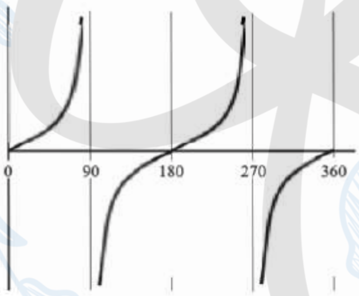
Coordinate Geometry
&
Differentiation

19	(a) (i)	$-\frac{1}{2}x+2$ oe	3	**SC2** for $y=-\frac{1}{2}x+c$ oe or **SC1** for $y=kx+2$ oe, $k\neq 0$ or **M1** for [gradient =] $\frac{-2}{4}$ and **M1** for substituting (4, 0) or (0, 2) into $y = (their\ m)x + c$
	(ii)	$\frac{16}{a^2}\left[+\frac{0^{[2]}}{b^2}\right]=1$ or $\frac{4^2}{a^2}\left[+\frac{0^{[2]}}{b^2}\right]=1$ and $a^{[2]}=4^{[2]}$ $\left[\frac{0^{[2]}}{a^2}\right]+\frac{4}{b^2}=1$ or $\left[\frac{0^{[2]}}{a^2}\right]+\frac{2^2}{b^2}=1$ and $b^{[2]}=2^{[2]}$	1 1	
	(b) (i)	1.73 or 1.732.. or $\sqrt{3}$	3	**M2** for $\frac{k^2}{4}=\frac{3}{4}$ or better or **M1** for $\frac{2^2}{16}+\frac{k^2}{4}=1$ oe
	(ii)	81.8 or 81.78 to 81.79	3	**M2** for $2\times\tan^{-1}\left(\frac{their\sqrt{3}}{2}\right)$ oe or **M1** for $\tan=\frac{their\sqrt{3}}{2}$ oe
	(c) (i)	8π final answer	1	
	(ii)	72π final answer	2FT	FT *their* (c)(i) × 9 in terms of π **M1** for area factor of 3^2 or 9 or [new a] = 12, [new b] = 6
29	(a)	19[.0] or 18.97.. nfww	3	**M2** for $\sqrt{(4--2)^2+(13--5)^2}$ oe or **M1** for $(4--2)^2+(13--5)^2$ oe
	(b)	[y =] $3x+1$	3	**B2** for answer [y =]$3x+c$ oe or answer $kx+1$ ($k\neq 0$) or **M1** for $\frac{13--5}{4--2}$ oe or 3 **and M1** for correct substitution of (–2, –5) or (4, 13) into $y = (their\ m)x + c$ oe
	(c)	$y=3x-5$ oe	2FT	FT *their* gradient from (b) **M1** for $y=mx-5$ with other m, $m\neq 0$ or y = {*their* gradient from (b)}$x+c$ If 0 scored, **SC1** for answer $3x-5$

