

Exercise 1.3

Q1. Solve the following equations.

(1) $2x^4 - 11x^2 + 5 = 0$

Solution:

$$2x^4 - 11x^2 + 5 = 0 \quad \dots\dots(i)$$

Let $x^2 = y$ then $x^4 = y^2$

So eq.(i) becomes

$$2y^2 - 11y + 5 = 0$$

$$2y^2 - 10y - y + 5 = 0$$

$$2y(y - 5) - 1(y - 5) = 0$$

$$(2y - 1)(y - 5) = 0$$

Either $(2y - 1) = 0$ or $(y - 5) = 0$

$$2y = 1 \qquad y = 5$$

Put $y = \frac{1}{2}$ in $x^2 = y$, we get

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

$$\sqrt{x^2} = \pm\sqrt{\frac{1}{2}}$$

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

Put $y = 5$ in $x^2 = y$, we get

$$x^2 = 5$$

$$\sqrt{x^2} = \pm\sqrt{5}$$

$$x = \pm\sqrt{5}$$

Thus, solution set = $\left\{ \pm\frac{1}{\sqrt{2}}, \pm\sqrt{5} \right\}$

$$(2) \quad 2x^4 = 9x^2 - 4$$

Solution:

$$2x^4 = 9x^2 - 4$$

$$2x^4 - 9x^2 + 4 = 0 \quad \dots\dots(i)$$

$$\text{Let } x^2 = y \text{ then } x^4 = y^2$$

So eq.(i) becomes

$$2y^2 - 9y + 4 = 0$$

$$2y^2 - 8y - y + 4 = 0$$

$$2y(y - 4) - 1(y - 4) = 0$$

$$(2y - 1)(y - 4) = 0$$

$$\text{Either } (2y - 1) = 0 \text{ or } (y - 4) = 0$$

$$2y = 1 \quad y = 4$$

$$\text{Put } y = \frac{1}{2} \text{ in } x^2 = y, \text{ we get}$$

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

$$\sqrt{x^2} = \pm \sqrt{\frac{1}{2}}$$

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

$$\text{Put } y = 4 \text{ in } x^2 = y, \text{ we get}$$

$$x^2 = 4$$

$$\sqrt{x^2} = \pm \sqrt{4}$$

$$x = \pm 2$$

$$\text{Thus, solution set} = \left\{ \pm \frac{1}{\sqrt{2}}, \pm 2 \right\}$$

$$(3) \quad 5x^{\frac{1}{2}} = 7x^{\frac{1}{4}} - 2$$

Solution:

$$5x^{\frac{1}{2}} = 7x^{\frac{1}{4}} - 2$$

$$\text{Let } x^{\frac{1}{4}} = y \text{ then } x^{\frac{1}{2}} = y^2$$

So eq.(i) becomes

$$5y^2 - 7y + 2 = 0$$

$$5y^2 - 5y - 2y + 2 = 0$$

$$5y(y-1) - 2(y-1) = 0$$

$$(5y-2)(y-1) = 0$$

$$\text{Either } (5y-2) = 0 \quad \text{or} \quad (y-1) = 0$$

$$5y = 2 \quad y = 1$$

$$y = \frac{2}{5} \quad y = 1$$

$$\text{Put } y = \frac{2}{5} \text{ in } x^{\frac{1}{4}} = y, \text{ we get} \quad \text{Put } y = 1 \text{ in } x^{\frac{1}{4}} = y, \text{ we get}$$

$$x^{\frac{1}{4}} = y$$

$$x^{\frac{1}{4}} = \frac{2}{5}$$

$$x^{\frac{1}{4}} = y$$

$$x^{\frac{1}{4}} = 1$$

Taking power '4' on both sides we get

$$\left(x^{\frac{1}{4}}\right)^4 = \left(\frac{2}{5}\right)^4$$

$$x = \frac{2^4}{5^4}$$

$$x = \frac{16}{625}$$

Taking power '4' on both sides we get

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

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

$$x = 1$$

$$\text{Thus, solution set} = \left\{\frac{16}{625}, 1\right\}$$

$$(4) \quad x^{\frac{2}{3}} + 54 = 15x^{\frac{1}{3}}$$

Solution:

