Solution

QUADRATIC EQUATIONS WS 4

Class 10 - Mathematics

1. Given, $3\sqrt{2}x^2 - 5x - \sqrt{2} = 0$

   By splitting the middle term, we have

   $3\sqrt{2}x^2 - 6x + x - \sqrt{2} = 0$

   $\Rightarrow 3\sqrt{2}x(x - \sqrt{2}) + 1(x - \sqrt{2}) = 0$

   $\Rightarrow (3\sqrt{2}x + 1)(x - \sqrt{2}) = 0$

   $\therefore\ 3\sqrt{2}x + 1 = 0$ or $x - \sqrt{2} = 0$

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

2. $x^2 - 3x - 10 = 0$

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

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

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

   $\Rightarrow x = 5, -2$

3. Here we have, $ax^2 + (4a^2 - 3b)x - 12ab = 0$

   $\Rightarrow ax^2 + 4a^2x - 3bx - 12ab = 0$

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

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

   $\Rightarrow x = \frac{3b}{a}$ or $-4a$ are two roots of the equation.

4. $6x^2 - x - 2 = 0$

   or, $6x^2 + 3x - 4x - 2 = 0$

   or, $3x(2x + 1) - 2(2x + 1) = 0$

   or, $(2x + 1)(3x - 2) = 0$

   $\Rightarrow$ either $3x - 2 = 0$ or $2x + 1 = 0$

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

   Therefore, Roots of equation are $\frac{2}{3}$ and $-\frac{1}{2}$.

5. Given, $\frac{x+1}{x-1} + \frac{x-2}{x+2} = 4 - \frac{2x+3}{x-2}$

   $\Rightarrow \frac{x^2+3x+2+x^2-3x+2}{x^2+x-2} = \frac{4x-8-2x-3}{x-2}$

   $\Rightarrow (2x^2 + 4)(x - 2) = (2x - 11)(x^2 + x - 2)$

   or, $5x^2 + 19x - 30 = 0$

   $\Rightarrow 5x^2 + 25x - 6x - 30 = 0$

   $\Rightarrow (x+5)(5x-6) = 0$

   $\Rightarrow x = -5, \frac{6}{5}$

6. We have, $16x - \frac{10}{x} = 27$

   $\Rightarrow \frac{16x^2 - 10}{x} = 27$

   $\Rightarrow 16x^2 - 10 = 27x$

   $\Rightarrow 16x^2 - 27x - 10 = 0$

   $\Rightarrow 16x^2 - 32x + 5x - 10 = 0$

   $\Rightarrow 16x(x - 2) + 5(x - 2) = 0$

   $\Rightarrow (16x + 5)(x - 2) = 0$

$\Rightarrow$ (16x + 5) = 0 or (x - 2) = 0

$\Rightarrow x = -\frac{5}{16}$ or, x = 2

Hence, the roots of given quadratic equation are 2 and $-\frac{5}{16}$

7. We have, $3\sqrt{7}x^2 + 4x - \sqrt{7} = 0$

Factorise the equation,

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

$\Rightarrow \sqrt{7}x(3x + \sqrt{7}) - 1(3x + \sqrt{7}) = 0$

$\Rightarrow (3x + \sqrt{7})(\sqrt{7}x - 1) = 0$

$\Rightarrow (3x + \sqrt{7}) = 0$ or $(\sqrt{7}x - 1) = 0$

$3x = -\sqrt{7}$ or $x = \frac{1}{\sqrt{7}}$

$x = \frac{-\sqrt{7}}{3}$ or $x = \frac{1 \times \sqrt{7}}{\sqrt{7} \times \sqrt{7}} = \frac{\sqrt{7}}{7}$

8. Consider,

$6 - x - x^2 = 0$

This can be written as,

$x^2 + x - 6 = 0$

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

x(x + 3) -2(x + 3) = 0

(x - 2)(x + 3) = 0

x - 2 = 0 (or) x + 3 = 0

x = 2 (or) x = -3

$\therefore$ Solution set is {2, -3}

9. 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

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

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

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

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

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

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

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

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

$\Rightarrow$ 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

10. We have,

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

$\Rightarrow x^2 + ax + \frac{1}{a}x + 1 = 0$

$\Rightarrow x(x + a) + \frac{1}{a}(x + a) = 0$

$\Rightarrow (x+a)\left(x+\frac{1}{a}\right)=0$

$\Rightarrow$ either x + a = 0 or, $x+\frac{1}{a}=0$

$\Rightarrow$ x = -a or $x=-\frac{1}{a}$

Hence, the roots of given quadratic equation are -a and $-\frac{1}{a}$

11. We have, $abx^2 + (b^2 - ac)x - bc = 0$

$\Rightarrow abx^2 + b^2x - acx - bc = 0$

$\Rightarrow bx(ax+b) - c(ax+b) = 0$

$\Rightarrow (ax+b)(bx-c) = 0$

Either ax+b = 0 or bx - c = 0

$\Rightarrow x=-\frac{b}{a},\ \frac{c}{b}$

Hence, $x=-\frac{b}{a},\ \frac{c}{b}$ are the required solutions.

