Chapter 10. Quadratic And Exponential Functions

Ex. 10.4

Answer 1CU.

Consider the equation $x^2-2x-15=0$

Method 1:- Factoring

$$x^2-2x-15=0 \quad \text{[Original equation]}$$
$$x^2-5x+3x-15=0$$
$$x\cdot x-5\cdot x+3\cdot x+(3)(-5)=0$$
$$x\cdot(x-5)+3(x+(-5))=0 \quad \text{[Use the distributive property]}$$
$$(x+3)(x-5)=0$$
$$x+3=0 \text{ or } x-5=0 \quad \text{[Use the zero product rule]}$$
$$x=-3 \text{ or } x=5 \quad [\text{Solve for } x]$$

The solution set is $\boxed{\{-3,5\}}$

Method 2:- Quadratic formula

The given equation is $2x^2-2x-15=0$

Now compare the equation $2x^2-2x-15=0$ with standard quadratic equation $ax^2+bx+c=0$ use obtain $a=1, b=-2$ and $c=-15$

Use the rule "The solution of quadratic equation is the form $ax^2+bx+c=0$. Where $a\neq 0$ are given by $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a} \quad \text{[Quadratic formula]}$$
$$=\frac{-(-2)\pm\sqrt{(-2)^2-4(1)(-15)}}{2\cdot(1)} \quad [\text{Replace } a \text{ by } 1, b \text{ by } -2 \text{ and } c \text{ by } -15]$$
$$=\frac{2\pm\sqrt{4+60}}{2}$$
$$=\frac{2\pm\sqrt{64}}{2}$$
$$=\frac{2\pm\sqrt{8^2}}{2} \quad [\text{Use the rule } \sqrt[n]{a^n}=a]$$
$$=\frac{2\pm 8}{2}$$
$$x=\frac{2+8}{2} \text{ or } x=\frac{2-8}{2}$$
$$x=\frac{10}{2} \text{ or } x=\frac{-6}{2}$$
$$x=5 \text{ or } x=-3$$

The solution set is $\boxed{\{-3,5\}}$

Method 3: Graph the function $y = f(x) = x^2 - 2x - 15$ (green curve)

Now we construct the table for $y = f(x) = x^2 - 2x - 15$

Now we can substitute different values of 'x' is $y = f(x) = x^2 - 2x - 15$. Plotting these all points and connected them, we get a smooth curve.

Table for $y = x^2 - 2x - 15$

x	$x^2 - 2x - 15$	y	(x, y)
-4	$(-4)^2 - 2(-4) - 15 = 9$	9	$(-4, 9)$
-3	$(-3)^2 - 2(-3) - 15 = 0$	0	$(-3, 0)$
-2	$(-2)^2 - 2(-2) - 15 = -7$	-7	$(-2, -7)$
-1	$(-1)^2 - 2(-1) - 15 = -12$	-12	$(-1, -12)$
0	$(0)^2 - 2(0) - 15 = -15$	-15	$(0, -15)$
1	$(1)^2 - 2(1) - 15 = -16$	-16	$(1, -16)$
2	$(2)^2 - 2(2) - 15 = -15$	-15	$(2, -15)$
3	$(3)^2 - 2(3) - 15 = -12$	-12	$(3, -12)$
4	$(4)^2 - 2(4) - 15 = -7$	-7	$(4, -7)$
5	$(5)^2 - 2(5) - 15 = 0$	0	$(5, 0)$

Now, add these all ordered pairs (brown dots), we get the parabola.

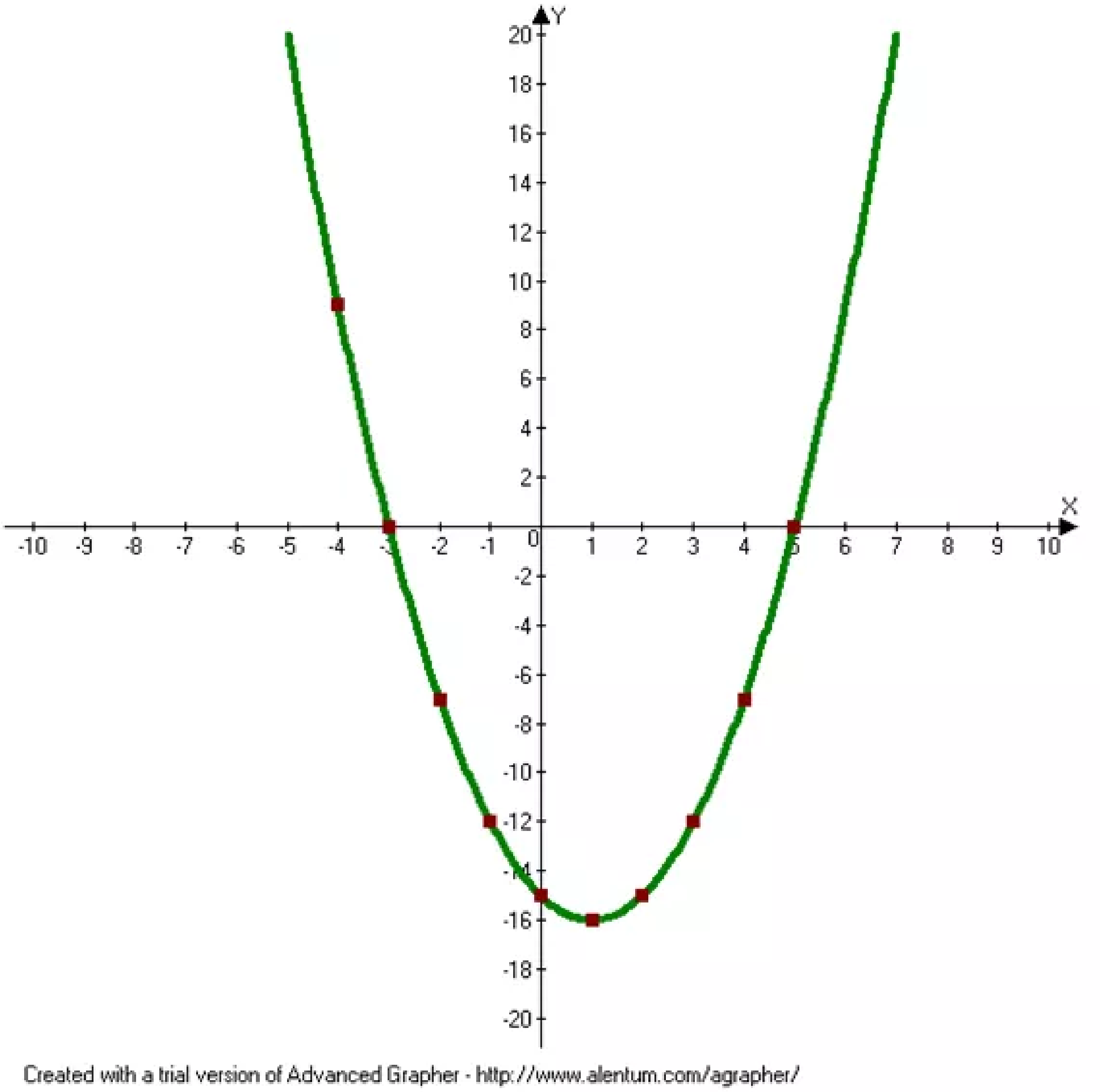
Note that these parabola intercept x – axis -3 and 5.

Therefore, the parabola meets at x –axis is $(-3,0)$ and $(5)^2-2(5)-15=0 \quad (5,0)$

Use the rule "The solution of the graph $y=f(x)=ax^2+bc+c$ is the x –intercept sof the that graph.

The solution of the $y=f(x)=x^2-2x-15$ is $\boxed{\{-3,5\}}$

Step 4 of 4



Answer 1GCI.

Solve the equations $y=-2(2x+3)$ and $y=x^2+2x+3$ for x and y using substitution method.

Put $y=-2(2x+3)$ into the original equation $y=x^2+2x+3$

$$
\begin{aligned}
y &= x^2+2x+3 && \text{(Original equation)}\\
-2(2x+3) &= x^2+2x+3 && (\text{Replace } y \text{ by} -2(2x+3))\\
-2\cdot 2x+2\cdot 3 &= x^2+2x+3 && \text{(Use distributive property)}\\
-4x-6 &= x^2+2x+3 \\
4x-4x-6+6 &= x^2+2x+3+4x+6 && (\text{Add } 4x \text{ and } 6 \text{ on both sides})\\
0 &= x^2+6x+9 && \text{(Combine like terms)}\\
x^2+6x+9 &= 0
\end{aligned}
$$

Solve the equation $x^2+6x+9=0$ by the quadratic formula.

Compare the equation $x^2+6x+9=0$ with the standard quadratic equation $ax^2+bx+c=0$.

a = 1, b = 6 and c = 9

Use the formula $x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$.

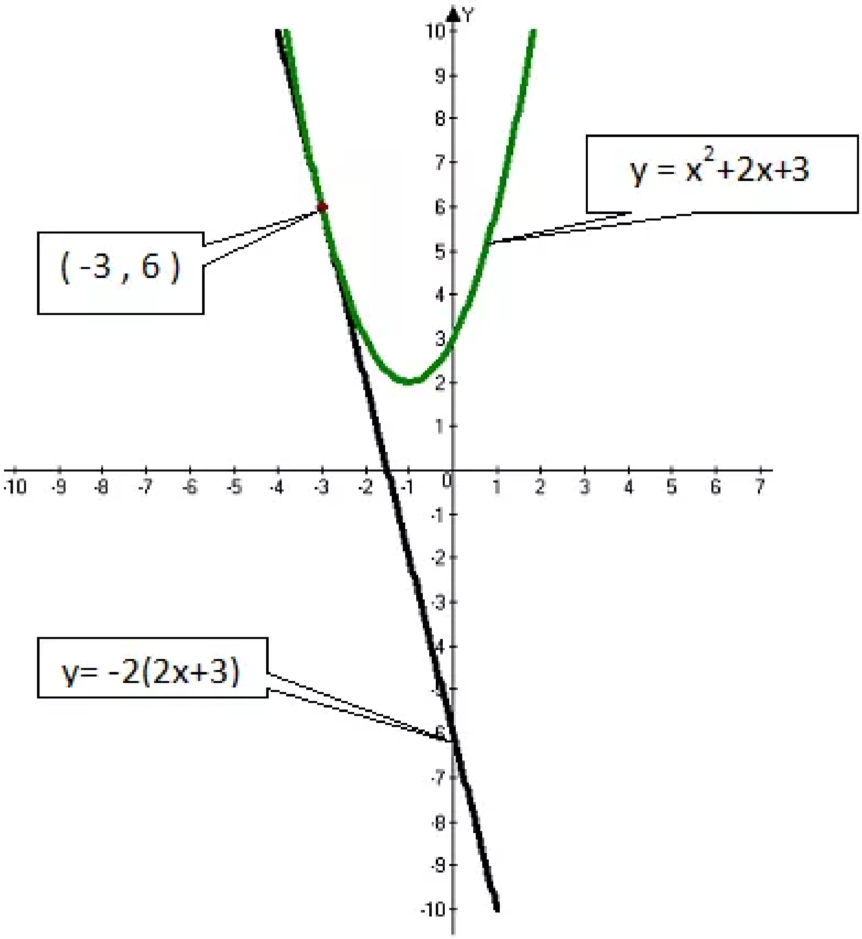
$$
\begin{aligned}
x &= \frac{-b\pm\sqrt{b^2-4ac}}{2a} && \text{(Quadratic formula)}\\
x &= \frac{-6\pm\sqrt{6^2-4\cdot 1\cdot 9}}{2\cdot 1} && (\text{Replace } a \text{ by } 1,\ b \text{ by } 6 \text{ and } c \text{ by } 9)\\
&= \frac{-6\pm\sqrt{36-36}}{2}\\
&= \frac{-6\pm\sqrt{0}}{2}\\
&= \frac{-6}{2}\\
&= \frac{-3\cdot 2}{2\cdot 1}\\
x &= -3
\end{aligned}
$$

Solve for *y*, substitute $x = -3$ is the linear equation $y = -2(2x+3)$

$$\begin{aligned} y &= -2(2x+3) && \text{(original linear equation)} \\ &= -2(2(-3)+3) \\ &= -2(-6+3) \\ &= -2(-3) \\ y &= 6 \end{aligned}$$

Therefore, the line $y = -2(2x+3)$ cuts the curve $y = x^2 + 2x + 3$ at $\boxed{(-3, 6)}$.