$$x^{\frac{2}{3}} + 54 = 15x^{\frac{1}{3}}$$

$$x^{\frac{2}{3}} - 15x^{\frac{1}{3}} + 54 = 0 \quad \dots\dots(i)$$

Let $x^{\frac{1}{3}} = y$, then $x^{\frac{2}{3}} = y^2$

So eq.(i) becomes

$$y^2 - 15y + 54 = 0$$

$$y^2 - 9y - 6y + 54 = 0$$

$$y(y-9) - 6(y-9) = 0$$

$$(y-6)(y-9) = 0$$

Either $(y-9) = 0$ or $(y-6) = 0$

$$y = 9$$

$$y = 6$$

Put $y = 9$ in $x^{\frac{1}{3}} = y$, we get

$$x^{\frac{1}{3}} = 9$$

$$x^{\frac{1}{3}} = 9$$

Put $y = 6$ in $x^{\frac{1}{3}} = y$, we get

$$x^{\frac{1}{3}} = 6$$

$$x^{\frac{1}{3}} = 6$$

Taking cube on both sides we get

$$\left(x^{\frac{1}{3}}\right)^3 = (9)^3$$

$$x = 729$$

Taking cube on both sides we get

$$\left(x^{\frac{1}{3}}\right)^3 = (6)^3$$

$$x = 216$$

Thus, solution set = $\{729, 216\}$

(5) $3x^{-2} + 5 = 8x^{-1}$

Solution:

$$3x^{-2} + 5 = 8x^{-1}$$

$$3x^{-2} - 8x^{-1} + 5 = 0 \quad \dots\dots(i)$$

Let $x^{-1} = y$, then $x^{-2} = y^2$

So eq.(i) becomes

$$3y^2 - 8y + 5 = 0$$

$$3y^2 - 5y - 3y + 5 = 0$$

$$y(3y - 5) - 1(3y - 5) = 0$$

$$(y - 1)(3y - 5) = 0$$

Either $y - 1 = 0$ or $3y - 5 = 0$

$$y = 1 \quad 3y = 5$$

$$y = 1 \quad y = \frac{5}{3}$$

Put $y = 1$ in $x^{-1} = y$, we get

$$x^{-1} = y$$

$$x^{-1} = 1$$

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

$$x = 1$$

Put $y = \frac{5}{3}$ in $x^{-1} = y$, we get

$$x^{-1} = y$$

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

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

$$x = \frac{3}{5}$$

Thus, solution set = $\left\{1, \frac{3}{5}\right\}$

$$(6) \quad (2x^2 + 1) + \frac{3}{2x^2 + 1} = 4$$

Solution:

$$(2x^2 + 1) + \frac{3}{2x^2 + 1} = 4 \dots\dots(i)$$

Let $2x^2 + 1 = y$,

So eq.(i) becomes

$$y + \frac{3}{y} = 4$$

Multiplying both sides by 'y', we get

$$y^2 + 3 = 4y$$

$$y^2 - 4y + 3 = 0$$

$$y^2 - 3y - y + 3 = 0$$

$$y(y-3) - 1(y-3) = 0$$

$$(y-1)(y-3) = 0$$

Either $y-1=0$ or $y-3=0$

$$y=1 \quad y=3$$

Put $y=1$ in $2x^2 + 1 = y$, we get Put $y=3$ in $2x^2 + 1 = y$, we get

$$2x^2 + 1 = 1$$

$$2x^2 = 1 - 1$$

$$2x^2 = 0$$

$$x^2 = 0$$

$$x = 0$$

$$2x^2 + 1 = 3$$

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

$$2x^2 = 2$$

$$x^2 = 1$$

$$x = \pm 1$$

Thus, solution set = $\{-1, 0, 1\}$

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

Solution:

$$\frac{x}{x-3} + 4\left(\frac{x-3}{x}\right) = 4 \quad \dots\dots(i)$$

$$\text{Let } \frac{x}{x-3} = y,$$

So eq.(i) becomes

(...)

