

# SHARP

## Worksheet 4 – Memo

1. a)  $2x^2 - x - 15$   
 $= (2x + 5)(x - 3)$
- b)  $2x^2 - \frac{5}{12} - \frac{1}{12}$   
 $= \left(2x + \frac{1}{4}\right)\left(x - \frac{1}{3}\right)$
- c)  $x^2 + 12x + 35$   
 $= (x + 5)(x + 7)$
- d)  $3d + e^2 + de + 3e$   
 $= 3d + 3e + e^2 + de$   
 $= 3(d + e) + e(e + d)$   
 $= (d + e)(3 + e)$
- e)  $6x^2 - 19x + 10$   
 $= (2x - 5)(3x - 2)$
- f)  $x^2 + 25$   
 $= \text{cannot factorise}$
- g)  $\frac{1}{2}x^2 + \frac{1}{12}x - \frac{1}{6}$   
 $= \left(\frac{1}{2}x + \frac{1}{3}\right)\left(x - \frac{1}{2}\right)$
- h)  $4x^2 - 19x + 21$   
 $= (x - 3)(4x - 7)$
- i)  $3x^2 - 16x + 16$   
 $= (3x - 4)(x - 4)$
- j)  $2x^2 - 5\frac{2}{5}x + 1$   
 $= (2x - 5)\left(x - \frac{1}{5}\right)$
- k)  $x^2 - 16$   
 $= (x - 4)(x + 4)$
- l)  $abc + a^3b + c^2 + a^2c$   
 $= ab(c + a^2) + c(c + a^2)$   
 $= (c + a^2)(ab + c)$
- m)  $3x^2 - 2x + \frac{1}{3}$   
 $= (3x - 1)\left(x - \frac{1}{3}\right)$
- n)  $3x^3 - 81$   
 $= 3(x^3 - 27)$   
 $= 3(x - 3)(x^2 + 3x + 9)$
- o)  $2xy + 3 + 6x + y$   
 $= 2xy + 6x + 3 + y$   
 $= 2x(y + 3) + (3 + y)$   
 $= (y + 3)(2x + 1)$
- p)  $2x^2 + 4x - 10\frac{1}{2}$   
 $= 2\left(x^2 + 2x - 5\frac{1}{4}\right)$   
 $= 2\left(x + \frac{7}{2}\right)\left(x - \frac{3}{2}\right)$

$$2. \quad a) \quad x^2 + 3x - 5 = 0$$

$$\therefore x^2 + 3x = 5$$

$$\therefore x^2 + 3x + \left(\frac{3}{2}\right)^2 = 5 + \left(\frac{3}{2}\right)^2$$

$$\therefore \left(x + \frac{3}{2}\right)^2 = 7\frac{1}{4}$$

$$\therefore x + \frac{3}{2} = \frac{\sqrt{29}}{2}$$

$$\therefore x = -\frac{3}{2} \pm \frac{\sqrt{29}}{2}$$

$$\therefore x = 1,19 \quad \text{or} \quad x = -4,19$$

$$b) \quad 2x^2 + 5x - 2 = 0$$

$$\therefore x^2 + \frac{5}{2}x = 1$$

$$\therefore x^2 + \frac{5}{2}x + \left(\frac{5}{4}\right)^2 = 1 + \left(\frac{5}{4}\right)^2$$

$$\therefore \left(x + \frac{5}{4}\right)^2 = \frac{41}{16}$$

$$\therefore x + \frac{5}{4} = \sqrt{\frac{41}{16}}$$

$$\therefore x = -\frac{5}{4} \pm \frac{\sqrt{41}}{4}$$

$$\therefore x = 0,35 \quad \text{or} \quad x = -2,85$$

$$c) \quad x^2 - 4x + 3 = 0$$

$$\therefore x^2 - 4x = -3$$

$$\therefore x^2 - 4x + \left(\frac{4}{2}\right)^2 = -3 + \left(\frac{4}{2}\right)^2$$

$$\therefore (x - 2)^2 = 1$$

$$\therefore x - 2 = \pm 1$$

$$\therefore x = 3 \quad \text{or} \quad x = 1$$

$$d) \quad 3x^2 - 7x = 0$$

$$\therefore x^2 - \frac{7}{3}x = 0$$

$$\therefore x^2 - \frac{7}{3}x + \left(\frac{7}{6}\right)^2 = \left(\frac{7}{6}\right)^2$$

