GCE AS MARKING SCHEME

SUMMER 2024

AS
MATHEMATICS
UNIT 1 PURE MATHEMATICS A
2300U10-1

About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

WJEC GCE AS MATHEMATICS

UNIT 1 PURE MATHEMATICS A

SUMMER 2024 MARK SCHEME

Q	Solution	Mark	Notes
1	$y = 12x^{\frac{1}{2}} - 27x^{-1} + 4$	B1	index form, si
	$\frac{\mathrm{d}y}{\mathrm{d}x} = 12 \times \frac{1}{2} \times x^{-\frac{1}{2}} - 27 \times (-1)x^{-2}$	B1	correct 1st term, ft fractional index.
		B1	correct 2nd term, ft -ve index.
	$\frac{\mathrm{d}y}{\mathrm{d}x} = 6x^{-\frac{1}{2}} + 27x^{-2}$		
	When $x = 9$, $\frac{\mathrm{d}y}{\mathrm{d}x} = 2 - \left(-\frac{1}{3}\right) = \frac{7}{3}$	B1	cao, accept decimal answers correctly derived from $\frac{7}{3}$, isw

Q	Solution	Mark	Notes
2	$2\sin 2\theta = 1$		
	$\sin 2\theta = \frac{1}{2}$		
	2θ = 30°, 150°	B1	either angle, si
	θ = 15°,	B1	
	θ = 75°	B1	

Notes:

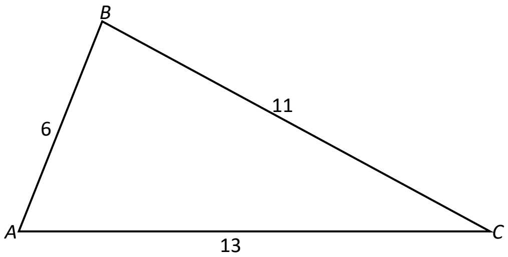
Ignore answers not in the range 0° < θ < 180°.

For an incorrect 3^{rd} answer, -1 mark from the last 2 marks.

For an incorrect 4^{th} answer, -1 mark from the last 2 marks.

Q	Solution	Mark	Notes
3	$\int(5x^{\frac{1}{4}} + 3x^{-2} - 2)\,\mathrm{d}x$		
	$= \frac{5}{5/4} \times x^{\frac{5}{4}} + \frac{3x^{-1}}{-1} - 2x + C$	B1	$\frac{5}{5/4} \times x^{\frac{5}{4}}$, oe, isw
		B1	$+\frac{3}{-1}x^{-1}$, oe, isw
		B1	$-2x$, isw
			–1 no C
	$= 4x^{\frac{5}{4}} - 3x^{-1} - 2x + C$		

Q	Solution		Mark	Notes
4	n	$n^2 - 2$		
	1	-1		
	2	2		
	3	7		
	4	14		
	5	23		
	6	34	M1	evaluating $n^2 - 2$ (for 1,…,6) at least twice
			A1	at least 4 values correct.
				Implied by correct conclusion.
	$n^2 - 2$ is not divisible by 3 for $1 \leq n \leq 6$		A1	all values correct, and conclusion.

Q	Solution	Mark	Notes
5			
	Cosine rule attempted	M1	allow one error
			Must have 2 and cos
	$11^2 = 6^2 + 13^2 - 2\times6\times13\cos\alpha$		
	$13^2 = 6^2 + 11^2 - 2\times6\times11\cos\beta$		
	$6^2 = 13^2 + 11^2 - 2\times13\times11\cos\gamma$	A1	any one
	$\cos\alpha = \frac{7}{13}$; $\cos\beta = -\frac{1}{11}$, $\cos\gamma = \frac{127}{143}$,		si
	($\alpha = 57.421°$, $\beta = 95.216°$, $\gamma = 27.363°$)		
	Area $= \frac{1}{2}\times 6\times 13\sin\left(\cos^{-1}\left(\frac{7}{13}\right)\right)$		
	Area $= \frac{1}{2}\times 6\times 11\sin\left(\cos^{-1}\left(-\frac{1}{11}\right)\right)$		
	Area $= \frac{1}{2}\times 11\times 13\sin\left(\cos^{-1}\left(\frac{127}{143}\right)\right)$	M1	any one, FT their angle
	Area = 32.86…(cm^2)	A1	Accept 32.7 to 33.0, cao

