Solution

QUADRATIC EQUATIONS

Class 10 - Mathematics

Section A

1. **(a)** $-2 < k < 2$

   Explanation:

   For no real roots, we must have: $b^2 - 4ac < 0$.

   $k^2 - 4 < 0 \Rightarrow k^2 < 4 \Rightarrow -2 < k < 2$.

2. **(c)** $b^2 - 4ac$

   Explanation:

   Discriminant of the quadratic equation $ax^2 + bx + c = 0$ is $D = b^2 - 4ac$

3. **(d)** $x^2 - 4x + 3\sqrt{2} = 0$

   Explanation:

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

   $a = 1, b = -4, c = 3\sqrt{2}$

   $\therefore b^2 - 4ac = (-4)^2 - 4 \times 1 \times 3\sqrt{2} = 16 - 12\sqrt{2}$

   $\Rightarrow b^2 - 4ac = 16 - 12 \times 1.41 = 16 - 16.97 = -0.97$

   Since $b^2 - 4ac < 0$ therefore, $x^2 - 4x + 3\sqrt{2} = 0$ has no real roots.

4. **(d)** $9x^2 + 28x + 25 = 0$

   Explanation:

   We have, $3x^{\frac{1}{2}} + 5x^{-\frac{1}{2}} = \sqrt{2}$

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

   $\Rightarrow 3x + 5 = (2x)^{\frac{1}{2}}$ ...(i)

   Squaring both sides of (i), we have

   $9x^2 + 25 + 30x = 2x$

   $\Rightarrow 9x^2 + 28x + 25 = 0$

5. **(a)** $a = \pm 1$

   Explanation:

   In the equation $ax^2 + 2x + a = 0$

   $D = b^2 - 4ac = (2)^2 - 4 \times a \times a = 4 - 4a^2$

   Roots are real and equal

   $D = 0$

   $\Rightarrow 4 - 4a^2 = 0$

   $\Rightarrow 4 = 4a^2$

   $\Rightarrow 1 = a^2$

   $\Rightarrow a^2 = 1$

   $\Rightarrow a^2 = (\pm 1)^2$

   $\Rightarrow a = \pm 1$

6. **(a)** $x^3 - x^2 = (x - 1)^3$

   Explanation:

In equation $x^3 - x^2 = (x-1)^3$
$\Rightarrow x^3 - x^2 = x^3 - 1 - 3x^2 + 3x$
$\Rightarrow -x^2 + 3x^2 - 3x + 1 = 0$
$\Rightarrow 2x^2 - 3x + 1 = 0$
It is a quadratic equation as its degree is 2.

7. **(a)** 210 sq.cm
Explanation:
Let base of the right triangle be x cm.
Given: Perpendicular = x + 29 = 70 ⇒ Perpendicular = $(41 - x)$ cm
Now, using Pythagoras theorem,
$(29)^2 = x^2 + (41-x)^2$
$\Rightarrow 841 = 1681 + x^2 - 82x + x^2$
$\Rightarrow 2x^2 - 82x + 840 = 0$
$\Rightarrow x^2 - 41x + 420 = 0$
$\Rightarrow x^2 - 20x - 21x + 420 = 0$
$\Rightarrow x(x-20) - 21(x-20) = 0$
$\Rightarrow (x-20)(x-21) = 0$
$\Rightarrow x - 20 = 0$ and $x - 21 = 0$
$\Rightarrow x = 20$ and $x = 21$
Therefore, the two sides other than hypotenuse are of 20 cm and 21 cm.
∴ Area of right triangle = $\frac{1}{2}$ × Base × Perpendicular = $\frac{1}{2}$ × 20 × 21 = 210 sq. cm

8.
(d) 2
Explanation:
If $\frac{1}{2}$ is a root of the equation $x^2 + kx - \frac{5}{4} = 0$ then, substituting the value of $\frac{1}{2}$ in place of x should give us the value of k.
Given, $x^2 + kx - \frac{5}{4} = 0$ where, $x = \frac{1}{2}$
$\Rightarrow \left(\frac{1}{2}\right)^2 + k\left(\frac{1}{2}\right) - \frac{5}{4} = 0$
$\Rightarrow \frac{k}{2} = \frac{5}{4} - \frac{1}{4}$
∴ k = 2

9. **(a)** $x^2 - 4x - 5 = 0$
Explanation:
put x = -1 in
$x_2 - 4x - 5 = 0$
$\Rightarrow (-1)^2 - 4(-1) - 5 = 0$
⇒ 1 + 4 - 5 = 20
⇒ 5 - 5 = 0
⇒ 0 = 0
∴ x = -1 satisfies
$x^2 - 4x - 5 = 0$
So, x = -1 is a root fo the equation $x^2 - 4x - 5 = 0$

10.
(c) 40 km/hr
Explanation:
Let the actual speed of the train be x km/hr
Time taken to cover 360 km at this speed = $\frac{360}{x}$ hrs.
Time taken to cover 360 km at the increased speed = $\frac{360}{x+5}$ hrs.
According to condition, $\frac{360}{x} - \frac{360}{x+5} = 1$
$\Rightarrow 360\left[\frac{1}{x} - \frac{1}{x+5}\right] = 1$

$\Rightarrow 360\left[\frac{x+5-x}{x(x+5)}\right]$ = 1
$\Rightarrow 360\left[\frac{5}{x(x+5)}\right]$ = 1
$\Rightarrow$ x^2 + 5x - 1800 = 0
$\Rightarrow$ x^2 + 45x - 40x - 1800
$\Rightarrow$ x(x + 45) - 40(x + 45) = 0
$\Rightarrow$ (x - 40)(x + 45) = 0
$\Rightarrow$ x - 40 = 0 and x + 45 = 0
$\Rightarrow$ x = 40 km/hr and x = -45 km/hr [But x = -45 is not possible]
Therefore, the actual speed of the train is 40 km/hr.

11. **(a)** $k \geq \frac{-9}{2}$
Explanation:
For real roots, we must have, $b^2 - 4ac \geq 0$.
$(-6)^2 - 4 \times k \times (-2) \geq 0 \Rightarrow 36 + 8k \geq 0$
$\Rightarrow 8k \geq -36 \Rightarrow k \geq \frac{-9}{2}$.

