

1. Solve

(a) $\sqrt{6m-5} = 4$ (2)

(b) $\frac{2a-5}{4} = 6 - \frac{a-2}{3}$ (3)

2. Solve then graph the solution on a number line.

(a) $7 - 4(x+3) \geq x$ (3)

(b) $\frac{7x}{3} > x - 2$ (3)

3. Solve

(a) $3y^2 - 2y - 8 = 0$ (2)

(b) $a + \frac{5}{a} = 6$ (2)

4. Use the "completing the square" method to solve $2x^2 - 6x - 1 = 0$ (3)5. Solve $4x^2 - 2x - 1 = 0$, giving the roots in their simplest surd form. (3)6. Solve

(a) $x^2 - x - 12 \geq 0$ (2)

(b) $7x > 3x^2$ (2)

7. Solve

(a) $\left| \frac{2x-5}{3} \right| = 4$ (3)

(b) $|2x+7| = 4x-1$ (4)

8. Solve then graph the solution on a number line.

(a) $|4x-3| > 9$ (4)

(b) $\frac{1}{|x+5|} \geq \frac{1}{2}$ (4)

9. Solve the following simultaneous equations.

(a)
$$\begin{cases} 5x - 3y = 38 \\ 7x + 2y = 16 \end{cases}$$
 (3)

(b)
$$\begin{cases} x^2 + y^2 = 16 \\ 3x - y = 4 \end{cases}$$
 (4)

(c)
$$\begin{cases} x + 2y + 4w = 15 \\ 3x + y - w = 7 \\ 5x + 4y + w = 9 \end{cases}$$
 (5)

10. Solve

(a) $\frac{x+5}{7-x} \geq 3$ (4)

(b) $\frac{2x}{x-3} < x$ (4)

(c) $|x+3| > 2|x-1|$ (4)

11. Simplify

(a) $\frac{x^2-9}{\sqrt{(x+3)^2}}$ (3)

(b) $|2x-1| + |x+3|$ (3)

1, a,

$$\begin{aligned} \sqrt{6m-5} &= 4 \\ 6m-5 &= 4^2 \\ 6m-5 &= 16 \\ 6m &= 16+5 \\ 6m &= 21 \\ m &= \frac{21}{6} \\ m &= 3\frac{1}{2} \end{aligned}$$

2

3, b,

$$\begin{aligned} a + \frac{5}{a} &= 6 \\ a \times a + a \times \frac{5}{a} &= a \times 6 \\ a^2 - 6a + 5 &= 0 \\ (a-5)(a-1) &= 0 \\ a &= 5, 1 \end{aligned}$$

2

7, a,

$$\begin{aligned} \left| \frac{2x-5}{3} \right| &= 4 \\ \frac{2x-5}{3} &= 4 & \frac{2x-5}{3} &= -4 \\ 2x-5 &= 4 \times 3 & 2x-5 &= -4 \times 3 \\ 2x-5 &= 12 & 2x-5 &= -12 \\ 2x &= 12+5 & 2x &= -12+5 \\ 2x &= 17 & 2x &= -7 \\ x &= \frac{17}{2} & x &= -\frac{7}{2} \\ x &= 8\frac{1}{2} & x &= -3\frac{1}{2} \\ \therefore x &= 8\frac{1}{2}, -3\frac{1}{2} \end{aligned}$$

3

1, b,

$$\begin{aligned} \frac{2a-5}{4} &= 6 - \frac{a-2}{3} \\ 12 \times \frac{2a-5}{4} &= 12 \times 6 - 12 \times \frac{a-2}{3} \\ 3(2a-5) &= 72 - 4(a-2) \\ 6a - 15 &= 72 - 4a + 8 \\ 6a + 4a &= 72 + 8 + 15 \\ 10a &= 95 \\ a &= \frac{95}{10} \\ a &= 9\frac{1}{2} \end{aligned}$$

