

ALGEBRA

Answers

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

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

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

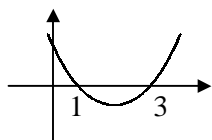
d $2a \geq 4$ **e** $15 < 3u$ **f** $2b \geq 9$
 $a \geq 2$ $u > 5$ $b \geq \frac{9}{2}$

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

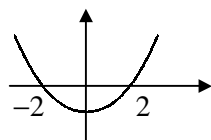
j $r - 2 > 6$ $7 \leq 7t$ **l** $6 + 2x \geq 24 - 4x$
 $r > 8$ $t \geq 1$ $6x \geq 18$
 $x \geq 3$

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

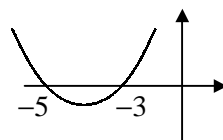
3 **a** $(x-1)(x-3) < 0$ **b** $(x+2)(x-2) \leq 0$ **c** $(x+5)(x+3) < 0$ **d** $x^2 + 2x - 8 \leq 0$
 $(x+4)(x-2) \leq 0$



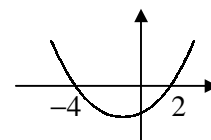
$$\therefore 1 < x < 3$$



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

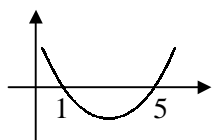


$$\therefore -5 < x < -3$$

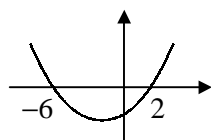


$$\therefore -4 \leq x \leq 2$$

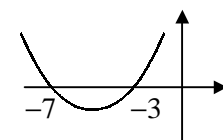
e $(x-1)(x-5) > 0$ **f** $x^2 + 4x - 12 > 0$
 $(x+6)(x-2) > 0$ **g** $(x+7)(x+3) \geq 0$ **h** $x^2 - 9x - 22 < 0$
 $(x+2)(x-11) < 0$



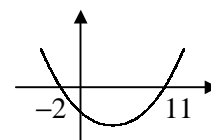
$$\therefore x < 1 \text{ or } x > 5$$



$$\therefore x < -6 \text{ or } x > 2$$

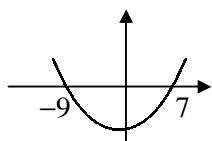


$$\therefore x \leq -7 \text{ or } x \geq -3$$

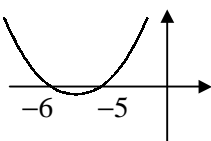


$$\therefore -2 < x < 11$$

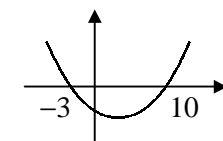
i $x^2 + 2x - 63 \geq 0$
 $(x+9)(x-7) \geq 0$ **j** $(x+6)(x+5) > 0$ **k** $x^2 - 7x - 30 < 0$
 $(x+3)(x-10) < 0$ **l** $x^2 - 20x + 91 \geq 0$
 $(x-7)(x-13) \geq 0$



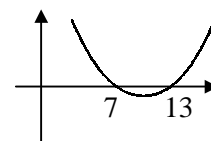
$$\therefore x \leq -9 \text{ or } x \geq 7$$



$$\therefore x < -6 \text{ or } x > -5$$

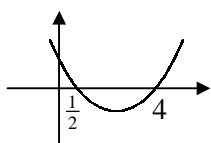


$$\therefore -3 < x < 10$$



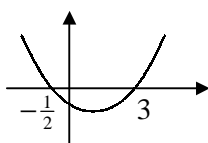
$$\therefore x \leq 7 \text{ or } x \geq 13$$

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



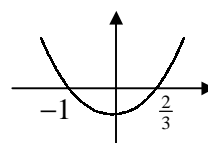
$$\therefore \frac{1}{2} \leq x \leq 4$$

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



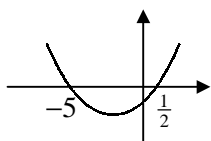
$$\therefore -\frac{1}{2} < r < 3$$

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



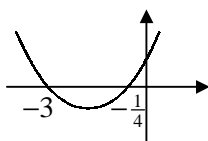
$$\therefore -1 \leq p \leq \frac{2}{3}$$