12.
(b) $\frac{c(a-b)}{a(b-c)}$
Explanation:
Given equation is
a(b - c)x^2 + b(c - a)x + c(a - b) = 0
Let α be the other root, then
Product of roots =$\alpha \times 1$ =$\frac{c(a-b)}{a(b-c)}$
$\Rightarrow \alpha = \frac{c}{a}\left(\frac{a-b}{b-c}\right)$

13. **(a)** $\frac{25}{2}$
Explanation:
$\frac{25}{2}$

14.
(c) $\frac{1}{x} + \frac{1}{17-x} = \frac{17}{62}$
Explanation:
Let one number be x, As the sum of the numbers is 17, then the other number will be (17 - x). Their reciprocals will be $\frac{1}{x}$ and $\frac{1}{17-x}$.
$\therefore$ According to question, $\frac{1}{x} + \frac{1}{17-x} = \frac{17}{62}$

15.
(b) x^2 - 6x + 7 = 0
Explanation:
Let α = $3 - \sqrt{2}$ and β = $3 + \sqrt{2}$
$\alpha + \beta$ = $(3 - \sqrt{2})$ + $(3 + \sqrt{2})$ = 6
$\alpha\beta$ = $(3 - \sqrt{2})(3 + \sqrt{2})$
= 9 - 2
= 7
$\therefore$ Quadratic equation is = x^2 - $(\alpha + \beta)$x + $\alpha\beta$
Quadratic = x^2 - 6x + 7

16.
(c) 16 m
Explanation:

$2(l + b) = 82 \Rightarrow l + b = 41 \Rightarrow l = (41 - b)$.
And, $lb = 400 \Rightarrow (41 - b)b = 400$
$\Rightarrow b^2 - 41b + 400 = 0 \Rightarrow b^2 - 25b - 16b + 400 = 0$
$\Rightarrow b(b - 25) - 16(b - 25) = 0$
$\Rightarrow (b - 25)(b - 16) = 0$
$\therefore b = 25$ or $b = 16$.
But for $b = 25$ we have $l = (41 - 25) = 16 < b$.
$\therefore$ breadth = 16 m.

17. **(a)** $2p + q, 2p - q$
Explanation:
Given: $x^2 - 4px + 4p^2 - q^2 = 0$
$\Rightarrow (x - 2p)^2 - q^2 = 0$
Using $a^2 - b^2 = (a + b)(a - b)$,
$\Rightarrow (x - 2p + q)(x - 2p - q) = 0$
$\Rightarrow x - 2p + q = 0$ and $x - 2p - q = 0$
$\Rightarrow x = 2p - q$ and $x = 2p + q$

18. **(a)** 20
Explanation:
Given: $n(n + 1) = 420$
$\Rightarrow n^2 + n = 420$
$\Rightarrow n^2 + n - 420 = 0$
$\Rightarrow n^2 + 21n - 20n - 420 = 0$
$\Rightarrow n(n + 21) - 20(n + 21) = 0$
$\Rightarrow (n - 20)(n + 21) = 0$
$\Rightarrow n - 20 = 0, n + 21 = 0$
$\Rightarrow n = 20$ and $n = -21$ [$n = -21$ is not possible]
Therefore, the value of n is 20.

19.
(d) $b^2 - 4ac = 0$
Explanation:
The roots of the quadratic equation $ax^2 + bx + c = 0$, In this formula the term $b^2 - 4ac$ is called the discriminant. If $b^2 - 4ac = 0$, so the equation has a single repeated root. If $b^2 - 4ac > 0$, the equation has two real roots. If $b^2 - 4ac < 0$, the equation has two complex roots.
Hence, For D = 0, roots are real and equal (coincident).

20.
(c) 0, 8
Explanation:
If a quadratic equation $ax^2 + bx + c = 0$, $a \neq 0$ has two equal roots, then its discriminant value will be equal to zero i.e., $D = b^2 - 4ac = 0$
Given, $2x^2 – kx + k = 0$
For equal roots,
$D = b^2 - 4ac = 0$
$\Rightarrow (-k)^2 - 4(2)(k) = 0$
$\Rightarrow k^2 - 8k = 0$
$\Rightarrow k(k - 8) = 0$
$\therefore k = 0,8$

21. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

Assertion $2x^2 - 3x + 5 = 0$

$\alpha + \beta = \frac{-b}{a}$

$= \frac{-(-3)}{2} = \frac{3}{2}$

and $\alpha\beta = \frac{c}{a} = \frac{5}{2}$

22.

(b) Both A and R are true but R is not the correct explanation of A.

Explanation:

Assertion: Given equation: $x^2 - bx + c = 0$

Let α, β be two roots such that

$|\alpha - \beta| = 1$

$(\alpha + \beta)^2 - 4\alpha\beta = 1$

$b^2 - 4ac = 1$

Reason: Given equation:

$4abc\, x^2 + (b^2 - 4ac)x - b = 0$

$D = (b^2 - 4ac) + 16ab^2c$

$D = (b^2 - 4ac)^2 > 0$

Hence roots are real and unequal.

23.

(d) A is false but R is true.

Explanation:

We have, $x^2 + 3x + 1 = (x - 2)^2 = x^2 - 4x + 4$

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

$\Rightarrow 7x - 3 = 0$

it is not of the form $ax^2 + 6x + c = 0$

So, A is false but R is true.

24. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

Assertion $9x^2 + 3kx + 4 = 0$

$D = b^2 - 4ac$

$= (3k)^2 - 4(9)(4)$

$= 9k^2 - 144$

For equal roots D = 0

$9k^2 = 144$

$k = \pm\frac{12}{3}$

$k = \pm 4$

25.

(c) A is true but R is false.

Explanation:

Assertion: We have,

$4x^2 - 10x + (k - 4) = 0$

Product of zeroes = 1

So, $\frac{k-4}{4} = 1$

$k = 8$

Assertion is correct.

Reason: For quadratic equation, $x^2 - x + 1 = 0$

We have, Discriminant = $(-1)^2 - 4 = -3 < 0$

So, no real roots are possible.

Reason is incorrect.

Hence, Assertion is correct and reason is incorrect.

26.

(c) A is true but R is false.

Explanation:

Assertion:

$4x^2 - 12x + 9 = 0$

$D = b^2 - 4ac$

$= (-12)^2 - 4(4)(9)$

$= 144 - 144 = 0$

Roots are repeated.

27. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

Both A and R are true and R is the correct explanation of A.

28.

(b) Both A and R are true but R is not the correct explanation of A.