12. We have, $4x^2 - 4ax + (a^2 - b^2) = 0$

$\Rightarrow 4x^2 - [2(a+b)x + 2(a-b)x] + (a^2 - b^2) = 0$

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

$\Rightarrow 2x(2x-a-b) - (a-b)(2x-a-b) = 0$

$\Rightarrow (2x-a-b)(2x-a+b) = 0$

Either 2x = a + b or 2x = a - b

$\Rightarrow x=\frac{a+b}{2},\ \frac{a-b}{2}$

Hence, $x=\frac{a+b}{2},\ \frac{a-b}{2}$ are the required solutions.

13. $x^2 + 3x = 9$

Subtract 9 from both sides of equation

$x^2 + 3x - 9 = 0$

Use the quadratic formula to find the solution

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

Substitute the values a = 1, b = 1, b = 3 and c = -9 into the quadratic formula and solve for x.

$$\frac{-3\pm\sqrt{3^2-4\cdot(1\cdot-9)}}{2\cdot1}$$

Simplify

$x=\frac{-3\pm3\sqrt{5}}{2}$

The result can be shown in multiple forms.

Exact Form:

$x=\frac{-3\pm3\sqrt{5}}{2}$

Decimal Form:

x = 1.85410196..., -4.85410196

14. We have the following equation,

$100x^2 - 20x + 1 = 0$

$\Rightarrow 100x^2 - 10x - 10x + 1 = 0$

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

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

$\Rightarrow (10x-1)^2 = 0$

$\Rightarrow 10x - 1 = 0$

$\Rightarrow x=\frac{1}{10}$

15. Here, area of a right-angled triangle is 96 sq metres.

Let the altitude of a triangle be the x meter.

Then , base = 3x meter.

Therefore, Area of triangle $= \frac{1}{2} \times (3x \times x)$ cm^2

$= \frac{1}{2} \times 3x^2 = 96 \Rightarrow x^2 = \frac{96 \times 2}{3}$

$\Longrightarrow x^2 = 64$

$\Rightarrow x = \sqrt{64} = x = \pm 8$

Therefore, x = 8 [length of altitude can never be negative]

Hence, the altitude of the triangle is 8 cm and base of triangle = 3x = 3(8) cm = 24cm

16. $y^2 - 3 = 0$

$\Longrightarrow y^2 - (\sqrt{3})^2 = 0$

$\Longrightarrow (y + \sqrt{3})(y - \sqrt{3}) = 0$ (Using Identity $a^2 - b^2 = (a + b)(a - b)$)

Either $y + \sqrt{3} = 0$ *or* $y - \sqrt{3} = 0$

$\therefore y = -\sqrt{3}, \sqrt{3}$

Thus, $y = -\sqrt{3}$ *and* $\sqrt{3}$ are the roots of the given equation.

17. In factorization, we write the middle term of the quadratic equation either as a sum of two numbers or difference of two numbers such that the equation can be factorized.

Here we have, $x^2 - (\sqrt{3} + 1)x + \sqrt{3} = 0$

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

$x(x - \sqrt{3}) - 1(x - \sqrt{3}) = 0$

$(x - \sqrt{3})(x - 1) = 0$

$\therefore$ x - $\sqrt{3}$ = 0 or x - 1 = 0

x = $\sqrt{3}$ or x = 1.

18. 3x2 - 8x - 1 = 0

$\Rightarrow$ x = $\frac{-(-8) \pm \sqrt{(-8)^2 - 4 \times 3 \times -1}}{2 \times 3}$

$= \frac{8 \pm \sqrt{64 + 12}}{6}$

$= \frac{8 \pm \sqrt{76}}{6}$

$= \frac{8 \pm 2\sqrt{19}}{6}$

$= \frac{4 \pm \sqrt{19}}{3}$

19. $\frac{2}{5}x^2 - x - \frac{3}{5} = 0$

or, $\frac{2x^2 - 5x - 3}{5} = 0$

or,$2x^2 - 5x - 3 = 0$

or, $2x^2 - 6x + x - 3 = 0$

or, 2x(x - 3) + 1(x - 3) = 0

or, (2x + 1)(x - 3) = 0

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

20. We have, $2x^2 + 3x + k = 0$.

a = 2, b = 3 and, c= k

The given equation will have real roots, if

D $\geq$ 0

$\therefore$ D = b^2 - 4ac $\geq$ 0

$\Rightarrow$ 9 - 4 $\times$ 2 $\times$ k $\geq$ 0

$\Rightarrow$ 9 - 8k $\geq$ 0

$\Rightarrow k \leq \frac{9}{8}$

21. We have the following equation,

$4x^2 + 4bx - (a^2 - b^2) = 0$

Now,

$4x^2 + 4bx - (a^2 - b^2) = 0$

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

$\Rightarrow 2x[2x - (a - b)] + (a + b)[2x - (a - b)] = 0$

$\Rightarrow [2x - (a - b)]\,[2x + (a + b)] = 0$

$\Rightarrow 2x - (a - b) = 0$ or $2x + (a + b) = 0$

$\Rightarrow 2x = a - b$ or $2x = -a - b$

$\Rightarrow x = \frac{a-b}{2}$ or $x = \frac{-a-b}{2}$

22. We have,

$\sqrt{3}x^2 + 11x + 6\sqrt{3} = 0$

Factorise the equation,

$\Rightarrow \sqrt{3}x^2 + 9x + 2x + 6\sqrt{3} = 0$

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

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

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

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

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

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

23. Given: $kx^2 + 6x + 1 = 0$

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

a = k, b = 6 and c = 1

For real and distinct roots: D > 0

Discriminant, $D = b^2 - 4ac > 0$

$6^2 - 4k > 0$

$36 - 4k > 0$

$4k < 36$

$k < 9$

24. According to the question,

$\frac{m}{n}x^2 + \frac{n}{m} = 1 - 2x$

$\Rightarrow \frac{m}{n}x^2 + 2x + \frac{n}{m} - 1 = 0$

$\Rightarrow x^2 + \frac{2nx}{m} + \frac{n^2}{m^2} - \frac{n}{m} = 0$ [multiplying both sides by 'n' and dividing both sides by 'm']

$\Rightarrow x^2 + \frac{2nx}{m} + \frac{n^2 - mn}{m^2} = 0$

To factorize $x^2 + \frac{2nx}{m} + \frac{n^2 - mn}{m^2}$, we have to find two numbers $'a'$ and $'b'$ such that.