3

4,

$$\begin{aligned} 2x^2 - 6x - 1 &= 0 \\ 2x^2 - 6x &= 1 \\ \frac{2x^2}{2} - \frac{6x}{2} &= \frac{1}{2} \\ x^2 - 3x &= \frac{1}{2} \\ x^2 - 3x + \left(\frac{-3}{2}\right)^2 &= \frac{1}{2} + \left(\frac{-3}{2}\right)^2 \\ \left(x - \frac{3}{2}\right)^2 &= \frac{1}{2} + \frac{9}{4} \\ \left(x - \frac{3}{2}\right)^2 &= \frac{11}{4} \\ x - \frac{3}{2} &= \pm \sqrt{\frac{11}{4}} \\ x - \frac{3}{2} &= \pm \frac{\sqrt{11}}{2} \\ x &= \frac{3 \pm \sqrt{11}}{2} \end{aligned}$$

3

7, b,

$$\begin{aligned} |2x+7| &= 4x-1 \\ 2x+7 &= 4x-1 & 2x+7 &= -(4x-1) \\ 2x-4x &= -1-7 & 2x+7 &= -4x+1 \\ -2x &= -8 & 2x+4x &= 1-7 \\ x &= \frac{-8}{-2} & 6x &= -6 \\ x &= 4 & x &= \frac{-6}{6} \\ x &= 4 & x &= -1 \end{aligned}$$

check:

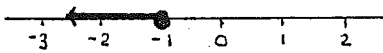
$$\begin{aligned} \text{since } |2x+7| &\geq 0 \\ \text{then } 4x-1 &\geq 0 \\ 4x &\geq 1 \\ x &\geq \frac{1}{4} \end{aligned}$$

$\therefore x=4$ is only solution

4

2, a,

$$\begin{aligned} 7 - 4(x+3) &\geq x \\ 7 - 4x - 12 &\geq x \\ -4x - x &\geq 12 - 7 \\ -5x &\geq 5 \\ x &\leq \frac{5}{-5} \\ x &\leq -1 \end{aligned}$$



3

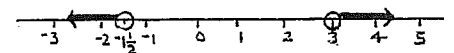
5,

$$\begin{aligned} 4x^2 - 2x - 1 &= 0 \\ x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ x &= \frac{-(-2) \pm \sqrt{(-2)^2 - 4 \times 4 \times (-1)}}{2 \times 4} \\ &= \frac{2 \pm \sqrt{4+16}}{8} \\ &= \frac{2 \pm \sqrt{20}}{8} \\ &= \frac{2 \pm \sqrt{4 \times 5}}{8} \\ &= \frac{2 \pm 2\sqrt{5}}{8} \\ &= \frac{2(1 \pm \sqrt{5})}{8} \\ &= \frac{1 \pm \sqrt{5}}{4} \end{aligned}$$

3

8, a,

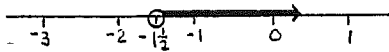
$$\begin{aligned} |4x-3| &> 9 \\ 4x-3 &> 9 & 4x-3 &< -9 \\ 4x &> 9+3 & 4x &< -9+3 \\ 4x &> 12 & 4x &< -6 \\ x &> \frac{12}{4} & x &< \frac{-6}{4} \\ x &> 3 & x &< -1\frac{1}{2} \end{aligned}$$



4

2, b,

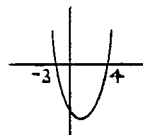
$$\begin{aligned} \frac{7x}{3} &> x-2 \\ 7x &> 3(x-2) \\ 7x &> 3x-6 \\ 7x-3x &> -6 \\ 4x &> -6 \\ x &> \frac{-6}{4} \\ x &> -1\frac{1}{2} \end{aligned}$$



3

6, a,

$$\begin{aligned} x^2 - x - 12 &\geq 0 \\ (x-4)(x+3) &\geq 0 \\ x \leq -3, & x \geq 4 \end{aligned}$$

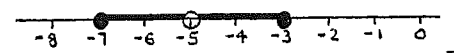


2

8, b,

$$\begin{aligned} \frac{1}{|x+5|} &\geq \frac{1}{2} \quad (\text{where } x \neq -5) \\ |x+5| &\leq 2 \end{aligned}$$

$$\begin{aligned} x+5 &\leq 2 & x+5 &\geq -2 \\ x &\leq 2-5 & x &\geq -2-5 \\ x &\leq -3 & x &\geq -7 \\ \therefore -7 &\leq x \leq -3 & \text{but } x &\neq -5 \\ \Rightarrow -7 &\leq x < -5, & -5 &< x \leq -3 \end{aligned}$$



