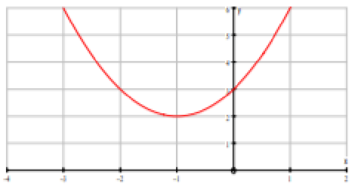
QUADRATICS AND INEQUALITIES ANSWERS EDEXCEL A LEVEL YEAR 1

1.

Attempt to use discriminant $b^2 - 4ac$ (Need not be equated to zero)	M1	
$144 - 4 \times k \times k = 0$	A1	
Attempt to solve for k	M1	
$k = 6$	A1	(4)
		4

2.

(a) $x^2 + 2x + 3 = (x+1)^2,\ +2$	$(a = 1,\quad b = 2)$	B1, B1	(2)
(b) 	"U"-shaped parabola	M1	
	Vertex in correct quadrant (ft from $(-a, b)$)	A1ft	
	(0, 3) (or 3 on y-axis)	B1	(3)
(c) $b^2 - 4ac = 4 - 12 = -8$		B1	
Negative, so curve does not cross x-axis		B1	(2)
(d) $b^2 - 4ac = k^2 - 12$	(May be within the quadratic formula)	M1	
$k^2 - 12 < 0$	(Correct inequality expression in any form)	A1	
$-\sqrt{12} < k < \sqrt{12}$	(or $-2\sqrt{3} < k < 2\sqrt{3}$)	M1 A1	(4)
		Total 11 marks	

3.

Use of $b^2 - 4ac$, perhaps implicit (e.g. in quadratic formula)		M1	
$(-3)^2 - 4 \times 2 \times -(k+1) < 0$	$(9 + 8(k+1) < 0)$	A1	
$8k < -17$	(Manipulate to get $pk < q$, or $pk > q$, or $pk = q$)	M1	
$k < -\frac{17}{8}$	$\left(\text{Or equiv} : k < -2\frac{1}{8} \text{ or } k < -2.125\right)$	A1cso	(4)
			4

4.

(a) $x^2 + kx + (8-k)$ $\quad (=0)$ $\quad$ $8-k$ need not be bracketed		M1	
$b^2 - 4ac = k^2 - 4(8-k)$		M1	
$b^2 - 4ac < 0 \Rightarrow k^2 + 4k - 32 < 0$	(*)	A1cso	(3)
(b) $(k+8)(k-4) = 0$ $\quad k = ...$		M1	
$k = -8$ $\quad k = 4$		A1	
Choosing 'inside' region (between the two k values)		M1	
$-8 < k < 4$ or $4 > k > -8$		A1	(4)
			7

5.

(a)	$b^2 - 4ac > 0 \Rightarrow \quad 16 - 4k(5-k) > 0$ or equiv., e.g. $16 > 4k(5-k)$		M1A1	
	So $\quad k^2 - 5k + 4 > 0$ (Allow any order of terms, e.g. $4 - 5k + k^2 > 0$)	(*)	A1cso	(3)
(b)	Critical Values $\quad (k-4)(k-1) = 0 \quad k = ...$		M1	
	$k = 1$ or 4		A1	
	Choosing "outside" region		M1	
	$\mathbf{k < 1}$ **or** $\mathbf{k > 4}$		A1	(4)
				[7]

6.

(a) $(x+2k)^2$ or $\left(x+\frac{4k}{2}\right)^2$	M1
$(x \pm F)^2 \pm G \pm 3 \pm 11k$ (where F and G are <u>any</u> functions of k, not involving x)	M1
$(x+2k)^2 - 4k^2 + (3+11k)$ Accept unsimplified equivalents such as $\left(x+\frac{4k}{2}\right)^2 - \left(\frac{4k}{2}\right)^2 + 3 + 11k$, <u>and i.s.w. if necessary</u>.	A1 (3)
(b) Accept part (b) solutions seen in part (a).	
$"4k^2 - 11k - 3" = 0$ $(4k+1)(k-3) = 0$ $k = \dots,$ [Or, 'starting again', $b^2 - 4ac = (4k)^2 - 4(3+11k)$ and proceed to $k = \dots$]	M1
$-\frac{1}{4}$ and 3 (Ignore any inequalities for the first 2 marks in (b)).	A1
Using $b^2 - 4ac < 0$ for no real roots, i.e. $"4k^2 - 11k - 3" < 0$, to establish inequalities involving their <u>two</u> critical values m and n (<u>even if the inequalities are wrong</u>, e.g. $k < m$, $k < n$).	M1
$-\frac{1}{4} < k < 3$ (See conditions below) Follow through their critical values. The final A1ft is still scored if the answer $m < k < n$ follows $k < m$, $k < n$. <u>Using x instead of k in the final answer</u> loses only the 2nd A mark, (condone use of x in earlier working).	A1ft (4)

7.

(a)	$b^2 - 4ac = (k-3)^2 - 4(3-2k)$	M1
	$k^2 - 6k + 9 - 4(3-2k) > 0$ or $(k-3)^2 - 12 + 8k > 0$ or better	M1
	<u>$k^2 + 2k - 3 > 0$</u> *	A1cso (3)
(b)	$(k+3)(k-1)[=0]$	M1
	Critical values are $k = 1$ or -3	A1
	(choosing "outside" region)	M1
	<u>$k > 1$ or $k < -3$</u>	A1 cao (4) 7

8.

(a)	$5x > 20$	M1
	$\underline{x > 4}$	A1 (2)
(b)	$x^2 - 4x - 12 = 0$	
	$(x+2)(x-6)\,[=0]$	M1
	$x = 6,\ -2$	A1
	$x < -2\ ,\ x > 6$	M1, A1ft
		(4)
		6 marks

9.

(a)	**Method 1:** Attempts $b^2 - 4ac$ for $a = (k+3)$, $b = 6$ and their c. $c \neq k$	M1
	$b^2 - 4ac = 6^2 - 4(k+3)(k-5)$	A1
	$(b^2 - 4ac =)\ \ -4k^2 + 8k + 96$ or $-(b^2 - 4ac =)\ \ 4k^2 - 8k - 96$ (with no prior algebraic errors)	B1
	As $b^2 - 4ac > 0$, then $-4k^2 + 8k + 96 > 0$ and so, $k^2 - 2k - 24 < 0$	A1 *
	Method 2: Considers $b^2 > 4ac$ for $a = (k+3)$, $b = 6$ and their c. $c \neq k$	M1
	$6^2 > 4(k+3)(k-5)$	A1
	$4k^2 - 8k - 96 < 0$ or $-4k^2 + 8k + 96 > 0$ or $9 > (k+3)(k-5)$ (with no prior algebraic errors)	B1
	and so, $k^2 - 2k - 24 < 0$ following correct work	A1 *
		[4]
(b)	Attempts to solve $k^2 - 2k - 24 = 0$ to give $k =$ ($\Rightarrow$ Critical values, $k = 6, -4$.)	M1
	$k^2 - 2k - 24 < 0$ gives $-4 < k < 6$	M1 A1
		[3]
		7 marks