$a + b = \frac{2n}{m}$ and $ab = \frac{n^2 - mn}{m^2}$

Clearly, $\frac{n + \sqrt{mn}}{m} + \frac{n - \sqrt{mn}}{m} = \frac{2n}{m}$ and $\frac{\left(n + \sqrt{mn}\right)}{m} \times \frac{\left(n - \sqrt{mn}\right)}{m} = \frac{n^2 - mn}{m^2}$ ($\therefore a = \frac{n + \sqrt{mn}}{m}$ and $b = \frac{n - \sqrt{mn}}{m}$)

$\Rightarrow x^2 + \frac{2nx}{m} + \frac{n^2 - mn}{m^2} = 0$

$\Rightarrow x^2 + \frac{\left(n+\sqrt{mn}\right)}{m}x + \frac{\left(n-\sqrt{mn}\right)}{m}x + \frac{n^2-mn}{m^2} = 0$

$\Rightarrow x\left[x + \frac{n+\sqrt{mn}}{m}\right] + \frac{n-\sqrt{mn}}{m}\left[x + \frac{n+\sqrt{mn}}{m}\right] = 0$

$\Rightarrow \left(x + \frac{n-\sqrt{mn}}{m}\right)\left(x + \frac{n+\sqrt{mn}}{m}\right) = 0$

$\Rightarrow x + \frac{n-\sqrt{mn}}{m} = 0$ or $x + \frac{n+\sqrt{mn}}{m} = 0$

$\Rightarrow x = \frac{-n-\sqrt{mn}}{m}$ or $x = \frac{-n+\sqrt{mn}}{m}$

25. Given;

$a^2b^2x^2 + b^2x - a^2x - 1 = 0$

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

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

$\Rightarrow x = \frac{-1}{a^2}$ or $x = \frac{1}{b^2}$

26. Let the successive multiples of 3 be 3x and 3x + 3. Then,

$3x(3x + 3) = 270$

$\Rightarrow 9x^2 + 9x = 270$

$\Rightarrow 9x^2 + 9x - 270 = 0$

$\Rightarrow 9(x^2 + x - 30) = 0$

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

$\Rightarrow x^2 + 6x - 5x - 30 = 0$

$\Rightarrow x(x + 6) - 5(x + 6) = 0$

$\Rightarrow (x + 6)(x - 5) = 0$

$\Rightarrow x - 5 = 0$ [$\because x + 6 \neq 0$]

$\therefore 3x = 3 \times 5 = 15$

And, $3x + 3 = 3 \times 5 + 3 = 18$

Hence, required multiples of 3 are 15 and 18.

27. We have, $100x^2 - 20x + 1 = 0$

$\Rightarrow 100x^2 - 10x - 10x + 1 = 0$

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

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

Either $10x - 1 = 0$ or $10x - 1 = 0$

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

$\therefore x = \frac{1}{10}$ are the repeated roots.

28. We have

$3x^2 + 5\sqrt{5}x - 10 = 0$

$\Rightarrow 3x^2 + 6\sqrt{5}x - \sqrt{5}x - 10 = 0$

$\Rightarrow 3x(x + 2\sqrt{5}) - \sqrt{5}(x + 2\sqrt{5}) = 0$

$\Rightarrow (x + 2\sqrt{5})(3x - \sqrt{5}) = 0$

$\Rightarrow x + 2\sqrt{5} = 0$ or $3x - \sqrt{5} = 0$

$\Rightarrow x = -2\sqrt{5}$ or $x = \frac{\sqrt{5}}{3}$.

29. Given, $\frac{2}{x^2} - \frac{5}{x} + 2 = 0$

$\Rightarrow \frac{2 - 5x + 2x^2}{x^2} = 0$

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

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

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

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

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

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

$2x = 1$ or $x = 2$

The value of x will be

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

Therefore roots of the equation will be $\frac{1}{2}$ and 2 .

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

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

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

31. Here,the hypotenuse of a right-angled triangle is 1 metre less than twice the shortest side.

Let the shorter side of a triangle be x meter.

Then, its hypotenuse = (2x - 1) meter

and let the altitude = x + 1 meter

Then, $(2x - 1)^2 = x^2 + (x + 1)^2$

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

$\Longrightarrow 4x^{2-}2x^2-4x-2x=1-1$

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

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

$\Rightarrow$ x - 3 = 0 or 2x = 0, as 2 can not be zero.

