1.

(a) $(\dfrac{5+13}{2}, \dfrac{-1+11}{2}), = \underline{\underline{(9,5)}}$

M1, A1 (2)

(b) $r^2 = (9-5)^2 + (5--1)^2 (= 52)$ or $r^2 = (13-9)^2 + (11-5)^2 (= 52)$ (or equiv.)

M1

Equation of circle: $(x-9)^2 + (y-5)^2 = 52$ (or equiv.)

M1 A1ft A1 (4)

2.

(a) Centre $(5, 0)$ (or $x = 5, y = 0$)   B1 B1 (2)

(b) $(x \pm a)^2 \pm b \pm 9 + (y \pm c)^2 = 0 \Rightarrow r^2 = ...$ or $r = ...$,   Radius $= 4$ M1, A1 (2)

(c) $(1, 0)$, $(9, 0)$ Allow just $x = 1$, $x = 9$ B1ft, B1ft (2)

(d) Gradient of $AT = -\dfrac{2}{7}$ B1

$y = -\dfrac{2}{7}(x-5)$ M1 A1ft (3)

3.

(a) Gradient of PQ is $-\dfrac{1}{3}$ B1

$y - 2 = -\dfrac{1}{3}(x-2)$ $(3y + x = 8)$ M1 A1 (3)

(b) $y = 1$: $3 + x = 8$ $x = 5$ (*)   B1 (1)

(c) $("5"-2)^2 + (1-2)^2$ M: Attempt PQ^2 or PQ M1 A1

$(x-5)^2 + (y-1)^2 = 10$ M: $(x \pm a)^2 + (y \pm b)^2 = k$ M1 A1 (4)

4.

(a)(i)	$15 + 4k = 7 \Rightarrow 4k = -8 \Rightarrow k = -2$	B1	1	AG (condone verification or $y = -2$)
(ii)	$\dfrac{1}{2}(x_1 + x_2)$ or $\dfrac{1}{2}(y_1 + y_2)$	M1		
	Midpoint coordinates $\left(3, -\dfrac{1}{2}\right)$	A1	2	One coordinate correct implies M1
(b)	Attempt at $\Delta y / \Delta x$ or $y = -\dfrac{3}{4}x + \dfrac{7}{4}$	M1		(Not x over y)(may use M instead of A/B)
	Gradient $AB = -\dfrac{3}{4}$	A1	2	−0.75 etc any correct equivalent

(c)(i)	$m_1 m_2 = -1$ used or stated	1		Follow through their gradient of AB from part (b)
	Hence gradient $AC = \dfrac{4}{3}$	A1√	2	
(ii)	$y - 1 = \dfrac{4}{3}(x-1)$ or $3y = 4x - 1$ etc	B1√	1	Follow through their gradient of AC from part (c) (i) must be **normal** & (1,1) used
(iii)	$y = 0 \qquad \Rightarrow x - 1 = -\dfrac{3}{4}$	M1		Putting $y = 0$ in their AC equation and attempting to find x
	$x = \dfrac{1}{4}$	A1	2	CSO. C has coordinates $\left(\dfrac{1}{4}, 0\right)$

5.

(a)(i)	$(x-2)^2$	B1		$p = 2$
	$+5$	B1	2	$q = 5$
(ii)	Minimum point (2, 5) or $x = 2, y = 5$	B2√	2	B1 for each coordinate correct or ft **Alt method M1, A1** sketch, differentiation
(b)(i)	$12 - 2x = x^2 - 4x + 9$ $\Rightarrow x^2 - 2x - 3 = 0$	B1	1	Or $x^2 - 4x + 9 + 2x = 12$ **AG** (be convinced) (must have = 0)
(ii)	$(x-3)(x+1) = 0$	M1		Attempt at factors or quadratic formula or one value spotted
	$x = 3, \; -1$	A1		Both values correct & simplified
	Substitute one value of x to find y	M1		May substitute into equation for L or C
	Points are $(3, 6)$ and $(-1, 14)$	A1	4	y-coordinates correct linked to x values

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6.

(a)	$(m+4)^2 = m^2 + 8m + 16$	B1		Condone $4m + 4m$
	$b^2 - 4ac = (m+4)^2 - 4(4m+1) = 0$	M1		$b^2 - 4ac$ (attempted and involving m's and no x's) or $b^2 - 4ac = 0$ stated
	$m^2 + 8m + 16 - 16m - 4 = 0$			
	$\Rightarrow m^2 - 8m + 12 = 0$	A1	3	**AG** (be convinced – all working correct- = 0 appearing more than right at the end)
(b)	$(m-2)(m-6) = 0$	M1		Attempt at factors or quadratic formula
	$m = 2, \; m = 6$	A1	2	**SC B1** for 2 or 6 only without working

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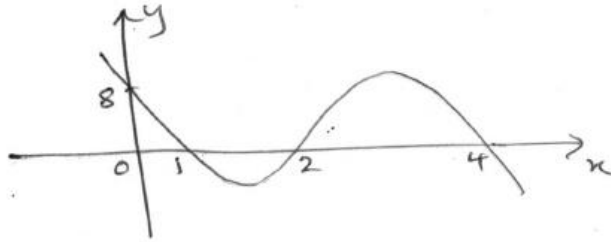7.

$-1 < x < 3.5$

8.

(a) $y = (2 - x)(x - 4)(x - 1)$

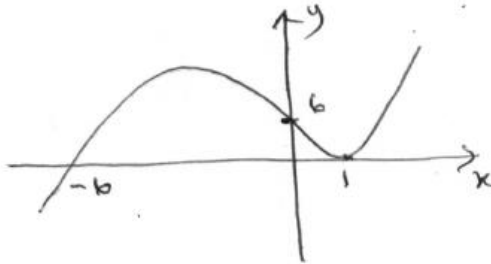$x = 2, 4, 1$

$y = (2)(-4)(-1) = 8$

(b) $y = (x - 1)^2 (x + 6)$

$x = 1, 1, -6$

Touch   cross
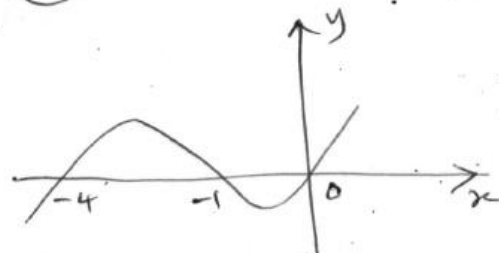
$y = (-1)^2 (6) = 6$

(c) $y = x^3 + 5x^2 + 4x$

$= x(x^2 + 5x + 4)$

$y = x(x + 4)(x + 1)$

$x = 0, -1, -4$

$y = (0)(4)(1) = 0$

9.

a $1 - 20x + 180x^2 - 960x^3$

b $0.817\,04,\ x = 0.01$