1 **a** $2x < 6$, $x < 3$ **b** $3x \geq 21$, $x \geq 7$ **c** $2x > 8$, $x > 4$ **d** $3x \leq 36$, $x \leq 12$

e $5x \geq -15$, $x \geq -3$ **f** $\frac{1}{3}x < 1$, $x < 3$ **g** $9x \geq 54$, $x \geq 6$ **h** $3x < -4$, $x < -\frac{4}{3}$

i $x < 14$ **j** $4x \leq -10$, $x \leq -\frac{5}{2}$ **k** $2 < 3x$, $x > \frac{2}{3}$ **l** $5 \geq \frac{1}{2}x$, $x \leq 10$

2 **a** $y > 7$ **b** $4p \leq 2$, $p \leq \frac{1}{2}$ **c** $6 < 2x$, $x > 3$

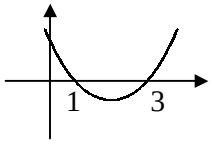
d $2a \geq 4$, $a \geq 2$ **e** $15 < 3u$, $u > 5$ **f** $2b \geq 9$, $b \geq \frac{9}{2}$

g $3x < -18$, $x < -6$ **h** $y \geq -13$ **i** $-20 \leq 4p$, $p \geq -5$

j $r - 2 > 6$, $r > 8$ **k** $3 - 6t \leq t - 4$, $7 \leq 7t$, $t \geq 1$ **l** $6 + 2x \geq 24 - 4x$, $6x \geq 18$, $x \geq 3$

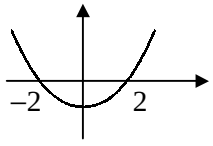
m $7y + 21 - 6y + 2 < 0$, $y < -23$ **n** $20 - 8x > 21 - 6x$, $-1 > 2x$, $x < -\frac{1}{2}$ **o** $12u - 3 - 5u + 15 < 9$, $7u < -3$, $u < -\frac{3}{7}$

