H/W 28/6/21

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Chapter-4
Quadratic Equations

Exercise 4.1

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

$\Rightarrow x^2 + 1^2 + 2\times x\times 1 = 2x-6$
$\Rightarrow x^2+1+2x = 2x-6$
$\Rightarrow x^2+1+\cancel{2x}-\cancel{2x}+6=0$
$\Rightarrow x^2+7=0$

$x^2+0x+7=0$
Hence, it is a quadratic equation.

ii) $x^2-2x = (-2)(3-x)$

$\Rightarrow x^2-2x = -6+2x$
$\Rightarrow x^2-2x+6-2x=0$
$\Rightarrow x^2-4x+6=0$
Hence, it is a quadratic equation.

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

$\Rightarrow x^2+x-2x-2 = x^2+3x-x-3$
$\Rightarrow \cancel{x^2}+x-2x-2-\cancel{x^2}-3x+x+3=0$
$\Rightarrow -x-2-2x+3=0$
$\Rightarrow -3x+1=0$
Hence, it is not a quadratic equation.

iv) $(x-3)(2x+1) = x(x+5)$

$\Rightarrow 2x^2+x-6x-3 = x^2+5x$
$\Rightarrow 2x^2-5x-3 = x^2+5x$
$\Rightarrow 2x^2-5x-3-x^2-5x=0$
$\Rightarrow x^2-10x-3=0$
Hence, it is a quadratic equation.

v) $(2x-1)(x-3) = (x+5)(x-1)$

$\Rightarrow 2x^2-6x-x+3 = x^2-x+5x-5$
$\Rightarrow 2x^2-7x+3 = x^2+4x-5$
$\Rightarrow 2x^2-7x+3-x^2-4x+5=0$
$\Rightarrow x^2-11x+8=0$
Hence, it is a quadratic equation.

vi) $x^2+3x+1 = (x-2)^2$

$\Rightarrow x^2+3x+1 = x^2+(2)^2-2.x.2$
$\Rightarrow x^2+3x+1 = x^2+4-4x$
$\Rightarrow x^2+3x+1-x^2-4+4x=0$
$\Rightarrow 7x-3=0$
Hence, it is not a quadratic equation.

vii) $(x+2)^3 = 2x(x^2-1)$

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

$\Rightarrow x^3+8+6x^2+12x = 2x^3-2x$

$\Rightarrow x^3+8+6x^2+12x-2x^3+2x = 0$

$\Rightarrow -x^3+6x^2+14x+8 = 0$

Hence, it is not a quadratic equation.

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

$\Rightarrow x^3-4x^2-x+1 = x^3-(2)^3-3x^2(2)+3x(2)^2$

$\Rightarrow x^3-4x^2-x+1 = x^3-8-6x^2+12x$

$\Rightarrow x^3-4x^2-x+1-x^3+8+6x^2-12x = 0$

$\Rightarrow 2x^2-13x+9 = 0$

Hence, it is a quadratic equation.

2) i) Let the length of rectangle be x.
Let the breadth of rectangle be y.

$x = 2y+1$

$x \times y = 528$

$\Rightarrow (2y+1) \times y = 528$

$\Rightarrow \boxed{2y^2+y-528=0}$ Ans

ii) Let the two numbers be x, $x+1$.

$x(x+1) = 306$

$\Rightarrow x^2+x = 306$

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

This is the required quadratic equation.

iii) Let the present age of Rohan be x.
So, the age of his mother $= x+26$

After 3 years,

Rohan's age $= x+3$

Mother's age $= (x+26)+3 = x+29$

A/Q,

$(x+3)(x+29) = 360$

$\Rightarrow x^2 + 29x + 3x + 87 = 360$

$\Rightarrow x^2 + 32x + 87 = 360$

$\Rightarrow x^2 + 32x + 87 - 360 = 0$

$\Rightarrow \boxed{x^2 + 32x - 273 = 0}$

This is the required equation.

iv) Let the uniform speed be x Km/h.

