Q1.

10 **(i)** $2(x-1)^2-1$ *OR* $a=2, b=-1, c=-1$ $A=(1,-1)$	B1, B1, B1 B1√ [4]	 Allow alt. method for final mark
(ii) $2x^2-5x-3=0 \Rightarrow (2x+1)(x-3)=0$ **OE** in y $x=-\frac{1}{2},\ y=3\frac{1}{2}$	M1, M1 A1 [3]	Complete elim & simplify, attempt soln. Additional (3, 7) not penalised
(iii) Mid-point of $AP=(2, 3)$	B1√	Follow through on *their A*
Gradient of line $=\dfrac{\frac{1}{2}}{\frac{-5}{2}}=\dfrac{-1}{5}$	B1	
Equation is $y-3=\dfrac{-1}{5}(x-2)$ **OE**	B1 [3]	Or $y-3\frac{1}{2}=-\dfrac{1}{5(x+\frac{1}{2})}$

Q2.

2 $y=mx+4$ $\quad$ $y=3x^2-4x+7$ Equate $\rightarrow 3x^2-(4+m)x+3=0$ Uses $b^2-4ac \rightarrow (4+m)^2-36$ Solution of quadratic $m=2$ or -10 Set of values $m>2$ or $m<-10$	 M1 M1 DM1 A1 A1 [5]	 Eliminates y (or x) completely Any use of b^2-4ac Method shown. Correct end-values co

Q3.

5 **(i)** $6x+2=7\sqrt{x} \Rightarrow 6\left(\sqrt{x}\right)^2-7\sqrt{x}+2=0$	**M1**	Expressing as a clear quadratic soi
$\left(3\sqrt{x}-2\right)\left(2\sqrt{x}-1\right)=0$	**M1**	oe e.g. $(3t-2)(2t-1)=0$
$\sqrt{x}=\frac{2}{3}$ or $\frac{1}{2}$	**A1**	1 solution sufficient. Accept e.g. $t=2/3$
$x=\frac{4}{9}$ or $\frac{1}{4}$ (or 0.444, 0.25)	**A1**	Both solutions required cao
OR $(6x+2)^2=49x \rightarrow 36x^2-25x+4=0$	**M1A1**	Attempt to square both sides
$(9x-4)(4x-1)=0$	**M1**	Attempt to solve (or formula etc.)
$x=\frac{4}{9}$ or $\frac{1}{4}$ (or 0.444, 0.25) oe	**A1** **[4]**	
(ii) $7^2-4\times6\times k(=0)$	**M1**	Apply $b^2-4ac(=0)$
$k=\frac{49}{24}$ or 2.04	**A1**	Attempt to equate derivatives
OR $\frac{\mathrm{d}}{\mathrm{d}x}\left(7x^{\frac{1}{2}}\right)=\frac{\mathrm{d}}{\mathrm{d}x}(6x+k) \rightarrow \frac{7}{2}x^{-\frac{1}{2}}=6$	**M1**	
$x=\frac{49}{144},\ y=\frac{49}{12} \rightarrow k=\frac{49}{24}$ or 2.04	**A1** **[2]**	

Q4.

10 $2y + x = k \quad xy = 6$		
(i) $2y + x = 8 \;\rightarrow\; y(8 - 2y) = 6$	M1	Complete elimination of x (or y)
$2y^2 - 8y + 6 = 0$ or $x^2 - 8x + 12 = 0$ $\rightarrow (6, 1)$ and $(2, 3)$	DM1A1	DM1 soln of quadratic. co
Midpoint $M(4, 2)$ $m = -½$	M1	for their 2 points
Perpendicular $m = 2$	M1	Uses $m_1m_2 = -1$ to find perp. gradient
$\rightarrow\; y - 2 = 2(x - 4)$	A1	co unsimplified
	[6]	
(ii) $(k - 2y)y = 6$		
$\rightarrow\; 2y^2 - ky + 6 = 0$ or $x^2 - kx + 12 = 0$		
Uses $b^2 - 4ac$ (0)	M1	Any use of $b^2 - 4ac$ on a quadratic = 0
$\rightarrow\; k^2 > 48$	A1	For $\sqrt{48}$ on its own
$\rightarrow\; k < -\sqrt{48}$ and $k > \sqrt{48}$	A1	All correct.
	[3]	

Q5.