Explanation:

As one root is $\frac{2}{3}$, $x = \frac{2}{3}$

$6 \times (\frac{2}{3})^2 - \frac{2}{3} - k = 0$

$6 \times \frac{4}{9} - \frac{2}{3} = k$

$k = \frac{8}{3} - \frac{2}{3} = \frac{6}{3} = 2$

$k = 2$

So, both A and R are true but R is not the correct explanation of A.

29.

(b) Both A and R are true but R is not the correct explanation of A.

Explanation:

Both A and R are true and R is the correct explanation of A.

Assertion $(2x - 1)^2 - 4x^2 + 5 = 0$

$-4x + 6 = 0$

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

$2x(x - 3) = 0$

$x = 0$

and $x = 3$

30. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

$8x^2 + 3kx + 2 = 0$

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

$D = (3k)^2 - 4 \times 8 \times 2 = 9k^2 - 64$

For equal roots, D = 0

$9k^2 - 64 = 0$

$9k^2 = 64$

$k^2 = \frac{64}{9}$

$k = \pm\frac{8}{3}$

So, both A and R are true and R is the correct explanation of A.

Section B

31. 36

Explanation:

Let the ten's digit of the required number be x and its unit's digit be y.

As per given condition

A two-digit number is four times the sum of its digits

Then, 10x + y = 4(x + y)

$\Rightarrow$ 6x - 3y = 0

$\Rightarrow$ 2x - y = 0......... (i)

And A two-digit number is twice the product of its digits.

Also, 10x + y = 2xy. .... (ii)

Putting y = 2x from (i) in (ii), we get

$10x + 2x = 4x^2$

$\Rightarrow 4x^2 - 12x = 0$

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

$\Rightarrow$ x - 3 = 0

$\Rightarrow$ x = 3 [ten's digit, $x \neq 0$]

Putting x = 3 in (i), we get y = 6.

Thus, ten's digit = 3 and unit's digit = 6.

Hence, the required number is 36.

32. 20

Explanation:

We have,

2 + 4 + 6 + 8 + ... to n terms = 420

$\Rightarrow \frac{n}{2}[2 \times 2+(n-1) \times 2]=420$

$\Rightarrow$ n (2 + n - 1) = 420

$\Rightarrow$ n (n + 1) = 420

$\Rightarrow n^2 + n - 420 = 0$

$\Rightarrow n^2 + 21n - 20n - 420 = 0$

$\Rightarrow$ n(n + 21) - 20 (n + 21) = 0

$\Rightarrow$ (n + 21) (n - 20) = 0

$\Rightarrow$ n = 20, -21

$\Rightarrow$ n = 20 [$\because$ n is a natural number, $\therefore$ n > 0]

33. 3

Explanation:

we have to find that non-zero value of k, for which the quadratic equation $kx^2 + 1 - 2(k - 1)x + x^2 = 0$ has equal roots.

Given, $kx^2 + 1 - 2(k - 1)x + x^2 = 0$

$(k + 1)x^2 - 2(k - 1)x + 1 = 0$

For equal roots $D = b^2 - 4ac = 0$

Here, a = k + 1, b = -2(k - 1), c = 1

$4(k - 1)^2 - 4(k + 1) \times 1 = 0$

or, $4k^2 - 8k + 4 - 4k - 4 = 0$

or, $4k^2 - 12k = 0$

or, 4k (k - 3) = 0

$\therefore$ k = 3 [k = 0 is rejected as it is coefficient of x^2]

34. 6

Explanation:

According to question,

3 + 5 + 7 + 9 +... to n terms = 48

$\Rightarrow \frac{n}{2}[2 \times 3 + (n - 1)2] = 48$ [Using: $S_n = \frac{n}{2}\{2a + (n - 1)d\}$ where a = 3 and d = 2]

$\Rightarrow n(6 + 2n - 2) = 96$

$\Rightarrow n(4 + 2n) = 96$

$\Rightarrow 2n^2 + 4n = 96$

$\Rightarrow n^2 + 2n - 48 = 0$

Factorise the equation,

$\Rightarrow n^2 + 8n - 6n - 48 = 0$

$\Rightarrow n(n + 8) - 6(n + 8) = 0$

$\Rightarrow (n + 8)(n - 6) = 0$

$\Rightarrow n = -8$ or, $n = 6$

Therefore, n = 6 [$\because n > 0$]

35. 0

Explanation:

$(k + 1)x^2 + 2(k + 1)x + 1 = 0$

has equal roots if D = 0

i.e $b^2 = 4ac$

Here, a = (k + 1), b = 2(k + 1), c = 1

or, $4(k + 1)^2 = 4(k + 1)$

$k^2 + 2k + 1 = k + 1$

$k^2 + 2k + 1 - k - 1 = 0$

$k^2 + k = 0$

$k(k + 1) = 0$

k = 0, -1

Since k = -1 does not satisfy the equation

$\Rightarrow k = 0$

36. 6

Explanation:

$kx(x - 2) + 6 = 0$

$\Rightarrow kx^2 - 2kx + 6 = 0$

Comparing quadratic equation $kx^2 - 2kx + 6 = 0$ with general form $ax^2 + bx + c = 0$, we get a = k, b = -2k and c = 6

Discriminant = $b^2 - 4ac = (-2k)^2 - 4(k)(6) = 4k^2 - 24k$

We know that two roots of quadratic equation are equal only if discriminant is equal to zero.

Putting discriminant equal to zero

$4k^2 - 24k = 0$

$\Rightarrow 4k(k - 6) \Rightarrow k = 0, 6$

The basic definition of quadratic equation says that quadratic equation is the equation of the form $ax^2 + bx + c = 0$, where $a \neq 0$

Therefore, in equation $kx^2 - 2kx + 6 = 0$, we cannot have k = 0.

Therefore, we discard k = 0.

Hence the answer is k = 6.

37. 3

Explanation:

Let α and 6α be the roots of equation.