Time $= \frac{480}{x}$ h

Case II :- Speed $= x - 8$ Km/hr

Time $= \left(\frac{480}{x} + 3\right)$ h

Speed × Time = Distance $\cancel{\frac{480}{x}} +$

$\Rightarrow (x-8)\left(\frac{480}{x} + 3\right) = 480$

$\Rightarrow \frac{480x}{x} + 3x - \frac{3840}{x} - 24 = 480$

$\Rightarrow 3x - \frac{3840}{x} = 480 - 480 + 24$

$\Rightarrow \frac{3x^2 - 3840}{x} = 24$

$\Rightarrow 3x^2 - 3840 = 24x$

$\Rightarrow 3x^2 - 24x - 3840 = 0$

$\Rightarrow 3(x^2 - 8x - 1280) = 0$

$\Rightarrow \boxed{x^2 - 8x - 1280 = 0}$

This is the required Quadratic equation.

Exercise 4.2

1) i) $x^2 - 3x - 10 = 0$

$a = 1,\ b = -3,\ c = -10.$

$x^2 + (2-5)x - 10 = 0$
$\Rightarrow x^2 + 2x - 5x - 10 = 0$
$\Rightarrow x(x+2) - 5(x+2) = 0$
$\Rightarrow (x+2)(x-5) = 0$

$x - 5 = 0,\quad x + 2 = 0$
$\Rightarrow \boxed{x = 5},\quad \boxed{x = -2}$

ii) $2x^2 + x - 6 = 0$

$a = 2,\ b = 1,\ c = -6$

$2x^2 + (4-3)x - 6 = 0$
$\Rightarrow 2x^2 + 4x - 3x - 6 = 0$
$\Rightarrow 2x(x+2) - 3(x+2) = 0$
$\Rightarrow (x+2)(2x-3) = 0$

$x + 2 = 0,\quad 2x - 3 = 0$
$\Rightarrow \boxed{x = -2},\quad \Rightarrow \boxed{x = \frac{3}{2}}$

iii) $\sqrt{2}x^2 + 7x + 5\sqrt{2} = 0$

$a = \sqrt{2},\ b = 7,\ c = 5\sqrt{2}$

$\sqrt{2}x^2 + (2+5)x + 5\sqrt{2} = 0$
$\Rightarrow \sqrt{2}x^2 + 2x + 5x + 5\sqrt{2} = 0$
$\Rightarrow \sqrt{2}x(x+\sqrt{2}) + 5(x+\sqrt{2}) = 0$
$\Rightarrow (\sqrt{2}x + 5)(x+\sqrt{2}) = 0$
$\sqrt{2}x + 5 = 0,\quad x + \sqrt{2} = 0$
$\Rightarrow \boxed{x = \frac{-5}{\sqrt{2}}},\quad \Rightarrow \boxed{x = -\sqrt{2}}$

iv) $2x^2 - x + \frac{1}{8} = 0$

~~$a = 2,\ b = -1,\ c = \frac{1}{8}$~~

$8\left(2x^2 - x + \frac{1}{8}\right) = 0 \times 8$

$\Rightarrow 16x^2 - 8x + 1 = 0$
$a = 16,\ b = -8,\ c = 1.$

$16x^2 - 8x + 1 = 0$
$\Rightarrow 16x^2 + (-4-4)x + 1 = 0$
$\Rightarrow 16x^2 - 4x - 4x + 1 = 0$
$\Rightarrow 4x(4x-1) - 1(4x-1) = 0$
$\Rightarrow (4x-1)(4x-1) = 0$
$4x - 1 = 0,\quad 4x - 1 = 0$
$\Rightarrow \boxed{x = \frac{1}{4}},\quad \Rightarrow \boxed{x = \frac{1}{4}}$

v) $100x^2 - 20x + 1 = 0$
$a = 100,\ b = -20,\ c = 1$
$100x^2 - 20x + 1 = 0$
$\Rightarrow 100x^2 + (-10-10)x + 1 = 0$
$\Rightarrow 100x^2 - 10x - 10x + 1 = 0$
$\Rightarrow 10x(10x-1) - 1(10x-1) = 0$

$\Rightarrow (10x-1)(10x-1)=0$

$\Rightarrow 10x-1=0, \quad 10x-1=0$

$\Rightarrow \boxed{x=\frac{1}{10}}, \quad \Rightarrow \boxed{x=\frac{1}{10}}$

2) i) Let the no. of marbles John had be x.