$$\therefore \left(x - \frac{7}{6}\right)^2 = \frac{49}{36}$$

$$\therefore x - \frac{7}{6} = \pm \frac{7}{6}$$

$$\therefore x = \frac{7}{3} \quad \text{or} \quad x = 0$$

$$e) \quad x^2 + \frac{5}{2}x - \frac{4}{3} = 0$$

$$\therefore x^2 + \frac{5}{2}x = \frac{4}{3}$$

$$\therefore x^2 + \frac{5}{2}x + \left(\frac{5}{4}\right)^2 = \frac{4}{3} + \left(\frac{5}{4}\right)^2$$

$$\therefore \left(x + \frac{5}{4}\right)^2 = \frac{139}{48}$$

$$\therefore x + \frac{5}{4} = \frac{\sqrt{417}}{12}$$

$$\therefore x = -\frac{5}{4} \pm \frac{\sqrt{417}}{12}$$

$$\therefore x = 0,45 \quad \text{or} \quad x = -2,95$$

$$f) \quad x^2 - 6x = -2$$

$$\therefore x^2 - 6x + \left(\frac{6}{2}\right)^2 = -2 + \left(\frac{6}{2}\right)^2$$

$$\therefore (x - 3)^2 = 7$$

$$\therefore x - 3 = \sqrt{7}$$

$$\therefore x = 3 \pm \sqrt{7}$$

$$\therefore x = 5,65 \quad \text{or} \quad x = 0,35$$

g)  $5x^2 - 25x + 70 = 0$

$$\therefore x^2 - 5x + 14 = 0$$

$$\therefore x^2 - 5x + \left(\frac{5}{2}\right)^2 = -14 + \left(\frac{5}{2}\right)^2$$

$$\therefore \left(x - \frac{5}{2}\right)^2 = -7\frac{3}{4}$$

$\therefore x$  is non - real

Because you cannot have a negative inside a square-root.

h)  $2x^2 + 6x - 13 = 0$

$$\therefore x^2 + 3x - \frac{13}{2} = 0$$

$$\therefore x^2 + 3x + \left(\frac{3}{2}\right)^2 = \frac{13}{2} + \left(\frac{3}{2}\right)^2$$

$$\therefore \left(x + \frac{3}{2}\right)^2 = \frac{35}{4}$$

$$\therefore x = -\frac{3}{2} \pm \frac{\sqrt{35}}{2}$$

$$\therefore x = 1,46 \text{ or } x = -4,46$$

i)  $x^2 + 2x - 1 = 0$

$$\therefore x^2 + 2x + \left(\frac{2}{2}\right)^2 = 1 + \left(\frac{2}{2}\right)^2$$

$$\therefore (x + 1)^2 = 2$$

$$\therefore x + 1 = \sqrt{2}$$

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

$$\therefore x = 0,41 \text{ or } x = -2,41$$

j)  $x^2 - 3x - 9 = 0$

$$\therefore x^2 - 3x + \left(\frac{3}{2}\right)^2 = 9 + \left(\frac{3}{2}\right)^2$$

$$\therefore \left(x - \frac{3}{2}\right)^2 = \frac{45}{4}$$

$$\therefore x - \frac{3}{2} = \frac{3\sqrt{5}}{2}$$

$$\therefore x = \frac{3}{2} \pm \frac{3\sqrt{5}}{2}$$

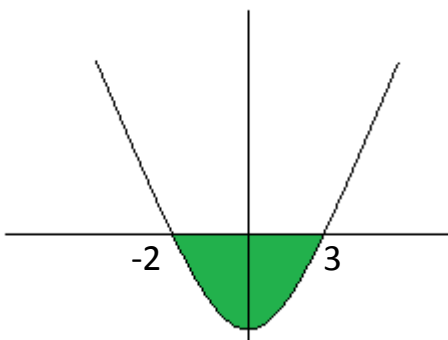
$$\therefore x = 4,85 \text{ or } x = -1,85$$