We have, $px^2 - 14x + 8 = 0$ where a = p, b = -14, c = 8

Sum of zeroes $= -\frac{b}{a} = -\frac{-14}{p}$

$\alpha + 6\alpha = \frac{14}{p}$

$7\alpha = \frac{14}{p}$

$\alpha = \frac{2}{p}$ ..... (i)

Also, Product of the zeroes $= \frac{8}{p} = \frac{c}{a}$

$\alpha \times 6\alpha = \frac{8}{p}$

$6\alpha^2 = \frac{8}{p}$

From (i)

$6(\frac{2}{p})^2 = \frac{8}{p}$

$6 \times \frac{4}{p^2} = \frac{8}{p}$

$\frac{6}{p^2} = \frac{2}{p}$

$\frac{6}{2} = \frac{p^2}{p}$

Hence, p = 3

38. 12

Explanation:

Ram and Bhagat together do the work m 4 days

$\therefore$ Ram and Bhagat will do in one days = $\frac{1}{4}$ work

Let Bhagat alone does the same work in x days.

$\therefore$ Ram will take = (x - 6) days

$\therefore \frac{1}{x} + \frac{1}{x-6} = \frac{1}{4}$

$\Rightarrow \quad \frac{x-6+x}{x(x-6)} = \frac{1}{4}$

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

$\Rightarrow x^2 - 6x - 8x + 24 = 0$

$\Rightarrow x^2 - 14x + 24 = 0$

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

$\Rightarrow x^2 - 12x - 2x + 24 = 0$

$\Rightarrow x^2 - 12x - 2x + 24 = 0$

$\Rightarrow x(x - 12) - 2(x - 12) = 0$

$\Rightarrow x = 12, x = 2$

$\therefore$ If Bhagat complete the work in 2 days

Ram will take = 2 - 6 = -4 days (impossible)

Hence, Bhagat can finish in 12 days

39. 3

Explanation:

Let the usual speed of the man be x km/hr.

Time taken to cover 3 km at usual speed = $\frac{3}{x}$ hours.

Actual speed of the man = (x + 1) km/hr.

Time taken to cover 3 km at actual speed = $\frac{3}{(x+1)}$ hours.

$\therefore \frac{3}{x} - \frac{3}{(x+1)} = \frac{15}{60}$

$\Rightarrow \frac{3}{x} - \frac{3}{(x+1)} = \frac{1}{4}$

$\Rightarrow \frac{1}{x} - \frac{1}{(x+1)} = \frac{1}{12}$

$\Rightarrow \frac{(x+1)-x}{x(x+1)} = \frac{1}{12}$

$\Rightarrow \frac{1}{(x^2+x)} = \frac{1}{12}$

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

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

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

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

$\Rightarrow x + 4 = 0$ or $x - 3 = 0$

$\Rightarrow x = - 4$ or $x = 3$

$\Rightarrow x = 3$ [$\because$ speed cannot be negative]

Hence, the usual speed of the man is 3 km/hr.

40. we have to solve the quadratic equation $2x^2 + ax - a^2 = 0$ for x.

A = 2, B = a, C = - a^2

$\therefore$By the formula, $x = \frac{-B \pm \sqrt{B^2 - 4AC}}{2A}$

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

$= \frac{-a \pm \sqrt{a^2 + 8a^2}}{4}$

$= \frac{-a \pm \sqrt{9a^2}}{4}$

$= \frac{-a \pm 3a}{4}$

x = $\frac{-a+3a}{4}, \frac{-a-3a}{4}$

$\therefore \quad x = \frac{a}{2}, -a$

41. D = -68

since D < 0, the equation does not have real roots.

42. We have $\frac{16}{x} - 1 = \frac{15}{x+1}, x \neq 0, -1$

$\Rightarrow \frac{16-x}{x} = \frac{15}{x+1}$

$\Rightarrow (16 - x)(x + 1) = 15x$

$\Rightarrow 16x + 16 - x^2 - x = 15x$

$\Rightarrow 15x - 16x - 16 + x^2 + x = 0$

$\Rightarrow x^2 - 16 = 0$

$\Rightarrow$ x^2 = 16

$\therefore$ x = ± 4

43. The given equation is $x^2 + k(2x + k - 1) + 2 = 0$

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

So, a = 1, b = 2 k, c = k(k - 1) + 2

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

$\Rightarrow D = (2k)^2 - 4 \times 1 \times [k(k - 1) + 2]$

$\Rightarrow D = 4k^2 - 4[k^2 - k + 2]$

$\Rightarrow D = 4k^2 - 4k^2 + 4k - 8$

$\Rightarrow D = 4k - 8 = 4(k - 2)$

For equal roots, D = 0

Thus, 4(k - 2) = 0

So, k = 2.

44. Let the required integer be x.

Then,

$x + x^2 = 90$

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

$\Rightarrow x^2 + 10x - 9x - 90 = 0$

$\Rightarrow$ x(x + 10) - 9(x + 10) = 0

$\Rightarrow$ (x + 10)(x - 9) = 0

$\Rightarrow$ x = -10 or x = 9

Hence, required integers are -10 or 9.

45. According to the question,A car covers a distance of 2592 km with a uniform speed. The number of hours taken for the journey is one half the number representing the speed in km/ hour.

Let the speed of the car be x km/hr.

There fore time taken = $\frac{x}{2}$ hour

$\therefore speed = \frac{\text{Distance}}{\text{Time}}$

$x = \frac{2592}{\frac{x}{2}}$

$\Rightarrow \quad x^2 = 2592 \times 2$

$x^2 = 5184$

$x^2 = \sqrt{5184}$

x = 72

Hence the time taken will be $\frac{72}{2} = 36$ hours.

46. We have, $\sqrt{2}x^2 + 7x + 5\sqrt{2} = 0$

$\implies \sqrt{2}x^2 + 2x + 5x + 5\sqrt{2} = 0$

$\implies \sqrt{2}x(x + \sqrt{2}) + 5(x + \sqrt{2}) = 0$

$\implies (\sqrt{2}x + 5)(x + \sqrt{2}) = 0$

$Either\ \sqrt{2}x + 5 = 0\ or\ x + \sqrt{2} = 0$

$\implies x = \frac{-5}{\sqrt{2}}, -\sqrt{2}$

$\therefore x = \frac{-5}{\sqrt{2}}, -\sqrt{2}$ are the required roots.

47. Let the time taken by the tap of smaller diameter to fill the tank separately be ‘x’ hours and the time taken by the tap of larger diameter to fill the tank separately be (x - 5) hours.

A.T.Q.

$\frac{1}{x} + \frac{1}{x-5} = \frac{3}{10}$

$\Rightarrow 3x^2 - 35x + 50 = 0$

$\Rightarrow (x - 10)(3x - 5) = 0$

$\Rightarrow x = 10$ or $x = \frac{5}{3}$

But $x = \frac{5}{3}$ is not possible, so x = 10

$\therefore$ time taken by the tap of smaller diameter to fill the tank separately is 10 hours

and time taken by the tap of larger diameter to fill the tank separately is 10 - 5 = 5 hours.