Let the no. of marbles Jivanti had be $45-x$.

After lost 5 marbles,

John had $= x-5$

Jivanti had $= 45-x-5$
$= 40-x$

$(x-5)(40-x)=124$

$\Rightarrow 40x-x^2-200+5x=124$

$\Rightarrow -x^2+45x-200=124$

$\Rightarrow -x^2+45x-200-124=0$

$\Rightarrow -x^2+45x-324=0$

$\Rightarrow -1(x^2-45x+324=0)$

$x^2-45x+324=0$

$a=1, \quad b=-45, \quad c=324$

$x^2-45x+324=0$

$\Rightarrow x^2+(-9-36)x+324=0$

$\Rightarrow x^2-9x-36x+324=0$

$\Rightarrow x(x-9)-36(x-9)=0$

$\Rightarrow (x-9)(x-36)=0$

$x-9=0, \quad x-36=0$

$\Rightarrow \boxed{x=9}, \quad \Rightarrow \boxed{x=36}$

If John have 36 marbles then Jivanti have 9 marbles.
If John have 9 marbles then Jivanti have 36 marbles.

ii) Let the number of toys produced be x. and
Cost of each toy will be $55-x$

$x(55-x)=750$

$\Rightarrow 55x-x^2=750$

$\Rightarrow -x^2+55x-750=0$

$\Rightarrow -1(x^2-55x+750=0)$

$x^2-55x+750=0$

$a=1, \quad b=-55, \quad c=750$

$x^2-55x+750=0$

$\Rightarrow x^2+(-30-25)x+750=0$

$\Rightarrow x^2-30x-25x+750=0$

$\Rightarrow x(x-30)-25(x-30)=0$

$\Rightarrow (x-30)(x-25)=0$

$x-30=0, \quad x-25=0$

$\Rightarrow \boxed{x=30}, \quad \Rightarrow \boxed{x=25}$

Number of toys will be either 30 or 25.

3) Let the first number be x
Then another number will be $27-x$.

$$x(27-x) = 182$$
$$\Rightarrow 27x - x^2 = 182$$
$$\Rightarrow -x^2 + 27x - 182 = 0$$
$$\Rightarrow -1(x^2 - 27x + 182) = 0$$
$$x^2 - 27x + 182 = 0$$
$$a = 1,\ b = -27,\ c = 182$$

$$x^2 - 27x + 182 = 0$$
$$\Rightarrow x^2 + (-14-13)x + 182 = 0$$
$$\Rightarrow x^2 - 14x - 13x + 182 = 0$$
$$\Rightarrow x(x-14) - 13(x-14) = 0$$
$$\Rightarrow (x-14)(x-13) = 0$$
$$x - 14 = 0,\quad x - 13 = 0$$
$$\Rightarrow \boxed{x = 14},\quad \Rightarrow \boxed{x = 13}$$

Hence, the required numbers are 13 and 14.

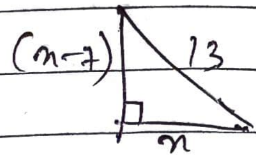
4) Let the consecutive integer be $x, x+1$.

$$x^2 + (x+1)^2 = 365$$
$$\Rightarrow x^2 + x^2 + 1 + 2x = 365$$
$$\Rightarrow 2x^2 + 2x + 1 = 365$$
$$\Rightarrow 2x^2 + 2x + 1 - 365 = 0$$
$$\Rightarrow 2x^2 + 2x - 364 = 0 \quad \Rightarrow 2(x^2 + x - 182) = 0$$
$$\Rightarrow a = 2,\ b = 2,\ c = -182.$$
$$\cancel{2x^2 + 2x - 364}\quad x^2 + x - 182 = 0$$
$$\Rightarrow x^2 + (14-13)x - 182 = 0$$
$$\Rightarrow x^2 + 14x - 13x - 182 = 0$$
$$\Rightarrow x(x+14) - 13(x+14) = 0$$
$$\Rightarrow (x+14)(x-13) = 0$$