7 (i) $x^2 - 4x + 4 = x \Rightarrow x^2 - 5x + 4 = 0$	**M1**	Eliminate y to reach 3-term quadratic
$(x-1)(x-4)(=0)$ or other valid method	**M1**	Attempt solution
$(1, 1), (4, 4)$	**A1**	
Mid-point $= (2½, 2½)$	**A1**√	ft dependent on 1[st] M1
	[4]	
(ii) $x^2 - (4+m)x + 4 = 0 \rightarrow (4+m)^2 - 4(4) = 0$	**M1**	Applying $b^2 - 4ac = 0$
$4 + m = \pm 4$ or $m(8+m) = 0$	**DM1**	Attempt solution
$m = -8$	**A1**	Ignore $m = 0$ in addition
$x^2 + 4x + 4 = 0$	**M1**	Sub non-zero m and attempt to solve
$x = -2,\; y = 16$	**A1**	Ignore $(2, 0)$ solution from $m = 0$
	[5]	
Alt (ii) $2x - 4 = m$	**M1**	**OR** $2x - 4 = m$
$x^2 - 4x + 4 = (2x - 4)x$	**DM1**	Sub $x = \frac{m+4}{2}$, $y = \frac{m(m+4)}{2}$ into quad
$x = -2$ (ignore +2)	**A1**	$m = -8$ from resulting quad $m(m+8)=0$
$m = -8$ (ignore 0)	**A1**	$x = -2$
$y = 16$	**A1**	$y = 16$

Q6.

2	$\frac{\delta y}{\delta x} = 9x^2 - 12x + 4$	M1A1		
	$(3x-2)^2 \geq 0$	A1	[3]	

Q7.

9	**(i)** $x^2+3x+4=2x+6 \Rightarrow x^2+x-2(=0)$	M1		3-term simplification
	$(x-1)(x+2)=0 \rightarrow (1,8), (-2,2)$	DM1A1		DM1 for attempted solution for x
	$AB=\sqrt{3^2+6^2}=6.71$ or $\sqrt{45}$ or $3\sqrt{5}$	B1		cao ($\sqrt{45}$ from wrong points scores B0)
	$\left(-\frac{1}{2}, 5\right)$	B1√	[5]	Ft *their* coordinates

	(ii) $x^2+(3-k)x+2k-6(=0)$	M1		Simplified to 3-term quadratic
	$(3-k)^2-4(2k-6)=0$	DM1		Apply $b^2-4ac=0$ as function of k only
	$(3-k)(11-k)=0$	DM1		Attempt factorisation or use formula Both correct
	$k=3$ or 11	A1	[4]	NB Alternative methods for **(ii)** possible

Q8.

3	**(i)** $2x^5+3x^2=2x \Rightarrow 2x^5+3x^2-2x=0$ $[x(2x]^4+3x^2-2)=0$ $2x^4+3x^2-2=0$	M1 A1	 [2]	First line essential **AG** Factorising needed for A1
	(ii) $(x^2+2)(2x^2-1)=0$	M1		Reasonable attempt at solving a quadratic in x^2
	$x=\pm\ {}^{1}/_{\sqrt{2}}$ only $\left({}^{1}/_{\sqrt{2}}, {}^{2}/_{\sqrt{2}}\right), \left({}^{-1}/_{\sqrt{2}}, {}^{-2}/_{\sqrt{2}}\right)$	A1 A1	 [3]	For a correct pair of solutions, either 2 x's or 1 x and 1 y SC (±0.707, ±1.41) AWRT B1

Q9.

7	**(i)** $y = m(x-2)$ oe	B1 [1]	Accept $y = mx + c$, $c = -2m$
	(ii) $x^2 - 4x + 5 = mx - 2m \Rightarrow x^2 - x(4+m) + 5 + 2m = 0$ $(4+m)^2 - 4(5+2m) = 0 \Rightarrow m^2 - 4 = 0$ $m = \pm 2$ $m = 2 \Rightarrow x^2 - 6x + 9 = 0 \Rightarrow x = 3$ $m = -2 \Rightarrow x^2 - 2x + 1 = 0 \Rightarrow x = 1$ (3, 2), (1, 2)	M1 DM1 A1 DM1 A1 A1 [6]	Apply $b^2 - 4ac$ Substitute their m and attempt to solve for x Allow for a pair of x values or 1 x and 1 y.
	OR m=2^x–4 **y=m^x–2m , y= x2 – 4x + 5**	M1 M1 M1 A1 A1 A1	**Eliminating 2 variables from 3 equations.** **Obtaining a quadratic in x or y.** **Solving their quadratic correctly.** A pair of x values or 1 x and 1 y.. m=2,–2 also needed for final mark.
	(iii) $(x-2)^2 + 1$, (2, 1)	B1,B1 [2]	

Q10.

10	**(i)**	B1 [1]	AG
	(ii) $(6+k)^2 1(4)(2)(2+3k) = 0$ k = 2 or 10	M1 A1 A1 [3]	Apply $b^2 - 4ac$ cao
	(iii) or (2,–2) k = 10 2(x – 4)^2 = 0 x = 4, y = 2 or (4, 2) *AB*:	M1 A1 M1 A1 M1 A1 [6]	 ($y = 2x - 6$)

Q11.

1	$(x+1)(x-2)$ or other valid method $-1, 2$ $x < -1, x > 2$	M1 A1 A1 [3]	Attempt soln of eqn or other method Penalise $\leq, \geq$