Therefore, x =3 or x = 0

So, x = 3 [base cannot be zero]

Hence, base = 3m.

hypotenuse = (2(3) - 1)m = 5m and

altitude = (3 + 1)m = 4m

32. $\frac{5}{2}x^2 + \frac{2}{5} = 1 - 2x$

$\Rightarrow \frac{5}{2}x^2 + 2x + \frac{2}{5} + 1 = 0$

$\Rightarrow 25x^2 + 20x + 14 = 0$

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

$= \frac{-20 \pm \sqrt{400 - 4 \times 25 \times 14}}{2 \times 25}$

$= \frac{-20 \pm \sqrt{400 - 1400}}{50}$

$= \frac{-20 \pm \sqrt{-1000}}{50}$

$= \frac{-20 \div 10\sqrt{-10}}{50}$

$\frac{-20 + 10\sqrt{-10}}{50}$ or $\frac{-20 - 10\sqrt{-10}}{50}$

$\frac{-20 + 10\sqrt{10}i}{50}$ or $\frac{-20 - 10\sqrt{10}i}{50}$

33. We have, $7x^2 + kx - 3 = 0$

Since $x = \frac{2}{3}$ is the solution of the given equation

$\therefore x = \frac{2}{3}$ satisfies the given equation

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

$\Rightarrow \frac{28}{9} + \frac{2k}{3} - 3 = 0$

$\Rightarrow \frac{1}{9} + \frac{2k}{3} = 0$

$\Rightarrow \frac{2k}{3} = -\frac{1}{9} \Rightarrow k = -\frac{3}{18}$

$\Rightarrow k = -\frac{1}{6}$

34. We have, $kx^2 + \sqrt{2}x - 4 = 0$; $x = \sqrt{2}$

Since x = $\sqrt{2}$ is the solution of the given equation

Substituting x = $\sqrt{2}$ in the given equation

$k(\sqrt{2})^2 + \sqrt{2} \times \sqrt{2} - 4 = 0$

$\implies$ 2k + 2 - 4 = 0

$\implies$ 2k = 2

$\implies$ k = 1

35. Let the base of the right triangle be x cm.

Then, altitude = (x - 7) cm

From pythagoras theorem,

$B^2 + P^2 = H^2$

$\therefore$ $x^2 + (x - 7)^2 = 13^2$

$\Rightarrow$ $x^2 + x^2 + 49 - 14x = 169$

$\Rightarrow$ $2x^2 - 14x - 120 = 0$

$\Rightarrow$ $x^2 - 7x - 60 = 0$

Factorise the equation,

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

$\Rightarrow$ x(x - 12) + 5(x - 12) = 0

$\Rightarrow$ (x - 12)(x + 5) = 0

$\Rightarrow$ x - 12 = 0 or x + 5 = 0,

$\Rightarrow$ x = 12 or x = -5

Since sides are positive, x = 12.

Therefore, the base = 12 cm and the altitude = (12 - 7) cm = 5 cm.

36. The given equation can be rewritten as

$\frac{a(x-a)+b(x-b)}{(x-b)(x-a)} = 2$

$a(x - a) + b(x - b) = 2[x^2 - (a + b)x + ab]$

$ax - a^2 + bx - b^2 = 2x^2 - 2(a + b)x + 2ab$

$2x^2 - 3(a + b)x + (a + b)^2 = 0$

$2x^2 - 2(a + b)x - (a + b)x + (a + b)^2 = 0$

$2x[x - (a + b)] - (a + b)[x - (a + b)]$

[2x - (a + b)] [x - (a + b)] = 0

$x = a + b, \frac{a+b}{2}$

37. We have,

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

So, $3x^2 - 14x - 5 = 0$

$\Rightarrow$ $3x^2 - 15x + 1x - 5 = 0$

$\Rightarrow$ 3x(x - 5) + 1(x - 5) = 0

$\Rightarrow$ (x - 5)(3x + 1) = 0

$\Rightarrow$ x - 5 = 0 or 3x + 1 = 0

$\Rightarrow$ x = 5 or $x = -\frac{1}{3}$. Hence the roots are 5 and $-\frac{1}{3}$

38. $\frac{1}{x+4} - \frac{1}{x+7} = \frac{11}{30}$

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

$\Rightarrow \frac{3}{x^2+4x+7x+28} = \frac{11}{30}$

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

$\Rightarrow$ $11x^2 + 121x + 308 = 90$

$\Rightarrow$ $11x^2 + 121x + 218 = 0$

$\Rightarrow$ $11(x^2 + 11x + 18) = 0$

$\Rightarrow$ $x^2 + 11x + 18 = 0$

$\Rightarrow$ $x^2 + 9x + 2x + 18 = 0$

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

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

$\Rightarrow$ $x = -2, -9$

39. Let the whole number be x.

According to question,

$(x - 20) = 69\left(\frac{1}{x}\right)$

$\Rightarrow$ $x^2 - 20x - 69 = 0$

$\Rightarrow$ $x^2 - 23x + 3x - 69=0$

$\Rightarrow$ $(x - 23)(x + 3) = 0$

$\Rightarrow$ $x = 23, -3$. Rejecting -3 as -3 is not a whole number.

$\Rightarrow x = 23$

40. We have,

$x^2 - 4ax + 4a^2 - b^2 = 0$

$\Rightarrow$ $(x - 2a)^2 - b^2 = 0$

$\Rightarrow$ $(x - 2a + b)(x - 2a - b) = 0$

$\Rightarrow$ $x - 2a + b = 0$ or $x - 2a - b = 0$

$\Rightarrow$ $x = 2a - b$ or $2a + b$

41. $15x^2 - 10\sqrt{6}x + 10 = 0$.

