Mathematics-10
Exercise - 1.1

Quadratic Equation (U.B)

(LHR 2014, 16, GRW 2014, FSD 2016, 17, MTN 2015, BWP 2015, D.G.K 2016)

"A polynomial equation, which contains the square of the unknown (variable) quantity, but no higher power, is called a quadratic equation, or an equation of degree two is called quadratic equation".

i.e., $ax^2+bx+c=0$ where $a,b,c\in R$ and $a\neq 0$.

For example: $5x^2+2x+1=0$, $x^2-1=0$ etc.

General or Standard Form of Quadratic Equation (U.B)

Standard form of quadratic equation in one variable x is: $ax^2+bx+c=0$ where $a,b,c\in R$ and $a\neq o$. Here a is the coefficient of x^2, b is coefficient of x and c is constant term.

Pure Quadratic Equation (U.B)

A quadratic equation in which coefficient of 'x' is zero is called pure quadratic equation.

OR

In standard form of quadratic equation $ax^2+bx+c=0$, if $b=0$, then it is called pure quadratic equation. i.e. $ax^2+c=0$

For example: $x^2-1=0$

Linear Equation (U.B)

An equation of degree one is called linear equation, or if $a=0$ in standard form of quadratic equation $ax^2+bx+c=0$ then it reduces to linear equation. i.e. $bx+c=0$ where $b,c\in R \wedge b\neq 0$. For example $3x+2=0$

Methods to Solve a Quadratic Equation (K.B)

(LHR 2017, GRW 2016, 17, SWL 2016, SGD 2013, 14, 15, MTN 2015, 17, RWP, 2016, D.G.K 2014, 17)

There are three methods to solve a quadratic equation.

(i) Factorization method

(ii) Completing square method

(iii) Using quadratic formula

Note (K.B)

- For factorization of $ax^2+bx+c=0$, we make two factors r and s of ac, such that $r+s=b \wedge rs=ac$.
- Cancelling of x on both sides of an equation (for example $5x^2=30x$) means the loss of one root. i.e. $x=0$
- For convenience, in the method of completing square, we make the coefficient of x^2 equal to 1.

Example 1: (Page # 2) **(FSD 2015)** **(A.B)**

Solve the quadratic equation

$3x^2-6x=x+20$ **by factorization.**

Solution:

$3x^2-6x=x+20$

$3x^2-6x-x-20=0$

$3x^2-7x-20=0$

$\because -12+5=-7,\ -12\times 5=-60$

$3x^2-12x+5x-20=0$

$3x(x-4)+5(x-4)=0$

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

Either $x-4=0$ *or* $3x+5=0$,

$\Rightarrow x=4$ or $3x=-5$

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

$x=-\frac{5}{3},4$ are the solutions of the given equation.

Thus, the solution set is $\left\{-\frac{5}{3},4\right\}$

Example 2: (Page # 4) **(A.B)**

Solve the equation $2x^2-5x-3=0$ **by completing square.**

Solution:

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

Dividing each term by 2

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

Now adding $\left(-\frac{5}{4}\right)^2$ on both sides

$x^2-\frac{5}{2}x+\left(-\frac{5}{4}\right)^2=\frac{3}{2}+\left(-\frac{5}{4}\right)^2$

$\left(x-\frac{5}{4}\right)^2=\frac{3}{2}+\frac{25}{16}=\frac{24+25}{16}$

$\left(x-\frac{5}{4}\right)^2=\frac{49}{16}$

Taking square root on both sides

$\sqrt{\left(x-\frac{5}{4}\right)^2}=\pm\sqrt{\frac{49}{16}}$

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

Either $x-\frac{5}{4}=\frac{7}{4}$ or $x-\frac{5}{4}=-\frac{7}{4}$

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

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

$=\frac{12}{4}$ or $=\frac{-2}{4}$

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

$\therefore\ x=-\frac{1}{2},3$ are the roots of the given equation.

Thus, the solution set is $\left\{-\frac{1}{2},3\right\}$

Exercise 1.1

Q.1 Write the following quadratic equations in the standard form and point out pure quadratic equations.

(SGD 2015, 17, RWP 2016) (A.B)

(i) $(x+7)(x-3)=-7$

Solution:

$(x+7)(x-3)=-7$

$x^2+7x-3x-21=-7$

$x^2+4x-21+7=0$

$x^2+4x-14=0$

Which is the required standard form of quadratic equation.