3. a)  $x(x + 2) \leq 3(x + 2)$

$$x^2 + 2x - 3x - 6 \leq 0$$

$$x^2 - x - 6 \leq 0$$

$$(x - 3)(x + 2) \leq 0$$



$$\therefore -2 \leq x \leq 3$$

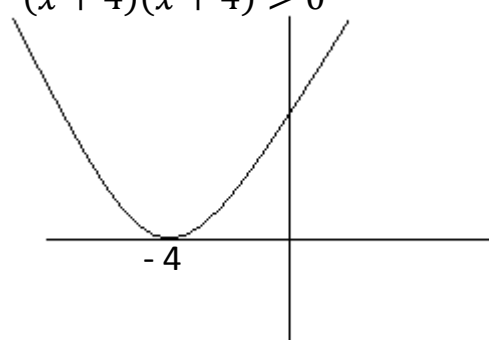
b)  $2x(x - 4) > -8(4 + 3x)$

$$2x^2 - 8x + 32 + 24x > 0$$

$$2x^2 + 16x + 32 > 0$$

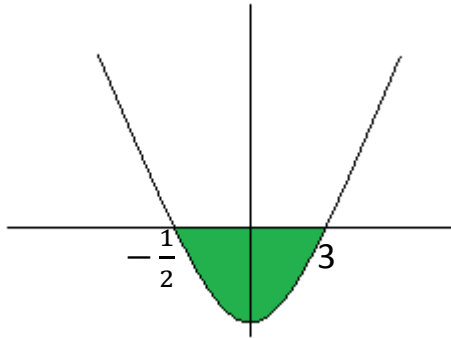
$$x^2 + 8x + 16 > 0$$

$$(x + 4)(x + 4) > 0$$



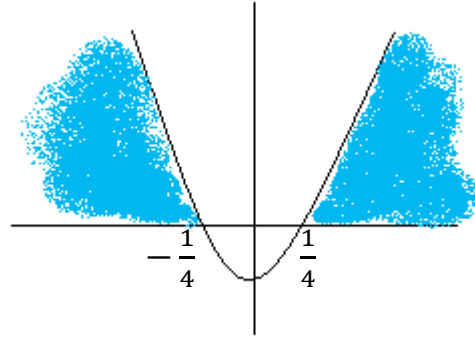
$$x \in R \quad x \neq -4$$

c)  $2x^2 - 5x < 3$   
 $2x^2 - 5x - 3 < 0$   
 $(2x + 1)(x - 3) < 0$



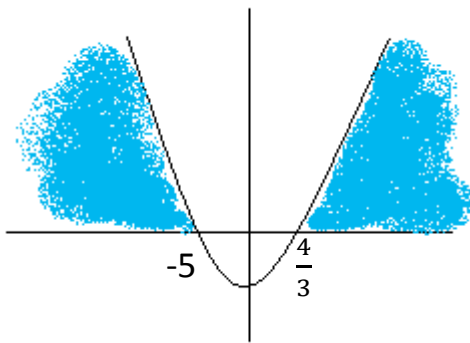
$\therefore -\frac{1}{2} < x < 3$

d)  $x^2 + 4x - \frac{1}{16} \geq 4x$   
 $x^2 - \frac{1}{16} \geq 0$   
 $(x + \frac{1}{4})(x - \frac{1}{4}) \geq 0$



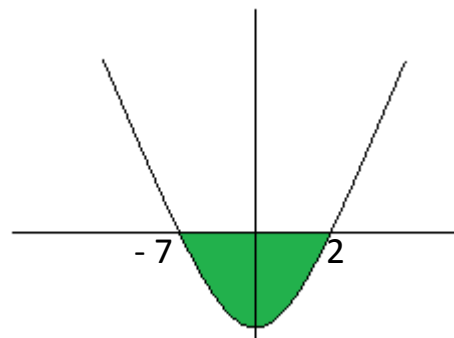
$\therefore x \leq -\frac{1}{4} \text{ or } x \geq \frac{1}{4}$

e)  $3x(x + 4) > x + 20$   
 $3x^2 + 12x - x - 20 > 0$   
 $3x^2 + 11x - 20 > 0$   
 $(3x - 4)(x + 5) > 0$