$3x^2 - 2\sqrt{6}x + 2 = 0$

$3x^2 - \sqrt{6}x - \sqrt{6}x + 2 = 0$

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

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

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

42. We have the following equation,

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

Taking LCM

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

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

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

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

Factorise the equation

$\Rightarrow 3x^2 - \left[\left(3 + \sqrt{3}\right)x + \left(3 - \sqrt{3}\right)x\right] + 2 = 0$

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

$\Rightarrow 3x^2 - \sqrt{3}(\sqrt{3}+1)x - \sqrt{3}(\sqrt{3}-1)x + 1(\sqrt{3}+1)(\sqrt{3}-1) = 0$

$\Rightarrow \sqrt{3}x(\sqrt{3}x - (\sqrt{3}+1)) - (\sqrt{3}-1)(\sqrt{3} - (\sqrt{3}+1)) = 0$

$\Rightarrow [\sqrt{3}x - (\sqrt{3}-1)][\sqrt{3}x - (\sqrt{3}+1)] = 0$

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

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

43. Here we have, $6x^2 - \sqrt{2}x - 2 = 6x^2 - 3\sqrt{2}x + 2\sqrt{2}x - 2$

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

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

Now, $6x^2 - \sqrt{2}x - 2 = 0$ gives $(3x + \sqrt{2})(2x - \sqrt{2}) = 0$ i.e., $3x + \sqrt{2} = 0$ or $2x - \sqrt{2} = 0$

So, the roots are $-\frac{\sqrt{2}}{3}$ and $\frac{\sqrt{2}}{2}$.

44. Let the required number be x.

Then, square of a number will be x^2.

According to given information, we have

$x^2 - 84 = 3(x + 8)$

$\Rightarrow x^2 - 84 = 3x + 24$

$\Rightarrow x^2 - 3x - 108 = 0$

$\Rightarrow x^2 - 12x + 9x - 108 = 0$

$\Rightarrow x(x - 12) + 9(x - 12) = 0$

$\Rightarrow (x - 12)(x + 9) = 0$

$\Rightarrow$ x - 12 = 0 or x + 9 = 0

$\Rightarrow$ x = 12 or x = -9

Since x is a natural number, x $\neq$ -9.

$\Rightarrow$ x = 12

Hence, required number is 12.

45. For the given equatioin, $2x^2 - 2\sqrt{2}x + 1 = 0$

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

$D = (2\sqrt{2})^2 - 4 \times 2 \times 1 = 8 - 8 = 0$

$\therefore$ The given equation has real roots.

So the roots are given by, $x_1 = \frac{-b+\sqrt{D}}{2a}$ and $x_2 = \frac{-b-\sqrt{D}}{2a}$

$x_1 = \frac{-(-2\sqrt{2})+0}{2\times 2}, x_2 = \frac{-(-2\sqrt{2})-0}{2\times 2}$

$x_1 = \frac{2\sqrt{2}}{4}, x_2 = \frac{2\sqrt{2}}{4}$

$\therefore x_1 = \frac{1}{\sqrt{2}}$ and $x_2 = \frac{1}{\sqrt{2}}$

46. $2x^2 + x - 6 = 0$

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

$\Rightarrow (2x-3)(x+2) = 0 \Rightarrow x = \frac{3}{2}, -2$

47. Let the required natural numbers be x and x - 3. Then,

$x^2 + (x - 3)^2 = 117$

$\Rightarrow x^2 + (x^2 + 9 - 6x) = 117$ [$\because$ $(a - b)^2 = a^2 + b^2 - 2ab$]

$\Rightarrow 2x^2 - 6x + 9 - 117 = 0$

$\Rightarrow 2x^2 - 6x - 108 = 0$

$\Rightarrow 2(x^2 - 3x - 54) = 0$

$\Rightarrow x^2 - 3x - 54 = 0$

$\Rightarrow$ $x^2 - 9x + 6x - 54 = 0$

$\Rightarrow$ $x(x - 9) + 6(x - 9) = 0$

$\Rightarrow$ $(x - 9)(x + 6)$ [$\because$ x is natural number $\therefore$ $x + 6 \neq 0$]

$\Rightarrow$ $x = 9$

$\Rightarrow$ $x - 3 = 9 - 3 = 6$

Hence, required numbers are 6 and 9.

48. We have ,$\sqrt{7}x^2 - 6x - 13\sqrt{7} = 0 \Rightarrow \sqrt{7}x^2 - 13x + 7x - 13\sqrt{7} = 0$

$\Rightarrow x(\sqrt{7}x - 13) + \sqrt{7}(\sqrt{7}x - 13) = 0$

$\Rightarrow$ $(x + \sqrt{7})(\sqrt{7}x - 13) = 0$

$\Rightarrow$ $x + \sqrt{7} = 0$ or $\sqrt{7}x - 13 = 0$

$x = -\sqrt{7}$ or $x = \frac{13}{\sqrt{7}} = \frac{13 \times \sqrt{7}}{\sqrt{7} \times \sqrt{7}} = \frac{13\sqrt{7}}{7}$.