	(d)	$y = -\frac{1}{3}x + \frac{13}{3}$ oe isw	**5**	**B2FT for** $-\frac{1}{3}x + c$ (*c* can be numeric or algebraic) **FT** –1/ *their* gradient from (b) or **M1** for –1/ *their* gradient from (b) soi **and** **B1** for [midpoint of *AB* =] (1, 4) and **M1** for substitution of (1, *k*) or (*k*, 4) into a linear equation
3	7(a)	(–0.5, 3)	**2**	**B1** for one correct value
	7(b)	[*y* =] –2*x* + 2 final answer	**3**	**M1** for $\frac{-2-8}{2--3}$ or better **M1** for substitution of (–3, 8) or (2, –2) or *their* midpoint into *y* = *mx* + *c* with *their m*
	7(c)	*y* = –2*x* + 7 oe	**2FT**	**FT** *their* **(b)** **M1** for *y* = (*their*–2)*x* + *k* ($k \neq 2$) or *y* = *kx* + 7 ($k \neq 0$) If zero scored, **SC1** for $(their - 2)x + 7$
	7(d)	*x* – 2*y* + 9 = 0 or 2*y* – *x* – 9 = 0 oe	**4**	**B3** for any correct equivalent in wrong form Or **M2** for *y* = ½ *x* + *k* oe (**FT** negative reciprocal of *their* gradient in **(b)**) or **M1** for grad = ½ (**FT** negative reciprocal of *their* gradient in **(b)**) **M1** for substitution of (1, 5) into *y* = *mx* + *c* oe with *their m*
4	4(a)(i)	1.5 oe	**1**	
	4(a)(ii)	(0, 2)	**1**	
	4(b)(i)	$y = -2x + 6$ oe final answer	**3**	**B2** for $y = -2x + c$ oe or $y = mx + 6$ oe $m \neq 0$ or for answer $-2x + 6$ or **B1** for [gradient =] $-\frac{6}{3}$ oe or *c* = + 6 soi
	4(b)(ii)	$y = 0.5x - 1.5$ oe final answer	**3**	**B1** for [gradient =] – 1 divided by *their* gradient from **(b)(i)** evaluated soi **M1** for substitution of (9, 3) into *y* = (*their m*)*x*+ *c* seen in working
	4(c)(i)	12.6 or 12.64 to 12.65	**3**	**M2** for $\sqrt{(8--4)^2 + (5-1)^2}$ oe or **M1** for $(8--4)^2 + (5-1)^2$ oe
	4(c)(ii)	(2, 3)	**2**	**B1** for each

5	8(a)(i)	Correct sketch	**2**	**B1** for correct shape but inaccurate
	8(a)(ii)	Rotational [symmetry] order 2 [centre] (180, 0)	**2**	**B1** for rotational [symmetry]
	8(b)	48.6 or 48.59 to 48.60 and 131.4 or 131.40 to 131.41	**3**	**B2** for 48.6 or 48.59 to 48.60 or 131.4 or 131.40 to 131.41 or **M1** for sin x = 0.75 or better If 0 scored, **SC1** for two answers adding to 180
	8(c)(i)	$(x + 5)^2 - 11$	**2**	**M1** for $(x + 5)^2 + k$ or $(x +$ *their* $5)^2 + 14 - ($*their* $5)^2$ or $a = 5$
	8(c)(ii)	Sketch of U-shaped parabola with a minimum indicated at (–5, –11) with no part of graph in 4th quadrant	**3**	**FT** *their* $(x + 5)^2 - 11$ provided in that form **B1** for U shape curve **B1FT** for turning point at (–5, k) or (k, –11)
6	10(a)(i)	15.7 or 15.65...	**3**	**M2** for $\sqrt{(4-10)^2+(4--3)^2}$ oe or **M1** for $(-4-10)^2 + (4--3)^2$ oe
	10(a)(ii)	$\dfrac{-10-4}{4--3}$ [= –2] oe	**M1**	
		10 = –2(–3) + c Or –4 = –2(4) + c and correct completion to $y = -2x + 4$	**A1**	
	10(a)(iii)	$y = \dfrac{1}{2}x + \dfrac{11}{4}$ oe	**4**	**M1** for grad = ½ soi **M1** for [midpoint =] (½, 3) **M1** for substitution of (1/2, 3) into *their* $y = mx + c$ oe
	10(b)(i)	$\left(-\dfrac{1}{3}, -\dfrac{22}{27}\right)$ oe and (–5, 50)	**6**	**B2** for $3x^2 + 16x + 5$ Or **B1** for one correct **M1** for derivative = 0 or *their* derivative = 0 **M1** for [x =] $-\dfrac{1}{3}$ and [x =] –5 **B1** for $-\dfrac{22}{27}$ and 50
	10(b)(ii)	$\left(-\dfrac{1}{3}, -\dfrac{22}{27}\right)$ minimum (–5, 50) maximum with correct reasons	**3**	**B2** for one correct with reason or **M1** for correct attempt e.g. 2nd derivatives, gradients or sketching