$x < -5 \text{ or } x > \frac{4}{3}$

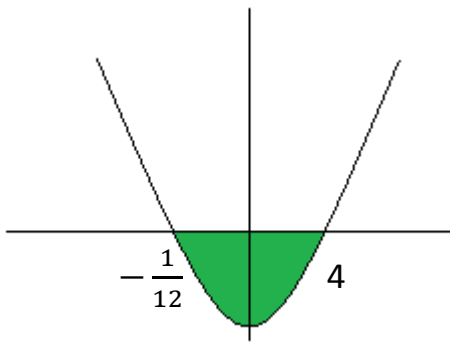
f)  $3x^2 + 15x < 42$   
 $3x^2 + 15x - 42 < 0$   
 $x^2 + 5x - 14 < 0$   
 $(x + 7)(x - 2) < 0$



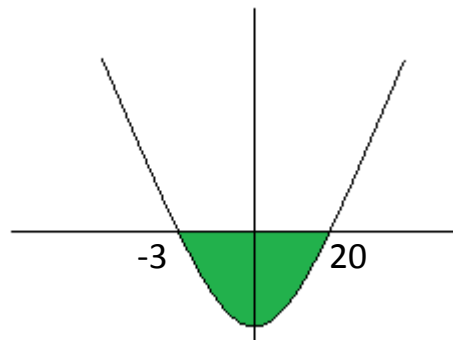
$-7 < x < 2$

g)  $3x(x - 4) \leq 1 - \frac{1}{4}x$   
 $3x^2 - 12x - 1 + \frac{1}{4}x \leq 0$   
 $3x^2 - 11\frac{3}{4}x - 1 \leq 0$   
 $(3x + \frac{1}{4})(x - 4) \leq 0$

h)  $x^2 - 2x \leq 15(x + 4)$   
 $x^2 - 2x - 15x - 60 \leq 0$   
 $x^2 - 17x - 60 \leq 0$   
 $(x + 3)(x - 20) \leq 0$

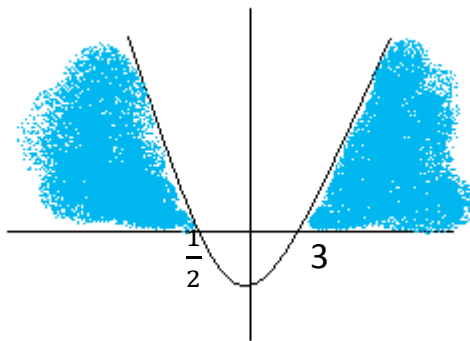


$$\therefore -\frac{1}{12} \leq x \leq 4$$



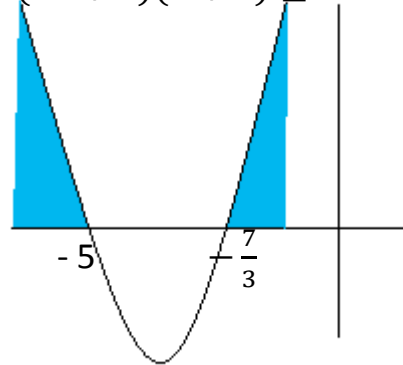
$$\therefore -3 \leq x \leq 20$$

i)  $x^2 - 3\frac{1}{2}x + \frac{3}{2} > 0$   
 $2x^2 - 7x + 3 > 0$   
 $(2x - 1)(x - 3) > 0$



$$\therefore x < \frac{1}{2} \quad \text{or} \quad x > 3$$

j)  $3x(x + 9) \geq 5(x - 7)$   
 $3x^2 + 27x - 5x + 35 \geq 0$   
 $3x^2 + 22x + 35 \geq 0$   
 $(3x + 7)(x + 5) \geq 0$



$$\therefore x \leq -5 \quad \text{or} \quad x \geq -\frac{7}{3}$$

4. a)  $y = -x + 5$ ... (1) and  $x^2 + 3x + y^2 - 5y = 12$ ... (2)  
 Substitute (1) into (2)

