Ex-4.3

(ii) $2x^2 - 7x + 3 = 0$

$= 2\left(x^2 - \frac{7}{2}x + \frac{3}{2}\right) = 0$

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

$= (x)^2 - \left(\frac{7}{2}x\right) + \left(\frac{7}{4}\right)^2 - \left(\frac{7}{2}\right)^2 + \frac{3}{2} = 0$

$= \left(x - \frac{7}{4}\right)^2 - \left(\frac{49}{16} - \frac{3}{2}\right) = 0$

$= \left(x - \frac{7}{4}\right)^2 - \left(\frac{49 - 24}{16}\right) = 0$

$= \left(x - \frac{7}{4}\right)^2 - \left(\frac{25}{16}\right) = 0$

$= \left(x - \frac{7}{4}\right)^2 - \left(\frac{5}{4}\right)^2 = 0$

$= \left(x - \frac{7}{4} + \frac{5}{4}\right)\left(x - \frac{7}{4} - \frac{5}{4}\right) = 0$

$= \left(x - \frac{12}{4}\right)\left(x - \frac{2}{4}\right) = 0$

$= (x - 3)\left(x - \frac{1}{2}\right) = 0$

$x = 3 \quad$ or $\quad x = \frac{1}{2}$

ii) $2x^2 + x - 4 = 0$

$\Rightarrow x^2 + \frac{x}{2} - 2 = 0$

$\Rightarrow x^2 + \frac{x}{2} + \left(\frac{1}{4}\right)^2 - \left(\frac{1}{4}\right)^2 - 2 = 0$

$\Rightarrow \left(x + \frac{1}{4}\right)^2 - \frac{1}{16} - 2 = 0$

$\Rightarrow \left(x + \frac{1}{4}\right)^2 - \left(\frac{33}{16}\right) = 0$

$\Rightarrow \left(x + \frac{1}{4}\right)^2 - \left(\frac{\sqrt{33}}{4}\right)^2 = 0$

$\Rightarrow \left(x + \frac{1}{4} + \frac{\sqrt{33}}{4}\right)\left(x + \frac{1}{4} - \frac{\sqrt{33}}{4}\right) = 0$

$x = \frac{-1 - \sqrt{33}}{4}$ or $x = \frac{-1 + \sqrt{33}}{4}$

iii) ~~$(x-2)(x+1) = (x-1)(x+3)$~~

iii) $4x^2 + 4\sqrt{3}x + 3 = 0$

$\Rightarrow (2x)^2 + 2 \times 2x \times \sqrt{3} + (\sqrt{3})^2 = 0$

$\Rightarrow (2x + \sqrt{3})^2 = 0$

$\Rightarrow (2x + \sqrt{3})(2x + \sqrt{3}) = 0$

$\Rightarrow 2x + \sqrt{3} = 0$

$x = \frac{-\sqrt{3}}{2}$ or $x = \frac{-\sqrt{3}}{2}$

iv) $2x^2 + x + 4 = 0$

$\Rightarrow x^2 + \frac{x}{2} + 2 = 0$

$\Rightarrow x^2 + \frac{x}{2} + \left(\frac{1}{4}\right)^2 - \left(\frac{1}{4}\right)^2 + 2 = 0$

$\Rightarrow \left(x + \frac{1}{4}\right)^2 - \left(\frac{1}{16} - 2\right) = 0$

$\Rightarrow \left(x + \frac{1}{4}\right)^2 - \left(\frac{-31}{16}\right) = 0$

$\Rightarrow \left(x + \frac{1}{4}\right)^2 - \left(\frac{\sqrt{(-31)}}{4}\right)^2 = 0$

. Do not exist

2i) $a = 2, b = -7 \& c = 3$

$D = b^2 - 4ac$

$(-7)^2 - 4 \times 2 \times 3 = 49 - 24 = 25$

$D > 0$

Let roots are α and β

$\alpha = \frac{-b + \sqrt{D}}{2a} = \frac{-(-7) + \sqrt{25}}{2 \times 2} = \frac{7+5}{4} = \frac{12}{4}$