Q	Solution	Mark	Notes
6(a)	$7x^{\frac{3}{4}} = \sqrt{147}$	B1	collect x term, $x^{\frac{3}{4}}$.
	$7x^{\frac{3}{4}} = 7\sqrt{3}$		
	$x^{\frac{3}{4}} = 3^{\frac{1}{2}}$	B1	collect constant term, $3^{\frac{1}{2}}$.
	$x = \left(3^{\frac{1}{2}}\right)^{\frac{4}{3}}$ or $x^3 = 9$	B1	si by correct answer
	$x = 3^{\frac{2}{3}}$	B1	cao, oe $\sqrt[3]{3^2} = \sqrt[3]{9}$
	OR		
	$7x^{\frac{5}{4}} = \sqrt{147}x^{\frac{1}{2}}$		
	$49x^{\frac{5}{2}} = 147x$		
	$49x^{\frac{3}{2}} = 147$	(B1)	collect x term, $x^{\frac{3}{2}}$.
	$x^{\frac{3}{2}} = 3$	(B1)	collect constant term, 3.
	$x = 3^{\frac{2}{3}}$	(B1)(B1)	

<u>Note</u>

Sight of 2.08… without working 0 marks

Sight of 2.08… from correct working B1 B1 B1 B0

Q	Solution	Mark	Notes
6(b)	$\frac{(8x-18)}{(2\sqrt{x}-3)} = \frac{(8x-18)(2\sqrt{x}+3)}{(2\sqrt{x}-3)(2\sqrt{x}+3)}$	M1	
	$= \frac{(8x-18)(2\sqrt{x}+3)}{(4x-9)}$	A1	correct denominator simplified
	$= \frac{2(4x-9)(2\sqrt{x}+3)}{(4x-9)}$		
	$= 2(2\sqrt{x}+3)$	A1	convincing
	OR		
	$\frac{(8x-18)}{(2\sqrt{x}-3)} = \frac{2(4x-9)}{(2\sqrt{x}-3)}$	(B1)	
	$= \frac{2(2\sqrt{x}+3)(2\sqrt{x}-3)}{(2\sqrt{x}-3)}$	(M1)	
	$= 2(2\sqrt{x}+3)$	(A1)	convincing

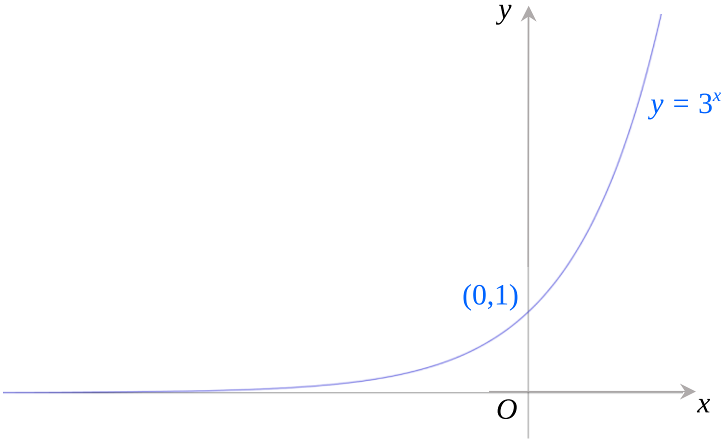
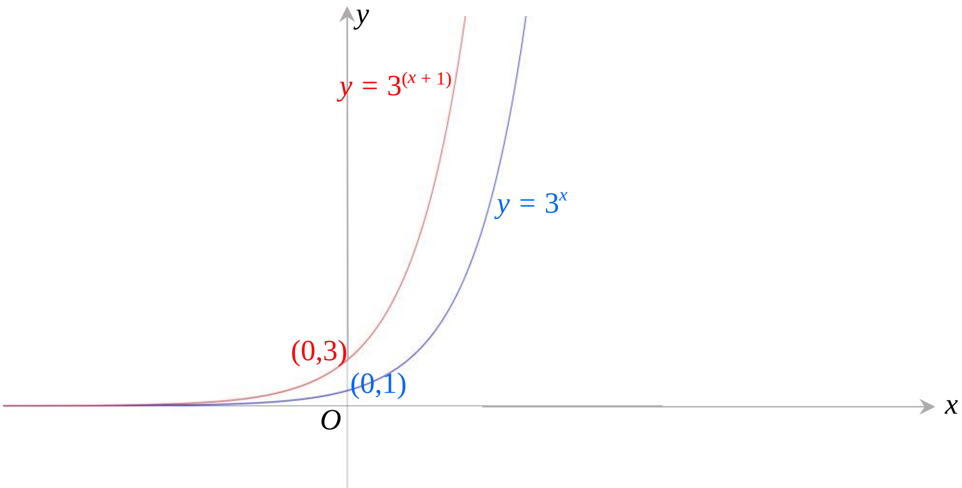
Q	Solution	Mark	Notes
7(a)	Gradient $L_1 = \frac{4-0}{1-(-3)}$ (= 1)	B1	si
	Correct method for finding equation of line	M1	
	Equation of L_1 is $y - 0 = 1(x - (-3))$	A1	$y - 4 = 1(x - 1)$ isw
	$y = x + 3$		
7(b)(i)	$x + 3 = 3x - 3$	M1	FT part (a) for M1 A1 A1
	$x = 3$	A1	
	$y = 6$	A1	
7(b)(ii)	At D, $y = 0$, $0 = 3x - 3$		
	$x = 1$		
	D is the point (1, 0)	B1	allow verification
7(c)	area of $ACD = \frac{1}{2} \times 4 \times 6$	M1	oe, FT their coord of C
	= 12	A1	cao