$$\begin{aligned} x^2 + 3x + (-x + 5)^2 - 5(-x + 5) - 12 &= 0 \\ x^2 + 3x + x^2 - 10x + 25 + 5x - 25 - 12 &= 0 \\ 2x^2 - 2x - 12 &= 0 \\ x^2 - x - 6 &= 0 \\ \therefore (x - 3)(x + 2) &= 0 \\ \therefore x = 3 \quad \text{or} \quad x = -2 \\ \text{Substitute back into (1)} \end{aligned}$$

$$\begin{aligned} \therefore y &= -(3) + 5 \\ \therefore y &= 2 \\ &(3; 2) \text{ and } (-2; 7) \end{aligned}$$

$$\begin{aligned} \therefore y &= -(-2) + 5 \\ \therefore y &= 7 \end{aligned}$$

b)  $y = -2x \dots$  (1) and  $x^2 - 2x + y^2 + 4y = 15 \dots$  (2)  
 Substitute (1) into (2)

$$x^2 - 2x + (-2x)^2 + 4(-2x) - 15 = 0$$

$$x^2 - 2x + 4x^2 - 8x - 15 = 0$$

$$5x^2 - 10x - 15 = 0$$

$$x^2 - 2x - 3 = 0$$

$$\therefore (x - 3)(x + 1) = 0$$

$$\therefore x = 3 \text{ or } x = -1$$

Substitute back into (1)

$$\therefore y = -2(3)$$

$$\therefore y = -6$$

$$(3; -6) \text{ and } (-1; 2)$$

$$\therefore y = -2(-1)$$

$$\therefore y = 2$$

c)  $3y = x + 14$  and  $2x^2 - 6x + y^2 - 4y = 20 \dots$  (2)  
 $\therefore x = 3y - 14 \dots$  (1)  
 Substitute (1) into (2)

$$2(3y - 14)^2 - 6(3y - 14) + y^2 - 4y - 20 = 0$$

$$2(9y^2 - 84y + 196) - 18y + 84 + y^2 - 4y - 20 = 0$$

$$18y^2 - 168y + 392 - 22y + 64 + y^2 = 0$$

$$19y^2 - 190y + 456 = 0$$

$$y^2 - 10y + 24 = 0$$

$$\therefore (y - 6)(y - 4) = 0$$

$$\therefore y = 6 \text{ or } y = 4$$

Substitute back into (1)

$$\therefore x = 3(6) - 14$$

$$\therefore x = 4$$

$$(4; 6) \text{ and } (-2; 4)$$

$$\therefore x = 3(4) - 14$$

$$\therefore x = -2$$

d)  $4y = x - 16$  and  $x^2 - 4x + 2y^2 + y - 15 = 0 \dots$  (2)  
 $\therefore x = 4y + 16 \dots$  (1)  
 Substitute (1) into (2)

$$(4y + 16)^2 - 4(4y + 16) + 2y^2 + y - 15 = 0$$

$$16y^2 + 128y + 256 - 16y - 64 + 2y^2 + y - 15 = 0$$

$$18y^2 + 113y + 177 = 0$$

$$\therefore (y + 3)(18y + 59) = 0$$

$$\therefore y = -3 \text{ or } y = -\frac{59}{18} \text{ or } -3\frac{5}{18}$$

Substitute back into (1)

$$\therefore x = 4(-3) + 16$$

$$\therefore x = 4\left(-3\frac{5}{18}\right) + 16$$

$$\therefore x = 4$$

$$\therefore x = 2\frac{8}{9}$$

$$(4; -3) \text{ and } \left(2\frac{8}{9}; -3\frac{5}{18}\right)$$

e)  $5y = 2x + 31$  and  $x^2 + 3x + y^2 - 5y = 24 \dots$  (2)

$$y = \frac{2}{5}x + \frac{31}{5} \dots$$
 (1)