49. Let the number be x and its reciprocal be $\frac{1}{x}$

According to the question

$x + \frac{1}{x} = 2\frac{1}{30}$

$\Rightarrow$ $\frac{x^2+1}{x} = \frac{61}{30}$

$\Rightarrow$ $30x^2 - 61x + 30 = 0$

$\Rightarrow$ $30x^2 - 36x - 25x + 30 = 0$

$\Rightarrow$ $6x(5x - 6) - 5(5x - 6) = 0$

$\Rightarrow$ $(6x - 5)(5x - 6) = 0$

Either $6x - 5 = 0$ or $5x - 6 = 0$

$\Rightarrow x = \frac{5}{6}, \frac{6}{5}$

Hence, the required number is $\frac{5}{6}$ or $\frac{6}{5}$

50. Let the first natural number be x

$\therefore$ Second consecutive natural number = x + 1

According to the question,

$x^2 + (x + 1)^2 = 421$

or, $x^2 + x^2 + 2x + 1 = 421$

$2x^2 + 2x - 420 = 0$

or, $x^2 + x - 210 = 0$[dividing by 2 b/s]

or, $x^2 + 15x - 14x - 210 = 0$

or,$x(x + 15) - 14(x + 15) = 0$

or,$(x + 15)(x - 14) = 0$

or,$x + 15 = 0$ or $x - 14 = 0$

$\therefore$ $x = -15$ or $x = 14$

Rejecting negative value

First number = 14

and consecutive number = 15

51. Given, $x^2 + 3\sqrt{3}x - 30 = 0$

$\Rightarrow x^2 + 5\sqrt{3}x - 2\sqrt{3}x - 30 = 0$

$\Rightarrow$ $x(x + 5\sqrt{3}) - 2\sqrt{3}(x + 5\sqrt{3}) = 0$

$\Rightarrow$ $(x + 5\sqrt{3})(x - 2\sqrt{3}) = 0$

$\Rightarrow$ $x + 5\sqrt{3} = 0$ or $x - 2\sqrt{3} = 0$

$\Rightarrow$ $x = -5\sqrt{3}$ or $x = 2\sqrt{3}$

52. We have

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

$\Rightarrow$ $16x^2 - 8x + 1 = 0$

$\Rightarrow$ $16x^2 - 4x - 4x + 1 = 0$
$\Rightarrow$ $4x(4x - 1) - 1(4x - 1) = 0$
$\Rightarrow$ $(4x - 1)(4x - 1) = 0$
$\Rightarrow$ $(4x - 1)^2 = 0$
$\Rightarrow$ $x = \frac{1}{4}$. Hence, $x=\frac{1}{4}$ is repeated root of the polynomial.

53. Let the tens digit be x.

Then, the units digit $= \frac{16}{x}$.

$\therefore$ Number $= 10x + \frac{16}{x}$

And, number obtained by interchanging the digits $= 10 \times \frac{16}{x} + x = \frac{160}{x} + x$.

$\therefore 10x + \frac{16}{x} - 54 = \frac{160}{x} + x$
$\Rightarrow 10x - x + \frac{16}{x} - \frac{160}{x} - 54 = 0$
$\Rightarrow 9x + \frac{16 - 160}{x} - 54 = 0$
$\Rightarrow 9x - \frac{144}{x} - 54 = 0$
$\Rightarrow$ $9x^2 - 144 - 54x = 0$ [Multiplying both sides of equation by x]
$\Rightarrow$ $9x^2 - 54x - 144 = 0$
$\Rightarrow$ $9(x^2 - 6x - 16) = 0$
$\Rightarrow$ $x^2 - 6x - 16 = 0$
$\Rightarrow$ $x^2 - 8x + 2x - 16 = 0$
$\Rightarrow$ $x(x - 8) + 2(x - 8) = 0$
$\Rightarrow (x - 8)(x + 2) = 0$
$\Rightarrow$ $x - 8 = 0$ or $x + 2 = 0$
$\Rightarrow$ $x = 8$ or $x = -2$

But, a digit can never be negative.

So, x = 8

Hence, the required number $= 10 \times 8 + \frac{16}{8} = 82$.

54. We have, $x^2 - x(a+b) + k = 0$

Since x = a is the solution of the given equation.

$\therefore$ x = a satisfies the given equation.

$a^2 - a(a+b) + k = 0$
$\Longrightarrow$ $a^2 - a^2 - ab + k = 0$
$\Longrightarrow$ $k - ab = 0$ or $k = ab$

55. Given,

$5^{(x+1)} + 5^{(2 - x)} = 5^3 + 1$
$\Rightarrow$ $5^x.5 + 5^2.5^{-x} = 125 + 1$
$\Rightarrow$ $5^x.5 + \frac{25}{5^x} = 126$

Let $y = 5^x$

$\Rightarrow$ $5y + \frac{25}{y} = 126$
$\Rightarrow 5y^2 + 25 = 126y$
$\Rightarrow$ $5y^2 - 126y + 25 = 0$

Factorise the equation,

$\Rightarrow$ $5y^2 - 125y - y + 25 = 0$
$\Rightarrow$ $5y(y - 25) - 1(y - 25) = 0$
$\Rightarrow (y - 25)(5y - 1) = 0$
$\Rightarrow$ $y - 25 = 0$ or $5y - 1 = 0$
$\Rightarrow$ $y = 25$ or $y = 1/5$

Now,

$\Rightarrow$ $5^x = 25$ or $5^x = 1/5$

$\Rightarrow$ $5^x = 5^2$ or $5^x = 5^{-1}$

$\Rightarrow$ x = 2 or x = -1.