48. In the figure we found that if the breadth of the hall is x m, then x satisfies the equation $2x^2 + x – 300 = 0$

Applying the factorisation method, we write this equation as

$2x^2 – 24x + 25x – 300 = 0$

$2x (x – 12) + 25 (x – 12) = 0$

i.e., $(x – 12)(2x + 25) = 0$

So, the roots of the given equation are x = 12 or x = – 12.5.

Since x is the breadth of the hall, it cannot be negative.

Thus, the breadth of the hall is 12 m and its length = 2x + 1 = 25 m

49. Let the ten's digit of the required number be x and its unit's digit be y.

As per given condition

A two-digit number is four times the sum of its digits

Then, $10x + y = 4(x + y)$

$\Rightarrow 6x - 3y = 0$

$\Rightarrow 2x - y = 0$......... (i)

And A two-digit number is twice the product of its digits.

Also, $10x + y = 2xy$. .... (ii)

Putting y = 2x from (i) in (ii), we get

$10x + 2x = 4x^2$

$\Rightarrow 4x^2 - 12x = 0$

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

$\Rightarrow x - 3 = 0$

$\Rightarrow x = 3$ [ten's digit, $x \neq 0$]

Putting x = 3 in (i), we get y = 6.

Thus, ten's digit = 3 and unit's digit = 6.

Hence, the required number is 36.

Section C

50. Given equation is $(2p + 1)x^2 – (7p + 2)x + (7p – 3) = 0$

Comparing with standard quadratic equation $ax^2 + bx + c = 0$

$a = (2p + 1), b = – (7p + 2)$ and $c = (7p – 3)$

Given that the roots of equation are real and equal

Thus D = 0

Discriminant, $D = b^2 – 4ac = 0$

$[– (7p + 2)]^2 – 4.(2p + 1).(7p – 3) = 0$

Using $(a + b)^2 = a^2 + 2ab + b^2$, we get

$(49p^2 + 28p + 4) – 4(14p^2 + p – 3) = 0$

$49p^2 + 28p + 4 – 56p^2 – 4p + 12 = 0$

$– 7p^2 + 24p + 16 = 0$

$7p^2 – 24p – 16 = 0$

$7p^2 – 28p + 4p – 16 = 0$

$7p(p – 4) + 4(p – 4) = 0$

$(7p + 4) (p – 4) = 0$

$(7p + 4) = 0$ or $(p – 4) = 0$

$p = \frac{-4}{7}$ or $p = 4$

The values of p are $\frac{-4}{7}$ or 4 for which roots of the quadratic equation are real and equal.

51. We have, $x^2 + 2x + (a^2 + 1) = 0$

Discriminant, D is given by;

$(2)^2 - 4(1)(a^2 + 1)$

$= 4 - 4(a^2 + 1)$

$= 4 - 4a^2 - 4$

$= - 4a^2$

$= a^2 \geq 0$

Now, D = 0 when a = 0.

So, the equation will have real and equal roots if a = 0.

And for all other values of a, the equation will have no real roots.

52. Let the digit at tens' place be 'x' and digit at ones' place be 'y'.

Hence, the number is 10x + y.

It is given that the number is 5 times the sum of its digits.

So,10x + y = 5(x + y)$\Rightarrow$ 10x+y=5x+5y$\Rightarrow$ 4y = 5x.

$\Rightarrow$ y = $\frac{5x}{4}$ ......(i)

Also, given that the number is 5 more than twice the product of its digits.

Hence, 10x + y = 2xy + 5

$\Rightarrow 10x + \frac{5x}{4} = 2x \times \frac{5x}{4} + 5$ [using (i)]

$\Rightarrow \frac{40x\ +5x}{4}\ = \frac{10x^2+20}{4}$

$\Rightarrow\ 45x =\ 10x^2\ + 20$

$\Rightarrow\ 10x^2 - 45x + 20 = 0$

$\Rightarrow\ 2x^2 - 9x + 4 = 0$

Dividing both sides by 5

$\Rightarrow 2x^2 - 8x - x + 4 = 0$

$\Rightarrow 2x(x - 4) - 1(x - 4) = 0$

$\Rightarrow\ 2x - 1 = 0$ or x - 4 = 0

$\Rightarrow\ x = \frac{1}{2}$ or x = 4

$x \neq\ \frac{1}{2}$ (since it is not a digit)

So, x = 4

so, from (i),

$y =\ \frac{5x}{4} = \frac{5\times4}{4} = 5$

Hence the number 10x + y= $\ 10 \times 4 + 5 =\ 45$

53. We have,

$\sqrt{x^2 - 4x + 3} + \sqrt{x^2 - 9} = \sqrt{4x^2 - 14x + 16}$

$\Rightarrow \sqrt{x^2 - 4x + 3} + \sqrt{x^2 - 9} - \sqrt{4x^2 - 14x + 16} = 0$

Substituting x = 3 in the given equation, we get

$\sqrt{(3)^2 - 4(3) + 3} + \sqrt{(3)^2 - 9} - \sqrt{4(3)^2 - 14 \times 3 + 16}$

$= \sqrt{9 - 12 + 3} + \sqrt{9 - 9} - \sqrt{36 - 42 + 16}$

$\sqrt{12-12}+\sqrt{0}-\sqrt{52-42}$
$=0+0-\sqrt{10}$
$=-\sqrt{10}\neq 0$
For x = 3,
$\sqrt{x^2-4x+3}+\sqrt{x^2-9}-\sqrt{4x^2-14x+16}\neq 0$
Therefore, x = 3 is not a solution or root of the given equation.

54. $3^{x+2}+3^{-x}=10$

$3^x.3^2 + 3^{-x} = 10$

$\Rightarrow$ 9y + $\frac{1}{y}$ = 10 where $3^x = y$

$\Rightarrow 9y^2-9y-y+1=0$

$\Rightarrow 9y(y-1)-1(y-1)=0$

$\Rightarrow (9y-1)=0\ or\ y-1=0$

$\Rightarrow$ y = $\frac{1}{9}$ or y = 1

If $3^x = \frac{1}{9} \Rightarrow 3^x = (3)^{-2} \Rightarrow x = -2$

If $3^x = 1 = 3^0 \Rightarrow x = 0$

Hence , -2, 0 are the roots of given equation.