$= 3$

$\beta = \frac{-b - \sqrt{D}}{2a} = \frac{-(-7) - \sqrt{25}}{2 \times 2} = \frac{7-5}{4} = \frac{2}{4} = \frac{1}{2}$

iii) $a=2, b=1$ & $c=-4$

$D = b^2 - 4ac$

$= (1)^2 - 4 \times 2(-4)$

$= 1 + 32 = 33$

$D > 0$

$\alpha = \frac{-b + \sqrt{D}}{2a} = \frac{-1 + \sqrt{33}}{4}$

$\beta = \frac{-b - \sqrt{D}}{2a} = \frac{-1 - \sqrt{33}}{4}$

iii) $a=4, b = 4\sqrt{3}$ & $c=3$

$D = b^2 - 4ac$

$= (4\sqrt{3})^2 - 4 \times 4 \times 3 = 48 - 48 = 0$

$D = 0$

$\alpha = \frac{-b + \sqrt{D}}{2a} = \frac{-4\sqrt{3} + 0}{8} = \frac{-4\sqrt{3}}{8}$

$= \frac{-\sqrt{3}}{2}$

$\beta = \frac{-b - \sqrt{D}}{2a} = \frac{-4\sqrt{3} - 0}{8} = \frac{-4\sqrt{3}}{8} = \frac{-\sqrt{3}}{2}$

iv) $a = 2, b = 1 \quad c = 4$

$D = b^2 - 4ac$

$= (1)^2 - 4 \times 2 \times 4$

$= 1 - 32 = -31 < 0$

Roots do not exist as D is negative.

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

$x^2 - 1 = 3x$

$\Rightarrow x^2 - 3x - 1 = 0$

$a = 1, b = -3$ & $c = -1$

$x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4 \times 1 \times (-1)}}{2 \times 1}$

$= \frac{3 \pm \sqrt{9+4}}{2} = \frac{3 \pm \sqrt{13}}{2}$

$x = \frac{3+\sqrt{13}}{2}$ or $x = \frac{3-\sqrt{13}}{2}$.

ii) $\frac{1}{x+4} - \frac{1}{x-7} = \frac{11}{30}, x \neq -4, 7$

$= (x-7) - (x+4) = \frac{11}{30} \times (x+4)(x-7)$

$$\Rightarrow \quad x-7-x-4 = \frac{11}{30}\left(x^2+4x+7x+28\right)$$

$$\Rightarrow \quad -11 = \frac{11}{30}\left(x^2-3x-28\right)$$

$$\Rightarrow \quad -11 \times 30 = 11\left(x^2-3x-28\right)$$

$$\Rightarrow \quad x^2-3x-28 = -30$$

$$\Rightarrow \quad x^2-3x+2=0$$

$$a=1,\ b=-3 \text{ and } c=2$$

$$x = \frac{-(-3) \pm \sqrt{(-3)^2-4\times1\times2}}{2\times1}$$

$$= \frac{3 \pm \sqrt{9-8}}{2}$$

$$= \frac{3 \pm \sqrt{1}}{2} = \frac{3 \pm 1}{2}$$

$$x = \frac{3+1}{2} \text{ or } x = \frac{3-1}{2}$$

$$x = 2 \text{ or } x = 1$$

4) Let the present age of Rehman be x years

3 years ago Rehman's age was = $(x-3)$ years.

5 years from now Rehman's age will be = $(x+5)$ years.

ATQ

$$\frac{1}{x-3} + \frac{1}{x+5} = \frac{1}{3}$$

$$= \frac{x+5+x-3}{(x-3)(x+5)} = \frac{1}{3}$$

$$= \frac{2x+2}{x^2+2x-15} = \frac{1}{3}$$

$$= 6x + 6 = x^2 + 2x - 15$$

$$= x^2 - 4x - 21 = 0$$

$$= x^2 - 7x + 3x - 21 = 0$$

$$= x^2 - 4x - 21 = 0$$

$$= (x+3)(x-7) = 0$$

$$= x(x-7) + 3(x-7) = 0$$

$x + 3 = 0$ or $x - 7 = 0$

$x = 7$ or -3

∴ His present age is 7 years.