3 **a** $(x - 1)(x - 3) < 0$



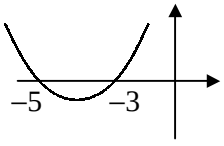
$\therefore 1 < x < 3$

b $(x + 2)(x - 2) \leq 0$



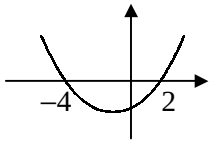
$\therefore -2 \leq x \leq 2$

c $(x + 5)(x + 3) < 0$



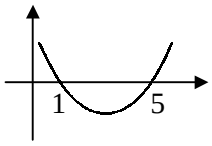
$\therefore -5 < x < -3$

d $x^2 + 2x - 8 \leq 0$, $(x + 4)(x - 2) \leq 0$



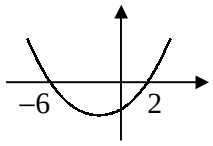
$\therefore -4 \leq x \leq 2$

e $(x - 1)(x - 5) > 0$



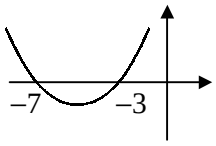
$\therefore x < 1$ or $x > 5$

f $x^2 + 4x - 12 > 0$, $(x + 6)(x - 2) > 0$



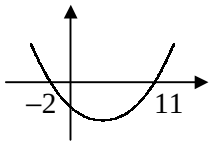
$\therefore x < -6$ or $x > 2$

g $(x + 7)(x + 3) \geq 0$



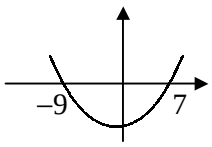
$\therefore x \leq -7$ or $x \geq -3$

h $x^2 - 9x - 22 < 0$, $(x + 2)(x - 11) < 0$



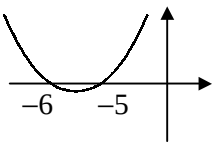
$\therefore -2 < x < 11$

i $x^2 + 2x - 63 \geq 0$, $(x + 9)(x - 7) \geq 0$



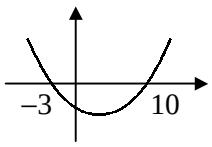
$\therefore x \leq -9$ or $x \geq 7$

j $(x + 6)(x + 5) > 0$



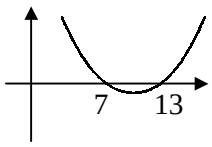
$\therefore x < -6$ or $x > -5$

k $x^2 - 7x - 30 < 0$, $(x + 3)(x - 10) < 0$



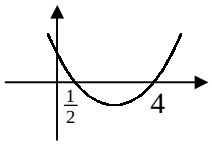
$\therefore -3 < x < 10$

l $x^2 - 20x + 91 \geq 0$, $(x - 7)(x - 13) \geq 0$



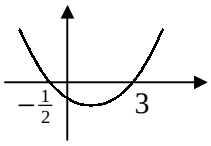
$\therefore x \leq 7$ or $x \geq 13$

4 **a** $(2x - 1)(x - 4) \leq 0$



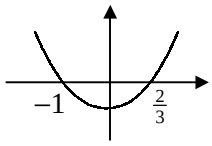
$\therefore\ \frac{1}{2} \leq x \leq 4$

b $(2r + 1)(r - 3) < 0$



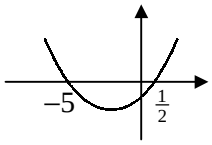
$\therefore\ -\frac{1}{2} < r < 3$

c $3p^2 + p - 2 \leq 0$
$(3p - 2)(p + 1) \leq 0$



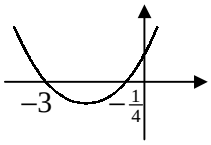
$\therefore\ -1 \leq p \leq \frac{2}{3}$

d $(2y - 1)(y + 5) > 0$



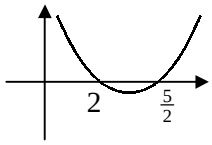
$\therefore\ y < -5$ or $y > \frac{1}{2}$

e $(4m + 1)(m + 3) < 0$



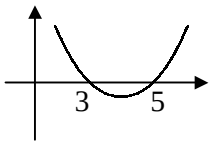
$\therefore\ -3 < m < -\frac{1}{4}$

f $2x^2 - 9x + 10 \geq 0$
$(2x - 5)(x - 2) \geq 0$



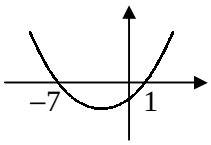
$\therefore\ x \leq 2$ or $x \geq \frac{5}{2}$

g $a^2 - 8a + 15 < 0$
$(a - 3)(a - 5) < 0$



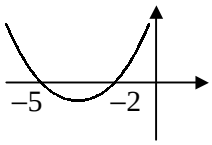
$\therefore\ 3 < a < 5$

h $x^2 + 4x \leq 7 - 2x$
$x^2 + 6x - 7 \leq 0$
$(x + 7)(x - 1) \leq 0$



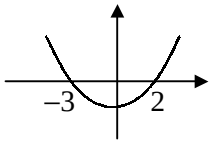
$\therefore\ -7 \leq x \leq 1$

i $y^2 + 9y > 2y - 10$
$y^2 + 7y + 10 > 0$
$(y + 5)(y + 2) > 0$



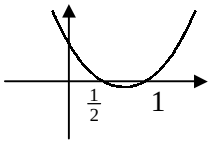
$\therefore\ y < -5$ or $y > -2$

j $2x^2 + x > x^2 + 6$
$x^2 + x - 6 > 0$
$(x + 3)(x - 2) < 0$



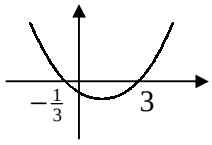
$\therefore\ -3 < x < -2$

k $5u - 6u^2 < 3 - 4u$
$2u^2 - 3u + 1 > 0$
$(2u - 1)(u - 1) > 0$



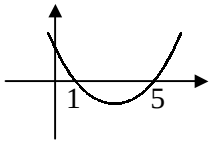
$\therefore\ u < \frac{1}{2}$ or $u > 1$

l $2t + 3 \geq 3t^2 - 6t$
$3t^2 - 8t - 3 \leq 0$
$(3t + 1)(t - 3) \leq 0$



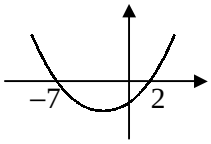
$\therefore\ -\frac{1}{3} \leq t \leq 3$