The following diagram supports the solution found above.



Answer 2CU.

Consider the quadratic equation $3x^2+4x+2=0$

Use the rule "The discriminant of the quadratic equation $ax^2+bx+c=0$ is b^2-4ac. Suppose the discriminant b^2-4ac. Suppose the discriminant b^2-4ac is positive, the roots are real. Suppose the discriminant b^2-4ac is negative, the roots are complex or no real solution. Suppose the discriminant b^2-4ac is zero, the roots real and same.

Now compare the given equation $3x^2+4x+2=0$ with the standard quadratic equation $ax^2+bx+c=0$. We get $a=3, b=4$ and $c=2$

The discriminant $=b^2-4ac$

$$
\begin{aligned}
&=(4)^2-4(3)(2) && [\text{Replace } a \text{ by } 3,\ b \text{ by } 4 \text{ and } c \text{ by } 2]\\
&=16-24\\
&=-8 && [\text{Simplify}]
\end{aligned}
$$

The discriminant of the equation $3x^2+4x+2=0$ is -8

Note that the discriminant of the equation is negative.

So the equation has no real roots.

Hence, the quadratic equation $\boxed{3x^2+4x+2=0}$ has no real roots.

Answer 2GCI.

Solve the equations $y-5=0$ and $y=-x^2$ for *x* and *y* using substitution method.

Put $y=-x^2$ into the original equation $y-5=0.$

$$
\begin{aligned}
y-5&=0 && (\text{Original equation})\\
-x^2-5&=0 && (\text{Replace } y \text{ by } x^2)
\end{aligned}
$$

Solve the equation $-x^2-5=0$ by the quadratic formula.

Compare the equation $-x^2-5=0$ with the standard quadratic equation $ax^2+bx+c=0$.

$a = -1$, $b = 0$ and $c = -5$

Use the formula $x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$.

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a} \qquad \text{(Quadratic formula)}$$

$$x=\frac{-0\pm\sqrt{0^2-4\cdot(-1)\cdot(-5)}}{2\cdot(-1)} \qquad (\text{Replace } a \text{ by } -1,\ b \text{ by } 0 \text{ and } c \text{ by } -5)$$

$$=\frac{\pm\sqrt{-20}}{-2}$$

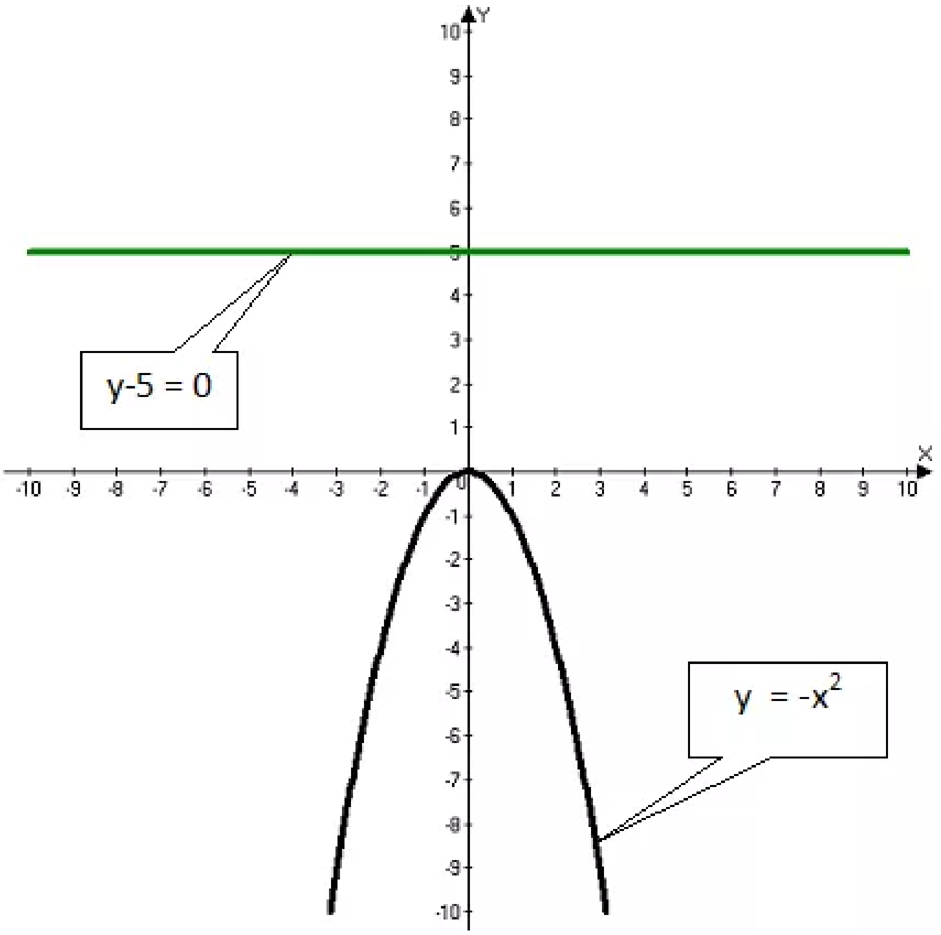
$$x=\frac{-\sqrt{-20}}{-2} \quad \text{or} \quad x=\frac{\sqrt{-20}}{-2}$$

$$x=\frac{-2\sqrt{5}\cdot i}{2} \quad \text{or} \quad x=\frac{2\sqrt{5}\cdot i}{2}$$

$$x=-\sqrt{5}i \quad \text{or} \quad x=\sqrt{5}i$$

Therefore, the line $y-5=0$ does not cut the curve $y=-x^2$.

The following diagram supports the solution found above.



Answer 3CU.

Consider the equation $5y^2 - 3y = 2$

Claim:- To find the number of solution of $5y^2 - 3y = 2$

Step 1:- Rewrite the equation $5y^2 - 3y = 2$ with the standard equation $ax^2 + bx + c = 0$

$$5y^2 - 3y = 2 \quad [\text{original equation}]$$
$$5y^2 - 3y - 2 = 2 - 2 \quad [\text{Substract '2' on both sides}]$$
$$5y^2 - 3y - 2 = 0$$

Step 2:- To find the discriminant of the equation $5y^2 - 3y - 2 = 0$

Now, compare the equation $5y^2 - 3y - 2 = 0$ with the standard equation $ax^2 + bx + c = 0$. Where $a \neq 0$. We obtain $a = 5, b = -3$ and $c = -2$

Use the formula "The discriminant of the equation $ax^2 + bx + c = 0$ is $\Delta = b^2 - 4ac$"

$$\Delta = b^2 - 4ac \quad \left[\begin{array}{l}\text{The discriminant of the equation} \\ ax^2 + bx + c = 0\end{array}\right]$$
$$= (-3)^2 - 4(5)(-2)$$
$$= 9 + 40$$
$$\Delta = 49$$

Since, the discriminant of the equation $5y^2 - 3y - 2 = 0$ is 49.

So, the equation has two real roots.

Hence Juanita, you must write the equation in the form $ax^2 + bx + c = 0$. To determine the value of *a*, *b* and *c*. therefore, the value of *c* is -2 not 2.

Answer 3GCI.

Solve the equations $1.8x + y = 3.6$ and $y = x^2 - 3x - 1$ for *x* and *y* using substitution Method.

Solve the first equation for *y*.

$$1.8x + y = 3.6 \quad (\text{Original equation})$$
$$-1.8x + 1.8x + y = 3.6 - 1.8x \quad (\text{Subtract } -1.8x \text{ on both side})$$
$$y = 3.6 - 1.8x$$

Put $y = 3.6 - 1.8x$ into the original equation

$$y = x^2 - 3x - 1 \quad (\text{Original quadratic equation})$$
$$3.6 - 1.8x = x^2 - 3x - 1$$
$$-3.6 + 3.6 - 1.8x + 1.8x = x^2 - 3x + 1.8x - 1 - 3.6$$
$$0 = x^2 - 1.2x - 4.6$$
$$x^2 - 1.2x - 4.6 = 0$$

Solve the equation $x^2 - 1.2x - 4.6 = 0$ by the quadratic formula.

Compare the equation $x^2 - 1.2x - 4.6 = 0$ with the standard quadratic equation

$ax^2 + bx + c = 0$.

a = 1, b = −1.2 and c = −4.6

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

$$\begin{aligned}
x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad \text{(Quadratic formula)} \\
&= \frac{-(-1.2) \pm \sqrt{(-1.2)^2 - 4\cdot(1)\cdot(-4.6)}}{2\cdot(1)} \\
&= \frac{1.2 \pm \sqrt{1.44 + 18.4}}{2} \\
&= \frac{1.2 \pm \sqrt{19.84}}{2} \\
&= \frac{1.2 \pm 4.5}{2}
\end{aligned}$$

$$x = \frac{1.2 + 4.5}{2} \quad \text{or} \quad x = \frac{1.2 - 4.5}{2}$$

$$x = \frac{5.7}{2} \quad \text{or} \quad x = \frac{-3.3}{2}$$

$$x = 2.85 \quad \text{or} \quad x = -1.65$$

Solve for 'y'

Substitute x = 2.85 and x = −1.65 in the linear equation $y = 3.6 - 1.8x$

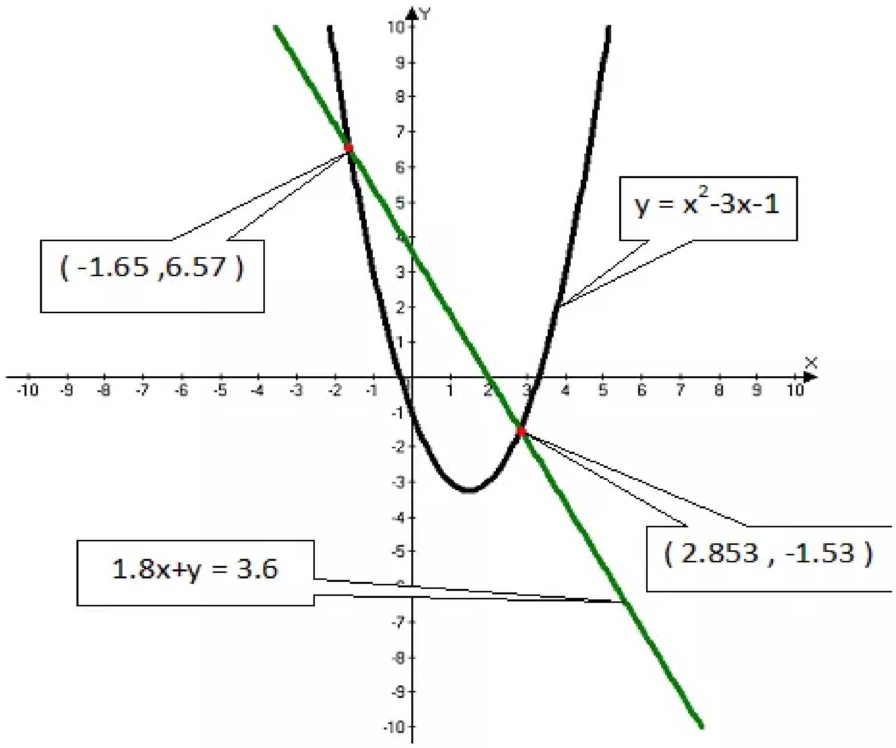
$$\begin{aligned}
y &= 3.6 - 1.8x \quad \text{(original linear equation)} \\
&= 3.6 - 1.8(2.85) \\
y &= -1.53
\end{aligned}$$

$$\begin{aligned}
y &= 3.6 - 1.8x \quad \text{(original linear equation)} \\
&= 3.6 - 1.8(-1.65) \\
y &= 6.57
\end{aligned}$$

Therefore, the line $1.8x + y = 3.6$ cuts the curve $y = x^2 - 3x - 1$ at

$\boxed{(2.85, -1.53) \text{ and } (-1.65, 6.57)}$.