Multiplying both sides by 'y', we get

$$y^2 + 4 = 4y$$

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

$$(y)^2 - 2(y)(2) + (2)^2 = 0$$

$$(y - 2)^2 = 0$$

$$(y - 2) = 0$$

Put $y = 2$ in $\frac{x}{x-3} = y$, we get

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

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

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

$$2x - 6 = x$$

$$2x - x = 6$$

$$x = 6$$

Thus, solution set = {6}

$$(8) \quad \frac{4x+1}{4x-1} + \frac{4x-1}{4x+1} = 2\frac{1}{6}$$

Solution:

$$\frac{4x+1}{4x-1} + \frac{4x-1}{4x+1} = 2\frac{1}{6}$$

$$\frac{4x+1}{4x-1} + \frac{4x-1}{4x+1} = \frac{13}{6} \quad \dots\dots(i)$$

$$\text{Let } \frac{4x+1}{4x-1} = y,$$

So eq.(i) becomes

$$y + \frac{1}{y} = \frac{13}{6}$$

Multiplying both sides by '6y', we get

$$6y^2 + 6 = 13y$$

$$6y^2 - 13y + 6 = 0$$

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

$$3y(2y - 3) - 2(2y - 3) = 0$$

$$(3y - 2)(2y - 3) = 0$$

Either $3y - 2 = 0$ or $2y - 3 = 0$

$$3y = 2 \quad 2y = 3$$

$$y = \frac{2}{3} \quad y = \frac{3}{2}$$

Put $y = \frac{2}{3}$ in $\frac{4x+1}{4x-1} = y$, we get

$$\frac{4x+1}{4x-1} = y$$

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

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

$$12x+3 = 8x-2$$

$$12x-8x = -2-3$$

$$4x = -5$$

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

Put $y = \frac{3}{2}$ in $\frac{4x+1}{4x-1} = y$, we get

$$\frac{4x+1}{4x-1} = y$$

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

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

$$12x-3 = 8x+2$$

$$12x-8x = 2+3$$

$$4x = 5$$

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

Thus, solution set = $\left\{ \pm \frac{5}{4} \right\}$

$$(9) \frac{x-a}{x+a} - \frac{x+a}{x-a} = \frac{7}{12}$$

Solution:

$$\frac{x-a}{x+a} - \frac{x+a}{x-a} = \frac{7}{12} \quad \dots\dots(i)$$

$$\text{Let } \frac{x-a}{x+a} = y,$$

So eq.(i) becomes

$$y - \frac{1}{y} = \frac{7}{12}$$

Multiplying both sides by '12y', we get

$$12y^2 - 12 = 7y$$

$$12y^2 - 7y - 12 = 0$$

$$12y^2 - 16y + 9y - 12 = 0$$

$$4y(3y - 4) + 3(3y - 4) = 0$$

$$(4y + 3)(3y - 4) = 0$$

Either $4y + 3 = 0$ or $3y - 4 = 0$

$$4y = -3 \quad 3y = 4$$

$$y = -\frac{3}{4} \quad y = \frac{4}{3}$$

Put $y = -\frac{3}{4}$ in $\frac{x-a}{x+a} = y$, we get

$$\frac{x-a}{x+a} = y$$

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

$$4(x-a) = -3(x+a)$$

$$4x - 4a = -3x - 3a$$

$$4x + 3x = 4a - 3a$$

$$7x = a$$

$$x = \frac{a}{7}$$

Put $y = \frac{4}{3}$ in $\frac{x-a}{x+a} = y$, we get

$$\frac{x-a}{x+a} = y$$

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

$$4(x+a) = 3(x-a)$$

$$4x + 4a = 3x - 3a$$

$$4x - 3x = -4a - 3a$$

$$x = -7a$$

Thus, solution set = $\left\{-7a, \frac{a}{7}\right\}$

Solution:

$$x^4 - 2x^3 - 2x^2 + 2x + 1 = 0$$

Dividing each term by x^2 , we get

$$\frac{x^4}{x^2} - 2\frac{x^3}{x^2} - 2\frac{x^2}{x^2} + \frac{2x}{x^2} + \frac{1}{x^2} = 0$$