Substitute (1) into (2)

$$x^2 + 3x + \left(\frac{2}{5}x + \frac{31}{5}\right)^2 - 5\left(\frac{2}{5}x + \frac{31}{5}\right) - 24 = 0$$

$$x^2 + 3x + \frac{4}{25}x^2 + \frac{961}{25} + \frac{124}{25}x - 2x - 31 - 24 = 0$$

$$25x^2 + 75x + 4x^2 + 961 + 124x - 50x - 775 - 600 = 0$$

$$29x^2 + 149x - 414 = 0$$

$$\therefore (x - 2)(29x + 207) = 0$$

$$\therefore x = 2 \text{ or } x = -\frac{207}{29}$$

Substitute back into (1)

$$\therefore y = \frac{2}{5}(2) + \frac{31}{5}$$

$$\therefore y = \frac{2}{5}\left(-\frac{207}{29}\right) + \frac{31}{5}$$

$$\therefore y = 7$$

$$\therefore y = 3\frac{10}{29}$$

$$(2; 7) \text{ and } \left(-\frac{207}{29}; 3\frac{10}{29}\right)$$

f)  $y + x = 12$  and  $3x^2 - 9x + y^2 - 9y - 16 = 0 \dots$  (2)

$$y = 12 - x \dots$$
 (1)

Substitute (1) into (2)

$$3x^2 - 9x + (12 - x)^2 - 9(12 - x) - 16 = 0$$

$$3x^2 - 9x + 144 - 24x + x^2 - 108 + 9x - 16 = 0$$

$$4x^2 - 24x + 20 = 0$$

$$x^2 - 6x + 5 = 0$$

$$\therefore (x - 5)(x - 1) = 0$$

$$\therefore x = 5 \quad \text{or} \quad x = 1$$

Substitute back into (1)

$$\therefore y = 12 - 5 = 7$$

$$(5; 7) \text{ and } (1; 11)$$

$$y = 12 - 1 = 11$$

g)  $y + 1 = x \dots$  (1) and  $x^2 - 3x + 2y^2 + y = 25 \dots$  (2)  
Substitute (1) into (2)

$$(y + 1)^2 - 3(y + 1) + 2y^2 + y - 25 = 0$$

$$y^2 + 2y + 1 - 3y - 3 + 2y^2 + y - 25 = 0$$

$$3y^2 - 27 = 0$$

$$y^2 - 9 = 0$$

$$\therefore (y + 3)(y - 3) = 0$$

$$\therefore y = -3 \quad \text{or} \quad y = 3$$

Substitute back into (1)

$$\therefore x = -3 + 1$$

$$\therefore x = -2$$

$$(-2; -3) \text{ and } (4; 3)$$

$$\therefore x = 3 + 1$$

$$\therefore x = 4$$

h)  $y = 5x - 12 \dots$  (1) and  $2x^2 - 5x + 3y^2 - 4y = 18 \dots$  (2)  
Substitute (1) into (2)

$$2x^2 - 5x + 3(5x - 12)^2 - 4(5x - 12) - 18 = 0$$

$$2x^2 - 5x + 3(25x^2 - 120x + 144) - 20x + 48 - 18 = 0$$

$$2x^2 - 25x + 30 + 75x^2 - 360x + 432 = 0$$

$$77x^2 - 385x + 462 = 0$$

$$x^2 - 5x + 6 = 0$$

$$\therefore (x - 3)(x - 2) = 0$$

$$\therefore x = 3 \quad \text{or} \quad x = 2$$

Substitute back into (1)

$$\therefore y = 5(3) - 12$$

$$\therefore y = 3$$

$$(3; 3) \text{ and } (2; -2)$$

$$\therefore y = 5(2) - 12$$

$$\therefore y = -2$$



i)  $y + 7x = 24$  and  $2x^2 - 7x + y^2 + 2y = 12 \dots$  (2)

$y = 24 - 7x \dots$  (1)

Substitute (1) into (2)

$$2x^2 - 7x + (24 - 7x)^2 + 2(24 - 7x) - 12 = 0$$

$$2x^2 - 7x + 576 - 336x + 49x^2 + 48 - 14x - 12 = 0$$

$$51x^2 - 357x + 612 = 0$$

$$x^2 - 7x + 12 = 0$$

$$\therefore (x - 3)(x - 4) = 0$$

$$\therefore x = 3 \text{ or } x = 4$$

Substitute back into (1)

$$\therefore y = 24 - 7(3)$$

$$\therefore y = 3$$

$$\therefore y = 24 - 7(4)$$

$$\therefore y = -4$$

(3; 3) and (4; -4)

j)  $2y = x - 2$  and  $x^2 - \frac{3}{2}x + y^2 + 5y = 16 \dots$  (2)