The following diagram supports the solution found above.



Answer 4CU.

Consider the equation $x^2+7x+6=0$

Claim:- Solve the equation $x^2+7x+6=0$

Now, compare the equation $x^2+7x+6=0$ with the standard equation $ax^2+bx+c=0$. We get $a=1, b=7$ and $c=6$

Use the formula "The solutions of a quadratic equation $ax^2+bx+c=0$, where $a\neq 0$ are given by the quadratic formula $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$"

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a} \quad \text{[Quadratic formula]}$$

$$x=\frac{-7\pm\sqrt{(7)^2-4(1)(6)}}{2(1)} \quad [\text{Replace } a \text{ by } 1,\ b \text{ by } 7 \text{ and } c \text{ by } 6]$$

$$x=\frac{-7\pm\sqrt{49-24}}{2}$$

$$x=\frac{-7\pm\sqrt{25}}{2}$$

$$x=\frac{-7\pm\sqrt{5^2}}{2}$$

$$x=\frac{-7\pm5}{2} \quad [\text{if } \sqrt[n]{a^n}=a \text{ if } n \text{ is an even}]$$

$$x=\frac{-4+5}{2} \quad \text{or} \quad x=\frac{-7-5}{2}$$

$$x=\frac{-2}{2} \quad \text{or} \quad x=\frac{-12}{2}$$

$$x=-1 \quad \text{or} \quad x=-6$$

The solution set is $\{-1,-6\}$

Check: Substitute each value of for 'x' in the original equation $x^2+7x+6=0$

$x^2+7x+6=0$ [original equation]

$(-1)^2+7(-1)+6\stackrel{?}{=}0$

$1-7+6\stackrel{?}{=}0$

$7-7\stackrel{?}{=}0$

$0=0$ True

$x^2+7x+6=0$ [original equation]

$(-6)^2+7(-6)+6\stackrel{?}{=}0$

$36-42+6\stackrel{?}{=}0$

$42-42\stackrel{?}{=}0$

$0=0$ True

$x=-1$ and $x=-6$ satisfies the equation $x^2+7x+6=0$

Hence, the solution set is $\boxed{\{-1,-6\}}$

Answer 4GCI.

Solve the equations $y=-1.4x-2.88$ and $y=x^2+0.4x-3.14$ for x and y using substitution method.

Substitute $y=-1.4x-2.88$ in the quadratic equation $y=x^2+0.4x-3.14$

$$y=x^2+0.4x-3.14 \quad \text{(Original equation)}$$

$$-1.4x-2.88=x^2+0.4x-3.14 \quad (\text{Replace } y \text{ by } -1.4x-2.88)$$

$$1.4x-1.4x-2.88+2.88=x^2+0.4x+1.4x-3.14+2.88$$

$$(\text{Add } 1.4x \text{ and } 2.88 \text{ on each side})$$

$$0=x^2+1.8x-0.26$$

$$x^2+1.8x-0.26=0$$

Solve the equation $x^2+1.8x-0.26=0$ by the quadratic formula.

Compare the equation $x^2+1.8x-0.26=0$ with the standard quadratic equation

$ax^2+bx+c=0$.

a = 1, *b* = 1.8 and $c=-0.26$

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

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a} \qquad \text{(Quadratic formula)}$$

$$=\frac{-1.8\pm\sqrt{(1.8)^2-4\cdot(1)\cdot(-0.26)}}{2\cdot(1)} \qquad \left(\begin{array}{l}\text{Replace } a \text{ by } 1,\ b \text{ by } 1.8\\ \text{and } c \text{ by } -0.26\end{array}\right)$$

$$=\frac{-1.8\pm\sqrt{3.24+1.04}}{2}$$

$$=\frac{-1.8\pm\sqrt{4.28}}{2}$$

$$x=\frac{-1.8\pm2.07}{2}$$

$$x=\frac{-1.8+2.07}{2} \quad \text{or} \quad x=\frac{-1.8-2.07}{2}$$

$$x=\frac{0.27}{3} \quad \text{or} \quad x=\frac{-3.87}{2}$$

$$x=0.135 \quad \text{or} \quad x=-1.935$$

Solve for '*y*'

Substitute $x=0.135$ and $x=-1.935$ in the linear equation $y=-1.4x-2.88$

$$y=-1.4x-2.88$$

$$=-1.4(0.135)-2.88 \qquad (\text{Replace } x \text{ by } 0.135)$$

$$=-0.189-2.88$$

$$y=-3.07$$

$$y=-1.4x-2.88$$

$$=-1.4(-1.935)-2.88 \qquad (\text{Replace } x \text{ by } -1.935)$$

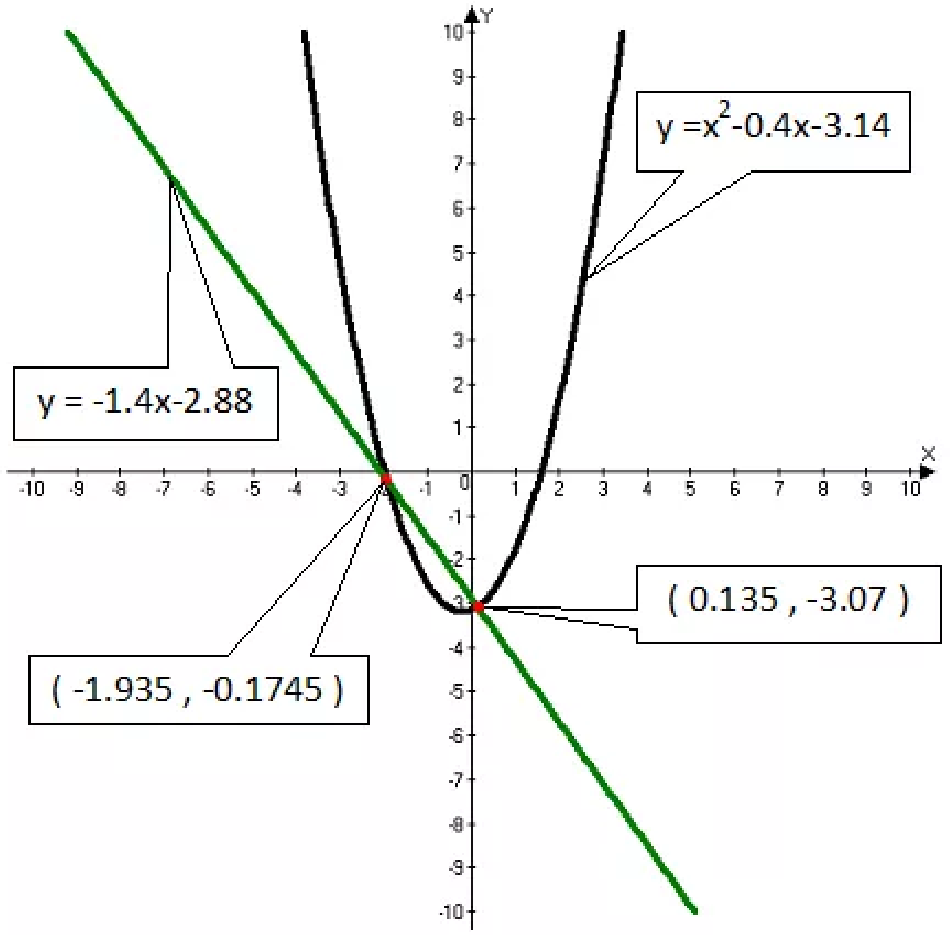
$$=2.709-2.88$$

$$y=-0.171$$

Therefore, the line $y=-1.4x-2.88$ cuts the curve $y=x^2+0.4x-3.14$ at

$\boxed{(0.135,-3.07) \text{ and } (-1.935,-0.171)}$.

The following diagram supports the solution found above.



Answer 5CU.

Consider the equation $t^2 + 11t = 12$

Claim: Solve the equation $t^2 + 11t = 12$

Step 1:- Rewrite the equation $t^2 + 11t = 12$ in standard form of the quadratic equation $ax^2 + bx + c = 0$

$$t^2 + 11t = 12 \quad \text{[original equation]}$$

$$t^2 + 11t - 12 = 12 - 12 \quad \text{[Substract '12" on both sides]}$$

$$t^2 + 11t - 12 = 0 \quad \text{[Simplify]}$$

Step 2: Now, solve the equation $t^2 + 11t = 12$ by using quadratic formula.

Now, compare the equation $t^2 + 11t = 12$ with the standard equation $ax^2 + bx + c = 0$.

We get $a = 1, b = 11$, $c = -12$ and $x = t$

Use the formula "The solutions of a quadratic equation $ax^2 + bx + c = 0$, where $a \neq 0$ are given by the quadratic formula $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$"

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

$$x=\frac{-11\pm\sqrt{(11)^2-4(1)(12)}}{2(1)}$$ [Replace a by 11, b by 12 and c by t]

$$x=\frac{-11\pm\sqrt{121+48}}{2}$$

$$x=\frac{-11\pm\sqrt{13^2}}{2}$$

$$x=\frac{-11\pm\sqrt{13^2}}{2}$$

$$x=\frac{-11\pm 13}{2}$$ [if $\sqrt[n]{a^n}=a$ if n is an even]

$$x=\frac{-11+13}{2} \quad \text{or} \quad x=\frac{-11-13}{2}$$

$$x=\frac{2}{2} \quad \text{or} \quad x=\frac{-24}{2}$$

$$x=1 \quad \text{or} \quad x=-12$$

The solution set is $\{-12,1\}$

Check: Substitute each value of for 'x' in the original equation $t^2+11t-12=0$

$$t^2+11t-12=0$$ [original equation]

$$(-12)^2+11(-12)-12\overset{?}{=}0$$

$$144-132-12\overset{?}{=}0$$

$$144-144\overset{?}{=}0$$

$0=0$ True

$$t^2+11t-12=0$$ [original equation]

$$(1)^2+11(1)-12\overset{?}{=}0$$

$$1+11-12\overset{?}{=}0$$

$$12-12\overset{?}{=}0$$

$0=0$ True

$t=-12$ and $t=1$ satisfies the equation $t^2+11t-12=0$

Hence, the solution set is $\boxed{\{-12,1\}}$

Answer 5GCI.

Solve the equations $y = x^2 - 3.5x + 2.2$ and $y = 2x - 5.3625$ for *x* and *y* using substitution method.

Substitute $y = 2x - 5.3625$ in the quadratic equation $y = x^2 - 3.5x + 2.2$

$$y = x^2 - 3.5x + 2.2 \qquad \text{(Original equation)}$$

$$2x - 5.3625 = x^2 - 3.5x + 2.2 \qquad (\text{Replace } y \text{ by } 2x - 5.3625)$$

$$-2x + 2x - 5.3625 + 5.3625 = x^2 - 3.5x - 2x + 2.2 + 5.3625$$

$$(\text{Add } -2x \text{ and } 5.3625 \text{ on each side})$$

$$0 = x^2 - 5.5x + 7.5625$$

$$x^2 - 5.5x + 7.5625 = 0$$

Solve the equation $x^2 - 5.5x + 7.5625 = 0$ by the quadratic formula.