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

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

$$\left(x^2 + \frac{1}{x^2}\right) - 2\left(x - \frac{1}{x}\right) - 2 = 0 \quad \dots(i)$$

Let $x - \frac{1}{x} = y$

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

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

$$x^2 + \frac{1}{x^2} = y^2 + 2$$

So eq. (i) becomes

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

$$y^2 - 2y = 0$$

$$y(y - 2) = 0$$

Either $y = 0$ or $y - 2 = 0, \Rightarrow y = 2$

Put $y = 0$ in $x - \frac{1}{x} = y$, we get Put $y = 2$ in $x - \frac{1}{x} = y$, we get

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

$$x - \frac{1}{x} = 0$$

$$x^2 - 1 = 0$$

$$x^2 = 1$$

$$x = \pm 1$$

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

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

$$x^2 - 1 = 2x$$

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

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

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

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

$$x = \frac{2 \pm \sqrt{8}}{2}$$

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

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

$$x = 1 \pm \sqrt{2}$$

Thus, solution set = $\{\pm 1, 1 \pm \sqrt{2}\}$

$$(11) \quad 2x^4 + x^3 - 6x^2 + x + 2 = 0$$

Solution:

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

Dividing each term by x^2 , we get

$$\frac{2x^4}{x^2} + \frac{x^3}{x^2} - \frac{6x^2}{x^2} + \frac{x}{x^2} + \frac{2}{x^2} = 0$$

$$2x^2 + x - 6 + \frac{1}{x} + \frac{2}{x^2} = 0$$

$$2x^2 + \frac{2}{x^2} + x + \frac{1}{x} - 6 = 0$$

$$2\left(x^2 + \frac{1}{x^2}\right) + \left(x + \frac{1}{x}\right) - 6 = 0 \dots (i)$$