4

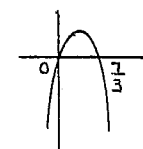
3, a,

$$\begin{aligned} 3y^2 - 2y - 8 &= 0 \\ \frac{(3y-6)(3y+4)}{3} &= 0 \\ (y-2)(3y+4) &= 0 \\ y &= 2, -\frac{4}{3} \\ y &= 2, -1\frac{1}{3} \end{aligned}$$

2

6, b,

$$\begin{aligned} 7x &> 3x^2 \\ 7x - 3x^2 &> 0 \\ x(7-3x) &> 0 \\ 0 < x &< \frac{7}{3} \\ 0 < x &< 2\frac{1}{3} \end{aligned}$$



2

7, a,

$$\begin{aligned} 5x - 3y &= 38 & \text{--- ①} \\ 7x + 2y &= 16 & \text{--- ②} \end{aligned}$$

$$\begin{aligned} \text{①} \times 2 & \quad 10x - 6y = 76 & \text{--- ③} \\ \text{②} \times 3 & \quad 21x + 6y = 48 & \text{--- ④} \end{aligned}$$

$$\begin{aligned} \text{③} + \text{④} & \quad 31x = 124 \\ & \quad x = \frac{124}{31} \\ & \quad x = 4 & \text{--- ⑤} \end{aligned}$$

sub ⑤ into ①

$$\begin{aligned} 5 \times 4 - 3y &= 38 \\ 20 - 3y &= 38 \\ -3y &= 38 - 20 \\ -3y &= 18 \\ y &= \frac{18}{-3} \\ y &= -6 \end{aligned}$$

$\therefore x = 4, y = -6$

3

7, b,

$$\begin{aligned} x^2 + y^2 &= 16 & \text{--- ①} \\ 3x - y &= 4 & \text{--- ②} \end{aligned}$$

from ②

$$3x - 4 = y \quad \text{--- ③}$$

sub ③ into ①

$$\begin{aligned} x^2 + (3x - 4)^2 &= 16 \\ x^2 + (3x)^2 - 2 \times 3x \times 4 + 4^2 &= 16 \\ x^2 + 9x^2 - 24x + 16 &= 16 \\ 10x^2 - 24x &= 0 \\ 2x(5x - 12) &= 0 \\ x &= 0, \frac{12}{5} & \text{--- ④} \end{aligned}$$

sub ④ into ③

when $x = 0$

$$y = 3 \times 0 - 4 = -4$$

when $x = \frac{12}{5}$

$$y = 3 \times \frac{12}{5} - 4 = \frac{36 - 20}{5} = \frac{16}{5}$$

$\therefore x = 0, y = -4$ or $x = \frac{12}{5}, y = \frac{16}{5}$

4

9, c,

$$\begin{aligned} x + 2y + 4w &= 15 & \text{--- ①} \\ 3x + y - w &= 7 & \text{--- ②} \\ 5x + 4y + w &= 9 & \text{--- ③} \end{aligned}$$

$$\begin{aligned} \text{②} + \text{③} & \quad 8x + 5y = 16 & \text{--- ④} \\ \text{②} \times 4 & \quad 12x + 4y - 4w = 28 & \text{--- ⑤} \\ \text{①} + \text{⑤} & \quad 13x + 6y = 43 & \text{--- ⑥} \\ \text{④} \times 6 & \quad 48x + 30y = 96 & \text{--- ⑦} \\ \text{⑥} \times 5 & \quad 65x + 30y = 215 & \text{--- ⑧} \\ \text{⑦} - \text{⑧} & \quad 17x = 119 & \end{aligned}$$

$$\begin{aligned} x &= \frac{119}{17} \\ x &= 7 & \text{--- ⑨} \end{aligned}$$

sub ⑨ into ④

$$\begin{aligned} 8 \times 7 + 5y &= 16 \\ 56 + 5y &= 16 \\ 5y &= 16 - 56 \\ 5y &= -40 \\ y &= \frac{-40}{5} \\ y &= -8 & \text{--- ⑩} \end{aligned}$$

sub ⑨ and ⑩ into ③

$$\begin{aligned} 5 \times 7 + 4 \times (-8) + w &= 9 \\ 35 - 32 + w &= 9 \\ w &= 9 - 35 + 32 \\ w &= 6 \end{aligned}$$

