EXERCISE 4.3

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

$a = 3, \; b = (-7), \; c = 3$

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

$$= \frac{-(-7) \pm \sqrt{(-7)^2 - 4(2)(3)}}{2(2)}$$

$$= \frac{7 \pm \sqrt{49 - 24}}{4}$$

$$= \frac{7 \pm \sqrt{25}}{4} = \frac{7 \pm 5}{4}$$

$\frac{7+5}{4}$	$\frac{7-5}{4}$
$\frac{12}{4} = 3$	$\frac{2}{4} = \frac{1}{2}$

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

$a = 2, \; b = 1, \; c = (-4)$

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

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

$$= \frac{-1 \pm \sqrt{1 + 32}}{4} = \frac{-1 \pm \sqrt{33}}{4}$$

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

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$2x \times 2$

(ii) Alternative - By completing square.

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

$\frac{2x^2 + x - 4}{2} = x^2 + \frac{x}{2} - \frac{4}{2}$

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

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

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

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

$\Rightarrow \left(x + \frac{1}{4}\right) = \sqrt{\frac{33}{16}}$

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

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

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

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

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

~~$\Rightarrow \sqrt{3}$~~

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

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

$\Rightarrow x = -\frac{\sqrt{3}}{2}$ and $x = -\frac{\sqrt{3}}{2}$

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

$\Rightarrow 2x^2 + x = -4$

$\Rightarrow x^2 + \frac{1}{2}x = 2 \Rightarrow x^2 + 2 \times x \times \frac{1}{4} = -2$

On adding $\left(\frac{1}{4}\right)^2$ to both the sides

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

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

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

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

$a = 2,\ b = -7,\ c = 3$

$$\Rightarrow x = \frac{7 \pm \sqrt{49 - 24}}{4} \Rightarrow x = \frac{7 \pm \sqrt{25}}{4}$$

$$\Rightarrow x = \frac{7 + 5}{4} \text{ or } \frac{7 - 5}{4}$$

$$\Rightarrow x = \frac{12}{4} \text{ or } \frac{2}{4}$$

$\therefore,\ x = 3$ or $\frac{1}{2}$

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

On comparing this equation with $ax^2 + bx + c = 0$, we obtain

$a = 2,\ b = 1,\ c = (-4)$

$$\Rightarrow x = \frac{-1 \pm \sqrt{1 + 32}}{4} \Rightarrow x = \frac{-1 \pm \sqrt{33}}{4}$$

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

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

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

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

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

Here, $a = 1$, $b = (-3)$, $c = (-1)$

So, we know the formula -

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

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

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

So, the roots of the equation are -

$$\frac{3 + \sqrt{13}}{2} \text{ ~~and~~ or } \frac{3 - \sqrt{3}}{2}$$

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

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

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

$$\Rightarrow \frac{-11}{x^2-7x+4x-28} = \frac{11}{30}$$

$$\Rightarrow \frac{-11}{x^2-3x-28} = \frac{11}{30}$$

$$\Rightarrow -\cancel{11}(30) = \cancel{11}(x^2-3x-28)$$

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

$$\Rightarrow x^2-3x-28+30=0$$

$$\Rightarrow \boxed{x^2-3x+2=0}$$

Here, $a=1$, $b=(-3)$, $c=(2)$

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

$$= \frac{3 \pm \sqrt{\cancel{b^2-4ac}\ (-3)^2-4(1)(2)}}{2(1)}$$

$$= \frac{3 \pm \sqrt{9-8}}{2} = \frac{3 \pm \sqrt{1}}{2} = \frac{3 \pm 1}{2}$$

So, the roots are -

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

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(4) ~~The~~ Let the present age of Rehman be x

The sum of reciprocals if their ages is 3 yrs ago and 5 yrs from now $= \frac{1}{3}$

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

The reciprocals are -

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

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

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

$$\Rightarrow \frac{2x+2}{x^2+5x-3x-15}=\frac{1}{3}$$

$$\Rightarrow 3(2x+2)=x^2+2x-15$$

$$\Rightarrow x^2+2x-15-6x-6=0$$

$$\Rightarrow \boxed{x^2-4x-21=0}$$

$a=1,\ b=(-4),\ c=(-21)$

$$\Rightarrow x=\frac{-b\pm\sqrt{b^2-4ac}}{2a} \Rightarrow x=\frac{4\pm\sqrt{(-4)^2-4(1)(-21)}}{2(1)}$$

$$\Rightarrow x=\frac{4\pm\sqrt{16+84}}{2}$$

$\Rightarrow x = \frac{4 \pm \sqrt{100}}{3} = \frac{4 \pm 10}{2}$

$\therefore$, the roots are -

$\frac{4 \pm 10}{2}$ | $= \frac{4-10}{2}$

$\frac{14}{2} = 7$ yrs | $= \frac{-6}{2} (-3) = (-3)$

$\therefore$, Rohan's present age is 7 years.