5) Let Shefali's marks in Mathematics be x.

Her marks in English will be 30 - x.

ATQ

$(x+2)(30-x-3) = 210$

$\Rightarrow (x+2)(27-x) = 210$

$\Rightarrow -x^2 + 25x + 54 = 210$

$\Rightarrow x^2 - 25x + 156 = 0$

$\Rightarrow x^2 - 12x - 13x + 156 = 0$

$\Rightarrow (x-12)(x-13) = 0$

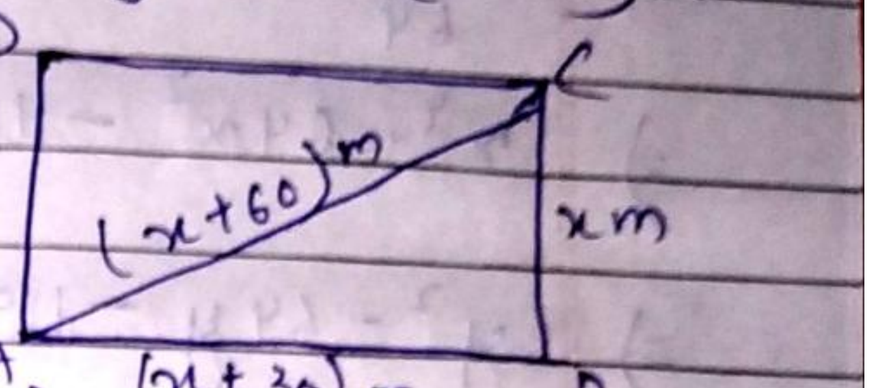
$\Rightarrow x = 12$ or $x = 13 = 0$

If $x = 12$, then marks in Math = 12 and in english = 30 - 12 = 18.

If $x = 13$, then marks in Math = 13 and in english = 30 - 13 = 17.

6) Let the shorter side of rectangle = x m

Longer side = (x+30) m and diagonal = (x+60) m



In ΔABC ; $(x+60)^2 = (x+30)^2 + x^2$

(pythagoreas Theorem)

$\Rightarrow x^2 + 120x + 3600 = x^2 + 60x + 900 + x^2$

$\Rightarrow x^2 - 60x - 2700 = 0$

$\Rightarrow x^2 - 90x + 30x - 2700 = 0$

$\Rightarrow x(x-90) + 30(x-90) = 0$

$\Rightarrow (x+30)(x-90) = 0$

$x + 30 = 0$ or $x - 90 = 0$

$x = -30$ (rejected) or $x = 90$

Shortere side = 90 m

Longer side = 90 + 30 = 120 m.

7) Let the smaller no = x

Larger no will be $\frac{x^2}{8}$

A T.Q

$$\left(\frac{x^2}{8}\right)^2 - x^2 = 180$$

$$\Rightarrow \frac{x^4}{64} - x^2 - 180 = 0$$

$$\Rightarrow x^4 - 64x^2 - 11520 = 0$$

$$\Rightarrow y^2 - 64y - 11520 = 0 \quad (\text{putting } x^2 = y)$$

$a = 1$, $b = -64$ and $c = -11520$

$$D = b^2 - 4ac$$

$$= (-64)^2 - 4 \times 1 \times (-11520)$$

$$= 4096 + 46080 = 50176$$

$$y = \frac{-b \pm \sqrt{D}}{2a}$$

$$\Rightarrow \frac{-(-64) \pm \sqrt{50176}}{2 \times 1} = \frac{64 \pm 224}{2}$$