(ii) $\frac{x^2+4}{3}-\frac{x}{7}=1$ **(A.B)**

Solution:

$\frac{x^2+4}{3}-\frac{x}{7}=1$

$\frac{x^2+4}{3}-\frac{x}{7}-1=0$

$\frac{7(x^2+4)-3(x)-1(21)}{21}=0$

$\frac{7x^2+28-3x-21}{21}=0$

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

Which is the required standard form of quadratic equation.

(iii) $\frac{x}{x+1}+\frac{x+1}{x}=6$ **(A.B)**

(BWP 2014, D.G.K 2014, 15)

Solution:

$$\frac{x}{x+1}+\frac{x+1}{x}=6$$
$$\frac{x}{x+1}+\frac{x+1}{x}-6=0$$
$$\frac{x(x)+(x+1)^2-6(x)(x+1)}{(x+1)(x)}=0$$
$$\frac{x^2+(x^2+2x+1)-6x(x+1)}{(x+1)(x)}=0$$
$$x^2+x^2+2x+1-6x(x+1)=0$$
$$2x^2+2x+1-6x^2-6x=0$$
$$-4x^2-4x+1=0$$
$$-(4x^2+4x-1)=0$$
$$4x^2+4x-1=0$$

Which is the required standard form of quadratic equation.

(iv) $\frac{x+4}{x-2}-\frac{x-2}{x}+4=0$ **(A.B)**

Solution:

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

Multiplying both sides by $x(x-2)$, we get

$$x(x+4)-(x-2)(x-2)+4x(x-2)=0$$
$$x^2+4x-(x^2-4x+4)+4x^2-8x=0$$
$$\cancel{x^2}+4x-\cancel{x^2}+4x-4+4x^2-8x=0$$
$$4x^2+\cancel{8x}-\cancel{8x}-4=0$$
$$4x^2-4=0$$
$$4(x^2-1)=0$$
$$x^2-1=0 \qquad \because 4\neq 0$$

Is the required standard form and it is a pure quadratic equation.

(v) $\frac{x+3}{x+4}-\frac{x-5}{x}=1$ **(A.B)**

Solution:

$$\frac{x+3}{x+4}-\frac{x-5}{x}=1$$
$$\frac{x(x+3)-(x+4)(x-5)}{(x+4)(x)}=1$$
$$\frac{x^2+3x-(x^2-5x+4x-20)}{(x+4)(x)}=1$$
$$\frac{x^2+3x-x^2+5x-4x+20}{(x+4)(x)}=1$$
$$\frac{4x+20}{(x+4)(x)}=1$$
$$4x+20=x(x+4)$$
$$4x+20-x(x+4)=0$$
$$4x+20-x^2-4x=0$$
$$-x^2+20=0 \quad \text{Or} \quad x^2-20=0$$

Is the required standard form of quadratic equation and it is a pure quadratic.

(vi) $\frac{x+1}{x+2}+\frac{x+2}{x+3}=\frac{25}{12}$ **(A.B)**

Solution:

$$\frac{x+1}{x+2}+\frac{x+2}{x+3}=\frac{25}{12}$$
$$\frac{(x+1)(x+3)+(x+2)^2}{(x+2)(x+3)}=\frac{25}{12}$$
$$\frac{x^2+x+3x+3+x^2+4x+4}{(x+2)(x+3)}=\frac{25}{12}$$
$$\frac{2x^2+8x+7}{(x+2)(x+3)}-\frac{25}{12}=0$$
$$\frac{12(2x^2+8x+7)-[25(x+3)(x+2)]}{12(x+2)(x+3)}=0$$
$$24x^2+96x+84-[25(x^2+5x+6)]=0$$
$$24x^2+96x+84-[25x^2+125x+150]=0$$
$$24x^2+96x+84-25x^2-125x-150=0$$
$$-x^2-29x-66=0$$
$$\text{Or} \quad x^2+29x+66=0$$

Is the required standard form of quadratic equation.