Q	Solution	Mark	Notes
7(d)	angle $ACD = \tan^{-1}(6/6) - \tan^{-1}(2/6)$	M1	oe, FT their coord of C
	$= 45° - 18.4349°$		
	$= 26.57°$	A1	cao Accept 26.6°
OR	angle $ACD = \tan^{-1}(3) - \tan^{-1}(1)$	(M1)	oe, FT their coord of C
	$= 71.5651° - 45°$		
	$= 26.57°$	(A1)	cao Accept 26.6°
OR			
	$AC = \sqrt{(6-0)^2 + (3--3)^2} = \sqrt{72} = 6\sqrt{2}$		
	$CD = \sqrt{(6-0)^2 + (3-1)^2} = \sqrt{40} = 2\sqrt{10}$		
	Area $= \frac{1}{2} \times \sqrt{72} \times \sqrt{40}\ \sin ACD = 12$	(M1)	FT their coord of C
	$\sin ACD = \frac{1}{\sqrt{5}}$		
	angle $ACD = 26.57°$	(A1)	cao Accept 26.6°

Q	Solution	Mark	Notes
8	$x - 10 < x^2 - 5x$		
	$x^2 - 6x + 10 > 0$	M1	For collecting terms on to one side
	$(x - 3)^2 + 1 > 0$	M1	oe
			or Showing minimum > 0
			or Discriminant < 0 (and a point > 0)
			or Discriminant < 0 (and +ve quadratic)
			or correct sketch
		A1	all correct
	Valid explanation, e.g. minimum ≥ 1	A1	Convincing
	This is true for all real values of *x*.		

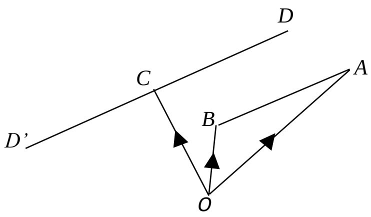
Q	Solution	Mark	Notes
9(a)	$(2 - x)^6$		
	$= 2^6 + 6 \times 2^5 \times (-x) + \frac{6 \times 5}{2 \times 1} \times 2^4 \times (-x)^2 + \dots$	B3	B1 for each term, isw
	$= 64 - 192x + 240x^2 - \dots$		
9(b)	$(1 + ax)(2 - x)^6$		
	$= (1 + ax)(64 - 192x + 240x^2 - \dots)$	M1	replace $(2 - x)^6$ by answer in (a) provided 3 terms.
	$= 64 + 64ax - 192x + 240x^2 - 192ax^2 + \dots$	A1	allow one slip, ignore extra terms FT (a)
	Therefore $64 + (64a - 192)x + (240 - 192a)x^2$ $\equiv 64 + bx + 336x^2 + \dots$		
			FT (a)
	$64a - 192 = b$	m1	equating coefficients
	$240 - 192a = 336$	A1	both equations correct
	$a = -\frac{1}{2}$	A1	cao
	$b = -224$	A1	cao
	OR		
	$(1 + ax)(2 - x)^6$		
	$= (1 + ax)(64 - 192x + 240x^2 - \dots)$	M1	FT their (a), implied by next line
	$(1 + ax)(64 - 192x + 240x^2 - \dots) \equiv$ $64 + bx + 336x^2 + \dots$	A1	si
			FT (a)
	$64a - 192 = b$	m1	equating coefficients
	$240 - 192a = 336$	A1	both equations correct
	$a = -\frac{1}{2}$	A1	cao
	$b = -224$	A1	cao