56. We have $\frac{16}{x} - 1 = \frac{15}{x+1}$

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

Cross multiply,

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

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

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

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

$\Rightarrow$ $x^2 = 16$

$\therefore$ $x = \pm 4$

57. We have,

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

In order to factorize $5x^2 - 3x - 2$, we have to find two numbers 'a' and 'b' such that

$a + b = -3$ and ab = 5 $\times$ -2 = -10

Clearly, -5 + 2 = -3 and -5 $\times$ 2 = -10

$\Rightarrow$ a = -5 and b = 2

Now,

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

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

$\Rightarrow$ $5x(x - 1) + 2(x - 1) = 0$

$\Rightarrow$ $(x - 1)(5x + 2) = 0$

$\Rightarrow$ x - 1 = 0 or 5x + 2 = 0

$\Rightarrow$ x = 1 or $x = -\frac{2}{5}$

Hence, the roots of given equation are 1 and $-\frac{2}{5}$

58. $y^2 + \frac{3\sqrt{5}}{2}y - 5 = 0$

$\frac{2y^2+3\sqrt{5}y-10}{2} = 0$

$\Rightarrow$ $2y^2 + 3\sqrt{5}y - 10 = 0$

$\Rightarrow$ $2y^2 + 4\sqrt{5}y - \sqrt{5}y - 10 = 0$

$\Rightarrow$ $2y(y + 2\sqrt{5}) - \sqrt{5}(y - 2\sqrt{5})$

$\Rightarrow$ $(2y - \sqrt{5})(y + 2\sqrt{5}) = 0$

$\therefore y = \frac{\sqrt{5}}{2}, -2\sqrt{5}$

59. Given, $2x^2 + \frac{5}{3}x - 2 = 0$

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

By splitting the middle term, we have

$6x^2 + 9x - 4x - 6 = 0$

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

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

$\therefore$ 2x + 3 = 0 or 3x - 2 = 0

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

60. $2x^2 - ax - a^2 = 0$

$\Longrightarrow$ $2x^2 - 2ax + ax - a^2 = 0$

$\Longrightarrow$ $2x(x - a) + a(x - a) = 0$

$\implies$ (2x+a)(x-a)=0

$\implies$ either 2x+a=0 or x-a=0

$\implies x = -\frac{a}{2}$ or $x = a$

$\implies x = -\frac{a}{2}, a$

Thus, $x = -\frac{a}{2}$ and $x = a$ are two roots of the given quadratic equation.

61. Given that,

$x^2 - (1 + \sqrt{2})x + \sqrt{2} = 0$

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

Factorise the equation, we get

$\Rightarrow x(x - 1) - \sqrt{2}(x - 1) = 0$

$\Rightarrow (x - 1)(x - \sqrt{2}) = 0$

$\Rightarrow x - 1 = 0$ or $x - \sqrt{2} = 0$

Therefore, x = 1 or $x = \sqrt{2}$

62. The given equation may be written as

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

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

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

This equation is of the form $ax^2 + bx + c = 0$, where $a = 3$, $b = -6$ and $c = 2$.

$\therefore D = (b^2 - 4ac) = (-6)^2 - 4 \times 3 \times 2 = 36 - 24 = 12 > 0$.

So, the given equation has real roots.

Now, $\sqrt{D} = \sqrt{12} = 2\sqrt{3}$

$\therefore \quad \alpha = \frac{-b+\sqrt{D}}{2a} = \frac{6+2\sqrt{3}}{2\times 3} = \frac{6+2\sqrt{3}}{6} = \frac{3+\sqrt{3}}{3}$

$\beta = \frac{-b-\sqrt{D}}{2a} = \frac{6-2\sqrt{3}}{2\times 3} = \frac{6-2\sqrt{3}}{6} = \frac{3-\sqrt{3}}{3}$

Hence, the required values of x are $\frac{(3+\sqrt{3})}{3}$ and $\frac{(3-\sqrt{3})}{3}$

63. Let the required number be x and x + 4. Then,

$x \times (x + 4) = 192$

$\Rightarrow x^2 + 4x = 192$

$\Rightarrow x^2 + 4x - 192 = 0$

$\Rightarrow x^2 + 16x - 12x - 192 = 0$

$\Rightarrow x(x + 16) - 12(x + 16) = 0$

$\Rightarrow (x + 16)(x - 12) = 0$

$\Rightarrow$ x + 16 = 0 or x - 12 = 0

$\Rightarrow$ x = -16 or x = 12

Case I: When x = -16

$\therefore$ x + 4 = -16 + 4 = -12

Case II: When x = 12

$\therefore$ x + 4 = 12 + 4 = 16

Hence, the numbers are -16, -12 or 12, 16.

64. We have,

$3x^2 - 2\sqrt{6}x + 2 = 0$

Factorise the equation,

$\Rightarrow 3x^2 - \sqrt{6}x - \sqrt{6}x + 2 = 0$

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

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

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

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

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

65. Let the natural number be x

Since the difference between the two natural numbers is 3, therefore,the other number is x + 3.

Given that the difference of the reciprocal

of the natural numbers is $\frac{3}{28}$.

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

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

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

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

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

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

$\Rightarrow x^2 + 7x - 4x - 28 = 0$

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

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

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

$\Rightarrow x = 4$ or $x = -7$

As a natural number cannot be negative, the two natural numbers are 4 and 7.