Q.2 Solve by factorization:

(i) $x^2-x-20=0$ **(A.B)**

(LHR 2014, 15, FSD 2016, SGD 2016, SWL 2016, RWP 2016)

Solution:

$x^2-x-20=0$

$x^2-5x+4x-20=0$

$\because -5+4=-1,\ -5\times4=-20$

$x(x-5)+4(x-5)=0$

Either

$x-5=0$ or $x+4=0$

$x=5$ $x=-4$

$\therefore$ **Solution Set** $=\{5,-4\}$

(ii) $3y^2=y(y-5)$ **(A.B)**

(FSD 2015, BWP 2017)

Solution:

$3y^2=y(y-5)$

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

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

$2y^2+5y=0$

$y(2y+5)=0$

Either

$y=0$ *or* $2y+5=0$

$y=0$ *or* $2y=-5$

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

$\therefore$ **Solution Set** $=\left\{0,-\frac{5}{2}\right\}$

Note

The cancelling of y on both sides of $3y^2=y(y-5)$ means the lose of 1 root i.e $y=0$

(iii) $4-32x=17x^2$ **(K.B, A.B)**

Solution:

$4-32x=17x^2$

$17x^2+32x-4=0$

$17x^2+34x-2x-4=0$

$17x(x+2)-2(x+2)=0$

$(x+2)(17x-2)=0$

$x+2=0$ or $17x-2=0$

$x=-2$ or $17x=2$

$x=\frac{2}{17}$

$\therefore$ **Solution Set** $=\left\{-2,\frac{2}{17}\right\}$

(iv) $x^2-11x=152$ **(A.B)**

Solution:

$x^2-11x=152$

$x^2-11x-152=0$

$x^2-19x+8x-152=0$

$x(x-19)+8(x-19)=0$

$(x-19)(x+8)=0$

Either

$x-19=0$ or $x+8=0$

$x=19$ $x=-8$

$\therefore$ **Solution Set** $=\{-8,19\}$

(v) $\frac{x+1}{x}+\frac{x}{x+1}=\frac{25}{12}$ **(A.B)**

(GRW 2014, 17, BWP 2016)

Solution:

$\frac{x+1}{x}+\frac{x}{x+1}=\frac{25}{12}$

$\frac{(x+1)^2+(x)^2}{(x+1)(x)}=\frac{25}{12}$

$\frac{x^2+2x+1+x^2}{(x+1)(x)}=\frac{25}{12}$

$\frac{2x^2+2x+1}{(x+1)(x)}=\frac{25}{12}$

$12(2x^2+2x+1)=25(x)(x+1)$

$24x^2+24x+12=25x(x+1)$

$24x^2+24x+12=25x^2+25x$

$24x^2+24x+12-25x^2-25x=0$

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

$x^2+x-12=0$

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

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

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

Either

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

$x=-4$ $x=3$

$\therefore$ **Solution Set** $=\{-4,3\}$

(vi) $\frac{2}{x-9}=\frac{1}{x-3}-\frac{1}{x-4}$ **(A.B)**

(LHR 2014, FSD 2017, RWP 2017, BWP 2016, D.G.K 2016)

Solution:

$$\frac{2}{x-9}=\frac{1}{x-3}-\frac{1}{x-4}$$
$$\frac{2}{x-9}=\frac{1(x-4)-1(x-3)}{(x-3)(x-4)}$$
$$\frac{2}{x-9}=\frac{x-4-x+3}{x^2-4x-3x+12}$$
$$\frac{2}{x-9}=\frac{-1}{x^2-7x+12}$$
$$2(x^2-7x+12)=-1(x-9)$$
$$2x^2-14x+24=-x+9$$
$$2x^2-14x+x+24-9=0$$
$$2x^2-13x+15=0$$
$$2x^2-10x-3x+15=0$$
$$2x(x-5)-3(x-5)=0$$
$$(x-5)(2x-3)=0$$

Either

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

$x=5$ or $2x=3$

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

$\therefore$ **Solution Set** $=\left\{\frac{3}{2},5\right\}$

Q.3 Solve the following equations by completing square

(i) $7x^2+2x-1=0$ **(A.B)**

Solution:

$$7x^2+2x-1=0$$
$$7x^2+2x=1$$

Divide by '7' on both sides

$$\frac{7x^2}{7}+\frac{2x}{7}=\frac{1}{7}$$
$$x^2+\frac{2x}{7}=\frac{1}{7}$$

Adding $\left(\frac{1}{7}\right)^2$ on both sides

$$x^2+\frac{2x}{7}+\left(\frac{1}{7}\right)^2=\frac{1}{7}+\left(\frac{1}{7}\right)^2$$
$$\left(x+\frac{1}{7}\right)^2=\frac{1}{7}+\frac{1}{49}$$
$$\left(x+\frac{1}{7}\right)^2=\frac{1(7)+1}{49}$$
$$\left(x+\frac{1}{7}\right)^2=\frac{7+1}{49}$$
$$\left(x+\frac{1}{7}\right)^2=\frac{8}{49}$$