(5) Let Shefali marks in English be x)

The product of their marks would have been = 210.

Shefali's marks in two subjects :-

$(x-3) \times (32-x) = 210$

$\Rightarrow x(32-x) - 3(32-x) = 210$

$\Rightarrow 32x - x^2 - 96 + 3x = 210$

$\Rightarrow -x^2 + 35x = 210 + 96$

$\boxed{x^2 - 35x + 306 = 0}$

$a = 1, b = (-35), c = 306$

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

$\Rightarrow x = \frac{-(-35) \pm \sqrt{(-35)^2 - 4(1)(306)}}{2(1)}$

$\Rightarrow x = \frac{35 \pm \sqrt{1225 - 1224}}{2}$

$\Rightarrow x = \frac{3 + \sqrt{1}}{2}$ The root are -

$\Rightarrow x = \frac{35+1}{2}$ | $\Rightarrow x = \frac{35-1}{2}$

$\Rightarrow x = \frac{36}{2} = 18$ | $x = \frac{34}{2} = 17$

$\therefore$, Shefali's marks of both the subjects
Eng - 17 marks & Maths = 12 marks

(26) Let the shorter side of x

The diagonal of the rectangular feild = $(x + 60)$

The longer side of the rectangular feild = $30 + x$

By pythagoras theorem,

$$h^2 = p^2 + b^2$$

$$(60+x)^2 = (30+x)^2 + x^2$$

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

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

$$\Rightarrow 3600 - 900 + 120x - 6x = 2x^2 - x^2$$

$$\Rightarrow 2700 + 60x = x^2$$

$$\boxed{x^2 - 60x - 2700 = 0}$$

$a = 1$, $b = (-60)$, $c = (-2700)$

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

$$\Rightarrow x = \frac{-(-60) \pm \sqrt{(-60)^2 - 4(1)(-2700)}}{2(1)}$$

$$\Rightarrow x = \frac{60 \pm \sqrt{3600 + 10800}}{2}$$

$$\Rightarrow x = \frac{60 \pm \sqrt{14400}}{2}$$

$$\Rightarrow x = \frac{60 \pm 120}{2}$$

$\therefore$ the roots are - $\frac{60+120}{2}$ & $\frac{60-120}{2}$

$\Rightarrow x = \frac{180}{2} = 90$, $\Rightarrow x = \frac{-60}{2} = (-30)$

From which 90 is the value of 'x'

So, the shorter side is 90 m and

~~other~~ longer side is $-(30+x)$
$= 30 + 90$
$= 120\ m.$

(7) Let the smaller number be 'x' and larger number be 'y'

The difference of squares of two numbers $= 180$.

Larger number $-$ smaller number $= 180$

$y^2 - x^2 = 180$ — (i)

$\boxed{x^2 = 8y}$

$x = \sqrt{8y}$ — (ii)

$\frac{x^2}{8} = y$

$y^2 - (\sqrt{8y})^2 = 180$, from eq. (i)

$\Rightarrow y^2 - 8y = 180$

$\Rightarrow \boxed{y^2 - 8y - 180 = 0}$

$a = 1,\ b = (-8),\ c = (-180)$

$\Rightarrow y = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$\Rightarrow y = \frac{-(-8) \pm \sqrt{(-8)^2 - 4(1)(-180)}}{2(1)}$

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$\Rightarrow y = \dfrac{8 \pm \sqrt{64 + 720}}{2}$

$\Rightarrow y = \dfrac{8 \pm \sqrt{784}}{2}$ $\Rightarrow x = \dfrac{8 \pm 28}{2}$

So, the roots are.

$\dfrac{8+28}{2}$ | $\dfrac{8-28}{2}$

$\Rightarrow y = \dfrac{36}{2} = 18$ | $\dfrac{-20}{2} = (-10)$

From eq^n. $x = \sqrt{8y}$ —— (ii)

$x = \sqrt{8 \times 18}$

$x = \sqrt{144}$

$x = 12$.

∴, the smaller no. is 18 and the larger no. is 12.