Compare the equation $x^2 - 5.5x + 7.5625 = 0$ with the standard quadratic equation

$ax^2 + bx + c = 0$.

a = 1, b = −5.5 and c = 7.5625

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

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad \text{(Quadratic formula)}$$

$$= \frac{-(-5.5) \pm \sqrt{(-5.5)^2 - 4 \cdot (1) \cdot (7.5625)}}{2 \cdot (1)} \qquad \left(\begin{array}{l}\text{Replace } a \text{ by } 1,\ b \text{ by } -5.5 \\ \text{and } c \text{ by } 7.5625\end{array}\right)$$

$$= \frac{5.5 \pm \sqrt{30.25 - 30.25}}{2}$$

$$= \frac{5.5 \pm \sqrt{0}}{2}$$

$$= \frac{5.5}{2}$$

$$x = 2.75$$

Solve for 'y'

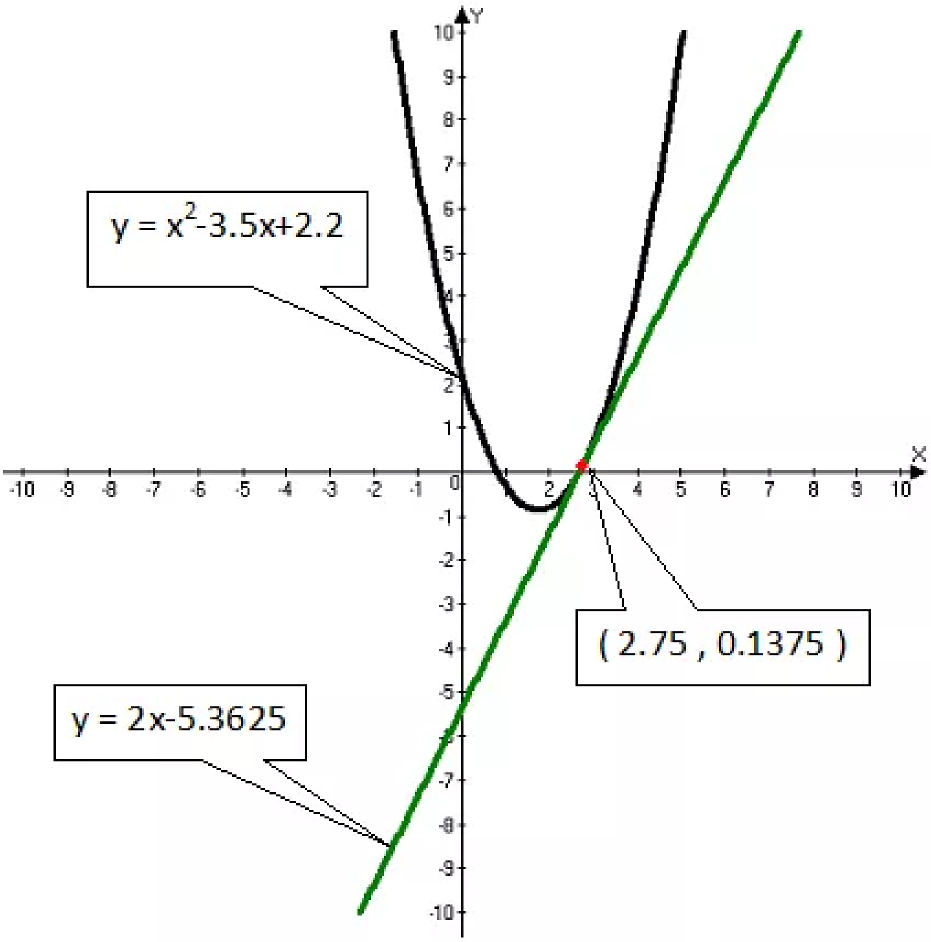
Substitute *x* = 2.75 in the linear equation $y = 2x - 5.3625$

$$\begin{aligned} y &= 2x - 5.3625 && \text{(original equation)} \\ &= 2(2.75) - 5.3625 && (\text{Replace } x \text{ by } 2.75) \\ &= 5.5 - 5.3625 \\ y &= 0.1375 \end{aligned}$$

Therefore, the line $y = 2x - 5.3625$ cuts the curve $y = x^2 - 3.5x + 2.2$ at

$\boxed{(2.75, 0.1375)}$.

The following diagram supports the solution found above.



Answer 6CU.

Consider the equation $r^2 + 10r + 12 = 0$

Claim:- Now, solve the equation $r^2 + 10r + 12 = 0$ by using quadratic formula.

Now, compare the equation $r^2 + 10r + 12 = 0$ with the standard equation $ax^2 + bx + c = 0$.

We get $a = 1, b = 10$, $c = 12$ and $x = r$

Use the formula "The solutions of a quadratic equation $ax^2 + bx + c = 0$, where $a \neq 0$ are given by the quadratic formula $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$"

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

$$=\frac{-10\pm\sqrt{(10)^2-4(1)(12)}}{2(1)}$$ [Replace a by 10, b by 12 and c by r]

$$=\frac{-10\pm\sqrt{100-48}}{2}$$

$$=\frac{-10\pm\sqrt{52}}{2}$$

$$=\frac{-10\pm\sqrt{4\cdot 13}}{2}$$

$$=\frac{-10\pm\sqrt{4}\cdot\sqrt{13}}{2}$$ [if $\sqrt[n]{a^n}=a$ if n is an even]

$$=\frac{-10\pm 2\sqrt{13}}{2}$$ [$\sqrt{4}=2$]

$$=\frac{2\cdot(-5)\pm 2\sqrt{13}}{2}$$

$$=\frac{2\left[-5\pm\sqrt{13}\right]}{2\cdot 1}$$ [Use the distributive property]

$$r=-5\pm\sqrt{13}$$

$r=-5+\sqrt{13}$ or $r=-5-\sqrt{13}$

$r=-1.39$ or $r=-8.6$

The solution set is $\boxed{\{-8.6,-1.39\}}$

Answer 6GCI.

Solve the equations $y = 0.35x - 1.648$ and $y = -0.2x^2 + 0.28x + 1.01$ for x and y using substitution method.

Substitute $y = 0.35x - 1.648$ in the quadratic equation $y = -0.2x^2 + 0.28x + 1.01$

$$y = -0.2x^2 + 0.28x + 1.01 \quad \text{(Original equation)}$$

$$0.35x - 1.648 = -0.2x^2 + 0.28x + 1.01 \quad \text{(Replace } y \text{ by} 0.35x - 1.648\text{)}$$

$$0.35x - 1.648 - 0.35x + 1.648 = -0.2x^2 + 0.28x + 1.01 - 0.35x + 1.648$$

$$\left(\text{Add } -0.35x \text{ and } 1.648 \text{ on each side}\right)$$

$$0 = -0.2x^2 - 0.07x + 2.658$$

$$-0.2x^2 - 0.07x + 2.658 = 0$$

$$0.2x^2 + 0.07x - 2.658 = 0$$

Solve the equation $0.2x^2 + 0.07x - 2.658 = 0$ by the quadratic formula.

Compare the equation $x^2 - 5.5x + 7.5625 = 0$ with the standard quadratic equation

$ax^2 + bx + c = 0$.

a = 0.2, b = 0.07 and c = -2.658

Use the formula $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad \text{(Quadratic formula)}$$

$$= \frac{-0.07 \pm \sqrt{(0.07)^2 - 4\cdot(0.2)\cdot(-2.658)}}{2(0.2)} \quad \left(\text{Replace } a \text{ by } 0.2,\ b \text{ by } 0.07 \text{ and } c \text{ by } -2.658\right)$$

$$= \frac{-0.07 \pm \sqrt{0.0049 + 2.1264}}{0.4}$$

$$x = \frac{-0.07 \pm 1.46}{0.4}$$

$$x = \frac{-0.07 + 1.46}{0.4} \quad \text{or} \quad x = \frac{-0.07 - 1.46}{0.4}$$

$$x = \frac{1.39}{0.4} \quad \text{or} \quad x = \frac{-1.53}{0.4}$$

$$x = 3.475 \quad \text{or} \quad x = -3.825$$

Substitute x =3.475 and x = -3.825 values in the linear equation

$$y = 0.35x - 1.648$$

$$\begin{aligned} y &= 0.35x - 1.648 && \text{(original equation)} \\ &= 0.35(3.475) - 1.648 && \text{(Replace } x \text{ by 3.475)} \\ &= 1.21625 - 1.648 \\ y &= -0.43175 \end{aligned}$$

$$y = -0.432$$

Now,

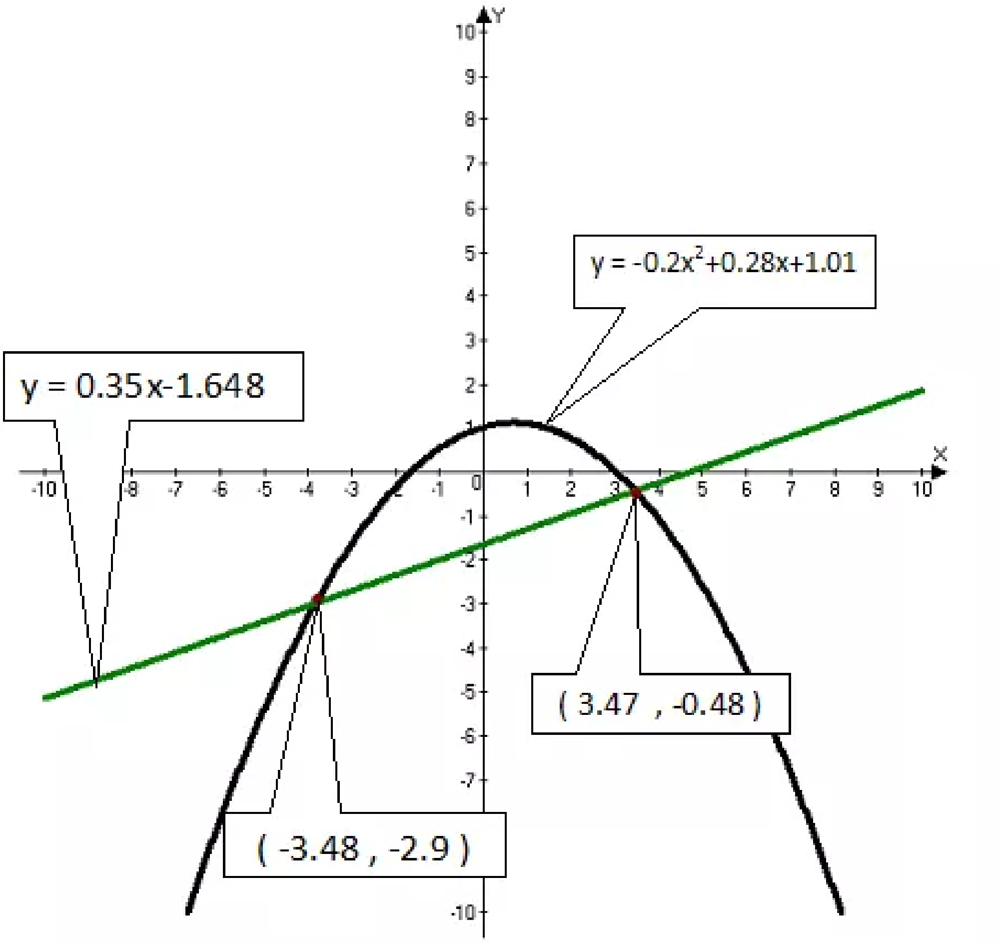
$$\begin{aligned} y &= 0.35x - 1.648 && \text{(original equation)} \\ &= 0.35(-3.825) - 1.648 && \text{(Replace } x \text{ by } -3.825) \\ &= -1.33875 - 1.648 \\ y &= -2.986 \end{aligned}$$

$$y = -2.99$$

Therefore, the line $y = 0.35x - 1.648$ cuts the curve $y = -0.2x^2 + 0.28x + 1.01$ at

$$\boxed{(3.475, -0.432) \text{ and } (-3.825, -2.99)}.$$

The following diagram supports the solution found above.



Answer 7CU.

Consider the equation $3v^2+5v+11=0$

<u>Claim:-</u> Now, solve the equation $3v^2+5v+11=0$ by using quadratic formula.

Now, compare the equation $3v^2+5v+11=0$ with the standard equation $ax^2+bx+c=0$.

We get $a=3, b=5, c=11$.