$x + 14 = 0$, $x - 13 = 0$

$\Rightarrow \boxed{x = -14}$, $\Rightarrow \boxed{x = 13}$

5) Let the base of triangle be x,
Then the altitude be $(x-7)$



By pythagoras theorem,

$$(13)^2 = x^2 + (x-7)^2$$
$$\Rightarrow 169 = x^2 + (x)^2 + (7)^2 - 2.x.7$$
$$\Rightarrow 169 = x^2 + x^2 + 49 - 14x$$
$$\Rightarrow 169 = 2x^2 - 14x + 49$$
$$\Rightarrow 2x^2 - 14x + 49 - 169 = 0$$
$$\Rightarrow 2x^2 - 14x - 120 = 0$$
$$\Rightarrow 2(x^2 - 7x - 60) = 0$$

$a = 2$, $b = -7$, $c = 60$

$$x^2 - 7x - 60 = 0$$
$$\Rightarrow x^2 + (5-12)x - 60 = 0$$
$$\Rightarrow x^2 + 5x - 12x - 60 = 0$$
$$\Rightarrow x(x+5) - 12(x+5) = 0$$
$$\Rightarrow (x+5)(x-12) = 0$$

$x + 5 = 0$, $x - 12 = 0$

$\Rightarrow \boxed{x = -5}$, $\Rightarrow \boxed{x = 12}$

Base $= \boxed{12 \text{ cm}}$

Altitude $= x - 7$

$= 12 - 7$

$= \boxed{5 \text{ cm}}$

6) Let the number of articles be x.
then the cost of each article be $2x+3$.

$90 = x(2x+3)$

$90 = 2x^2+3x \Rightarrow 2x^2+3x-90=0$

Total cost = Total items x Cost of each item

$2x^2+3x-90=0$

$a=2, b=3, c=-90$

$\Rightarrow 2x^2+(15-12)x-90=0$

$\Rightarrow 2x^2+15x-12x-90=0$

$\Rightarrow x(2x+15)-6(2x+15)=0$

$\Rightarrow (2x+15)(x-6)=0$

$2x+15=0, \quad x-6=0$

$\Rightarrow \boxed{x=-\frac{15}{2}}, \quad \Rightarrow \boxed{x=6}$

Number of articles = 6

Cost of each article $= 2x+3$

$= 2(6)+3$

$= 12+3$

$= 15$

Exercise 4.3

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

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

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

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

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

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

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

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

$$x - \frac{7}{4} = \pm\frac{5}{4}$$

$$x = \frac{7}{4} + \frac{5}{4}, \quad \frac{7}{4} - \frac{5}{4}$$

$$x = \frac{\cancel{12}\,3}{\cancel{4}}, \quad \frac{\cancel{2}\,1}{\cancel{4}\,2}$$

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

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

$$\frac{\cancel{2}x^2}{\cancel{2}} + \frac{x}{2} - \frac{\cancel{4}\,2}{\cancel{2}} = \frac{0}{2}$$

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

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

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

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

$$\sqrt{\left(x + \frac{1}{4}\right)^2} = \sqrt{\frac{1+32}{16}}$$

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

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

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

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

$$\frac{\cancel{4}x^2}{\cancel{4}} + \frac{\cancel{4}\sqrt{3}x}{\cancel{4}} + \frac{3}{4} = 0$$

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

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

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

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

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

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

$$\left(x + \frac{\sqrt{3}}{2}\right)\left(x + \frac{\sqrt{3}}{2}\right) = 0$$

$$x + \frac{\sqrt{3}}{2} = 0, \quad x + \frac{\sqrt{3}}{2} = 0$$

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

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

$$\frac{2x^2}{2} + \frac{x}{2} + \frac{4}{2} = \frac{0}{2}$$

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

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

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

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

$$\left(x + \frac{1}{4}\right)^2 = \frac{1-32}{16}$$

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

The square of a number
$\cancel{x + \frac{1}{4}}$ cannot be negative.
∴ No real roots for this equation.