$$\Rightarrow y = -80 \text{ or } 144$$

$y = -80$ is rejected

$$y = 144$$

$$\Rightarrow x^2 = 144 = (12)^2$$

$$\Rightarrow x = \pm 12$$

Smaller no = ± 12

When smaller no is $+12$,

the greater no is $\frac{1}{8} \times \cancel{144}^{18} = 18$

No. are 12 and 18 or -12 and 18

8) Total distance travelled = 360 km

Let uniform speed be x km/h

Increased speed = $(x+5)$ km/h

ATQ

$$\frac{360}{x} - \frac{360}{x+5} = 1$$

$$\Rightarrow \frac{360(x+5) - 360x}{x(x+5)} = 1$$

$$\Rightarrow 360x + 1800 - 360x = x(x+5)$$

$$\Rightarrow 1800 = x^2 + 5x$$

$$\Rightarrow x^2 + 5x - 1800 = 0$$

$$\Rightarrow x^2 + 45x - 40x - 1800 = 0$$

$$\Rightarrow x(x+45) - 40(x+45) = 0$$

$$\Rightarrow (x-40)(x+45) = 0$$

$\Rightarrow$ $x - 40 = 0$ or $x + 45 = 0$

$\Rightarrow$ $x = 40$ or $x = -45$ (rejected)

Speed of the train = 40km/h

9) Let the smaller tap takes x to fill the tank.

Larger tap will take $(x-10)$

If the two work together, the amount of water following in one hour = $\frac{1}{x} + \frac{1}{x-10}$

ATQ

$$\frac{1}{x} + \frac{1}{x-10} = 9\frac{3}{8}$$

$\Rightarrow$ $\frac{x + 10 + x}{x(x-10)} = \frac{8}{75}$

$\Rightarrow$ $75(2x - 10) = 8x(x-10)$

$\Rightarrow$ $150x - 750 = 8x^2 - 80x$

$\Rightarrow$ $8x^2 - 230x + 750 = 0$

$a = 8$, $b = -230$ & $C = 750$

$D = b^2 - 4ac$

$= (-230)^2 - 4 \times 8 \times 750$

$= 52900 - 24000 = 28900$

$x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-(-230) \pm \sqrt{28900}}{2 \times 8}$

$= \frac{230 \pm 170}{16}$

$x = \frac{230 + 170}{16}$ or $\frac{230 - 170}{16}$

$x = 25$ or $x = \frac{15}{4}$

$x = \frac{15}{4} \cdot x = 25$

10) Let the speed of passenger train = x km/h

the speed of express train be $(x + 11)$ km/h

ATP

$\frac{132}{x} - \frac{132}{x+11} = 1$

$\Rightarrow \frac{132(x+11) - 132x}{x(x+11)} = 1$

$\Rightarrow 132x + 1452 - 132x = x^2 + 11x.$

$\Rightarrow x^2 + 11x - 1452 = 0$

$\Rightarrow x^2 + 44x - 33x - 1452 = 0$

$\Rightarrow x(x+44) - 33(x+44) = 0$

$\Rightarrow (x-33)(x+44) = 0$

$\Rightarrow x - 33 = 0$ or $x + 44 = 0$

$x = 33$ or $x = -44$ rejected.

Speed of passenger train $= 33 km/h$

Speed of the express train $= 33 + 11 = 44 km/h$

1) Let the side of smaller square be x and that of largere square be y.

Perimeter of smaller square will be $4x$ and that of largere square will be $4y$.

ATQ

$4y - 4x = 24$

$\Rightarrow y - x = 6$

$\Rightarrow y = x + 6$

$$x^2 + y^2 = 468$$

$$x^2 + (x+6)^2 = 468$$

$$\Rightarrow x^2 + x^2 + 12x + 36 = 468$$

$$\Rightarrow 2x^2 + 12x - 432 = 0$$

$$\Rightarrow x^2 + 6x - 216 = 0$$

$$D = b^2 - 4ac$$

$$= (6)^2 - 4 \times 1 \times (-216) = 36 + 864 = 900$$

$$x = \frac{-b \pm \sqrt{D}}{2a}$$

$$= \frac{-6 \pm \sqrt{900}}{2 \times 1} = \frac{-6 \pm 30}{2}$$

$$x = \frac{-6+30}{2} \text{ or } \frac{-6-30}{2}$$

$$x = 12 \text{ or } x = -18$$

-18 is reject.

$x = 12$ & $y = 12 + 6 = 18$

$\therefore$ sides of two squares are 12m and 18m.