$x = 2y + 2 \dots$  (1)

Substitute (1) into (2)

$$(2y + 2)^2 - \frac{3}{2}(2y + 2) + y^2 + 5y - 16 = 0$$

$$4y^2 + 8y + 4 - 3y - 3 + y^2 + 5y - 16 = 0$$

$$5y^2 + 10y - 15 = 0$$

$$y^2 + 2y - 3 = 0$$

$$\therefore (y + 3)(y - 1) = 0$$

$$\therefore y = -3 \text{ or } y = 1$$

Substitute back into (1)

$$\therefore x = 2(-3) + 2$$

$$\therefore x = -4$$

$$\therefore x = 2(1) + 2$$

$$\therefore x = 4$$

(-4; -3) and (4; 1)

5. a)  $\frac{1}{x+1} = \frac{3}{x+2}$   
 Restrictions:  $x \neq -1$   
 $x \neq -2$   
 $\therefore 1(x+2) = 3(x+1)$   
 $\therefore x+2 = 3x+3$   
 $\therefore -1 = 2x$   
 $\therefore x = -\frac{1}{2}$

b)  $\frac{x+2}{3} = \frac{x-3}{4}$   
 $\therefore 4(x+2) = 3(x-3)$   
 $\therefore 4x+8 = 3x-9$   
 $\therefore x = -17$

c)  $\frac{5}{x+2} = \frac{x-2}{3}$   
 Restrictions:  $x \neq -2$   
 $15 = (x+2)(x-2)$   
 $15 = x^2 - 4$   
 $19 = x^2$   
 $x = \pm \sqrt{19}$

d)  $\frac{3}{x+2} + \frac{2}{x-3} = \frac{1}{x-2}$   
 Restrictions:  $x \neq -2$   
 $x \neq 3$   
 $x \neq 2$   
 LCD:  $(x+2)(x-3)(x-2)$   
 $3(x-3)(x-2) + 2(x+2)(x-2) = (x+2)(x-3)$   
 $3(x^2 - 5x + 6) + 2(x^2 - 4) = x^2 - x - 6$   
 $3x^2 - 15x + 18 + 2x^2 - 8 - x^2 + x + 6 = 0$   
 $4x^2 - 14x + 16 = 0$   
 $2x^2 - 7x + 8 = 0$   
 $\therefore x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$   
 $\therefore x = \frac{-(-7) \pm \sqrt{(-7)^2 - 4(2)(8)}}{2(2)}$   
 $\therefore x$  is non-real

e)  $\frac{4}{x-2} = \frac{x}{x+3}$   
 Restrictions:  $x \neq 2$   
 $x \neq -3$   
 $4(x+3) = x(x-2)$   
 $4x+12 = x^2 - 2x$   
 $0 = x^2 - 2x - 4x - 12$

f)  $\frac{2}{x-5} = \frac{x}{x-3}$   
 Restrictions:  $x \neq 5$   
 $x \neq 3$   
 $2(x-3) = x(x-5)$   
 $2x-6 = x^2 - 5x$   
 $0 = x^2 - 5x - 2x + 6$

$$x^2 - 6x - 12 = 0$$

$$\therefore x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\therefore x = \frac{-(-6) \pm \sqrt{(-6)^2 - 4(1)(-12)}}{2(1)}$$

$$\therefore x = 7,58 \text{ or } x = -1,58$$

$$x^2 - 7x + 6 = 0$$

$$\therefore (x - 6)(x - 1) = 0$$

$$\therefore x = 6 \text{ or } x = 1$$

g)  $\frac{3}{x+4} = \frac{1}{x-2} - \frac{3}{x}$

Restrictions:  $x \neq -4$  or  $x \neq 2$  or  $x \neq 0$

LCD:  $(x + 4)(x - 2)(x)$

$$3(x)(x - 2) = 1(x)(x + 4) - 3(x + 4)(x - 2)$$

$$3x^2 - 6x = x^2 + 4x - 3(x^2 + 2x - 8)$$

$$0 = x^2 + 4x - 3x^2 + 6x - 3x^2 - 6x + 24$$

$$-5x^2 + 4x + 24 = 0$$

$$5x^2 - 4x - 24 = 0$$

$$\therefore x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(5)(-24)}}{2(5)}$$

