Quadratics 1 MS

Q1.

10	f : $x \mapsto 2x^2 - 8x + 14$			
	(i) $y + kx = 12$, Sim Eqns. $\rightarrow 2x^2 - 8x + kx + 2 = 0$ Use of $b^2 - 4ac$ $\rightarrow (k-8)^2 = 16 \rightarrow k = 12$ or 4.	M1 A1 M1 A1 [4]		Complete elimination of y (or x) Uses $b^2 - 4ac$ on eqn = 0, no "x" in a, b, c. co.co
	(ii) $2x^2 - 8x + 14 = 2(x-2)^2 + 6$	B1×3 [3]		
	(iii) Range of f $\geqslant 6$.	B1√ [1]		√ for c or from calculus.

Q2.

11	**(i)** $9 - x^3 = \dfrac{8}{x^3}$	M1		Together with attempt to mult by x^3
	$x^6 - 9x^3 + 8 = 0$	A1		**AG** completely correct working
	$(X-1)(X-8) = 0 \rightarrow X = 1$ or 8	M1		Attempt to solve quadratic in X or x^3
	$a = 1$, $b = 2$	A1	[4]	

Q3.

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

Q4.

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

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Q5.

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
$x = \pm \frac{1}{\sqrt{2}}$ only	A1	
$\left(\frac{1}{\sqrt{2}}, \frac{2}{\sqrt{2}}\right), \left(\frac{-1}{\sqrt{2}}, \frac{-2}{\sqrt{2}}\right)$	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

Q6.

10 **(i)** $4(x-3)^2 - 25$ Vertex is (3, –25)	**B1B1B1** **B1√** **[4]**	Or $a = 4,\ b = 3,\ c = -25$ ft to *their* (b, c). Accept if not 'hence'

Q7.

10 **(i)** $-2x + k = \frac{2}{x-3} \Rightarrow 2x^2 - (6+k)x + 2 + 3k = 0$	B1 [1]	AG
(ii) $(6+k)^2 - (4)(2)(2+3k) = 0$ $k^2 - 12k + 20\ (= 0)$ $(k-10)(k-2) = 0$ $k = 2$ or 10	M1 A1 A1 [3]	Apply $b^2 - 4ac$ cao
(iii) $k = 2 \Rightarrow 2(x-2)^2 = 0$ $x = 2, y = -2$ or (2,–2) $k = 10 \Rightarrow 2(x-4)^2 = 0$ $x = 4,\ y = 2$ or (4, 2) AB: $y - 2 = 2(x-4)$ or $y + 2 = 2(x-2)$	M1 A1 M1 A1 M1 A1 [6]	 $(y = 2x - 6)$

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Q8.

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

Q9.

10 $f: x \mapsto 2x^2-3x$, $g: x \mapsto 3x+k$, **(i)** $2x^2-3x-9>0$ $\rightarrow x=3$ or $-1½$ Set of x $x>3$, or $x<-1½$	M1 A1 A1 [3]	For solving quadratic. Ignore > or ⩾ condone ⩾ or ⩽
(ii) $2x^2-3x=2(x-\frac{3}{4})^2-\frac{9}{8}$ Vertex $(\frac{3}{4},-\frac{9}{8})$	B3,2,1 B1✓ [4]	$-x^2$ in bracket is an error. ✓ on 'c' and 'b'.

Q10.

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 $\leq, \geq$

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Q11.

2 **(i)** $(2x-3)^2-9$	**B1B1** **[2]**	For −3 and −9
(ii) $2x-3>4 \quad 2x-3<-4$ $x>3\frac{1}{2}$ *(or)* $x<-\frac{1}{2}$ cao Allow $-\frac{1}{2}>x>3\frac{1}{2}$	**M1** **A1**	At least one of these statements Allow 'and' $3\frac{1}{2}$, $-\frac{1}{2}$ soi scores first M1
OR $4x^2-12x-7 \rightarrow (2x-7)(2x+1)$ $x>3\frac{1}{2}$ *(or)* $<-\frac{1}{2}$ cao Allow $-\frac{1}{2}>x>3\frac{1}{2}$	**M1** **A1** **[2]**	Attempt to solve 3-term quadratic Allow 'and' $3\frac{1}{2}$, $-\frac{1}{2}$ soi scores first M1

Q12.

8 $2x^2-10x+8 \rightarrow a(x+b)^2+c$		
(i) $a=2,\ b=-2\frac{1}{2},\ c=-4\frac{1}{2}$	3 × B1	Or $2\left(x-2\frac{1}{2}\right)^2-4\frac{1}{2}$
$\rightarrow$ min value is $-4\frac{1}{2}$ Allow $(2\frac{1}{2},-4\frac{1}{2})$	B1√	Can score by sub $x=2\frac{1}{2}$ into original but not by differentiation
	[4]	
(ii) $2x^2-10x+8-kx=0$		Sets equation to 0 and uses
Use of "b^2-4ac"	M1	discriminant correctly
$(-10-k)^2-64<0$ or $k^2+20k+36<0$	M1	Realises discriminant < 0. Allow ≤
$\rightarrow k=-18$ or -2	A1	co Dep on 1st M1 only
$-18<k<-2$	A1	co
	[4]	