 20), and indicating differences.[M1]	
	Equal differences + conclusion (or "common difference = 8"). [A1]	
(b)	$a = 4$ and $d = 8$ (stated or implied here or elsewhere).	B1
	$T_{40} = a + (n-1)d = 4 + (39 \times 8) = 316$	M1 A1 (3)
(c)	$S_n = \frac{1}{2}n[2a + (n-1)d] = \frac{1}{2}n[8 + 8(n-1)]$	M1 A1ft
	$= 4n^2 = (2n)^2$	A1 (3)
		(8)

Question	Mark Scheme	Marks
4.(a)	$b^2 - 4ac = (-k)^2 - 36 = k^2 - 36$	M1 A1
	Or, (completing the square), $\left(x - \frac{1}{2}k\right)^2 = \frac{1}{4}k^2 - 9$	
	Or, if b^2 and $4ac$ are compared directly, [M1] for finding both [A1] for k^2 and 36.	
	No real solutions: $k^2 - 36 < 0$, $-6 < k < 6$ (ft their "36")	M1, A1ft (4)
(b)	$x^2 - 4x + 9 = (x-2)^2$.......... $(p = 2)$	B1
	Ignore statement $p = -2$ if otherwise correct.	
	$x^2 - 4x + 9 = (x-2)^2 - 4 + 9 = (x-2)^2 + 5$ $(q = 5)$ M: Attempting $(x \pm a)^2 \pm b \pm 9$, $a \neq 0$, $b \neq 0$.	M1 A1 (3)
(c)	Min value 5 (or just q), occurs where $x = 2$ (or just p)	B1ft, B1ft (2)
	<u>Alternative:</u> $f'(x) = 2x - 4$ (Min occurs where) $x = 2$ [B1]	
	Where $x = 2$, $f(x) = 5$ [B1ft]	**(9)**
5.(a)	$\sqrt{8} = 2\sqrt{2}$ seen or used somewhere (possibly implied).	B1
	$\frac{12}{\sqrt{8}} = \frac{12\sqrt{8}}{8}$ or $\frac{12}{2\sqrt{2}} = \frac{12\sqrt{2}}{4}$	
	Direct statement, e.g. $\frac{6}{\sqrt{2}} = 3\sqrt{2}$ (no indication of method) is M0.	M1
	At $x = 8$, $\frac{dy}{dx} = 3\sqrt{8} + \frac{12}{\sqrt{8}} = 6\sqrt{2} + 3\sqrt{2} = 9\sqrt{2}$ (*)	A1 (3)
(b)	Integrating: $\frac{3x^{3/2}}{\left(3/2\right)} + \frac{12x^{1/2}}{\left(1/2\right)} (+C)$ (C not required)	M1 A1 A1
	At (4, 30), $\frac{3 \times 4^{3/2}}{\left(3/2\right)} + \frac{12 \times 4^{1/2}}{\left(1/2\right)} + C = 30$ (C required)	M1
	$(f(x) =)$ $2x^{3/2} + 24x^{1/2}, -34$	A1, A1 (6)
		(9)

Question	Mark Scheme	Marks
6.(a)	(2, 0) (or $x = 2,\ y = 0$)	B1 (1)
(b)	$y^2 = 4\left(\frac{3y+12}{2} - 2\right)$ or $\left(\frac{2x-12}{3}\right)^2 = 4(x-2)$	M1
	$y^2 - 6y - 16 = 0$ or $x^2 - 21x + 54 = 0$ (or equiv. 3 terms)	A1
	$(y+2)(y-8) = 0$, $y = \ldots$ or $(x-3)(x-18) = 0$, $x = \ldots$ (3 term quad.)	M1
	$y = -2,\ y = 8$ or $x = 3,\ x = 18$	A1
	$x = 3,\ x = 18$ or $y = -2,\ y = 8$ (attempt one for M mark) (A1ft requires both values)	M1 A1ft (6)
(c)	Grad. of $AQ = \frac{8-0}{18-2}$, Grad. of $AP = \frac{0-(-2)}{2-3}$ (attempt one for M mark)	M1 A1ft
	$m_1 \times m_2 = \frac{1}{2} \times -2 = -1$, so $\angle PAQ$ is a right angle (A1 is c.s.o.)	M1 A1 (4)
	Alternative: Pythagoras: Find 2 lengths [M1] $AQ = \sqrt{320}$, $AP = \sqrt{5}$, $PQ = \sqrt{325}$ (O.K. unsimplified) [A1ft] (if decimal values only are given, with no working shown, require at least 1 d.p. accuracy for M1(implied) A1) $AQ^2 + AP^2 = PQ^2$, so $\angle PAQ$ is a right angle [M1, A1] M1 requires attempt to use Pythag. for right angle at A, and A1 requires correct exact working + conclusion.	**(11)**

Question	Mark Scheme	Marks
7.(a)	Solve $\frac{3}{2}x^2 - \frac{1}{4}x^3 = 0$ to find $p = 6$, or verify: $\frac{3}{2} \times 6^2 - \frac{1}{4} \times 6^3 = 0$ (*)	B1 (1)
(b)	$\frac{dy}{dx} = 3x - \frac{3x^2}{4}$	M1 A1
	$m = -9$, $y - 0 = -9(x - 6)$ (Any correct form)	M1 A1 (4)
(c)	$3x - \frac{3x^2}{4} = 0$, $x = 4$	M1, A1ft (2)
(d)	$\int \left(\frac{3x^2}{2} - \frac{x^3}{4} \right) dx = \frac{x^3}{2} - \frac{x^4}{16}$ (Allow unsimplified versions)	M1 A1
	$[\ldots\ldots\ldots]_0^6 = \frac{6^3}{2} - \frac{6^4}{16} = 27$ M: Need 6 and 0 as limits.	M1 A1 (4)
		(11)
8.(a)	$\theta - 10 = 15$ $\theta = 25$ ($\cos(\theta - 10) = \cos\theta - \cos 10$, etc, is B0)	B1
	$\theta - 10 = 345$ $\theta = 355$ M: Using 360 – "15" (can be implied) Stating θ = 345 scores M1 A0	M1 A1 (3)
	(Other methods: M1 for <u>complete</u> method, A1 for 25 and A1 for 355)	
(b)	$2\theta = 21.8\ldots$ (α) (At least 1 d.p.) (Could be implied by a correct θ).	B1
	$2\theta = \alpha + 180$ or $2\theta = \alpha + 360$ or $2\theta = \alpha + 540$ (One more solution)	M1
	$\theta = 10.9,\ 100.9,\ 190.9,\ 280.9$ (M1: divide by 2)	M1 A1ft A1
	(A1ft: 2 correct, ft their α) (A1: all 4 correct cao, at least 1 d .p.)	(5)
(c)	$2\sin\theta\left(\frac{\sin\theta}{\cos\theta}\right) = 3$, $2\sin^2\theta = 3\cos\theta$	M1, A1
	$2(1 - \cos^2\theta) = 3\cos\theta$	M1
	$2\cos^2\theta + 3\cos\theta - 2 = 0$	
	$(2\cos\theta - 1)(\cos\theta + 2) = 0$ $\cos\theta = \frac{1}{2}$ (M: solve 3 term quadratic up to cos θ = … or x = …)	M1 A1
	$\theta = 60$, $\theta = 300$	A1 (6)
		(14)