(8) Let the speed be 'x' Km/hr.
The distance travelled by a train at a uniform speed = 360 Km

If the speed has been $= (x+5)$

it would have taken 1 hr less for the same journey.

$T = \dfrac{D}{S}$

The speed of the train =

$t_1 + t_2 = 1$

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

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

$\Rightarrow \frac{\cancel{360x} + 1800 - \cancel{360x}}{x^2 + 5x} = \frac{1}{1}$

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

$\Rightarrow x^2 + 5x - 1800$, is the eq^n.

$a = 1, b = 5, c = (-1800)$

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

$\Rightarrow x = \frac{-5 \pm \sqrt{(5)^2 - 4(1)(-1800)}}{2}$

$\Rightarrow x = \frac{-5 \pm \sqrt{25 + 7200}}{2}$

$\Rightarrow x = \frac{-5 \pm \sqrt{7225}}{2} \Rightarrow \frac{-5 \pm 85}{2}$

So, the roots are $\Rightarrow \frac{-5+85}{2}$ | $\frac{-85-5}{2}$

$\Rightarrow x = \frac{80}{2} = 40$ | $x = \frac{-90}{2} = (-45)$

So, the speed of the train is 40 km/hr.

(9) Let the smaller one can fill be (x) hrs
The small tap can fill the tank in a hour $= \frac{1}{x}$

The time taken to fill two water taps $= 9\frac{3}{8}$

Time taken by the larger tap $= (x-10)$ hrs.

Large tap can fill the tank in 1 hr be $= \frac{1}{x-10}$

$$\frac{75}{8} \times \frac{1}{x} + \frac{75}{8} \times \frac{1}{x-10} = 1$$

$$\Rightarrow \frac{75}{8}\left(\frac{1}{x} + \frac{1}{x-10}\right) = 1$$

$$\Rightarrow \frac{1}{x} + \frac{1}{(x-10)} = \frac{8}{75}$$

$$\Rightarrow \frac{2x-10}{x^2-10x} = \frac{8}{75}$$

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

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

$$\Rightarrow 8x^2 - 80x - 150x + 750 = 0$$

$$\Rightarrow 2(4x^2 - 115x + 375) = 0$$

$a = 4$, $b = (-115)$, $c = 375$

$\Rightarrow x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$\Rightarrow x = \dfrac{115 \pm \sqrt{13225 - 6000}}{8}$

$\Rightarrow x = \dfrac{115 \pm \sqrt{7225}}{8}$

$\Rightarrow x = \dfrac{115 \pm 85}{8}$

So, the roots are -

$\Rightarrow x = \dfrac{115 + 85}{8}$	$\Rightarrow x = \dfrac{115 - 85}{8}$
$\Rightarrow x = \dfrac{\cancel{200}^{25}}{\cancel{8}}$	$\Rightarrow x = \dfrac{\cancel{30}^{15}}{\cancel{8}_4}$
$\Rightarrow x = 25$	$\Rightarrow x = \dfrac{15}{4}$

So, the time taken by the smaller one to fill the tank 25 hrs and the larger tank is $(x-10)$ which is 15 hrs respectively.

1) Let the one side of a square be 'x' and one side of another.

As we have the Area of Square = A^2 square bet.

The sum of the areas of two squares = $468 m^2$.

According to case-I

$x^2 + y^2 = 468 m^2$ —(i)

According to case-II

$4y - 4x = 24$

$y - x = \frac{24}{4}$

$\boxed{y = 6 + x}$ —(other side of the square)

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

$\Rightarrow x^2 + \cancel{36} + x^2 \; \{(6)^2 + 2 \cdot 6 \cdot x + (x)^2\} - 468 =$

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

$\Rightarrow x^2 + 36 + 12x + x^2 - 468 = 0$

$\boxed{2x^2 + 12x - 432 = 0}$

$a = 2, \; b = 12, \; c = (-432)$

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

$\Rightarrow x = \frac{-12 \pm \sqrt{(12)^2 - 4(2)(-432)}}{2(2)}$

$\Rightarrow x = \frac{-12 \pm \sqrt{144 + 3456}}{4}$

$\Rightarrow x = \frac{-12 \pm \sqrt{3600}}{4}$

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$\Rightarrow x = \frac{-12 \pm 60}{4}$

So, the roots are-

$\frac{-12+60}{4}$ | $\frac{-12-60}{4}$

$\frac{48}{4} = 12$ | $= \frac{-72}{4} = (-18)$

So, the ~~roots~~ are side of the square is 12m and that of the other side of the square is $\{y = (6+x)\}$
$= 6+12$
$= 18m$.