$$\therefore x = 2,63 \text{ or } x = -1,83$$

h)  $\frac{3}{x-2} = \frac{4}{x+2} - \frac{5}{x}$

Restrictions:  $x \neq -2$  or  $x \neq 2$  or  $x \neq 0$

LCD:  $x(x - 2)(x + 2)$

$$3(x)(x + 2) = 4(x)(x - 2) - 5(x + 2)(x - 2)$$

$$3x^2 + 6x = 4x^2 - 8x - 5(x^2 - 4)$$

$$0 = 4x^2 - 8x - 3x^2 - 6x - 5x^2 + 20$$

$$-4x^2 - 14x + 20 = 0$$

$$2x^2 + 7x - 10 = 0$$

$$\therefore x = \frac{-7 \pm \sqrt{7^2 - 4(2)(-10)}}{2(2)}$$

$$\therefore x = 1,09 \text{ or } x = -4,59$$

j)  $\frac{7}{x-1} + \frac{3}{x+3} = \frac{x}{x-1}$

Restrictions:  $x \neq 1$  or  $x \neq -3$

LCD:  $(x - 1)(x + 3)$

$$7(x + 3) + 3(x - 1) = x(x + 3)$$

$$7x + 21 + 3x - 3 = x^2 + 3x$$

$$10x + 18 = x^2 + 3x$$

$$x^2 + 3x - 10x - 18 = 0$$

$$x^2 - 7x - 18 = 0$$

$$\therefore (x - 9)(x + 2) = 0$$

$$\therefore x = 9 \text{ or } x = -2$$

i)  $\frac{1}{2x-4} = \frac{2}{3x-4}$

Restrictions:  $x \neq 2$  or  $x \neq \frac{4}{3}$

LCD:  $(2x - 4)(3x - 4)$

$$1(3x - 4) = 2(2x - 4)$$

$$3x - 4 = 4x - 8$$

$$\therefore x = 4$$

$$6. \quad a) \quad 3^x = 27$$

$$\log_3 27 = x$$

$$\therefore x = 3$$

$$b) \quad 2.5^x = 250$$

$$5^x = 125$$

$$\log_5 125 = x$$

$$\therefore x = 3$$

$$c) \quad x^3 = 64$$

$$\therefore x = \sqrt[3]{64}$$

$$\therefore x = 4$$

$$d) \quad x^5 = 32$$

$$\therefore x = \sqrt[5]{32}$$

$$\therefore x = 2$$

$$e) \quad 2^3 = x$$

$$\therefore x = 8$$

$$f) \quad 4^0 = x$$

$$\therefore x = 1$$

$$g) \quad 2^x + 2^{x-1} = 12$$

$$2^x(1 + 2^{-1}) = 12$$

$$2^x \left(1 \frac{1}{2}\right) = 12$$

$$2^x = 8$$

$$\therefore x = \log_2 8$$

$$\therefore x = 3$$

$$h) \quad 4.5^x - 4.5^{x-1} = \frac{16}{25}$$

$$5^x - 5^{x-1} = \frac{4}{25}$$

$$5^x(1 - 5^{-1}) = \frac{4}{25}$$

$$5^x \left(\frac{4}{5}\right) = \frac{4}{25}$$

$$5^x = \frac{1}{5}$$

$$\therefore x = \log_5 \left(\frac{1}{5}\right)$$

$$\therefore x = -1$$

$$i) \quad 3^{x+1} - 3^{x-1} = \frac{8}{27}$$

$$3^x(3 - 3^{-1}) = \frac{8}{27}$$

$$3^x \left(\frac{8}{3}\right) = \frac{8}{27}$$

$$3^x = \frac{1}{9}$$

$$\therefore x = \log_3 \frac{1}{9}$$

$$\therefore x = -2$$

$$j) \quad 2^x - 2^{x-4} = 30$$

$$2^x(1 - 2^{-4}) = 30$$

$$2^x \left(\frac{15}{16}\right) = 30$$

$$2^x = 32$$

$$\therefore x = \log_2 32$$

$$\therefore x = 5$$