Use the formula "The solutions of a quadratic equation $ax^2+bx+c=0$, where $a \neq 0$ are given by the quadratic formula $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$"

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a} \quad \text{[Quadratic formula]}$$

$$v=\frac{-5\pm\sqrt{(5)^2-4(3)(11)}}{2(3)} \quad \left[\begin{array}{l}\text{Replace } a \text{ by } 3,\ b \text{ by } 5,\\ c \text{ by } 11 \text{ and } x \text{ by } v\end{array}\right]$$

$$=\frac{-5\pm\sqrt{25-132}}{6}$$

$$=\frac{-5\pm\sqrt{-107}}{6}$$

$$=\frac{-5\pm\sqrt{-1\cdot 107}}{6}$$

$$=\frac{-5\pm\sqrt{-1}\cdot\sqrt{107}}{6} \quad \left[\text{if } \sqrt[n]{a^n}=a \text{ if } n \text{ is an even}\right]$$

$$=\frac{-5\pm i\sqrt{107}}{6} \quad \left[\sqrt{-1}=i\right]$$

$$v=\frac{-5+i\sqrt{107}}{6} \quad \text{or} \quad v=\frac{-5-i\sqrt{107}}{6}$$

The solution set is $\boxed{\left\{\frac{-5+i\sqrt{107}}{6}, \frac{-5-i\sqrt{107}}{6}\right\}}$

Answer 8CU.

Consider the equation $4x^2+2x=17$

Claim: Solve the equation $4x^2+2x=17$

Step 1:- Rewrite the equation $4x^2+2x=17$ in standard form of the quadratic equation $ax^2+bx+c=0$, where $a\neq 0$

$$4x^2+2x=17 \quad \text{[original equation]}$$
$$4x^2+2x-17=17-17 \quad \text{[Substract '17" on both sides]}$$
$$4x^2+2x-17=0 \quad \text{[Simplify]}$$

Step 2: Now, solve the equation $4x^2+2x-17=0$ by using quadratic formula.

Now, compare the equation $4x^2+2x-17=0$ with the standard equation $ax^2+bx+c=0$.

We get $a=4, b=2$, $c=-17$

Use the formula "The solutions of a quadratic equation $ax^2+bx+c=0$, where $a\neq 0$ are given by the quadratic formula $x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$"

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a} \quad \text{[Quadratic formula]}$$
$$x=\frac{-2\pm\sqrt{(2)^2-4(4)(-17)}}{2(4)} \quad [\text{Replace } a \text{ by } 4,\ b \text{ by and } c \text{ by } -17]$$
$$x=\frac{-2\pm\sqrt{4+272}}{8}$$
$$x=\frac{-2\pm\sqrt{276}}{8} \quad [\sqrt{276}=16.6 \text{ aproximately}]$$
$$=\frac{-2\pm 16.6}{2}$$
$$=\frac{-2\pm 2(8.3)}{8}$$
$$=\frac{2\cdot(-1)\pm 2(8.3)}{2\cdot 4}$$
$$=\frac{-1\pm 8.3}{4} \quad \text{[Use the distributive property]}$$
$$=\frac{-1\pm 8.3}{4} \quad \left[\begin{array}{l}\text{Cancellation the common factor}\\ \text{is the numerator and the denominator}\end{array}\right]$$
$$x=\frac{-1+8.3}{4} \quad \text{or} \quad x=\frac{-1-8.3}{4}$$
$$x=\frac{7.3}{4} \quad \text{or} \quad x=\frac{-9.3}{4}$$
$$x=1.825 \quad \text{or} \quad x=-2.325$$

The solution set is $\boxed{\{1.825,-2.325\}}$

Answer 9CU.

Consider the equation $w^2+\frac{2}{25}=\frac{3}{5}w$

Claim: Solve the equation $w^2+\frac{2}{25}=\frac{3}{5}w$

Step 1:- Rewrite the equation $w^2+\frac{2}{25}=\frac{3}{5}w$ in standard form of the quadratic equation $ax^2+bx+c=0$, where $a\neq 0$

$$w^2+\frac{2}{25}=\frac{3}{5}w \qquad [\text{original equation}]$$

$$w^2+\frac{2}{25}-\frac{3}{5}w=\frac{3}{5}w-\frac{3}{5}w \qquad \left[\text{Substract '}\frac{3}{5}w\text{" on both sides}\right]$$

$$w^2+\frac{2}{25}-\frac{3}{5}w=0$$

$$1\cdot w^2-1\cdot\frac{3}{5}w+\frac{2}{25}=0$$

$$\frac{25}{25}\cdot w^2-\frac{5}{5}\cdot\frac{3}{5}w+\frac{2}{25}=0$$

$$\frac{25w^2}{25}-\frac{15}{25}w+\frac{2}{25}=0$$

$$\frac{25w^2-15w+2}{25}=0$$

$$\frac{25\left[25w^2-15w+2\right]}{25}=0.25 \qquad [\text{Multiply 25 on both sides}]$$

$$25w^2-15w+2=0$$

Step 2: Now, solve the equation $25w^2-15w+2=0$ by using quadratic formula.

Now, compare the equation $25w^2-15w+2=0$ with the standard equation $ax^2+bx+c=0$.

We get $a=25, b=-15, c=12$ and $x=w$

Use the formula "The solutions of a quadratic equation $ax^2+bx+c=0$, where $a \neq 0$ are given by the quadratic formula $x=\frac{-b \pm \sqrt{b^2-4ac}}{2a}$"

$$x=\frac{-b \pm \sqrt{b^2-4ac}}{2a} \qquad \text{[Quadratic formula]}$$

$$w=\frac{-(-15) \pm \sqrt{(-15)^2-4(25)(2)}}{2(25)} \qquad \left[\begin{array}{l}\text{Replace } a \text{ by } 25,\ b \text{ by } -15, \\ c \text{ by } 2 \text{ and } x \text{ by } w\end{array}\right]$$

$$=\frac{15 \pm \sqrt{225-200}}{50}$$

$$=\frac{15 \pm \sqrt{25}}{50}$$

$$=\frac{15 \pm \sqrt{5^2}}{50}$$

$$=\frac{15 \pm 5}{50}$$

$$w=\frac{15+5}{50} \quad \text{or} \quad w=\frac{15-5}{50}$$

$$w=\frac{20}{50} \quad \text{or} \quad w=\frac{10}{50}$$

$$w=0.4 \text{ or} \quad w=-0.2$$

The solution set is $\boxed{\{0.4, 0.2\}}$

Check:

Substitute for each value of *w* in the equation $25w^2-15w+2=0$

$$25w^2-15w+2=0 \qquad \text{[Original equation]}$$

$$25(0.4)^2-15(0.4)+2 \stackrel{?}{=} 0 \qquad [\text{Replace } w \text{ by } 0.4]$$

$$25(0.16)-15(0.4)+2 \stackrel{?}{=} 0$$

$$4-6+2 \stackrel{?}{=} 0$$

$$6-6 \stackrel{?}{=} 0$$

$$0=0$$

$$25w^2 - 15w + 2 = 0 \quad [\text{Original equation}]$$

$$25(0.2)^2 - 15(0.2) + 2 \overset{?}{=} 0 \quad [\text{Replace } w \text{ by } 0.2]$$

$$25(0.04) - 15(0.2) + 2 \overset{?}{=} 0$$

$$1 - 3 + 2 \overset{?}{=} 0$$

$$3 - 3 \overset{?}{=} 0$$

$$0 = 0$$

$w = 0.4$ and $w = 0.2$ satisfies the equation $25w^2 - 15w + 2 = 0$

Hence, the solution set is $\boxed{\{0.4, 0.2\}}$

Answer 10CU.

Consider the equation $m^2 + 5m - 6 = 0$

Now, compare the equation $m^2 + 5m - 6 = 0$ with the standard equation $ax^2 + bx + c = 0$.

We get $a = 1, b = 5, c = -6$,

Use the formula "The solutions of a quadratic equation $ax^2 + bx + c = 0$, where $a \neq 0$, where $a \neq 0$ is $\Delta = b^2 - 4ac$"

$$\Delta = b^2 - 4ac \quad [\text{Discriminant formula}]$$

$$= (5)^2 - 4(1)(-6) \quad [\text{Replace } a \text{ by } 1,\ b \text{ by } 5 \text{ and } c \text{ by } -6]$$

$$= 25 + 24$$

$$\Delta = 49$$

The discriminant of the equation $m^2 + 5m - 6 = 0$ is $\boxed{49}$. Since, the discriminant is positive, the equation has $\boxed{\text{two roots}}$.

Answer 11CU.

Consider the equation $s^2+8s+16=0$

Now, compare the equation $s^2+8s+16=0$ with the standard equation $ax^2+bx+c=0$.

We get $a=1, b=8, c=16$

Use the formula "The solutions of a quadratic equation $ax^2+bx+c=0$, where $a \neq 0$, where $a \neq 0$ is $\Delta = b^2-4ac$"

$$\begin{aligned} \Delta &= b^2-4ac && \text{[Discriminant formula]} \\ &= (8)^2-4(1)(16) && \text{[Replace } a \text{ by 1, } b \text{ by 8 and } c \text{ by 16]} \\ &= 64-64 \\ \Delta &= 0 \end{aligned}$$

The discriminant of the equation $s^2+8s+16=0$ is $\boxed{0}$.

Since, the discriminant is 0, the equation has $\boxed{\text{one real root}}$.

Answer 12CU.

Consider the equation $2z^2+z=-50$

Step 1: Rewrite the equation $2z^2+z=-50$ is the standard form of the quadratic equation $ax^2+bx+c=0$, where $a \neq 0$

$$\begin{aligned} 2z^2+z &= -50 && \text{[Original equation]} \\ 2z^2+z+50 &= -50+50 && \text{[Add 50 on each side]} \\ 2z^2+z+50 &= 0 \end{aligned}$$

Step 2: To find the discriminant of the equation $2z^2+z+50=0$

Now, compare the equation $2z^2+z+50=0$ with the standard form of the quadratic equation $ax^2+bx+c=0$, where $a \neq 0$. We obtain $a=2, b=1, c=50$.

Use the formula "The solutions of a quadratic equation $ax^2+bx+c=0$, where $a \neq 0$, where $a \neq 0$ is $\Delta = b^2-4ac$"

$$\begin{aligned} \Delta &= b^2-4ac && \text{[Discriminant formula]} \\ &= (1)^2-4(2)(50) && \text{[Replace } a \text{ by 2, } b \text{ by 1 and } c \text{ by 50]} \\ &= 1-400 \\ \Delta &= -399 \end{aligned}$$

The discriminant of the equation $2z^2+z+50=0$ is $\boxed{-399}$.

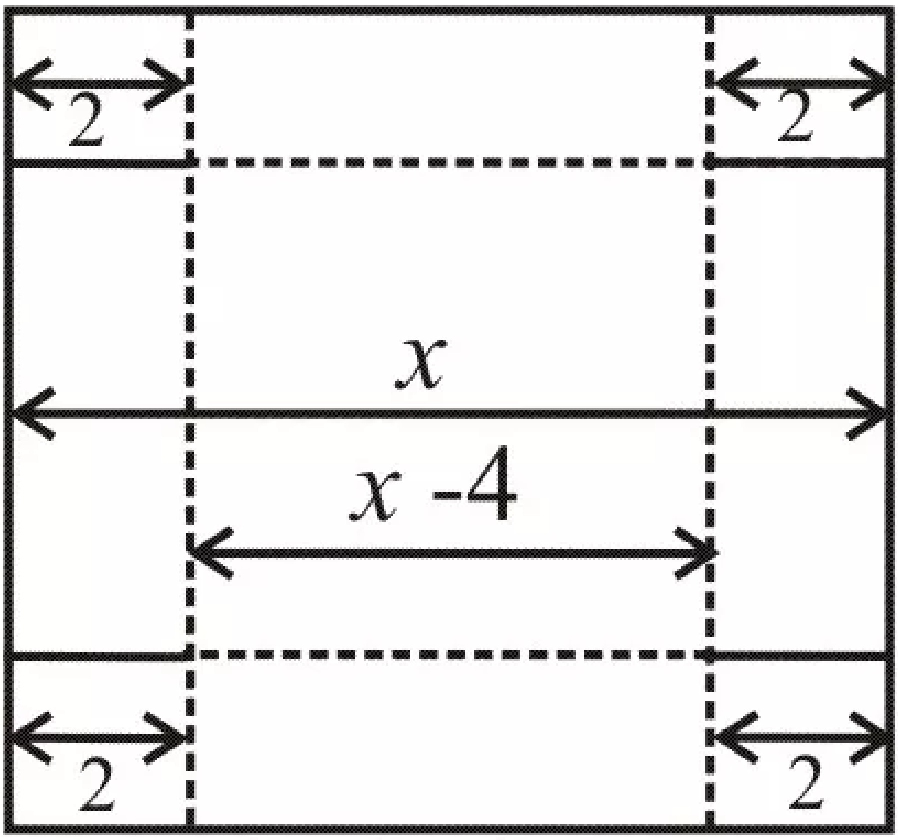
Since, the discriminant is negative, the equation has $\boxed{\text{no real solution}}$.