55. According to the question,

$16x^2=24x+1$

$\Rightarrow 16x^2-24x-1=0$

Here, a = 16, b = -24 and c = -1

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

$= (-24)^2 - 4 \times 16 \times (-1)$

= 576 + 64

= 640 > 0

$\therefore$ D > 0

So, the given equation has real roots given by

$\alpha=\frac{-b+\sqrt{D}}{2a}=\frac{-(-24)+\sqrt{640}}{2\times 16}$

$=\frac{24+\sqrt{640}}{32}$

$=\frac{24+8\sqrt{10}}{32}$

$=\frac{8[3+\sqrt{10}]}{32}$

$=\frac{3+\sqrt{10}}{4}$

$\therefore\ \alpha=\frac{3+\sqrt{10}}{4}$

And, $\beta=\frac{-b-\sqrt{D}}{2a}$

$=\frac{-(-24)-\sqrt{640}}{2\times 16}$

$=\frac{24-8\sqrt{10}}{32}$

$=\frac{3-\sqrt{10}}{4}$

$\therefore\ x=\frac{3+\sqrt{10}}{4},\frac{3-\sqrt{10}}{4}$

56. Let the width of the path be x meters,

We know that, if length of rectangle = l, width of rectangle =b & width of path around it x then,

Area of path = $lb\ -(l-2x)(b-2x)$

$\Rightarrow 16 \times 10 - (16 - 2x)(10 - 2x) = 120$

$\Rightarrow 16 \times 10 - \{160 - 32x - 20x + 4x^2\} = 120$

$\Rightarrow 160 - 160 + 32x + 20x - 4x^2 = 120$

$\Rightarrow -4x^2 + 52x - 120 = 0$

$\Rightarrow 2x^2 - 26x + 60 = 0$

$\Rightarrow x^2 - 13x + 30 = 0$

$\Rightarrow x^2 - 10x - 3x + 30 = 0 \Rightarrow x(x - 10) - 3(x - 10) = 0$

$\Rightarrow (x - 10) (x - 3) = 0$

$\Rightarrow$ x - 10 = 0 or x - 3 = 0

But x ≠10 ,as width of path can't be greater than width of rectangle. So, x = 3m

Hence, the width of the path = 3 m

57. Assume denominator = x then, numerator = x - 1

$\therefore$ Fraction = $\frac{x-1}{x}$

According to given situation, we have

$\frac{x-1+3}{x+3} = \frac{x-1}{x} + \frac{3}{28}$

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

$\Rightarrow \frac{(x+2)x-(x-1)(x+3)}{(x+3)x} = \frac{3}{28}$

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

$\Rightarrow 3\times 28 = 3(x^2 + 3x)$

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

Factorize the above quadratic equation, we get

$\Rightarrow (x + 7)(x - 4) = 0 \Rightarrow x = -7$ or $x = 4$

Rejecting x = -7 $\therefore$ x = 4

$\therefore$ Fraction is $\frac{4-1}{4} = \frac{3}{4}$

58. Let the digit at tens' place be x.

So, the digit at ones' place $= \frac{8}{x}$. (Product of the digits is 18)

$\therefore$ Number $= 10x + \frac{8}{x}$

And, number obtained by interchanging the digits $= 10 \times \frac{8}{x} + x$

Now, according to the question ;-

$\therefore 10x + \frac{8}{x} - 18 = 10 \times \frac{8}{x} + x$

$\Rightarrow 10x + \frac{8}{x} - \frac{80}{x} - x - 18 = 0$

$\Rightarrow 9x + \frac{8-80}{x} - 18 = 0$

$\Rightarrow 9x - \frac{72}{x} - 18 = 0$

$\Rightarrow 9x^2 - 72 - 18x = 0$ [Multiplying both sides of equation by x]

$\Rightarrow 9(x^2 - 8 - 2x) = 0$

$\Rightarrow x^2 - 2x - 8 = 0$

$\Rightarrow x^2 - 4x + 2x - 8 = 0$

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

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

$\Rightarrow x = 4$ or $x = -2$

But, a digit in a number can never be negative. $\therefore x \neq -2$

Thus, x = 4

Hence, the required number$= 10x + \frac{8}{x} = 10 \times 4 + \frac{8}{4}$

= 40 + 2

= 42

59. Given: $\frac{x+3}{x-2} - \frac{1-x}{x} = 4\frac{1}{4}$

$\Rightarrow \frac{(x+3)}{(x-2)} - \frac{(1-x)}{x} = \frac{17}{4}$

$\Rightarrow \frac{x(x+3)-(1-x)(x-2)}{(x-2)x} = \frac{17}{4}$

$\Rightarrow \frac{x^2+3x-\left(x-2-x^2+2x\right)}{x^2-2x} = \frac{17}{4}$

$\Rightarrow \frac{x^2+3x+x^2-3x+2}{x^2-2x} = \frac{17}{4}$

$\Rightarrow \frac{2x^2+2}{x^2-2x} = \frac{17}{4}$

$\Rightarrow 8x^2 + 8 = 17x^2 - 34x$ [On cross multiplying]

$\Rightarrow -9x^2 + 34x + 8 = 0$

$\Rightarrow 9x^2 - 36x + 2x - 8 = 0$

$\Rightarrow 9x(x - 4) + 2(x - 4) = 0$

$\Rightarrow (x - 4)(9x + 2) = 0$

$\Rightarrow$ x - 4 = 0 or 9x + 2 = 0

$\Rightarrow$ x = 4 or x = $\frac{-2}{9}$

Hence, the roots of the equation are 4 and $\frac{-2}{9}$

Section D

60. i. (18 + x) (12 + x) = 2(18 $\times$ 12)

ii. x^2 + 30x - 216 = 0

iii. Solving : x^2 + 30x - 216 = 0

$\Rightarrow$ (x + 36)(x - 6) = 0

x $\neq$ -36 $\therefore \Rightarrow$ x = 6.

new dimensions are 24 cm $\times$ 18 cm

OR

If (18 + x)(12 + x) = 220

then x^2 + 30x - 4 = 0

Here D = 900 + 16 = 916 which is not a perfect square.

Thus we can't have any such rational value of x.