Let $x + \frac{1}{x} = y$

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

$$x^2 + \frac{1}{x^2} + 2 = y^2$$

$$\sim \quad \sim \quad \sim$$

So eq. (i) becomes

$$2(y^2 - 2) + y - 6 = 0$$

$$2y^2 - 4 + y - 6 = 0$$

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

$$2y^2 + 5y - 4y - 10 = 0$$

$$y(2y + 5) - 2(2y + 5) = 0$$

$$(y - 2)(2y + 5) = 0$$

Either $y - 2 = 0$ or $2y + 5 = 0$

$$y = 2 \quad 2y = -5$$

$$y = 2 \quad y = -\frac{5}{2}$$

Put $y = 2$ in $x + \frac{1}{x} = y$, we get

$$x + \frac{1}{x} = y$$

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

$$x^2 + 1 = 2x$$

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

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

$$\Rightarrow x - 1 = 0$$

$$\Rightarrow x = 1$$

Put $y = -\frac{5}{2}$ in $x + \frac{1}{x} = y$, we get

$$x + \frac{1}{x} = y$$

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

$$2x^2 + 2 = -5x$$

$$2x^2 + 5x + 2 = 0$$

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

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

Either $2x + 1 = 0$ or $x + 2 = 0$

$$2x = -1 \quad x = -2$$

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

Thus, solution set = $\left\{1, -2, -\frac{1}{2}\right\}$

(12) $4 \cdot 2^{2x+1} - 9 \cdot 2^x + 1 = 0$

$$4 \cdot 2^{2x+1} - 9 \cdot 2^x + 1 = 0$$

$$4 \cdot 2^{2x} \cdot 2 - 9 \cdot 2^x + 1 = 0 \quad \dots\dots\dots(i)$$

Let $2^x = y$ Then $2^{2x} = y^2$

So eq. (i) becomes

$$4 \cdot y^2 \cdot 2 - 9 \cdot y + 1 = 0$$

$$8y^2 - 9y + 1 = 0$$

$$8y^2 - 8y - y + 1 = 0$$

$$8y(y-1) - 1(y-1) = 0$$

$$(8y-1)(y-1) = 0$$

Either $8y - 1 = 0$ or $y - 1 = 0$

$$8y = 1 \quad y = 1$$

$$y = \frac{1}{8} \quad y = 1$$

Put $y = \frac{1}{8}$ in $2^x = y$, we get Put $y = 1$ in $2^x = y$, we get

$$2^x = y$$

$$2^x = y$$

$$2^x = \frac{1}{8}$$

$$2^x = 1$$

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

$$2^x = 2^0$$

$$2^x = 2^{-3}$$

$$x = 0$$

$$x = -3$$

Thus, solution set = $\{-3, 0\}$

(13) $3^{2x+2} = 12 \cdot 3^x - 3$

Solution:

$$3^{2x+2} = 12 \cdot 3^x - 3$$

$$3^{2x} \cdot 3^2 - 12 \cdot 3^x + 3 = 0 \quad \dots\dots\dots(i)$$

So eq. (i) becomes

$$y^2 \cdot 9 - 12y + 3 = 0$$

$$9y^2 - 12y + 3 = 0$$

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

$$9y(y-1) - 3(y-1) = 0$$

$$(9y-3)(y-1) = 0$$

Either $9y-3=0$ or $y-1=0$

$$9y=3 \quad y=1$$

$$y=\frac{3}{9} \quad y=1$$

$$y=\frac{1}{3} \quad y=1$$

Put $y=\frac{1}{3}$ in $3^x = y$, we get

$$3^x = y$$

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

$$3^x = 3^{-1}$$

$$x = -1$$

Put $y=1$ in $3^x = y$, we get

$$3^x = y$$

$$3^x = 1$$

$$3^x = 3^0$$

$$x = 0$$

Thus, solution set = $\{-1, 0\}$

$$(14) \quad 2^x + 64 \cdot 2^{-x} - 20 = 0$$

Solution:

$$2^x + 64 \cdot 2^{-x} - 20 = 0 \quad \dots\dots\dots(i)$$

$$\text{Let } 2^x = y, \text{ Then } 2^{-x} = \frac{1}{y}$$

So eq. (i) becomes

1

$$y^2 - 64 - 20y = 0$$

$$y^2 - 20y - 64 = 0$$

$$y^2 - 16y - 4y - 64 = 0$$

$$y(y-16) - 4(y-16) = 0$$

$$(y-4)(y-16) = 0$$

Either $y-4=0$ or $y-16=0$

$$y=4 \quad y=16$$

Put $y=4$ in $2^x = y$, we get Put $y=16$ in $2^x = y$, we get

$$2^x = y$$

$$2^x = y$$

$$2^x = 4$$

$$2^x = 16$$

$$2^x = 2^2$$

$$2^x = 2^4$$

$$x=2$$

$$x=4$$

Thus, solution set = $\{2, 4\}$

$$(15) \quad (x+1)(x+3)(x-5)(x-7) = 192$$

Solution:

$$(x+1)(x+3)(x-5)(x-7) = 192$$

$$\text{As } 1-5 = 3-7$$

$$4 = 4$$

$$\text{So } [(x+1)(x-5)][(x+3)(x-7)] = 192$$

$$[x^2 - 5x + x - 5][x^2 - 7x + 3x - 21] = 192$$

$$(x^2 - 4x - 5)(x^2 - 4x - 21) = 192 \quad \dots\dots(i)$$

$$\text{Let } x^2 - 4x = y$$

$$\begin{aligned}
 (y-5)(y-21) &= 192 \\
 y^2 - 21y - 5y + 105 &= 192 \\
 y^2 - 26y + 105 - 192 &= 0 \\
 y^2 - 26y - 87 &= 0 \\
 y^2 - 29y + 3y - 87 &= 0 \\
 y(y-29) + 3(y-29) &= 0 \\
 (y+3)(y-29) &= 0
 \end{aligned}$$