Taking square root on both sides

$$\sqrt{\left(x+\frac{1}{7}\right)^2}=\sqrt{\frac{8}{49}}$$
$$x+\frac{1}{7}=\pm\frac{\sqrt{8}}{7}$$
$$x=-\frac{1}{7}\pm\frac{\sqrt{8}}{7}$$
$$x=\frac{-1\pm\sqrt{8}}{7}$$

Or $x=\frac{-1\pm2\sqrt{2}}{7}$

$\therefore$ **Solution Set** $=\left\{\frac{-1\pm2\sqrt{2}}{7}\right\}$

(ii) $ax^2+4x-a=0$, where $a\neq0$ **(A.B)**

Solution:

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

Divide by 'a'

$$\frac{ax^2}{a}+\frac{4x}{a}=\frac{a}{a}$$
$$x^2+\frac{4x}{a}=1$$

Adding $\left(\frac{2}{a}\right)^2$ on both sides

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

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

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

Taking square root on both sides

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

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

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

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

$\therefore$ **Solution Set** = $\left\{\frac{-2\pm\sqrt{a^2+4}}{a}\right\}$

(iii) $11x^2-34x+3=0$ **(A.B)** **(FSD 2018)**

Solution:

$$11x^2-34x+3=0$$

$$11x^2-34x=-3$$

Divide by '11' on both sides

$$\frac{11x^2}{11}-\frac{34x}{11}=\frac{-3}{11}$$

$$x^2-\frac{34x}{11}=-\frac{3}{11}$$

Adding $\left(\frac{17}{11}\right)^2$ on both sides

$$x^2-\frac{34}{11}x+\left(\frac{17}{11}\right)^2=\frac{-3}{11}=\left(\frac{17}{11}\right)^2$$

$$\left(x-\frac{17}{11}\right)^2=\frac{-3}{11}+\frac{289}{121}$$

$$\left(x-\frac{17}{11}\right)^2=\frac{-3(11)+289}{121}$$

$$\left(x-\frac{17}{11}\right)^2=\frac{-33+289}{121}$$

$$\left(x-\frac{17}{11}\right)^2=\frac{256}{121}$$

Taking square root on both sides

$$\sqrt{\left(x-\frac{17}{11}\right)^2}=\sqrt{\frac{256}{121}}$$

$$x-\frac{17}{11}=\pm\frac{16}{11}$$

$$x=\frac{17}{11}\pm\frac{16}{11}$$

Either

$$x=\frac{16}{11}+\frac{17}{11} \quad \text{or} \quad x=\frac{-16}{11}+\frac{17}{11}$$

$$x=\frac{16+17}{11} \quad \text{or} \quad x=\frac{-16+17}{11}$$

$$x=\frac{33}{11} \quad \text{or} \quad x=\frac{1}{11}$$

$$x=3$$

$\therefore$ **Solution Set** = $\left\{\frac{1}{11},3\right\}$

(iv) $lx^2+mx+n=0$ **(FSD 2015)** **(A.B)**

Solution:

$$lx^2+mx+n=0$$

$$lx^2+mx=-n$$

Divide by 'l' on both sides

$$\frac{lx^2}{l}+\frac{mx}{l}=\frac{-n}{l}$$

$$x^2+\frac{mx}{l}=\frac{-n}{l}$$

Adding $\left(\frac{m}{2l}\right)^2$ on both sides

$$x^2+\frac{m}{l}x+\left(\frac{m}{2l}\right)^2=\left(\frac{m}{2l}\right)^2-\frac{n}{l}$$

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

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

Taking square roots on both sides

$$\sqrt{\left(x+\frac{m}{2l}\right)^2} = \pm\sqrt{\frac{m^2-4ln}{4l^2}}$$

$$x+\frac{m}{2l} = \pm\frac{\sqrt{m^2-4ln}}{2l}$$

$$x = -\frac{m}{2l}\pm\frac{\sqrt{m^2-4ln}}{2l}$$

Or $x = \dfrac{-m\pm\sqrt{m^2-4ln}}{2l}$

$\therefore$ **Solution Set** $= \left\{\dfrac{-m\pm\sqrt{m^2-4ln}}{2l}\right\}$

(v) $3x^2+7x=0$ **(A.B)**

Solution:

$$3x^2+7x=0$$

Dividing by 3

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

$$\because \frac{1}{2}(\text{Coefficient of } x) = \frac{1}{2}\times\frac{7}{3} = \frac{7}{6}$$