Q	Solution	Mark	Notes
10(a)	$t^2 - 14t + 49 = 25$	M1	
	$t^2 - 14t + 24 = 0$		
	$(t - 2)(t - 12) = 0$	A1	method to solve must be seen
	$t = 2, 12$		
	Required value is $t = 2$, (since $t \leq 7$).	A1	$t = 12$ rejected
10(b)	$\frac{dy}{dt} = 2t - 14$	M1	at least 1 correct term.
	$t = 3$, $\frac{dy}{dt} = 2 \times 3 - 14$	A1	substitute $t = 3$, si
	$\frac{dy}{dt} = -8$	A1	cao
	Rate of decrease is 8 (cms^{-1})		

Q	Solution	Mark	Notes
11(a)			
		G1	graph of $y = 3^x$, -ve domain required. x-axis not crossed.
		B1	(0,1) accept all correct methods.
11(b)			
		B1	graph of $y = 3^{x+1}$, same shape as (a), graphs do not intersect, ft (a) provided G1 awarded.
		B1	(0,3) accept all correct methods.

Q	Solution	Mark	Notes
12(a)	$\frac{dy}{dx} = -3x^2 + 12$	B1	
	$\frac{dy}{dx} = -3x^2 + 12 = 0$	M1	si
	$x = 2$, $x = -2$	A1	cao any pair of correct values
	$y = -4$, $y = -36$	A1	cao all 4 values correct, no extra.
	$\frac{d^2y}{dx^2} = -6x$	M1	oe, ft quadratic $\frac{dy}{dx}$, si Eg -ve cubic has min before max. Correct sketch of negative cubic.
	FT only if x-coordinate of min < x-coordinate of max.		
	($x = 2$, $\frac{d^2y}{dx^2} = -12 < 0$.)		
	(2, –4) is a maximum point	A1	ft their x value except $x = 0$.
	($x = -2$, $\frac{d^2y}{dx^2} = 12 > 0$.)		
	(−2, –36) is a minimum point	A1	ft their x value provided different conclusion except $x = 0$.

Q	Solution	Mark	Notes
12(b)	Curve is decreasing when		
	$\frac{\mathrm{d}y}{\mathrm{d}x} < 0$		FT their $\frac{\mathrm{d}y}{\mathrm{d}x}$
	$-3x^2 + 12 < 0$	M1	allow ≥ or ≤ throughout, oe
	$x^2 > 4$		
	$x < -2$ or $x > 2$	A1	A0 if 'and' instead of 'or'
	$(x \in) (-\infty, -2) \cup (2, \infty)$	B1	cao Allow –2] ∪ [2
	OR		
	$\{x : x < -2\} \cup \{x : x > 2\}$	(B1)	cao
	Alternative Solution		
	$x < -2$	B1	ft their -2, if used.
	or $x > 2$	B1	ft their 2, if used.
	$(x \in) (-\infty, -2) \cup (2, \infty)$	B1	cao Allow –2] ∪ [2
	OR		
	$\{x : x < -2\} \cup \{x : x > 2\}$	(B1)	cao