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

$$ax^2 + bx + c = 0$$
$$a = 2,\ b = -7,\ c = 3$$

By quadratic formula,

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

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

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

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

$$x = \frac{7 \pm 5}{4}$$

$$x = \frac{7+5}{4}, \frac{7-5}{4}$$

$$x = \frac{\cancel{12}\,3}{\cancel{4}}, \frac{\cancel{2}\,1}{\cancel{4}\,2}$$

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

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

$a = 2,\ b = 1,\ c = -4.$

By Quadratic formula,

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

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

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

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

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

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

$a = 4,\ b = 4\sqrt{3},\ c = 3.$

By Quadratic formula,

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

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

$$x = \frac{-4\sqrt{3} \pm \sqrt{48-48}}{8}$$

$$x = \frac{-\cancel{4}\sqrt{3}}{\cancel{8}\,2}$$

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

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

$a = 2, b = 1, c = 4$

By Quadratic formula,

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

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

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

$$x = \frac{-1 \pm \sqrt{-31}}{4}$$

The square of a number can't be negative.

∴ There is no real roots for this equation.

3) i) $x - \frac{1}{x} = 3, x \neq 0$

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

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

$x^2 - 1 = 3x$

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

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

By Quadratic formula,

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

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

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

$$x = \frac{3 \pm \sqrt{13}}{2}$$

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

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

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

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

$$\Rightarrow \frac{\cancel{-11}\,-1}{x^2-3x-28} = \frac{\cancel{11}\,1}{30}$$

$$\Rightarrow \frac{x^2-3x-28}{-1} = 30$$

$$\Rightarrow x^2-3x-28 = 30(-1)$$

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

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

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

$$\Rightarrow x^2+(-2-1)x+2 = 0$$

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

$$\Rightarrow x(x-2)-1(x-2) = 0$$

$$\Rightarrow (x-2)(x-1) = 0$$

~~Ans~~ $x-2=0, \quad x-1=0$

$\Rightarrow x=2, \quad \Rightarrow x=1$

4) Let the present age ~~be x~~ of Rehman be x.

3 years ago, his age was $= (x-3)$
5 years later, his age will be $= (x+5)$
A/q,

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

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

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

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

$\Rightarrow 3(2x+2) = 1(x^2+2x-15)$
$\Rightarrow 6x+6 = x^2+2x-15$
$\Rightarrow x^2+2x-6x-15-6=0$
$\Rightarrow x^2-4x-21=0$
$\Rightarrow x^2+(3-7)x-21=0$
$\Rightarrow x^2+3x-7x-21=0$
$\Rightarrow x(x+3)-7(x+3)=0$
$\Rightarrow (x+3)(x-7)=0$
$x+3=0$, $x-7=0$
$\Rightarrow x=-3$, $\Rightarrow x=7$
Age can't be negative.
So, Rehman's present age is 7 years.

5) Let her marks in maths = x

~~both~~ Then, her marks in English = $(30-x)$

~~A/Q~~

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

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

$\Rightarrow 27x - x^2 + 54 - 2x = 210$

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

$\cancel{\Rightarrow -1(x^2 - 25x - 54) = 210}$

$\cancel{\Rightarrow x^2 - 25x - 54 - 210 = 0}$

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

$\Rightarrow -x^2 + 25x + 54 - 210 = 0$

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

$\Rightarrow -1(x^2 - 25x + 156) = 0$

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

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

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

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

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

$x - 12 = 0, \quad x - 13 = 0$

$\Rightarrow x = 12, \quad \Rightarrow x = 13$

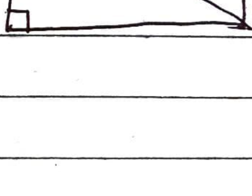
If maths = 12, then eng = 30-12 = 18.