$\therefore x = 7, y = -8, w = 6$

5

10, a,

$$\frac{x+5}{7-x} \geq 3$$

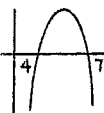
[undefined when $x = 7$]

$$\frac{x+5}{7-x} \times (7-x)^2 \geq 3 \times (7-x)^2$$

$$\begin{aligned} (x+5)(7-x) - 3(7-x)^2 &\geq 0 \\ (7-x)[(x+5) - 3(7-x)] &\geq 0 \\ (7-x)(x+5 - 21 + 3x) &\geq 0 \\ (7-x)(4x - 16) &\geq 0 \\ 4(7-x)(x-4) &\geq 0 \end{aligned}$$

$$4 \leq x \leq 7$$

but since $x \neq 7$
then $4 \leq x < 7$



4

10, b,

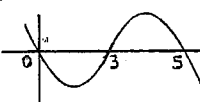
$$\frac{2x}{x-3} < x$$

[undefined when $x = 3$]

$$\frac{2x}{x-3} \times (x-3)^2 < x \times (x-3)^2$$

$$\begin{aligned} 2x(x-3) - x(x-3)^2 &< 0 \\ (x-3)[2x - x(x-3)] &< 0 \\ (x-3)(2x - x^2 + 3x) &< 0 \\ (x-3)(5x - x^2) &< 0 \\ x(x-3)(5-x) &< 0 \end{aligned}$$

$\therefore 0 < x < 3, x > 5$

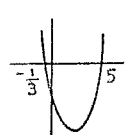


4

10, c,

$$\begin{aligned} |x+3| &> 2|x-1| \\ [x+3]^2 &> [2|x-1|]^2 \\ [x+3]^2 &> 4(x-1)^2 \\ x^2 + 2x \times 3 + 3^2 &> 4[x^2 - 2x \times 1 + 1^2] \\ x^2 + 6x + 9 &> 4[x^2 - 2x + 1] \\ x^2 + 6x + 9 &> 4x^2 - 8x + 4 \\ 0 &> 4x^2 - x^2 - 8x - 6x + 4 - 9 \\ 0 &> 3x^2 - 14x - 5 \\ 0 &> \frac{(3x-15)(3x+1)}{3} \\ 0 &> (x-5)(3x+1) \\ (x-5)(3x+1) &< 0 \end{aligned}$$

$\therefore -\frac{1}{3} < x < 5$



4

11, a,

$$\frac{x^2-9}{\sqrt{(x+3)^2}}$$

$$= \frac{(x-3)(x+3)}{|x+3|}$$

$$= \begin{cases} \frac{(x-3)(x+3)}{x+3} & \text{if } x > -3 \\ \frac{(x-3)(x+3)}{-(x+3)} & \text{if } x < -3 \end{cases}$$

$$= \begin{cases} x-3 & \text{if } x > -3 \\ -(x-3) & \text{if } x < -3 \end{cases}$$

$$= \begin{cases} x-3 & \text{if } x > -3 \\ 3-x & \text{if } x < -3 \end{cases}$$

3

11, b,

$$|2x-1| + |x+3|$$

[critical values $x = \frac{1}{2}, -3$]

$$|2x-1| + |x+3|$$

$$= \begin{cases} -(2x-1) - (x+3) & \text{if } x < -3 \\ -(2x-1) + (x+3) & \text{if } -3 < x < \frac{1}{2} \\ (2x-1) + (x+3) & \text{if } x \geq \frac{1}{2} \end{cases}$$

$$= \begin{cases} -2x+1-x-3 & \text{if } x < -3 \\ -2x+1+x+3 & \text{if } -3 < x < \frac{1}{2} \\ 2x-1+x+3 & \text{if } x \geq \frac{1}{2} \end{cases}$$

$$= \begin{cases} -3x-2 & \text{if } x < -3 \\ -x+4 & \text{if } -3 < x < \frac{1}{2} \\ 3x+2 & \text{if } x \geq \frac{1}{2} \end{cases}$$

3