7	10(a)(i)	5	2	**M1** for $(-1)^4 - 4(-1)^3$
	10(a)(ii)	(0, 0) and (3, –27)	6	**B2** for $4x^3 - 12x^2$ [= 0] or **B1** for $4x^3$ or $12x^2$ AND **M1** for derivative = 0 or *their* derivative = 0 **M1** for $4x^2(x-3)$[= 0] **B1** for [x =] 0 and [x =] 3 or [y =] 0 and [y =] –27 or for one correct coordinate pair
	10(b)	[p =] 11 [q =] 5	2	**B1** for each or **M1** for $\frac{dy}{dx} = px^{p-1} + 2qx^{q-1}$
8	9(a)(i)	$\frac{3}{8}$	2	**M1** for $8y = 3x + 20$ or better
	9(a)(ii)	(0, 2.5) oe	1	
	(b)(i)	15.6 or 15.62…	3	**M2** for $\sqrt{(9--3)^2 + (-2-8)^2}$ oe seen or **M1** for $(9--3)^2$ or $(-2-8)^2$ oe seen
	9(b)(ii)	$y = -\frac{5}{6}x + 4$ oe	3	**M1** for gradient $\frac{-2-8}{9--3}$ oe **M1** for substituting (6, –1) into a linear equation oe
	9(b)(iii)	$y = \frac{6}{5}x - \frac{3}{5}$ oe	4	**M1** for gradient -1 / *their* $\left(-\frac{5}{6}\right)$ **B1** for midpoint at (3, 3) **M1** for *their* midpoint substituted into $y = their\ m \times x + c$ oe

9	10(a)(i)	*A*(–4, 0) *B*(1, 0) *C*(0, –4)	4	**B3** for A and B correct Or **B2** for B (–4, 0) and A (1, 0) Or **B1** for $(x+4)(x-1)$ or for $\frac{-3\pm\sqrt{3^2-4\times1\times-4}}{2}$ oe and **B1** for A or B correct **B1** for C(0, –4) OR **SC2** for –4, 1 and –4 in correct positions on the graph
	10(a)(ii)	$2x + 3$ [± 0] final answer	2	**B1** for answer $2x + c$ or for $ax + 3$, $a \neq 0$ or for correct answer seen
	10(a)(iii)	$y = 7x - 8$ oe	3	**B2** for answer $7x - 8$ OR **M1** for [gradient =] 2(2) + 3 FT *their* part **(a)(ii)** of the form $ax + b$ **M1dep** for substitution of (2, 6) into $y =$ *their* $mx + c$ oe
	10(b)(i)	Correct sketch 	2	**B1** for one correct section out of 4 OR **B1** for two properties correct from • Crosses x-axis at (0, 0) (180, 0) and (360, 0) only • Correct curvature in each section of 90° • Asymptotes at $x = 90$ and $x = 270$
	10(b)(ii)	125.5 or 125.53 to 125.54 and 305.5 or 305.53 to 305.54	3	**B2** for one correct angle or **B1** for –54.5 or –54.46… or for 2 angles with a difference of 180.
10	7(a)(i)	$(8 - x)(3 + x)$	2	**M1** for $8(3 + x) - x(3 + x)$ or $3(8 - x) + x(8 - x)$ or $(a - x)(b + x)$ where $ab = 24$ or $a - b = 5$
	7(a)(ii)	[a =] –3 [b =] 8 [c =] 24	3	**FT** *their* **(a)(i)** for a and b **B1FT** for each of a and b or both correct but reversed **B1** for [c =] 24
	7(a)(iii)	8	3	**M2** for $5 - 2x$ or **M1** for $-2x$ or $5 - kx$, $k \neq 0$

	7(b)(i)	Correct sketch: positive cubic shape and max on the y-axis or to the right of y-axis with one root at $(-1, 0)$ and turning point at $(3, 0)$ and y-intercept at $(0, 9)$ all labelled	**4**	**B1** for positive cubic shape with max on the y-axis or to the right of y-axis **B1** for root at $(-1, 0)$ **B1** for turning point at $(3, 0)$ **B1** for y-intercept $(0, 9)$ If 0 score **SC1** for all three intercepts on axes identified
	7(b)(ii)	$x^3 - 5x^2 + 3x + 9$ final answer	**3**	**B2** for correct expansion of three brackets unsimplified **B1** for correct expansion of two brackets with at least 3 terms correct