If maths = 13, then eng = 30-13 = 17

6) Let the Shorter Side = x

Then, the longest Side = $(x+30)$

and Diagonal = $(x+60)$



By pythagoras theorem,

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

$\Rightarrow x^2 + x^2 + (30)^2 + 2.x.30 = x^2 + (60)^2 + 2.x.60$

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

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

$\Rightarrow 2x^2 - x^2 + 60x - 120x + 900 - 3600 = 0$
$\Rightarrow x^2 - 60x - 2700 = 0$

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

$x+30 = 0, \quad x-90 = 0$
$\Rightarrow x = -30, \quad \Rightarrow x = 90$
Side can't be negative.
$\therefore$ Shorter Side $= x = \boxed{90}$
longest Side $= (x+30) = \boxed{120}$
Diagonal $= (x+60) = 150$

7) Let the larger number be x.
And the ~~long~~ Smaller number $= y$.

$y^2 = 8x$
$x^2 - y^2 = 180$

$x^2 - 8x = 180$
$\Rightarrow x^2 - 8x - 180 = 0$
$\Rightarrow x^2 + (10-18)x - 180 = 0$
$\Rightarrow x^2 + 10x - 18x - 180 = 0$
$\Rightarrow x(x+10) - 18(x+10) = 0$
$\Rightarrow (x+10)(x-18) = 0$

$x+10 = 0, \quad x-18 = 0$
$\Rightarrow x = -10, \quad \Rightarrow x = 18$
$y^2 = 8(18)$

$y^2 = 144$
$\Rightarrow \sqrt{y^2} = \sqrt{144}$
$\Rightarrow \boxed{y = 12}$

So, larger no. = 18
Smaller no. = 12

8) Let the speed of train = x Km/hr
Distance = 360 Km
Time = $\frac{360}{x}$

New Speed = $x+5$
Time = $\frac{360}{x+5}$

A/Q,
$\frac{360}{x} - \frac{360}{x+5} = 1$

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

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

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

$\Rightarrow 1800 = x^2+5x$
$\Rightarrow x^2+5x-1800 = 0$
$\Rightarrow x^2+(45-40)x-1800 = 0$
$\Rightarrow x^2+45x-40x-1800 = 0$
$\Rightarrow x(x+45) - 40(x+45) = 0$
$\Rightarrow (x+45)(x-40) = 0$
$x+45 = 0$, $x-40 = 0$
$\Rightarrow x = -45$, $\Rightarrow x = 40$
Speed can't be negative.
The speed of train = 40 Km/hr

9) Let the time taken by smaller tap = x hrs
Then, the time taken by larger tap = $(x-10)$ hrs
Time taken to fill the tank together = $9\frac{3}{8} = \frac{75}{8}$

Part of tank filled by smaller tap in 1 hour = $\frac{1}{x}$
Part of tank filled by larger tap in 1 hour = $\frac{1}{x-10}$
Part of tank filled by both taps in 1 hour = $\frac{8}{75}$

A/Q,

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

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

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

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

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

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

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

$$\Rightarrow 8x^2 + (-200-30)x + 750 = 0$$

$$\Rightarrow 8x^2 - 200x - 30x + 750 = 0$$

$$\Rightarrow 8x(x-25) - 30(x-25) = 0$$

$$\Rightarrow (x-25)(8x-30) = 0$$

$x - 25 = 0$, $8x - 30 = 0$

$\Rightarrow x = 25$, $\Rightarrow x = \frac{30}{8}$ 3.75,

$$\Rightarrow x = 3.75$$

Time taken by smaller tap = 25 hrs
Time taken by larger tap = $(x-10)$
= 15 hrs

10)

10) Let the Speed of passenger train be x Km/hr
Then, the Speed of Express train $= (x+11)$ Km/hr
Distance $= 132$ Km