66. The given equation is:

$a^2x^2 - 3abx + 2b^2 = 0$

$a^2x^2 - abx - 2abx + 2b^2 = 0$

$ax(ax - b) - 2b(ax-b) = 0$

$(ax - b)(ax-2b) = 0$

$ax - b = 0$; $x = \frac{b}{a}$

$ax - 2b = 0$; $x = \frac{2b}{a}$

So zeroes are $\frac{b}{a}$ and $\frac{2b}{a}$

67. Given that the quadratic equation $2x^2 + px + 8 = 0$ has real roots

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

a = 2, b = p and c = 8

Thus, D = 0

Discriminant, $D = b^2 - 4ac \geq 0$

$(p)^2 - 4(2)(8) \geq 0$

$(p)^2 - 64 \geq 0$

$p^2 \geq 64$

Taking square root on both sides, we get

$p \geq 8$ or $p \leq -8$

The roots of equation are real for $p \geq 8$ or $p \leq -8$.

68. Let the two consecutive natural numbers be x and x+1.

According to the question

$x^2 + (x+1)^2 = 313$

$\Rightarrow x^2 + x^2 + 2x + 1 = 313$

$\Rightarrow 2x^2 + 2x - 312 = 0$

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

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

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

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

Either x +13 = 0 or x - 12 = 0

$\Rightarrow$ x = -13, 12

Since x being a natural number. It cannot be negative.

$\therefore$ x = 12

Hence, two consecutive numbers are 12, and 13.

69. Given quadric equation is $x^2 - kx + 4 = 0$, and roots are equal.

we have to find the value of k.

Here, a = 1, b = -k and, c = 4

As we know that $D = b^2 - 4ac$

Putting the value of a = 1, b = -k and, c = 4

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

$= k^2 - 16$

The given equation will have equal roots, if D = 0

$k^2 - 16 = 0$

$k^2 = 16$

$k = \sqrt{16}$

$k = \pm 4$

Therefore, the value of $k = \pm 4$

70. Let the numbers be x and 15 - x.

According to question,

$\frac{1}{x} + \frac{1}{15-x} = \frac{3}{10}$

$\Rightarrow \frac{15-x+x}{x(15-x)} = \frac{3}{10}$

$\Rightarrow \frac{15}{x(15-x)} = \frac{3}{10}$

$\Rightarrow$ 150 = 3x(15 - x)

$\Rightarrow 150 = 45x - 3x^2$

$\Rightarrow 150 = 3(15x - x^2)$

$\Rightarrow x^2 - 15x + 50 = 0$

$\Rightarrow x^2 - 10x - 5x + 50 = 0$

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

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

$\Rightarrow$ x - 10 = 0 or, x - 5 = 0

$\Rightarrow$ x = 10 or, x = 5

Therefore, the two numbers are 10 and 5

71. The given equation is: $48x^2 - 13x - 1 = 0$

$\Rightarrow 48x^2 - 16x + 3x - 1 = 0$

$\Rightarrow 16x(3x - 1) + 1(3x - 1) = 0$

$\Rightarrow$ 16x + 1 = 0 or (3x - 1) = 0

$\Rightarrow x = \frac{-1}{16}$ or $x = \frac{1}{3}$

72. We have, $2x^2 - x + \frac{1}{8} = 0$

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

$\Longrightarrow x(2x - \frac{1}{2}) - \frac{1}{4}(2x - \frac{1}{2}) = 0$

$\Longrightarrow (2x - \frac{1}{2})(x - \frac{1}{4}) = 0$

$Either\ (2x - \frac{1}{2}) = 0\ or\ (x - \frac{1}{4}) = 0$

$\Longrightarrow x = \frac{1}{4}, \frac{1}{4}$

So, this root is repeated root.

$\therefore$ both the roots are $\frac{1}{4}$.

73. $3x^2 - 2\sqrt{6}x + 2 = 0$

$3x^2 - \sqrt{6}x - \sqrt{6}x + 2 = 0$

$= \sqrt{3}x\left(\sqrt{3}x - \sqrt{2}\right) - \sqrt{2}\left(\sqrt{3}x - \sqrt{2}\right)$

$= \left(\sqrt{3}x - \sqrt{2}\right)\left(\sqrt{3}x - \sqrt{2}\right)$

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

$\Rightarrow \sqrt{3}x - \sqrt{2} = 0$ or $x = \sqrt{\frac{2}{3}}$.

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

74. We have, $x^2 - \frac{11}{4}x + \frac{15}{8} = 0$

Multiplying the given equation by 8, we get

$8x^2 - 22x + 15 = 0$

$\Rightarrow 8x^2 - 12x - 10x + 15 = 0$

$\Rightarrow 4x(2x - 3) - 5(2x - 3) = 0$

$\Rightarrow (2x - 3)(4x - 5) = 0$

Either $2x - 3 = 0$ or $4x - 5 = 0$

$\Rightarrow x = \frac{3}{2}, \frac{5}{4}$

Hence, $x = \frac{3}{2}, \frac{5}{4}$ are the required solution.

75. We have the following equation,

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

$\Rightarrow 10x^2 - 1 = 3x$

$\Rightarrow 10x^2 - 3x - 1 = 0$

Factorise the equation,

$\Rightarrow 10x^2 - 5x + 2x - 1 = 0$

$\Rightarrow 5x(2x - 1) + 1(2x - 1) = 0$

$\Rightarrow (5x + 1)(2x - 1) = 0$

$\Rightarrow 5x + 1 = 0$ or $2x - 1 = 0$

Therefore, $x = \frac{-1}{5}$ or $x = \frac{1}{2}$