The Discriminant Exam Questions MS (from OCR 4721)

Q1, (Specimen Q3)

(i)	Discriminant is $k^2 - 4k$	M1		For attempted use of the discriminant
		A1	**2**	For correct expression (in any form)
(ii)	For no real roots, $k^2 - 4k < 0$	M1		For stating their $\Delta < 0$
	Hence $k(k-4) < 0$	M1		For factorising attempt (or other soln method)
	So $0 < k < 4$	A1		For both correct critical values 0 and 4 seen
		A1	**4**	For correct pair of inequalities
			$\boxed{6}$	

Q2, (Jun 2007, Q4)

(i)	$(-4)^2 - 4 \times k \times k$	M1		Uses $b^2 - 4ac$ (involving k)
	$= 16 - 4k^2$	A1	2	$16 - 4k^2$
(ii)	$16 - 4k^2 = 0$	M1		Attempts $b^2 - 4ac = 0$ (involving k) or attempts to complete square (involving k)
	$k^2 = 4$			
	$k = 2$	B1		
	or $k = -2$	B1	3	
			5	

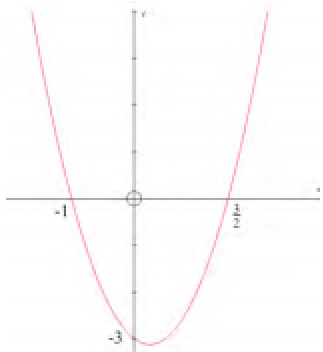
Q3, (Jan 2010, Q10)

$(-30)^2 - 4 \times k \times 25k = 0$	**M1**		Attempts $b^2 - 4ac$ involving k
$900 - 100k^2 = 0$	**M1**		States their discriminant = 0
$k = 3$	**B1**		
or $k = -3$	**B1**	4	
		$\boxed{4}$	

Q4, (Jan 2013, Q10)

$\frac{dy}{dx} = x^2 - 9x^{-2}$	B1	x^2 from differentiating first term
	M1	kx^{-2}
	A1	$-9x^{-2}$ (no + c)
Gradient of line = 8	B1	
$x^2 - 9x^{-2} = 8$	M1	Equate their $\frac{dy}{dx}$ to 8 (or their gradient of line, if clear)
$x^4 - 8x^2 - 9 = 0$ $k^2 - 8k - 9 = 0$	*M1	Use a correct substitution to obtain a 3 term quadratic or factorise into 2 brackets each containing x^2
$(k-9)(k+1) = 0$	DM1	Correct method to solve 3 term quadratic – **dependent on previous M1**
$k = 9$ (don't need $k = -1$)	A1	No extras
$x = 3,\ -3$	DM1	Attempt to find x by square rooting – accept one value
$y = 12,\ -12$	A1	No extras
	[10]	

Q5, (Jun 2015, Q8)

(i)	$(2x-3)(x+1)=0$	M1	Correct method to find roots – **see appendix 1**
	$x=\frac{3}{2}, x=-1$	A1	Correct roots
		A1ft	Good curve: • Correct shape, symmetrical positive quadratic • Minimum point in the correct quadrant for their roots **(ft)** • their x intercepts correctly labelled **(ft)**
		B1	y intercept at $(0, -3)$. Must have a graph.
		[4]	
(ii)	$x<-1, x>\frac{3}{2}$	M1	Chooses the "outside region"
		A1ft	Follow through x-values in (i). Allow "$x<-1, x>\frac{3}{2}$", "$x<-1$ **or** $x>\frac{3}{2}$" but do not allow "$x<-1$ **and** $x>\frac{3}{2}$"
		[2]	
(iii)	$b^2-4ac=1^2-4\times 2\times -(3+k)$	M1	Rearrangement and use of $b^2-4ac<0$, must involve 3 and k in constant term (not $3k$)
	$25+8k<0$	A1	$p+8k<0$ oe found, any constant p. p need not be simplified
	$k<-\frac{25}{8}$	A1	Correct final answer
		[3]	

Q6, (Jun 2016, Q9)

$x^2+(2-2k)x+11+k=0$	**M1***	Attempt to rearrange to a three-term quadratic
$(2-2k)^2-4(11+k)$	**M1dep***	Uses b^2-4ac, involving k and not involving x
$4k^2-12k-40>0$	**A1**	Correct simplified inequality obtained **www**
$k^2-3k-10>0$		
$(k-5)(k+2)$	**M1dep***	Correct method to find roots of 3-term quadratic
	A1	5 and -2 seen as roots
$k<-2, k>5$	**M1dep***	$b^2-4ac>0$ and chooses "outside region"
	A1	Fully correct, strict inequalities.
	[7]	