Question Number	Scheme	Marks
9. (a)	20	B1 **(1)**
(b)	$(160°, -1)$	B1 **(1)**
(c)	$x = 3670°, 3850°$	B1, dB1 **(2)**
(d)(i)	$(160°, 4)$	B1ft
(ii)	$(240°, -1)$	B1ft **(2)** **(6 marks)**

Must be in degrees but condone lack of degree symbols throughout.

(a)

B1: 20 (allow if embedded in the equation)

(b)

B1: $(160°, -1)$ Condone missing brackets (one or both). May be written separately $x = 160°,\ y = -1$

(c)

B1: One of $3670°, 3850°$

dB1: Both $3670°, 3850°$ and no others. Cannot be scored without the previous mark being scored.

(d) (i)

B1ft: $(160°, 4)$ OR follow through on their answer to (b). So, accept $(a, b) \rightarrow (a, -4b)$ even where *a* may appear to be an angle in radians as we are looking for *y*-coordinate to change. Condone missing brackets (one or both). May be written separately e.g. $x = 160°,\ y = 4$

(d)(ii)

B1ft: $(240°, -1)$ OR follow through on their answer to (a). So, accept $(180 + 3k, -1)$ with their *k* substituted in. Condone missing brackets (one or both).
May be written separately e.g. $x = 240°,\ y = -1$

Special Case: All 3 of (b) $(-1,\ 160°)$ (d)(i) $(4, 160°)$ (d)(ii) $(-1,\ 240°)$ score (b) B0 (d)(i) B1 (d)(ii) B1

Question Number	Scheme	Marks
10 (a)	Substitute $y = 2x + k$ fully into $x^2 + 2y^2 - 6x + y - 1 = 0$	
	$\Rightarrow x^2 + 2(2x + k)^2 - 6x + 2x + k - 1 = 0$	M1
	$\Rightarrow 9x^2 + (8k - 4)x + 2k^2 + k - 1 = 0$	A1
	l touches C when $'b^2 - 4ac' \Rightarrow (8k - 4)^2 - 4 \times 9 \times (2k^2 + k - 1)$	dM1
	$8k^2 + 100k - 52 = 0 \Rightarrow 2k^2 + 25k - 13 = 0$ *	A1*
		(4)
(b)	$2k^2 + 25k - 13 = 0 \Rightarrow k = \left(\frac{1}{2},\right) - 13$	B1
	When $k = -13 \Rightarrow 9x^2 - 108x + 324 = 0$	M1
	$\Rightarrow x^2 - 12x + 36 = 0 \Rightarrow (x - 6)^2 = 0 \Rightarrow x = 6$	A1
	Substitutes $k = -13, x = 6$ in $y = 2x + k \Rightarrow y = ...$	dM1
	$P(6, -1)$	A1
		(5)
		(9 marks)

(a)

M1: Substitutes $y = 2x + k$ fully into $x^2 + 2y^2 - 6x + y - 1 = 0$

Alternatively substitutes $x = \frac{y - k}{2}$ fully into $x^2 + 2y^2 - 6x + y - 1 = 0$

Condone slips provided an equation in x or y and k only is achieved. Condone the omission of = 0

e.g. $x^2 + 2(2x + k)^2 - 6x + 2x + k - 1 = 0$

A1: Correct simplified equation in x or y and k only. The two terms in x (or the two terms in y) must be collected. The = 0 and the equation may be implied by further work i.e. their attempt at the discriminant.

$9x^2 + (8k - 4)x + 2k^2 + k - 1 = 0$ or or $9y^2 + (-2k - 8)y + k^2 + 12k - 4 = 0$

For the x or y term they may take a factor out e.g. $9x^2 + 2(4k - 2)x + 2k^2 + k - 1 = 0$ which is fine.

dM1: Attempts $'b^2 - 4ac'$ for their quadratic in x or y with b and c expressions in k. It is dependent on the previous method mark. Ignore any inequality or the presence or absence of =0 for this mark.

A1*: Proceeds to the given answer of $2k^2 + 25k - 13 = 0$ with all previous marks scored and no errors seen. They must have multiplied out all the brackets after attempting the discriminant before proceeding to the given quadratic. Condone invisible brackets to be recovered. The =0 must have appeared before they usually divide through by 4.

(b)

B1: Achieves at least $k = -13$ Ignore any other solutions/ do not withhold this mark but if it is rejected then B0

M1: Substitutes their negative k into their equation in (a) (may restart) to form a 3TQ in x only or y only. Condone the omission of = 0. Condone miscopying the equation provided the intention is clear.

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