Adding $\left(\dfrac{7}{6}\right)^2$ on both sides, we get

$$x^2+\frac{7}{3}x+\left(\frac{7}{6}\right)^2 = 0+\left(\frac{7}{6}\right)^2$$

$$(x)^2+2(x)\left(\frac{7}{6}\right)+\left(\frac{7}{6}\right)^2 = \left(\frac{7}{6}\right)^2$$

$$\left(x+\frac{7}{6}\right)^2 = \frac{49}{36}$$

Taking square roots on both sides

$$\sqrt{\left(x+\frac{7}{6}\right)^2} = \pm\sqrt{\frac{49}{36}}$$

$$x+\frac{7}{6} = \pm\frac{7}{6}$$

Either

$x = -\frac{7}{6}+\frac{7}{6}$ or $x = -\frac{7}{6}-\frac{7}{6}$

$x=0$ $\quad$ $x = \dfrac{-7-7}{6}$

$$x = \frac{-14}{6}$$

$$x = -\frac{7}{3}$$

$\therefore$ **Solution Set** $= \left\{0, -\dfrac{7}{3}\right\}$

(vi) **Given:**

$x^2-2x-195=0$ **(A.B)**

Solution:

$$x^2-2x-195=0$$

$$x^2-2x=195$$

Adding $(1)^2$ on both sides

$$x^2-2x+(1)^2 = 195+(1)^2$$

$$(x-1)^2 = 195+1$$

$$(x-1)^2 = 196$$

Taking square root on both sides

$$\sqrt{(x-1)^2} = \sqrt{196}$$

$$x-1 = \pm 14$$

Either

$x-1=14$ or $x-1=-14$

$x=14+1$ $\quad$ $x=-14+1$

$x=15$ $\quad$ $x=-13$

$\therefore$ **Solution Set** $= \{-13, 15\}$

(vii) $-x^2+\dfrac{15}{2} = \dfrac{7}{2}x$ **(A.B)**

Solution:

$$-x^2+\frac{15}{2} = \frac{7}{2}x$$

$$x^2+\frac{7}{2}x-\frac{15}{2} = 0$$

$$x^2+\frac{7}{2}x = \frac{15}{2}$$

$$\because \frac{1}{2}(\text{Coefficient of } x) = \frac{1}{2}\left(\frac{7}{2}\right) = \frac{7}{4}$$

Adding $\left(\frac{7}{4}\right)^2$ on both sides

$$x^2+\frac{7}{2}x+\left(\frac{7}{4}\right)^2=\left(\frac{15}{2}\right)+\left(\frac{7}{4}\right)^2$$

$$(x)^2+2(x)\left(\frac{7}{4}\right)+\left(\frac{7}{4}\right)^2=\frac{15}{2}+\frac{49}{16}$$

$$\left(x+\frac{7}{4}\right)^2=\frac{120+49}{16}$$

$$=\frac{169}{16}$$

Taking square root on both sides

$$x+\frac{7}{4}=\pm\sqrt{\frac{169}{16}}$$

$$x+\frac{7}{4}=\pm\frac{13}{4}$$

$$x=-\frac{7}{4}\pm\frac{13}{4}$$

Either

$$x=-\frac{7}{4}+\frac{13}{4} \quad \text{or} \quad x=-\frac{7}{4}-\frac{13}{4}$$

$$=\frac{-7+13}{4} \quad \text{or} \quad x=\frac{-7-13}{4}$$

$$=\frac{6}{4} \quad \text{or} \quad =-\frac{20}{4}$$

$$x=\frac{3}{2} \quad \text{or} \quad x=-5$$

$\therefore$ **Solution Set** $=\left\{-5,\frac{3}{2}\right\}$

(viii) $x^2+17x+\frac{33}{4}=0$ **(A.B)**

Solution:

$$x^2+17x+\frac{33}{4}=0$$

$$x^2+17x=-\frac{33}{4}$$

Adding $\left(\frac{17}{2}\right)^2$ on both sides

$$x^2+17x+\left(\frac{17}{2}\right)^2=\frac{-33}{4}+\left(\frac{17}{2}\right)^2$$