Q	Solution	Mark	Notes
13(a)	$\mathbf{AB} = (\mathbf{i} + 3\mathbf{j}) - (4\mathbf{i} + 7\mathbf{j})$	M1	allow $(4\mathbf{i} + 7\mathbf{j}) - (\mathbf{i} + 3\mathbf{j})$
	$\mathbf{AB} = -3\mathbf{i} - 4\mathbf{j}$	A1	cao
13(b)	Distance = $\sqrt{(-3)^2 + (-4)^2}$	M1	correct method for $\lvert a\mathbf{i} + b\mathbf{j}\rvert$, $a, b \neq 0$, si
	Distance = 5	A1	ft (a)
13(c)	 		
	$\mathbf{d} = \mathbf{c} - \mathbf{BA} = \mathbf{c} + \mathbf{AB}$	M1	si
	$\mathbf{d} = (-2\mathbf{i} + 5\mathbf{j}) + (-3\mathbf{i} - 4\mathbf{j})$		
	$\mathbf{d} = -5\mathbf{i} + \mathbf{j}$	A1	ft **AB**
	or		
	$\mathbf{d} = \mathbf{c} + \mathbf{BA} = \mathbf{c} - \mathbf{AB}$	M1	si $\mathbf{a} + \mathbf{BC}$, $\mathbf{BC} = -3\mathbf{i} + 2\mathbf{j}$
	$\mathbf{d} = (-2\mathbf{i} + 5\mathbf{j}) - (-3\mathbf{i} - 4\mathbf{j})$		$4\mathbf{i} + 7\mathbf{j} - 3\mathbf{i} + 2\mathbf{j}$
	$\mathbf{d} = \mathbf{i} + 9\mathbf{j}$	A1	ft **AB**

Q	Solution	Mark	Notes
14(a)	*A* is the point (–2, 0)	B1	
	B is the point (0, 2)	B1	
14(b)	I = $\int_{-2}^{0}(2 - 3x - 2x^2)\,\mathrm{d}x$	M1	attempt to integrate *y* wrt *x* Limits not required. At least one power of *x* increased
	$= \left[2x - \frac{3}{2}x^2 - \frac{2}{3}x^3\right]_{-2}^{0}$	A1	correct integration
	$= \left[0 - \left(-4 - 6 + \frac{16}{3}\right)\right]$	m1	correct use of candidate's limits,
	$= \frac{14}{3}$	A1	cao, allow one decimal place correctly derived from $\frac{14}{3}$.
	Area of triangle $\left(= \frac{1}{2} \times 2 \times 2\right) = 2$	B1	oe, ft (a)
	Required area $\left(= \frac{14}{3} - 2\right) = \frac{8}{3}$	A1	cao, allow one decimal place correctly derived from $\frac{8}{3}$.

Note:

Must be supported by workings.

If M0, award SC1 for sight of $\frac{14}{3}$, OR SC2 for $\frac{8}{3}$

Q	Solution	Mark	Notes
	Alternative solution		
14(b)	I = $\int_{-2}^{0}(2 - 3x - 2x^2 - x - 2)\,\mathrm{d}x$	(M1)	attempt to integrate y wrt x Limits not required. At least one power of x increased
		(A1)	attempt to subtract integrand
	$= \int_{-2}^{0}(-4x - 2x^2)\,\mathrm{d}x$		
	$= \left[-2x^2 - \frac{2x^3}{3}\right]_{-2}^{0}$	(A1)	correct integration
	$= \left[0 - \left(-8 + \frac{16}{3}\right)\right]$	(m1)	correct use of candidate's limits,
	$= \frac{8}{3}$	(A2)	cao

Note:

Must be supported by workings.

If M0, SC2 for $\frac{8}{3}$

Q	Solution	Mark	Notes
15	$2\sin x + 3\cos^2 x - 3 = 0$	M1	
	$2\sin x + 3(1 - \sin^2 x) - 3 = 0$	M1	$\sin^2 x + \cos^2 x = 1$
	$3\sin^2 x - 2\sin x = 0$	A1	si by $\sin x = 0$ AND $\sin x = \frac{2}{3}$
	$\sin x(3\sin x - 2) = 0$		
	$\sin x = \frac{2}{3}$ or $\sin x = 0$	A1	cao both roots (no extra roots)
			FT their $\sin x = k$ for $0 < k \leq 1$.
	(At *A*,) $x = 41.81°$	B1	
	(At *B*,) $x = 138.19°$	B1	
	(At *C*,) $x = 180°$	B1	