61. i. Let the no of articles produced be x

Price of each article = 2x + 1

Price of all articles produced = ₹ 210

x(2x + 1) = 210

$2x^2$ + x - 210 = 0

ii. On solving

$2x^2$ + x - 210 = 0

$x = \frac{-1 \pm \sqrt{1-(4)(2)(-210)}}{2 \times 2}$

$x \ = \ \frac{-1 \pm \sqrt{1680}}{4}$

$x \ = \ \frac{-1 \pm \sqrt{1681}}{4}$

$x \ = \ \frac{-1 \pm 41}{4}$

x = $\frac{40}{4}$ = 10

x = 10

x = $\frac{-42}{4}$

neglected as no of article's cannot be -ve

$\therefore$ no of articles = 10

$\therefore$ cost of each article = 2x + 1

= 2 $\times$ 10 + 1

= ₹ 21

iii. Since cost of 1 article = 21

$\therefore$ cost of 15 article = 21 $\times$ 15

= ₹ 315

OR

Since 21 is the manufacturing cost of 1 article

$\therefore$ 1 is the manufacturing cost of $\frac{1}{21}$ article

$\therefore$ 1575 is the manufacturing cost $\frac{1}{21}$ $\times$ 1575

= 75 article

62. i. Length of flower bed = x m

Length of grassland = 2x + 3

Total length of field = length of grassland + length of flower bed =(2x + 3) + x

= (3x + 3) m

ii. Perimeter of whole figure = 2(l + b)

= 2(3x + 3 + x)

= 2(4x + 3)

= (8x + 6)m

iii. A = (3x + 3)x

$1260 = 3x^2 + 3x$

$420 = x^2 + x$

$x^2 + x - 420 = 0$

(x + 21) (x - 20) = 0

They x = 20 is only possible value.

OR

Area of grassland = $l \times b$

= 43×20

= 860 m^2

Area of flowerbed = $(side)^2$

= $(20)^2$

= 400 m^2

63. i. If Arjuna has x arrows

He used half of his arrows to cut down Bheeshm's arrow

$\therefore$ Arjuna used $\frac{x}{2}$ arrows to cut down arrows thrown by Bheeshm.

ii. According to question

The no of arrows Arjuna used to laid Bheeshm unconscious on arrow bed is

$4\sqrt{x} + 1$

iii. The total no of arrows Arjuna had is given by equation

$y^2 - 8y - 20 = 0$

$y^2 - 10y + 2y - 20 = 0$

y(y - 10) + 2(y - 10) = 0

(y + 2) (y - 10) = 0

y = -2; y = 10

$\therefore x = y^2 = 10^2 = 100$

$\therefore$ Arjuna had 100 arrows.

on taking Y=-2, we get x=4, which is not possible, because x must be greater than 9.

OR

Let Arjuna has x arrows

No of arrows he used to cut arrow of Bheeshm = $\frac{x}{2}$

No of arrows used to kill rath driver = 6

No of arrows used to laid Bheeshm unconscious = $4\sqrt{x} + 1$

No of other arrows used = 6

$\therefore \frac{x}{2} + 6 + 3 + 4\sqrt{x} + 1 = x$

$\Rightarrow x + 18 + 8\sqrt{x} = 2x$

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

on putting $x = y^2$, equation becomes

$y^2 = 18 + 8y$

$y^2 - 8y - 18 = 0$

64. i. $200x^2 = 128(x + 1)^2$

ii. $25x^2 = 16x^2 + 32x + 16$

$\Rightarrow 9x^2 - 32x - 16 = 0$

iii. a. $9x^2 - 32x - 16 = 0$

$\Rightarrow (9x + 4)(x - 4) = 0$

$x \neq \frac{-4}{9}$ so, x = 4

OR

b. x = $\frac{32\pm\sqrt{1024+576}}{18} = \frac{32\pm40}{18}$

$x \neq \frac{-4}{9}$ so, x = 4

65. i. h = $5t^2 + 14t + 3$

When ball touches ground h = 0

= $-5t^2 + 14t + 3 = 0$

= $5t^2 - 14t - 3 = 0$

= $5t^2 - 15t + t - 3 = 0$

$5t(t - 3) + 1(t - 3) = 0$

$(5t + 1)(t - 3) = 0$

t = $\frac{-1}{5}$ Not possible

t = 3s

Hence the ball touches the ground after 3s.

ii. Ball is at maximum height at t = $\frac{3}{2}$ sec

$\because$ time of ascent = time of decent

$h_{max} = -5t^2 + 14t + 3$

= $-5\left(\frac{3}{2}\right)^2 + 14 \times \left(\frac{3}{2}\right) + 3$

= $-5 \times \frac{9}{4} + 14 \times \frac{3}{2} + 3$

= $\frac{-45}{4} + 24$

$\frac{-45+96}{4}$

= $\frac{51}{4}$

= 12.75 m

iii. At h_{max}, vertical component of velocity is always zero.

OR

h = $-5t^2 + 14t + 3$

(h) t = 18 = $-5(1)^2 + 14(1) + 3$

= $-5 + 14 + 3$

h = 12 m

i.e., ball is at a height of 12 m from the ground.

Section E

66. Let the ten's digit be x and the one's digit be y.

The number will be 10x + y

Given, a product of digits is 24

$\therefore$ xy = 24

or, y = $\frac{24}{x}$ ...(i)

Given that when 18 is subtracted from the number, the digits interchange their places.

$\therefore$ 10x + y - 18 = 10y + x

or, 9x - 9y = 18

Substituting y from equation (i) in equation (ii), we get

$9x - 9\left(\frac{24}{x}\right)$ = 18

or, $x - \frac{24}{x}$ = 2

or, $x^2 - 24 - 2x = 0$

or, $x^2 - 2x - 24 = 0$

or, $x^2 - 6x + 4x - 24 = 0$

or, x(x - 6) + 4(x - 6) = 0

or, (x - 6)(x + 4) = 0

or, x - 6 = 0 and x + 4 = 0

or, x = 6 and x = -4

Since, the digit cannot be negative, so, x = 6

Substituting x = 6 in equation (i), we get

y = $\frac{24}{6}$ = 4

$\therefore$ The number = 10(6) + 4 = 60 + 4 = 64

67. If the present age of sister be x,then ,by the first condition of the question,we have,
present age of the girl = 2x
By the second condition of the question,we have,
(2x + 4)(x + 4) = 160
$2x^2 + 8x + 4x + 16 = 160$
$2x^2 + 12x - 144 = 0$
$2x^2 + (24 - 12)x - 144 = 0$
2x(x + 12) - 12(x + 12) = 0
(2x - 12)(x +12) = 0
$\therefore$ x = 6; x = -12
Since age can't be negative,therefore
x=6
So, Age of sister = 6 and Age of girl = 2(6)=12