m $y^2 - 4y + 4 \leq 2y - 1$
$y^2 - 6y + 5 \leq 0$
$(y - 1)(y - 5) \leq 0$



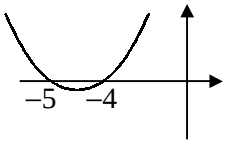
$\therefore\ 1 \leq y \leq 5$

n $p^2 + 5p + 6 \geq 20$
$p^2 + 5p - 14 \geq 0$
$(p + 7)(p - 2) \geq 0$



$\therefore\ p \leq -7$ or $p \geq 2$

o $26 + 4x < 6 - 5x - x^2$
$x^2 + 9x + 20 < 0$
$(x + 5)(x + 4) < 0$



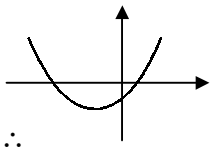
$\therefore\ -5 < x < -4$

5 **a** for critical values

$x = \dfrac{-2 \pm \sqrt{4+4}}{2}$

$x = \dfrac{-2 \pm 2\sqrt{2}}{2}$

$x = -1 \pm \sqrt{2}$



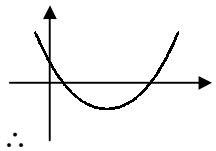
$\therefore$ $-1-\sqrt{2} < x < -1+\sqrt{2}$

b for critical values

$x = \dfrac{6 \pm \sqrt{36-16}}{2}$

$x = \dfrac{6 \pm 2\sqrt{5}}{2}$

$x = 3 \pm \sqrt{5}$



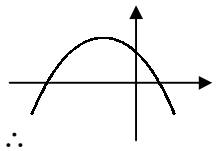
$\therefore$ $x < 3-\sqrt{5}$ or $x > 3+\sqrt{5}$

c for critical values

$x = \dfrac{6 \pm \sqrt{36+44}}{-2}$

$x = \dfrac{6 \pm 4\sqrt{5}}{-2}$

$x = -3 \pm 2\sqrt{5}$



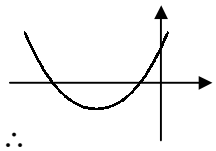
$\therefore$ $-3-2\sqrt{5} < x < -3+2\sqrt{5}$

d for critical values

$x = \dfrac{-4 \pm \sqrt{16-4}}{2}$

$x = \dfrac{-4 \pm 2\sqrt{3}}{2}$

$x = -2 \pm \sqrt{3}$



$\therefore$ $x \leq -2-\sqrt{3}$ or $x \geq -2+\sqrt{3}$

6 **a** equal roots

$\therefore$ $b^2 - 4ac = 0$

$36 - 4k = 0$

$k = 9$

b real and distinct roots

$\therefore$ $b^2 - 4ac > 0$

$4 - 4k > 0$

$4 > 4k$

$k < 1$

c no real roots

$\therefore$ $b^2 - 4ac < 0$

$9 - 4k < 0$

$9 < 4k$

$k > \frac{9}{4}$

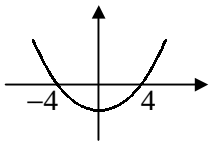
d real roots

$\therefore$ $b^2 - 4ac \geq 0$

$k^2 - 16 \geq 0$

$(k + 4)(k - 4) \geq 0$

$k \leq -4$ or $k \geq 4$



e equal roots

$\therefore$ $b^2 - 4ac = 0$

$1 + 4k = 0$

$k = -\frac{1}{4}$

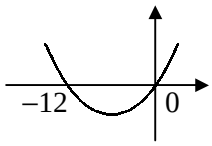
f no real roots

$\therefore$ $b^2 - 4ac < 0$

$k^2 + 12k < 0$

$k(k + 12) < 0$

$-12 < k < 0$



g real and distinct roots

$\therefore$ $b^2 - 4ac > 0$

$4 - 4(k - 2) > 0$

$12 > 4k$

$k < 3$

h equal roots

$\therefore$ $b^2 - 4ac = 0$

$k^2 - 8k = 0$

$k(k - 8) = 0$

$k = 0$ or 8

i no real roots

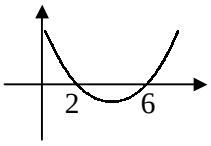
$\therefore$ $b^2 - 4ac < 0$

$k^2 - 4(2k - 3) < 0$

$k^2 - 8k + 12 < 0$

$(k - 2)(k - 6) < 0$

$2 < k < 6$



j real roots

$\therefore$ $b^2 - 4ac \geq 0$

$(k - 1)^2 - 36 \geq 0$

$k^2 - 2k - 35 \geq 0$

$(k + 5)(k - 7) \geq 0$

$k \leq -5$ or $k \geq 7$