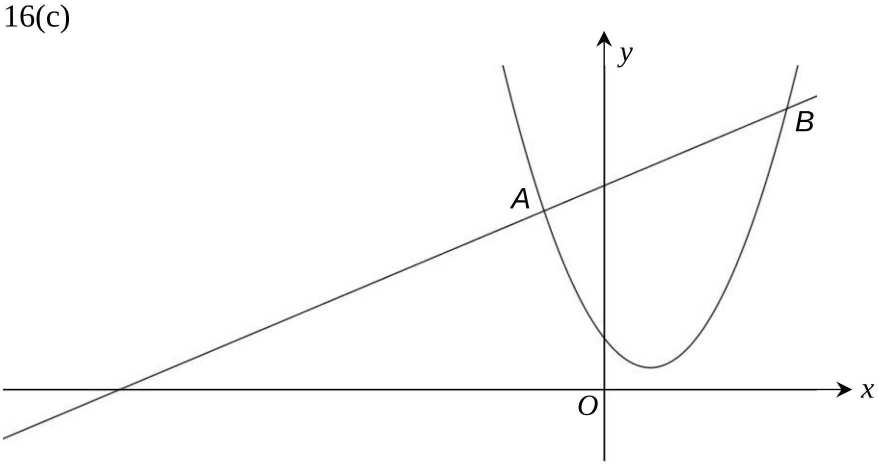
Note:

Do not follow through for trig functions other than sine.

Ignore angles greater than 180°

Q	Solution	Mark	Notes
16(a)	Discriminant = $(-k)^2 - 4\times1\times4$	B1	si
	$= k^2 - 16$		
	If no real roots, discriminant < 0	M1	condone ≤, si by correct answer.
	$k^2 - 16 < 0$		
	Critical values −4, 4	B1	si
	$-4 < k < 4$	A1	cao, oe, e.g. $k > -4$ **and** $k < 4$ Mark final answer
16(b)	$x^2 - 3x + 4 = x + 16$	M1	
	$x^2 - 4x - 12 = 0$	m1	write as quadratic equation
	$(x + 2)(x - 6) = 0$		
	$x = -2$, $x = 6$	A1	cao one correct pair
	$y = 14$, $y = 22$	A1	cao all correct
	Points of intersection are (−2, 14) and (6, 22).		

16(c)



		Mark	Notes
		G1	+ve quadratic, above x-axis
		G1	straight line, +ve gradient 1 point of intersection in 1st quadrant, 1 point of intersection in 2nd quadrant

Q	Solution	Mark	Notes
17(a)	$1 = \log_{10}(2 - c)$	M1	si
	$2 - c = 10$		
	$c = -8$	A1	
17(b)	$\log_{10}(5 - \alpha) - \log_{10}(2 - \alpha) = 1.2$	M1	Condone $\log_{10}(2 - \alpha) - \log_{10}(5 - \alpha) = 1.2$
	$\log_{10}\left(\frac{5-\alpha}{2-\alpha}\right) = 1.2$	B1	subtraction law
	$\frac{5-\alpha}{2-\alpha} = 10^{1.2}$ (= 15.8489…)	m1	logs removed correctly
	$5 - \alpha = 10^{1.2}(2 - \alpha)$	A1	removal of denominator
	$5 - \alpha = 2\times10^{1.2} - 10^{1.2}\times\alpha$		
	$\alpha(10^{1.2} - 1) = 2\times10^{1.2} - 5$		
	$\alpha = 1.798$	A1	cao

Q	Solution	Mark	Notes
18(a)	$(x - -3)^2 + (y - - 1)^2 = \left(\sqrt{5}\right)^2$	M1	condone $\sqrt{5}$ on RHS
	$(x + 3)^2 + (y + 1)^2 = 5$		
	$x^2 + 6x + 9 + y^2 + 2y + 1 = 5$		
	$x^2 + y^2 + 6x + 2y + 5 = 0$	A1	convincing
	OR		
	Equation of circle radius r is		
	$x^2 + y^2 + 2fx + 2gy + c = 0$		
	Centre $(-f, -g)$, $c = f^2 + g^2 - r^2$	(M1)	used
	$f = 3$, $g = 1$, $c = 3^2 + 1^2 - \sqrt{5}^2 = 5$	(A1)	
	OR		
	$x^2 + y^2 + 6x + 2y + 5 = 0$		
	$(x + 3)^2 + (y + 1)^2 - 9 - 1 + 5 = 0$	(M1)	M0 if no working shown.
	$(x + 3)^2 + (y + 1)^2 = 5$		
	Hence centre = $(-3, -1)$, radius = $\sqrt{5}$	(A1)	