68. Since the given equation has equal roots,
$D = b^2 - 4ac = 0$
Here, a = (3k + 1), b = 2(k + 1), c = 1
$[2(k+1)]^2 - 4(3k+1)(1) = 0$
or, $4\left(k^2 + 2k + 1\right) - (12k + 4) = 0$
or, $4k^2 + 8k + 4 - 12k - 4 = 0$
$\therefore 4k^2 - 4k = 0$
k = 0,1
Put k = 0, in the given equation,
$x^2 + 2x + 1 = 0$
or, $(x+1)^2 = 0$
or, x = -1
Again put k = 1, in the given equation,
$4x^2 + 4x + 1 = 0$
$(2x+1)^2 = 0$
or, $x = -\frac{1}{2}$
Hence, roots = $-1, -\frac{1}{2}$

69. For equal roots $k^2 - 64 = 0$
$\Rightarrow k = \pm 8$
Equations are $2x^2 + 8x + 8 = 0$ and $2x^2 - 8x + 8 = 0$
$\Rightarrow 2(x + 2)^2 = 0$ or $2(x - 2)^2 = 0$
$\Rightarrow$ x = -2 or x = 2

70. Let the larger number be x. Then,
Square of the smaller number = 4x
Also, Square of the larger number = x^2
It is given that the difference of the squares of the numbers is 45.
$\therefore x^2 - 4x = 45$
$\Rightarrow x^2 - 4x - 45 = 0$
$\Rightarrow x^2 - 9x + 5x - 45 = 0$
$\Rightarrow$ x (x - 9) + 5 (x - 9) = 0
$\Rightarrow$ x - 9 = 0 or, x + 5 = 0 $\Rightarrow$ x = 9, -5
Case I When x = 9: In this case, we have
Square of the smaller number = 4x = 36
$\therefore$ Smaller number = ± 6.
Thus, the numbers are 9, 6 or 9, - 6
CASE II When x = -5: In this case, we have
Square of the smaller number = 4x = - 20. But, square of a number is always positive. Therefore, x = - 5 is not possible.
Hence, the numbers are 9, 6 or 9, - 6.

71. x = - 4 is the root of the equation $x^2 + 2x + 4p = 0$

$(-4)^2 + (2 \times -4) + 4p = 0$
or, p = -2
Equation $x^2 - 2(1+3k)x + 7(3+2k) = 0$ has equal roots.
$\therefore 4(1+3x)^2 - 28(3+2k) = 0$
or, $9k^2 - 8k - 20 = 0$
or, (9k +10)(k-2) = 0
or, $k = \frac{-10}{9}, 2$
Hence, the value of k = $-\frac{10}{9}, 2$

72. Let the original price of the book = ₹ x
$\therefore$ Number of books bought for ₹ 600 = $\frac{600}{x}$
Reduced price of the book = ₹ (x - 5)
$\therefore$ Number of books bought for ₹ 600 = $\frac{600}{x-5}$
It is given that
$\frac{600}{x-5} - \frac{600}{x} = 4$
$\Rightarrow \frac{600x - 600x + 3000}{x^2 - 5x}$ = 4
$\Rightarrow$ 3000 = $4x^2$ - 20x
$\Rightarrow$ $4x^2$ - 20x - 3000 = 0
$\Rightarrow$ x^2 - 5x - 750 = 0
$\Rightarrow$ x^2 - 30x + 25x - 750 = 0
$\Rightarrow$ x(x - 30) + 25(x - 30) = 0
$\Rightarrow$ x - 30 = 0 or x + 25 = 0
$\Rightarrow$ x = 30 or x = -25
Since the price of a book cannot be negative, x $\neq$ -25
$\Rightarrow$ x = 30
Hence, the original price of a book is ₹ 30

73. Let S_1 and S_2 be two squares. Let the side of the square S_2 be x cm in length. Then,
the side of square S_1 is (x + 4) cm.
Therefore, area of square S_1 = $(x + 4)^2$ [Because, Area = $(\text{side})^2$]
and, Area of square S_2 = x^2
It is given that
Area of square S_1 + Area of square S_2 =400 cm^2
$\Rightarrow$ $(x + 4)^2 + x^2 = 400$
$\Rightarrow$ $(x^2 + 8x + 16) + x^2 = 400$
$\Rightarrow$ $2x^2 + 8x - 384 = 0$
$\Rightarrow$ $x^2 + 4x - 192 = 0$
$\Rightarrow$ $x^2 + 16x - 12x - 192 = 0$
$\Rightarrow$ x(x + 16) - 12(x + 16) = 0
$\Rightarrow$ (x + 16) (x - 12) = 0
$\Rightarrow$ x = 12 or, x = -16
As the length of the side of a square cannot be negative. Therefore, x = 12.
Therefore, side of square S_1 = x + 4 = 12 + 4 = 16 cm and, Side of square S_2 = 12 cm.Hence the side of square S_1 and S_2 are 16 cm and 12 cm respectively.

74. $\frac{1}{a+b+x} - \frac{1}{x} = \frac{1}{a} + \frac{1}{b}$
$\frac{x-a-b-x}{x(a+b+x)} = \frac{b+a}{ab}$
-ab = x^2 + (a + b)x
x^2 + (a + b)x + ab = 0
(x + a) (x + b) = 0
x = -a, x = -b

75. Let the boy and his sister's ages be 'x' years and 'y' years, respectively

According to the question,

x + y = 25 ...(i)

and xy = 150

or, y = $\frac{150}{x}$ ...(ii)

Using equation (ii) in equation (i), we get

$x + \frac{150}{x}$ = 25

⇒ x^2 - 25x + 150 = 0

⇒ x^2 - 15x - 10x + 150 = 0

⇒ x(x - 15) -10(x - 15) = 0

⇒ x - 15 = 0 or x - 10 = 0

⇒ x = 15 or x = 10

When x = 15 i.e., boy's age is 15 years.

Then, sister's age, y = $\frac{150}{15}$ = 10 years

When x = 10 i.e, boy's age is 10 years

Then, sister's age, y = $\frac{150}{10}$ = 15 years