Either $y+3=0$ or $y-29=0$

$$y = -3 \quad y = 29$$

<p>Put $y = -3$ in $x^2 - 4x = y$, we get</p> $x^2 - 4x = y$ $x^2 - 4x = -3$ $x^2 - 4x + 3 = 0$ $x^2 - 3x - x + 3 = 0$	<p>Put $y = 29$ in $x^2 - 4x = y$, we get</p> $x^2 - 4x = y$ $x^2 - 4x = 29$ $x^2 - 4x - 29 = 0$
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Here $a = 1, b = -4, c = -29$

$x(x-3) - 1(x-3) = 0$ $(x-1)(x-3) = 0$	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(-29)}}{2(1)}$
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Either $x-1=0$ or $x-3=0$

$$x = 1 \quad x = 3$$

$$\begin{aligned}
 x &= \frac{4 \pm \sqrt{16 + 116}}{2} \\
 x &= \frac{4 \pm \sqrt{132}}{2} \\
 x &= \frac{4 \pm 2\sqrt{33}}{2} \\
 x &= \frac{2(2 \pm \sqrt{33})}{2} \\
 x &= 2 \pm \sqrt{33}
 \end{aligned}$$

$$(16) \quad (x-1)(x-2)(x-8)(x+5) + 360 = 0$$

Solution:

$$(x-1)(x-2)(x-8)(x+5) + 360 = 0$$

$$\begin{aligned} \text{As} \quad -1-2 &= -8+5 \\ -3 &= -3 \end{aligned}$$

$$\begin{aligned} \text{So} \quad & [(x-1)(x-2)][(x-8)(x+5)] + 360 = 0 \\ & [x^2 - 2x - x + 2][x^2 + 5x - 8x - 40] + 360 = 0 \\ & (x^2 - 3x + 2)(x^2 - 3x - 40) + 360 = 0 \quad \dots\dots(i) \end{aligned}$$

$$\text{Let} \quad x^2 - 3x = y$$

So eq.(i) becomes

$$\begin{aligned} (y+2)(y-40) + 360 &= 0 \\ y^2 - 40y + 2y - 80 + 360 &= 0 \\ y^2 - 38y + 280 &= 0 \\ y^2 - 28y - 10y + 280 &= 0 \\ y(y-28) - 10(y-28) &= 0 \\ (y-10)(y-28) &= 0 \end{aligned}$$

Either $y-10=0$ or $y-28=0$

$$y=10 \quad y=28$$

Put $y=10$ in $x^2 - 3x = y$, we get

$$\begin{aligned} x^2 - 3x &= y \\ x^2 - 3x &= 10 \\ x^2 - 3x - 10 &= 0 \\ x^2 - 5x + 2x - 10 &= 0 \\ x(x-5) + 2(x-5) &= 0 \\ (x+2)(x-5) &= 0 \end{aligned}$$

Either $x+2=0$ or $x-5=0$

$$x=-2 \quad x=5$$

Put $y=28$ in $x^2 - 3x = y$, we get

$$\begin{aligned} x^2 - 3x &= y \\ x^2 - 3x &= 28 \\ x^2 - 3x - 28 &= 0 \\ x^2 - 7x + 4x - 28 &= 0 \\ x(x-7) + 4(x-7) &= 0 \\ (x+4)(x-7) &= 0 \end{aligned}$$

Either $x+4=0$ or $x-7=0$

$$x=-4 \quad x=7$$