Answer 13CU.

Let *x* cm be the length of the original metal sheet.

After cutting 2 centimeter by 2 centimeter each corner and folding the side, it becomes cuboids with side $(x-4)$ cm and height 2 cm

Use the formula



The volume of the cuboid is $\text{length} \cdot \text{breadth} \cdot \text{height}$

The volume of the cuboid is

$$=(x-4)(x-4)(2)$$

$$=2(x-4)^2 \text{ cubic centimeters}$$

According to the problem,

The volume of the cuboid is 441 cubic centimeters

Therefore,

$$2(x-4)^2 = 441 \qquad [\text{divide '2' on each sides}]$$

$$\frac{2(x-4)^2}{2} = \frac{441}{2} \qquad \left[\text{Write 441 as } 21\cdot 21 \text{ and 2 as } \sqrt{2}\cdot\sqrt{2}\right]$$

$$(x-4)^2 = \frac{21\cdot 21}{\sqrt{2}\sqrt{2}}$$

$$(x-4)^2 = \frac{(21)^2}{\left(\sqrt{2}\right)^2} \qquad \left[\text{Use the rule } \frac{a^m}{b^m} = \left(\frac{a}{b}\right)^m\right]$$

$$(x-4)^2 = \left(\frac{21}{\sqrt{2}}\right)^2$$

$$x-4 = \pm\sqrt{\left(\frac{21}{12}\right)^2}$$

$$x-4 = \pm\frac{21}{\sqrt{2}}$$

$$x-4 = \pm 14.8$$

$$x-4 = 14.8 \quad \text{or} \quad x-4 = -14.8$$

$$x = 4+14.8 \quad \text{or} \quad x = -14.8+4$$

$$x = 18.8 \quad \text{or} \quad x = -10.8$$

Since, the length is always positive, then we neglect $x=-8$

Therefore,

The length of the original metal sheet is $\boxed{18.8}$ centimeter and breadth is also 18.8

Hence, the original metal sheet is square and its dimension is 18.8 centimeter by 18.8 centimeter.

Answer 14PA.

Consider the equation $x^2+3x-18=0$

Claim:- Now, solve the equation $x^2+3x-18=0$ by using quadratic formula.

Now, compare the equation $x^2+3x-18=0$ with the standard equation $ax^2+bx+c=0$.

We get $a=1, b=3$ and $c=-18$

Use the formula "The solutions of a quadratic equation $ax^2+bx+c=0$, where $a \neq 0$ are given by the quadratic formula $x=\dfrac{-b \pm \sqrt{b^2-4ac}}{2a}$"

$$x=\frac{-b \pm \sqrt{b^2-4ac}}{2a} \qquad \text{[Quadratic formula]}$$

$$=\frac{-3 \pm \sqrt{(3)^2-4(1)(-18)}}{2(1)} \qquad [\text{Replace } a \text{ by } 1,\ b \text{ by } 3 \text{ and } c \text{ by } -18]$$

$$=\frac{-3 \pm \sqrt{9+72}}{2}$$

$$=\frac{-3 \pm \sqrt{81}}{2}$$

$$=\frac{-3 \pm \sqrt{9^2}}{2}$$

$$=\frac{-3 \pm 9}{2}$$

$$x=\frac{-3+9}{2} \quad \text{or} \quad x=\frac{-3-9}{2}$$

$$x=\frac{6}{2} \quad \text{or} \quad x=\frac{-12}{2}$$

$$x=\frac{3 \cdot 2}{2 \cdot 1} \quad \text{or} \quad x=\frac{-6 \cdot 2}{1 \cdot 2}$$

$$x=3 \quad \text{or} \quad x=-6$$

Check:

Substitute for each value of x is the original equation $x^2+3x-18=0$

$x^2+3x-18=0$ [original equation]

$(3)^2+3(3)-18\overset{?}{=}0$

$9+9-18\overset{?}{=}0$

$18-18\overset{?}{=}0$

$0=0$ True

$x^2+3x-18=0$ [original equation]

$(-6)^2+3(-6)-18\overset{?}{=}0$ [Replace x by -6]

$36-18-18\overset{?}{=}0$

$36-36\overset{?}{=}0$

$0=0$ True

Therefore, $x=3$ and $x=-6$ satisfies the original equation $x^2+3x-18=0$

Hence, the solution set is $\boxed{\{3,-6\}}$

<**Answer 15PA.**
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Check:

Substitute for each value of x is the original equation $v^2+12v+20=0$

$v^2+12v+20=0$ [original equation]

$(-2)^2+12(-2)+20\overset{?}{=}0$ [Replace v by -2]

$4-24+20\overset{?}{=}0$

$24-24\overset{?}{=}0$

$0=0$ True

$$v^2+12v+20=0 \qquad [\text{original equation}]$$

$$(-10)^2+12(-10)+20\overset{?}{=}0 \qquad [\text{Replace } x \text{ by } -10]$$

$$100-120+20\overset{?}{=}0$$

$$120-120\overset{?}{=}0$$

$0=0$ True

Therefore, $v=-2$ and $v=-10$ satisfies the original equation $v^2+12v+20=0$

Hence, the solution set is $\boxed{\{-2,-10\}}$

Answer 16PA.

Consider the equation $3t^2-7t-20=0$

Claim:- Now, solve the equation $3t^2-7t-20=0$ by using quadratic formula.

Now, compare the equation $3t^2-7t-20=0$ with the standard equation $ax^2+bx+c=0$.

We get $a=3, b=-7, c=-20$ and $x=t$

Use the formula "The solutions of a quadratic equation $ax^2+bx+c=0$, where $a\neq 0$ are given by the quadratic formula $x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$"

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a} \qquad [\text{Quadratic formula}]$$

$$v=\frac{-(-7)\pm\sqrt{(-7)^2-4(3)(-20)}}{2(3)} \qquad \left[\begin{array}{l}\text{Replace } a \text{ by } 3,\ b \text{ 'by } -7,\\ c \text{ by } -20 \text{ and } x \text{ by } t\end{array}\right]$$

$$=\frac{7\pm\sqrt{49+240}}{6}$$

$$=\frac{7\pm\sqrt{289}}{6}$$

$$=\frac{7\pm\sqrt{17^2}}{6}$$

$$t=\frac{7\pm 17}{6}$$

$$t=\frac{7+17}{6} \quad \text{or} \quad t=\frac{7-17}{6}$$

$$t=\frac{24}{6} \quad \text{or} \quad t=\frac{-10}{6}$$

$$t=4 \quad \text{or} \quad t=-\frac{5}{3}$$

Check:

Substitute for each value of *x* is the original equation $3t^2 - 7t - 20 = 0$

$$3t^2 - 7t - 20 = 0 \quad [\text{original equation}]$$

$$3(4)^2 - 7(4) - 20 \overset{?}{=} 0 \quad [\text{Replace } t \text{ by } 4]$$

$$48 - 28 - 20 \overset{?}{=} 0$$

$$48 - 48 \overset{?}{=} 0$$

$0 = 0$ True

$$3t^2 - 7t - 20 = 0 \quad [\text{original equation}]$$

$$3\left(\frac{-5}{3}\right)^2 - 7\left(\frac{-5}{3}\right) - 20 \overset{?}{=} 0 \quad \left[\text{Replace } t \text{ by } \frac{-5}{3}\right]$$

$$3 \cdot \frac{25}{9} + \frac{35}{3} - 20 \overset{?}{=} 0$$

$$\frac{75}{9} + \frac{5}{3} - 20 \overset{?}{=} 0$$

$$\frac{75 + 35 \cdot 3 - 20 \cdot 9}{9} \overset{?}{=} 0$$

$$\frac{75 + 105 - 180}{9} \overset{?}{=} 0$$

$$\frac{180 - 180}{9} \overset{?}{=} 0$$

$$\frac{0}{9} \overset{?}{=} 0$$

$0 = 0$ True

Therefore, $t = 4$ and $t = \frac{-5}{3}$ satisfies the original equation $3t^2 - 7t - 20 = 0$

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

Answer 17PA.

Consider the equation $5y^2 - y - 4 = 0$

<u>Claim:-</u> Now, solve the equation $5y^2 - y - 4 = 0$ by using quadratic formula.

Now, compare the equation $5y^2 - y - 4 = 0$ with the standard equation $ax^2 + bx + c = 0$.

We get $a = -1, b = -4, c = -4$ and $x = y$

Use the formula "The solutions of a quadratic equation $ax^2 + bx + c = 0$, where $a \neq 0$ are given by the quadratic formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$"

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad \text{[Quadratic formula]}$$

$$y = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(5)(-4)}}{2(5)} \quad \left[\begin{array}{l}\text{Replace } a \text{ by } 5,\ b \text{ 'by } -1, \\ c \text{ by } -4 \text{ and } x \text{ by } y\end{array}\right]$$

$$= \frac{1 \pm \sqrt{1 + 80}}{10}$$

$$= \frac{1 \pm \sqrt{81}}{10}$$

$$= \frac{1 \pm \sqrt{9^2}}{10}$$

$$y = \frac{1 \pm 9}{10}$$

$$y = \frac{1+9}{10} \quad \text{or} \quad y = \frac{1-9}{10}$$

$$y = \frac{10}{10} \quad \text{or} \quad y = -\frac{8}{10}$$

$$y = 1 \quad \text{or} \quad y = \frac{-4}{5}$$

Check:

Substitute for each value of *x* is the original equation $5y^2 - y - 4 = 0$

$$5y^2 - y - 4 = 0 \qquad \text{[original equation]}$$

$$5(1)^2 - (1) - 4 \stackrel{?}{=} 0 \qquad \text{[Replace } y \text{ by 1]}$$

$$5 - 1 - 4 \stackrel{?}{=} 0$$

$$5 - 5 \stackrel{?}{=} 0$$

$0 = 0$ True

$$5y^2 - y - 4 = 0 \qquad \text{[original equation]}$$

$$5\left(\frac{-4}{5}\right)^2 - \left(\frac{-4}{5}\right) - 4 \stackrel{?}{=} 0 \left[\text{Replace } y \text{ by } \frac{-4}{5}\right]$$

$$5 \cdot \frac{16}{25} + \frac{4}{5} - 4 \stackrel{?}{=} 0$$

$$\frac{80}{25} + \frac{4}{5} - 4 \stackrel{?}{=} 0$$

$$\frac{80 + 4 \cdot 5 - 4 \cdot 25}{25} \stackrel{?}{=} 0$$

$$80 + 20 - 100 \stackrel{?}{=} 0$$

$$100 - 100 \stackrel{?}{=} 0$$

$0 = 0$ True

Therefore, $y = 1$ and $y = \frac{-4}{5}$ satisfies the original equation $5y^2 - y - 4 = 0$

Hence, the solution set is $\boxed{\left\{1, \frac{-4}{5}\right\}}$

Answer 18PA.

Consider the equation $x^2-25=0$

Claim:- Solve the equation $x^2-25=0$ by using quadratic formula.

Now, compare the equation $x^2-25=0$ with the standard equation $ax^2+bx+c=0$.