Q	Solution	Mark	Notes
18(b)(i)	Tangents have equations $y = mx$	B1	
	Touches circle when		
	$x^2 + (mx)^2 + 6x + 2mx + 5 = 0$	M1	
	$(1 + m^2)x^2 + 2(3 + m)x + 5 = 0$	A1	si
	Discriminant = $4(3 + m)^2 - 4(1 + m^2)\times 5$	B1	ft 1 slip in quadratic
	If tangent, discriminant = 0	M1	used
	$9 + 6m + m^2 - 5 - 5m^2 = 0$		
	$2m^2 - 3m - 2 = 0$		
	$(2m + 1)(m - 2) = 0$		
	$m = -\frac{1}{2}$ $\quad m = 2$	A1	cao, both values
	$y = -\frac{1}{2}x$ $\quad y = 2x$		

Special case 1

Candidates who substitute $y = mx + c$ can only earn method marks, B0 M1 A0 B0 M1 A0

Special case 2

Candidates who obtain the correct answer using any method, award as follows:

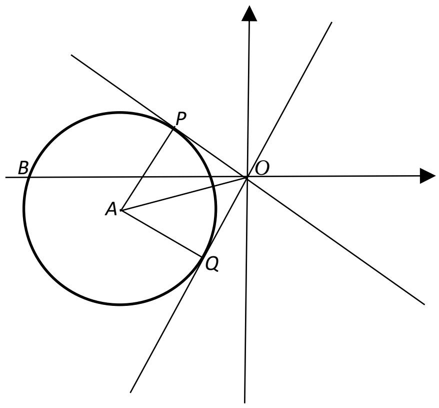
$y = -\frac{1}{2}x \quad y = 2x$	SC1

Q	Solution	Mark	Notes
18(b)(ii)	$m = -\frac{1}{2}$, $\frac{5}{4}x^2 + 5x + 5 = 0$	M1	FT their derived m provided $y = mx$
	$x^2 + 4x + 4 = 0$		
	$(x + 2)^2 = 0$	m1	must be a perfect square, si
	$x = -2$, $y = 1$ $(-2, 1)$	A1	cao
	$m = 2$, $5x^2 + 10x + 5 = 0$	(M1)	award if previous M1 not awarded
	$x^2 + 2x + 1 = 0$		
	$(x + 1)^2 = 0$	(m1)	must be a perfect square, si
	$x = -1$, $y = -2$ $(-1, -2)$	A1	cao
	OR		
	$x = \frac{-b}{2a} = \frac{-2(3+m)}{2(1+m^2)} = \frac{-(3+m)}{(1+m^2)}$	(M1)	
	At $m = -\frac{1}{2}$, $x = \frac{-\left(3-\frac{1}{2}\right)}{\left(1+\frac{1}{4}\right)} = -2$	(m1)	
	$y = -\frac{1}{2} \times (-2) = 1$ $(-2, 1)$	(A1)	
	At $m = 2$, $x = \frac{-(3+2)}{(1+4)} = -1$		
	$y = 2 \times (-1) = -2$ $(-1, -2)$	(A1)	
	<u>Special case</u>		
	Candidates who obtained the correct answer using any method, award as follows:		
	$(-2, 1)$ $(-1, -2)$	SC1	

Q	**Solution**	**Mark**	**Notes**

<u>Alternative solution</u>

18(b)(i)



	$\tan(BOA) = \frac{1}{3}$		
	$BOA = 18.43494882°$	B1	$BOP = 26.56505118°$
	$OA = \sqrt{(3)^2 + (1)^2} = \sqrt{10}$	B1	
	$OP = OQ = \sqrt{\left(\sqrt{10}\right)^2 - \left(\sqrt{5}\right)^2} = \sqrt{5}$	B1	
	Triangle *POA* and *QOA* are isosceles right angled		
	Angles $POA = 45°$ and $QOA = 45°$	B1	
	Gradient $OQ = \tan(45 + 18.43494882) = 2$	B1	$\tan(243.\ 43494882) = 2$
	$y = 2x$		
	Gradient $OP = -\frac{1}{2}$	B1	$\tan(26.56505118) = \frac{1}{2}$
			$\tan(116.56505118) = -\frac{1}{2}$
	$y = -\frac{1}{2}x$		