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



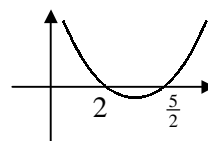
$$\therefore y < -5 \text{ or } y > \frac{1}{2}$$

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



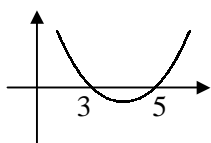
$$\therefore -3 < m < -\frac{1}{4}$$

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



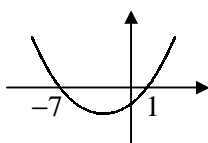
$$\therefore x \leq 2 \text{ or } x \geq \frac{5}{2}$$

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



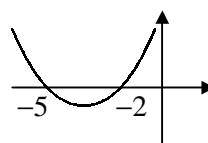
$$\therefore 3 < a < 5$$

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



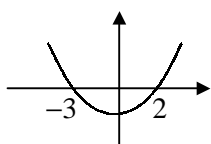
$$\therefore -7 \leq x \leq 1$$

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



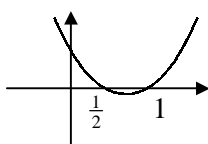
$$\therefore y < -5 \text{ or } y > -2$$

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



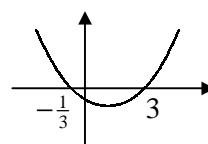
$$\therefore -3 < x < 2$$

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



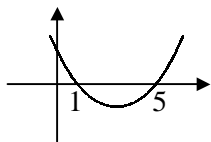
$$\therefore u < \frac{1}{2} \text{ or } u > 1$$

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



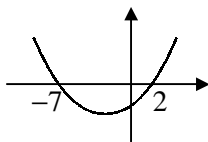
$$\therefore -\frac{1}{3} \leq t \leq 3$$

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



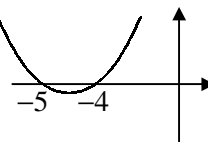
$$\therefore 1 \leq y \leq 5$$

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



$$\therefore p \leq -7 \text{ or } p \geq 2$$

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

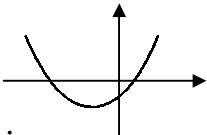


$$\therefore -5 < x < -4$$

- 5**
- a** for critical values

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

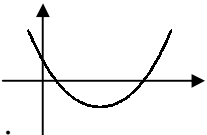
$$x = \frac{-2 \pm 2\sqrt{2}}{2}$$

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


$$\therefore -1 - \sqrt{2} < x < -1 + \sqrt{2}$$
- b** for critical values

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

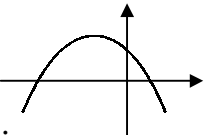
$$x = \frac{6 \pm 2\sqrt{5}}{2}$$

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


$$\therefore x < 3 - \sqrt{5} \text{ or } x > 3 + \sqrt{5}$$
- c** for critical values

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

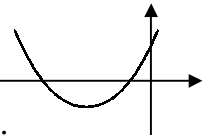
$$x = \frac{6 \pm 4\sqrt{5}}{-2}$$

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


$$\therefore -3 - 2\sqrt{5} < x < -3 + 2\sqrt{5}$$
- d** for critical values

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

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

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


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

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

$$9 - 4k < 0$$

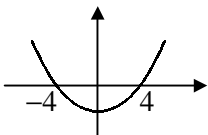
$$9 < 4k$$

$$k > \frac{9}{4}$$
- d** real roots

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

$$k^2 - 16 \geq 0$$

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

$$k \leq -4 \text{ or } k \geq 4$$

- e** equal roots

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

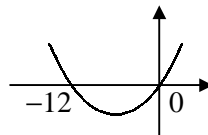
$$1 + 4k = 0$$

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

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

$$k^2 - 8k = 0$$

$$k(k-8) = 0$$

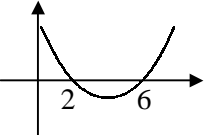
$$k = 0 \text{ or } 8$$
- i** no real roots

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

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

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

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

$$2 < k < 6$$

- j** real roots

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

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

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

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

$$k \leq -5 \text{ or } k \geq 7$$