We get $a=1, b=0$ and $c=-25$

Use the formula "The solutions of a quadratic equation $ax^2+bx+c=0$, where $a\neq 0$ are given by the quadratic formula $x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$"

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a} \qquad \text{[Quadratic formula]}$$

$$x=\frac{-(0)\pm\sqrt{(0)^2-4(1)(-25)}}{2(1)} \qquad \left[\begin{array}{l}\text{Replace } a \text{ by } 1,\ b \text{ 'by } 0,\\ c \text{ by } -25\end{array}\right]$$

$$x=\frac{0\pm\sqrt{100}}{2}$$

$$x=\frac{\pm\sqrt{10^2}}{10}$$

$$x=\frac{\pm 10}{2}$$

$$x=\frac{10}{2} \quad \text{or} \quad x=\frac{-10}{2}$$

$$x=5 \quad \text{or} \quad x=-5$$

Check:

Substitute for each value of *x* is the original equation $x^2-25=0$

$$x^2-25=0 \qquad \text{[original equation]}$$

$$(5)^2-25\overset{?}{=}0 \qquad [\text{Replace } x \text{ by } 5]$$

$$25-25\overset{?}{=}0$$

$$0=0 \text{ True}$$

$$x^2 - 25 = 0 \qquad [\text{original equation}]$$

$$(-5)^2 - 25 \stackrel{?}{=} 0 \qquad [\text{Replace } x \text{ by } -5]$$

$$25 - 25 \stackrel{?}{=} 0$$

$$0 = 0 \text{ True}$$

Therefore, $x = 5$ and $x = -5$ satisfies the original equation $x^2 - 25 = 0$

Hence, the solution set is $\boxed{\{5, -5\}}$

Answer 19PA.

Consider the equation $r^2 + 25 = 0$

Claim:- Solve the equation $r^2 + 25 = 0$ by using quadratic formula.

Now, compare the equation $r^2 + 25 = 0$ with the standard equation $ax^2 + bx + c = 0$.

We get $a = 1, b = 0, c = 25 \text{ and } x = r$

Use the formula "The solutions of a quadratic equation $ax^2 + bx + c = 0$, where $a \neq 0$ are given by the quadratic formula $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$"

$$r = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad [\text{Quadratic formula}]$$

$$r = \frac{-(0) \pm \sqrt{(0)^2 - 4(1)(25)}}{2(1)} \qquad \left[\begin{array}{l}\text{Replace } a \text{ by } 1,\ b \text{ 'by } 0, \\ c \text{ by } 25 \text{ and } x \text{ by } r\end{array}\right]$$

$$r = \frac{0 \pm \sqrt{-100}}{2}$$

$$r = \frac{\pm\sqrt{(-1) \cdot 100}}{2}$$

$$r = \frac{\pm\sqrt{-1} \cdot \sqrt{100}}{2}$$

$$r = \frac{\pm\sqrt{-1} \cdot \sqrt{10^2}}{2}$$

$$r = \pm\frac{10i}{2}$$

$$r = \frac{10i}{2} \quad \text{or} \quad r = \frac{-10i}{2}$$

$$r = \frac{5 \cdot 2}{2 \cdot 1} i \quad \text{or} \quad r = -\frac{5 \cdot 2}{2 \cdot 1}$$

$$r = 5i \quad \text{or} \quad r = -5i$$

Check:

Substitute for each value of *x* is the original equation $r^2+25=0$

$$r^2+25=0 \qquad [\text{original equation}]$$

$$(5i)^2+25\overset{?}{=}0 \qquad [\text{Replace } r \text{ by } 5i]$$

$$5^2i^2+25\overset{?}{=}0$$

$$-25+25\overset{?}{=}0$$

$$0=0 \text{ True}$$

$$r^2+25=0 \qquad [\text{original equation}]$$

$$(-5i)^2+25\overset{?}{=}0 \qquad [\text{Replace } r \text{ by } 5i]$$

$$(-5)^2 i^2+25\overset{?}{=}0$$

$$25(-1)+25\overset{?}{=}0$$

$$-25+25\overset{?}{=}0$$

$$0=0 \text{ True}$$

Therefore, $r=5i$ and $r=-5i$ satisfies the original equation $r^2+25=0$

Hence, the solution set is $\boxed{\{5i,-5i\}}$

Answer 20PA.

Consider the equation $2x^2+98=28x$

Step 1: Rewrite the equation $2x^2+98=28x$ in standard form of the quadratic equation $ax^2+bx+c=0$

$$2x^2+98=28x \qquad [\text{original equation}]$$

$$2x^2+98-28x=28x-28 \qquad [\text{Substract } 28x \text{ on both sides}]$$

$$2x^2-28x+98=0$$

Step 2:- Now, solve the equation $2x^2-28x+98=0$ by using quadratic formula.

Now, compare the equation $2x^2-28x+98=0$ with the standard equation $ax^2+bx+c=0$.

We get $a=2, b=-28, c=98$

Use the formula "The solutions of a quadratic equation $ax^2+bx+c=0$, where $a\neq 0$ are given by the quadratic formula $x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$ "

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

$$x=\frac{-(-28)\pm\sqrt{(-28)^2-4(2)(98)}}{2(2)}$$ [Replace a by 2, b 'by -28, c by 98]

$$x=\frac{28\pm\sqrt{784-784}}{4}$$

$$x=\frac{28\pm\sqrt{0}}{4}$$

$$x=\frac{28\pm 0}{4}$$

$x=\frac{28+0}{4}$ or $x=\frac{28-0}{4}$

$x=\frac{28}{4}$ or $x=\frac{28}{4}$

$x=\frac{7\cdot 4}{1\cdot 4}$ or $x=\frac{7\cdot 4}{1\cdot 4}$

$x=7$ or $x=7$

Check:

Substitute for each value of x is the original equation $2x^2-28x+98=0$

$2x^2-28x+98=0$ [original equation]

$2(7)^2-28(7)+98\overset{?}{=}0$ [Replace x by 7]

$98-196+98\overset{?}{=}0$

$196-196\overset{?}{=}0$

$0=0$ True

Answer 21PA.

Consider the equation $4s^2+100=40s$

Step 1: Rewrite the equation $4s^2+100=40s$ in standard form of the quadratic equation $ax^2+bx+c=0$

$$4s^2+100=40s \qquad \text{[original equation]}$$
$$4s^2+100-40s=40s-40s \qquad \text{[Substract } -40s \text{ on both sides]}$$
$$4s^2+100-40s=0 \qquad \text{[Simplify]}$$

Step 2:- Now, solve the equation $4s^2+100-40s=0$ by using quadratic formula.

Now, compare the equation $4s^2+100-40s=0$ with the standard equation $ax^2+bx+c=0$.

We get $a=4, b=-40, c=100 \text{ and } x=s$

Use the formula "The solutions of a quadratic equation $ax^2+bx+c=0$, where $a\neq 0$ are given by the quadratic formula $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$"

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a} \qquad \text{[Quadratic formula]}$$
$$s=\frac{-(-40)\pm\sqrt{(-40)^2-4(4)(100)}}{2(4)} \qquad \left[\begin{array}{l}\text{Replace } a \text{ by } 4,\ b \text{ 'by } -40, \\ c \text{ by } 100 \text{ and } x \text{ by } s\end{array}\right]$$
$$s=\frac{40\pm\sqrt{14600-1600}}{8}$$
$$s=\frac{40\pm\sqrt{0}}{4}$$
$$s=\frac{40}{8}$$
$$s=\frac{8\cdot 5}{8\cdot 1} \qquad \left[\begin{array}{l}\text{Cancellation of the common} \\ \text{numerator and denominator}\end{array}\right]$$
$$s=5$$

Therefore, the solution set is $\boxed{\{5,5\}}$

Answer 22PA.

Consider the equation $2r^2 + r - 14 = 0$

Claim:1 Solve the equation $2r^2 + r - 14 = 0$ by using quadratic formula.

Now, compare the equation $2r^2 + r - 14 = 0$ with the standard equation $ax^2 + bx + c = 0$.

We get $a = 2, b = 1, c = -14 \text{ and } x = r$

Use the formula "The solutions of a quadratic equation $ax^2 + bx + c = 0$, where $a \neq 0$ are given by the quadratic formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$"

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad \text{[Quadratic formula]}$$

$$r = \frac{-(1) \pm \sqrt{(1)^2 - 4(2)(-14)}}{2(2)} \quad \left[\begin{array}{l}\text{Replace } a \text{ by } 2,\ b \text{ 'by } 1, \\ c \text{ by } -14 \text{ and } x \text{ by } r\end{array}\right]$$

$$r = \frac{-1 \pm \sqrt{1 + 112}}{4}$$

$$r = \frac{-1 \pm \sqrt{133}}{4}$$

$$r = \frac{-1 + \sqrt{133}}{4} \quad \text{or} \quad r = \frac{-1 - \sqrt{133}}{4}$$

$$r = \frac{-1 + 10.63}{4} \quad \text{or} \quad r = \frac{-1 - 10.63}{4}$$

$$r = \frac{9.63}{4} \quad \text{or} \quad r = \frac{-11.63}{4}$$

$$r = 2.4 \quad \text{or} \quad r = -2.9$$

Therefore, the solution set is $\boxed{\{2.4, -2.9\}}$

Answer 23PA.

Consider the equation $2n^2-7n-3=0$

Claim:1 Solve the equation $2n^2-7n-3=0$ by using quadratic formula.

Now, compare the equation $2n^2-7n-3=0$ with the standard equation $ax^2+bx+c=0$.

We get $a=2, b=7, c=-3$ and $x=n$

Use the formula "The solutions of a quadratic equation $ax^2+bx+c=0$, where $a\neq 0$ are given by the quadratic formula $x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$"

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a} \qquad \text{[Quadratic formula]}$$

$$n=\frac{-(-7)\pm\sqrt{(-7)^2-4(2)(-3)}}{2(2)} \qquad \left[\begin{array}{l}\text{Replace } a \text{ by } 2,\ b \text{ 'by } -7,\\ c \text{ by } -3 \text{ and } x \text{ by } n\end{array}\right]$$

$$n=\frac{7\pm\sqrt{49+24}}{4}$$

$$n=\frac{7\pm\sqrt{73}}{4}$$

$$n=\frac{7+\sqrt{73}}{4} \quad \text{or} \quad n=\frac{7-\sqrt{73}}{4}$$

$$n=\frac{7+8.5}{4} \quad \text{or} \quad n=\frac{7-8.5}{4}$$

$$n=3.875 \quad \text{or} \quad n=-0.375$$

$$n\approx 2.4 \quad \text{or} \quad n\approx -0.4$$

Therefore, the solution set is $\boxed{\{3.9,-0.4\}}$

Answer 24PA.

Consider the equation $5v^2-7v=1$

<u>Claim:1</u> Solve the equation $5v^2-7v=1$ by using quadratic formula.

Now, compare the equation $5v^2-7v=1$ with the standard equation $ax^2+bx+c=0$.

We get $a=5, b=-7, c=-1$ and $x=v$

Use the formula "The solutions of a quadratic equation $ax^2+bx+c=0$, where $a \neq 0$ are given by the quadratic formula $x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$"

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a} \quad \text{[Quadratic formula]}$$

$$v=\frac{-(-7)\pm\sqrt{(-7)^2-4(5)(-1)}}{2(5)} \quad \left[\begin{array}{l}\text{Replace } a \text{ by } 5,\ b \text{ by } -7, \\ c \text{ by } -1 \text{ and } x \text{ by } v\end{array}\right]$$

$$v=\frac{7\pm\sqrt{49+20}}{10}$$

$$v=\frac{7\pm\sqrt{69}}{10}$$

$$v=\frac{7+\sqrt{69}}{10} \quad \text{or} \quad v=\frac{7-\sqrt{69}}{10}$$

$$v=\frac{7+8.3}{10} \quad \text{or} \quad v=\frac{7-8.3}{10}$$

$$v=\frac{15.3}{10} \quad \text{or} \quad v=\frac{-1.3}{10}$$

$$v\approx 1.53 \quad \text{or} \quad v\approx -0.13$$

Therefore, the solution set is $\boxed{\{1.53,-0.13\}}$

Answer 25PA.

Consider the equation $11z^2 - z = 3$

Claim:1 Solve the equation $11z^2 - z = 3$ by using quadratic formula.

Now, compare the equation $11z^2 - z = 3$ with the standard equation $ax^2 + bx + c = 0$.