A.Q.,

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

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

$$\Rightarrow \frac{\cancel{132x} + 1452 - \cancel{132x}}{x^2+11x} = 1$$

$$\Rightarrow \frac{1452}{x^2+11x} = 1$$

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

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

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

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

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

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

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

Speed of passenger train $= 33$ Km/hr
Speed of Express train $= (x+11) = 33+11$
$= 44$ Km/hr

11) Let the side of 1st square = x m
And the side of 2nd square = y m

Area	Perimeter
x^2	$4x$
y^2	$4y$

A/Q,
$4x - 4y = 24$
$\Rightarrow 4(x-y) = 24$
$\Rightarrow x - y = \frac{24}{4}$

$\Rightarrow x - y = 6$

$x = 6 + y \quad \ldots i)$

$x^2 + y^2 = 468$
$\Rightarrow (6+y)^2 + y^2 = 468$
$\Rightarrow (6)^2 + (y)^2 + 2.6.y + y^2 = 468$
$\Rightarrow 36 + y^2 + 12y + y^2 = 468$
$\Rightarrow 2y^2 + 12y + 36 - 468 = 0$
$\Rightarrow 2y^2 + 12y - 432 = 0$

$\Rightarrow 2(y^2 + 6y - 216) = 0$
$\Rightarrow y^2 + 6y - 216 = 0$

$\Rightarrow y^2 + (18-12)y - 216 = 0$
$\Rightarrow y^2 + 18y - 12y - 216 = 0$
$\Rightarrow y(y+18) - 12(y+18) = 0$
$\Rightarrow (y+18)(y-12) = 0$

$y + 18 = 0$, $\quad y - 12 = 0$
$\Rightarrow y = -18$ $\quad \Rightarrow y = 12$

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

1) i)

Side of first side = 18m
and Side of Second Side = 12m

Exercise 4.4

1) i) $2x^2 - 3x + 5 = 0$

$a = 2, b = -3, c = 5$

$D = b^2 - 4ac$
$D = (-3)^2 - 4(2)(5)$
$D = 9 - 40$
$D = -31$

$\therefore$ No Real roots for this equation.

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

$a = 3, b = -4\sqrt{3}, c = 4$
$D = b^2 - 4ac$
$D = (4\sqrt{3})^2 - 4(3)(4)$
$D = 48 - 48$
$D = 0$

$\therefore$ Real and same roots exist for this equation.

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

$x = \frac{-(-4\sqrt{3}) \pm \sqrt{0}}{2(3)}$

$x = \frac{\cancel{4}^{2}\sqrt{3}}{\cancel{6}_{3}} = \frac{2\sqrt{3}}{3}$

$x = \frac{2\sqrt{\cancel{3}}}{\sqrt{3} \times \cancel{3}} = \frac{2}{\sqrt{3}}, \frac{2}{\sqrt{3}}$

Hence, the roots are $\frac{2}{\sqrt{3}}, \frac{2}{\sqrt{3}}$.

iii) $2x^2 - 6x + 3 = 0$

$a = 2, b = -6, c = 3.$

$D = b^2 - 4ac$
$D = (-6)^2 - 4(2)(3)$
$D = 36 - 24$
$D = 12$

$\therefore$ Real and distinct roots exist for this equation.

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

$x = \frac{-(-6) \pm \sqrt{12}}{2(2)}$

$x = \frac{6 \pm 2\sqrt{3}}{4}$

$x = \frac{\cancel{2}(3 \pm \sqrt{3})}{\cancel{4}\,2}$

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

$x = \frac{3 + \sqrt{3}}{2}, \frac{3 - \sqrt{3}}{2}$

Hence, roots are $\frac{3+\sqrt{3}}{2}, \frac{3-\sqrt{3}}{2}$

2) i) $2x^2 + Kx + 3 = 0$

$a = 2, b = K, c = 3.$

$D = 0$
$b^2 - 4ac = 0$
$K^2 - 4(2)(3) = 0$
$K^2 - 24 = 0$
$\sqrt{K^2} = \sqrt{24}$
$K = \sqrt{2 \times 2 \times 2 \times 3}$
$K = \pm 2\sqrt{6}$

ii) $Kx(x-2) + 6 = 0$

$Kx^2 - 2Kx + 6 = 0$
$a = K, b = -2K, c = 6$

$D = 0$
$b^2 - 4ac = 0$
$(-2K)^2 - 4(K)(6) = 0$
$4K^2 - 24K = 0$
$4K(K-6) = 0$
$4K = 0, K - 6 = 0$
$K = \frac{0}{4}, \boxed{K = 6}$