$$\left(x+\frac{17}{2}\right)^2=\frac{-33}{4}+\frac{289}{4}$$

$$\left(x+\frac{17}{2}\right)^2=\frac{-33+289}{4}$$

$$\left(x+\frac{17}{2}\right)^2=\frac{256}{4}$$

Taking square root on both sides

$$\sqrt{\left(x+\frac{17}{2}\right)^2}=\sqrt{\frac{256}{4}}$$

$$x+\frac{17}{2}=\pm\frac{16}{2}$$

$$x=\pm\frac{16}{2}-\frac{17}{2}$$

Either

$$x=\frac{16}{2}-\frac{17}{2} \quad \text{or} \quad x=\frac{-16}{2}\frac{-17}{2}$$

$$x=\frac{16-17}{2} \quad \text{or} \quad x=\frac{-16-17}{2}$$

$$x=\frac{-1}{2} \quad \text{or} \quad x=\frac{-33}{2}$$

$\therefore$ **Solution Set** = $\left\{-\frac{1}{2},-\frac{33}{2}\right\}$

(ix) $4-\frac{8}{3x+1}=\frac{3x^2+5}{3x+1}$

(A.B + K.B + U.B)

Solution:

$$4-\frac{8}{3x+1}=\frac{3x^2+5}{3x+1}$$

$$4=\frac{3x^2+5}{3x+1}+\frac{8}{3x+1}$$

$$\text{Or}\ \frac{3x^2+5}{3x+1}+\frac{8}{3x+1}=4$$

$$\frac{3x^2+5+8}{3x+1}=4$$

$$\frac{3x^2+13}{3x+1}=4$$
$3x^2+13=4(3x+1)$
$3x^2+13=12x+4$
$3x^2-12x=4-13$
$3x^2-12x=-9$
Divide by '3' on both sides
$x^2-4x=-3$
Adding $(2)^2$ on both side
$x^2-4x+(2)^2=-3+(2)^2$
$(x-2)^2=-3+4$
$(x-2)^2=1$
Taking square root on both sides
$\sqrt{(x-2)^2}=\sqrt{1}$
$x-2=\pm1$
$x=\pm1+2$
Either
$x=1+2$ or $x=-1+2$
$x=3$ or $x=1$
$\therefore$ **Solution Set** $=\{1,3\}$

(x) $7(x+2a)^2+3a^2=5a(7x+23a)$ **(A.B + K.B + U.B)**

Solution:

$7(x+2a)^2+3a^2=5a(7x+23a)$
$7(x^2+4ax+4a^2)+3a^2=35ax+115a^2$
$7x^2+28ax+28a^2+3a^2=35ax+115a^2$
$7x^2+28ax+31a^2-35ax-115a^2=0$
$7x^2-7ax-84a^2=0$
$7x^2-84a^2-7ax=0$
$7(x^2-ax-12a^2)=0$
$x^2-ax-12a^2=0 \qquad \because 7\neq0$
$x^2-ax=12a^2$
Adding $\left(\frac{a}{2}\right)^2$ on both sides
$$x^2-ax+\left(\frac{a}{2}\right)^2=12a^2+\left(\frac{a}{2}\right)^2$$
$$\left(x-\frac{a}{2}\right)^2=12a^2+\frac{a^2}{4}$$
$$\left(x-\frac{a}{2}\right)^2=\frac{4(12a^2)+a^2}{4}$$
$$\left(x-\frac{a}{2}\right)^2=\frac{48a^2+a^2}{4}$$
$$\left(x-\frac{a}{2}\right)^2=\frac{49a^2}{4}$$
Taking square root on both sides
$$\sqrt{\left(x-\frac{a}{2}\right)^2}=\sqrt{\frac{49a^2}{4}}$$
$$x-\frac{a}{2}=\pm\frac{7a}{2}$$
$$x=\pm\frac{7a}{2}+\frac{a}{2}$$
Either
$$x=\frac{7a}{2}+\frac{a}{2} \quad \text{or} \quad x=\frac{-7a}{2}+\frac{a}{2}$$
$$=\frac{7a+a}{2} \qquad =\frac{-7a+a}{2}$$
$$=\frac{8a}{2} \qquad =\frac{-6a}{2}$$
$x=4a$ or $x=-3a$
$\therefore$ **Solution Set** $=\{-3a,4a\}$