$K = 0$

K can't be zero.
$\therefore K = 6$

3) Let the breadth be xm,
then, the length $= 2x$m
Area $= 800\ m^2$
A/Q,
$(x)(2x) = 800$
$\Rightarrow 2x^2 = 800$
$\Rightarrow x^2 = \frac{\cancel{800}^{400}}{\cancel{2}}$

$\Rightarrow x^2 = 400$
$\Rightarrow x^2 - 400 = 0$

$a = 1, b = 0, c = -400$

$D = b^2 - 4ac$
$D = (0)^2 - 4(1)(-400)$
$D = 0 + 1600$
$D = 1600$
The equation have real root.
$\therefore$ Rectangular mango grove can be designed.

$x^2 - 400 = 0$
$\Rightarrow \sqrt{x^2} = \sqrt{400}$
$\Rightarrow x = \sqrt{20 \times 20}$
$\Rightarrow x = 20$

Breadth $= 20$m
Length $= 2(20)$
$= 40$m

4) Let the age of first friend be x yrs
Then, the age of second friend $= (20-x)$ yrs

~~Four years ago, First fr $(x-4)$ $(20-x-4)$~~

Four years ago,
first friend's age $= (x-4)$ yrs
Second friend's age $= (20-x-4)$ yrs

A/Q,

$(x-4)(20-x-4) = 48$

$\Rightarrow (x-4)(16-x) = 48$

$\Rightarrow 16x - x^2 - 64 + 4x = 48$

$\Rightarrow -x^2 + 20x - 64 = 48$

$\Rightarrow -x^2 + 20x - 64 - 48 = 0$

$\Rightarrow -x^2 + 20x - 112 = 0$

$\Rightarrow -1(x^2 - 20x + 112 = 0)$

$x^2 - 20x + 112 = 0$

$a = 1, \; b = -20, \; c = 112$

$D = b^2 - 4ac$

$D = (-20)^2 - 4(1)(112)$

$D = 400 - 448$

$\boxed{D = -48}$

No real roots are possible for this equation.
Hence, this situation is not possible.

5) Let, length $= x$ m
breadth $= y$ m $= 40 - x$

Perimeter $= 2(l+b)$
$= 80$

A/Q,

$2(l+b) = 80$

$\Rightarrow 2(x+y) = 80$

$\Rightarrow \cancel{2}x + \cancel{2}y = \frac{\cancel{80}}{2} 40$

$\Rightarrow x + y = 40$

$\Rightarrow y = 40 - x$

Area $= l \times b$

$\Rightarrow x(40-x) = 400$

A/Q,

$x(40-x) = 400$

$\Rightarrow 40x - x^2 = 400$

$\Rightarrow -x^2 + 40x - 400 = 0$

$\Rightarrow -1(x^2 - 40x + 400 = 0)$

$\Rightarrow x^2 - 40x + 400 = 0$

$a = 1, \; b = -40, \; c = 400$

$D = b^2 - 4ac$

$D = (-40)^2 - 4(1)(400)$

$D = 1600 - 1600$

$D = 0$

The equation has real roots.
Hence, this situation is possible.

$x^2 - 40x + 400 = 0$

$a = 1, \; b = -40, \; c = 400$

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

$$x = \frac{-(-40) \pm \sqrt{0}}{2(1)}$$

$$x = \frac{\cancel{40}^{20}}{\cancel{2}}$$

$$x = 20$$

So, Length $= x = 20$ m
Breadth $= 40 - 20$
$= 20$ m