We get $a = 11, b = -1, c = -3$ and $x = z$

Use the formula "The solutions of a quadratic equation $ax^2 + bx + c = 0$, where $a \neq 0$ are given by the quadratic formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$"

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad \text{[Quadratic formula]}$$

$$z = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(11)(-3)}}{2(11)} \qquad \begin{bmatrix} \text{Replace } a \text{ by } 11,\ b \text{ by } -1, \\ c \text{ by } -3 \text{ and } x \text{ by } z \end{bmatrix}$$

$$z = \frac{1 \pm \sqrt{1 + 132}}{22}$$

$$z = \frac{1 \pm \sqrt{133}}{22}$$

$$z = \frac{1 + \sqrt{133}}{22} \quad \text{or} \quad z = \frac{1 - \sqrt{133}}{22}$$

$$z = \frac{1 + 11.53}{22} \quad \text{or} \quad z = \frac{1 - 11.53}{22}$$

$$z = \frac{12.53}{22} \quad \text{or} \quad z = \frac{-10.53}{22}$$

$$z = 0.569 \quad \text{or} \quad z = -0.478$$

$$z = 0.6(\text{approximately}) \text{ or} \quad z = -0.5(\text{approximately})$$

Check Substitute for each value of z is the original equation $11z^2 - z - 3 = 0$

$$11z^2 - z - 3 = 0 \qquad \text{[original equation]}$$

$$11(0.6)^2 - (0.6) - 3 \stackrel{?}{=} 0 \qquad \text{[Replace } z \text{ by } 0.6]$$

$$11(0.36) - 0.6 - 3 \stackrel{?}{=} 0$$

$$3.96 - 0.6 - 3 \stackrel{?}{=} 0$$

$$0.3 \stackrel{?}{=} 0$$

$$0 = 0 \text{ True}$$

$$11z^2 - z - 3 = 0 \qquad \text{[original equation]}$$

$$11(0.25)^2 - (0.25) - 3 \stackrel{?}{=} 0 \qquad [\text{Replace } z \text{ by } 0.25]$$

$$11(0.25) - 0.25 - 3 \stackrel{?}{=} 0$$

$$2.75 + 0.5 - 3 \stackrel{?}{=} 0$$

$$3.25 - 3 \stackrel{?}{=} 0$$

$$0.25 \stackrel{?}{=} 0$$

$$0 = 0 \text{ True}$$

Therefore, $z = 0.6$ and $z = -0.5$ satisfies the original equation $11z^2 - z - 3 = 0$

Hence, The solution set is $\boxed{\{0.6, -0.5\}}$

Answer 26PA.

Consider the equation $2w^2 = 9(7w + 3)$

Step:1 Rewrite the equation $2w^2 = -(7w + 3)$ is the standard form of the quadratic equation $ax^2 + bx + c = 0$, where $a \neq 0$

$$2w^2 = -(7w + 3) \qquad \text{[original equation]}$$

$$2w^2 + (7w + 3) = -(7w + 3) + (7w + 3) \; [\text{Add "}(7w+3)\text{" on both sides}]$$

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

Step: 2 Now, compare the equation $2w^2 + 7w + 3 = 0$ with the standard equation $ax^2 + bx + c = 0$, we get $a = 2, b = 7, c = 3 \text{ and } x = w$

Use the formula "The solutions of a quadratic equation $ax^2 + bx + c = 0$, where $a \neq 0$ are given by the quadratic formula $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$"

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

$$w=\frac{-7\pm\sqrt{7^2-4(2)(3)}}{2(2)}$$ [Replace a by 2, b by 7, c by 3 and x by w]

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

$$w=\frac{-7\pm\sqrt{25}}{4}$$

$$w=\frac{-7\pm\sqrt{5^2}}{4}$$

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

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

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

$w=\frac{-2\cdot 1}{2\cdot 2}$ or $w=\frac{-4\cdot 3}{4\cdot 1}$

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

Check Substitute for each value of z is the original equation $2w^2+7w+3=0$

$2w^2+7w+3=0$ [original equation]

$$2\left(\frac{-1}{2}\right)^2+7\left(\frac{-1}{2}\right)+3\overset{?}{=}0$$ [Replace w by $\frac{-1}{2}$]

$$2\cdot\frac{1}{4}-7\cdot\frac{1}{2}+3\overset{?}{=}0$$

$$\frac{2-7\cdot(2)+3(4)}{4}\overset{?}{=}0$$

$$2-14+12\overset{?}{=}0$$

$$14-14\overset{?}{=}0$$

$$0=0 \text{ True}$$

$$2w^2+7w+3=0 \qquad [\text{original equation}]$$

$$2(-3)^2+7(-3)+3\overset{?}{=}0 \qquad [\text{Replace } w \text{ by } -3]$$

$$2(9)-7(3)+3\overset{?}{=}0$$

$$18-21+3\overset{?}{=}0$$

$$21-21\overset{?}{=}0$$

$$0=0 \text{ True}$$

Therefore, $w=-\frac{1}{2}$ and $w=-3$ satisfies the original equation $2w^2=-(7w+3)$

Hence, The solution set is $\boxed{\left\{-\frac{1}{2},-3\right\}}$

Answer 27PA.

Consider the equation $2(12g^2-g)=15$

<u>**Step:1**</u> Rewrite the equation $2(12g^2-g)=15$ is the standard form of the quadratic equation $ax^2+bx+c=0$, where $a\neq 0$

$$2(12g^2-g)=15 \qquad [\text{original equation}]$$

$$24g^2-2g=15 \qquad [\text{Multiply } 2(12g^2-g)=24g^2-2g]$$

$$24g^2-2g-15=15-15 \qquad [\text{Substract "15" on both sides}]$$

$$24g^2-2g-15=0$$

<u>**Step: 2**</u> Now, compare the equation $24g^2-2g-15=0$ with the standard equation $ax^2+bx+c=0$, we get $a=24, b=-2, c=-15 \text{ and } x=g$

Use the formula "The solutions of a quadratic equation $ax^2+bx+c=0$, where $a\neq 0$ are given by the quadratic formula $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ "

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a} \qquad [\text{Quadratic formula}]$$

$$g=\frac{-(-2)\pm\sqrt{(-2)^2-4(24)(-15)}}{2(2)} \qquad \left[\begin{array}{l}\text{Replace } a \text{ by 24, } b \text{ by } -2,\\ c \text{ by } -15 \text{ and } x \text{ by } g\end{array}\right]$$

$$g=\frac{2\pm\sqrt{4+1440}}{48}$$

$$g=\frac{2\pm\sqrt{1444}}{48}$$

$$g=\frac{2\pm\sqrt{38^2}}{48}$$

$$g=\frac{2\pm 38}{48}$$

$$g=\frac{2+38}{48} \quad \text{or} \quad g=\frac{2-38}{48}$$

$$g=\frac{40}{48} \quad \text{or} \quad g=\frac{-36}{48}$$

$$g=\frac{8\cdot 5}{8\cdot 6} \quad \text{or} \quad g=\frac{-6\cdot 6}{8\cdot 6}$$

$$g=\frac{5}{6} \quad \text{or} \quad g=\frac{-3\cdot 2\cdot 6}{4\cdot 2\cdot 6}$$

$$g=\frac{5}{6} \quad \text{or} \quad g=\frac{-3}{4}$$

Check Substitute for each value of z is the original equation $24g^2-2g-15=0$

$$24g^2-2g-15=0 \qquad [\text{original equation}]$$

$$24\left(\frac{5}{6}\right)^2-2\left(\frac{5}{6}\right)-15\overset{?}{=}0 \left[\text{Replace } g \text{ by } \frac{5}{6}\right]$$

$$24\cdot\frac{25}{36}-2\cdot\frac{5}{6}-15\overset{?}{=}0$$

$$\frac{24\cdot(25)-2(5)(6)-15(36)}{36}\overset{?}{=}0$$

$$600-60-540\overset{?}{=}0$$

$$600-600\overset{?}{=}0$$

$$0=0 \text{ True}$$

$$24g^2 - 2g - 15 = 0 \qquad [\text{original equation}]$$

$$24\left(\frac{-3}{4}\right)^2 - 2\left(\frac{-3}{4}\right) - 15 \stackrel{?}{=} 0 \qquad \left[\text{Replace } g \text{ by } \frac{-3}{4}\right]$$

$$24\left(\frac{9}{10}\right) + 2\left(\frac{3}{4}\right) - 15 \stackrel{?}{=} 0$$

$$\frac{24(9) + 2(3)(4) - 15(16)}{16} \stackrel{?}{=} 0$$

$$24(9) + 2\cdot(3)\cdot(4) - 15 \stackrel{?}{=} 0$$

$$216 + 24 - 240 \stackrel{?}{=} 0$$

$$240 - 240 \stackrel{?}{=} 0$$

$$0 = 0 \text{ True}$$

Therefore, $g = \frac{5}{6}$ and $g = \frac{-3}{4}$ satisfies the original equation $2(12g^2 - g) = 15$

Hence, the solution set is $\boxed{\left\{\frac{5}{6}, \frac{-3}{4}\right\}}$

Answer 28PA.

Consider the equation $1.34d^2 - 1.1d = -1.02$

Step:1 Rewrite the equation $1.34d^2 - 1.1d = -1.02$ is the standard form of the quadratic equation $ax^2 + bx + c = 0$, where $a \neq 0$

$$1.34d^2 - 1.1d = -1.02 \qquad [\text{original equation}]$$

$$1.34d^2 - 1.1d + 1.02 = -1.02 + 1.02 \qquad [\text{Adding 1.02 on both sides}]$$

$$1.34d^2 - 1.1d + 1.02 = 0$$

Step: 2 Now, compare the equation $1.34d^2 - 1.1d + 1.02 = 0$ with the standard equation $ax^2 + bx + c = 0$, we get $a = 1.34, b = -1.1, c = 1.02 \text{ and } x = d$

Use the formula "The solutions of a quadratic equation $ax^2 + bx + c = 0$, where $a \neq 0$ are given by the quadratic formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$"

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a} \quad \text{[Quadratic formula]}$$

$$d=\frac{-(1.1)\pm\sqrt{(1.1)^2-4(1.34)(1.02)}}{2(1.34)} \quad \left[\begin{array}{l}\text{Replace } a \text{ by } 1.34,\ b \text{ by } 1.1,\\ c \text{ by } 1.02 \text{ and } x \text{ by } d\end{array}\right]$$

$$d=\frac{-1.1\pm\sqrt{1.21-5.4672}}{2.68}$$

$$d=\frac{-1.1\pm\sqrt{-4.2572}}{2.68}$$

$$d=\frac{-1.1\pm 2.06\sqrt{-1}}{2.68} \quad \left[\begin{array}{l}i^2=-1\\ i=\sqrt{-1}\end{array}\right]$$

$$d=\frac{-1.1\pm 2.06i}{2.68}$$

$$d=\frac{-1.1+2.06i}{2.68} \quad \text{or} \quad d=\frac{-1.1-2.06i}{2.68}$$

The solution set is $\boxed{\left\{\frac{-1.1+2.06i}{2.68},\frac{-1.1-2.06i}{2.68}\right\}}$

Answer 29PA.

Consider the equation $-2x^2+0.7x=-0.3$

<u>Step:1</u> Rewrite the equation $-2x^2+0.7x=-0.3$ is the standard form of the quadratic equation $ax^2+bx+c=0$, where $a\neq 0$

$$-2x^2+0.7x=-0.3 \quad \text{[original equation]}$$

$$-2x^2+0.7x+0.3=-0.3+0.3 \quad \text{[Adding 0.3 on both sides]}$$

$$-2x^2+0.7x+0.3=0$$

<u>Step: 2</u> Now, compare the equation $-2x^2+0.7x+0.3=0$ with the standard equation $ax^2+bx+c=0$, we get $a=-2, b=0.3, c=0.3$ and $x=x$

Use the formula "The solutions of a quadratic equation $ax^2+bx+c=0$, where $a\neq 0$ are given by the quadratic formula $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ "

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a} \qquad \text{[Quadratic formula]}$$

$$x=\frac{-(0.7)\pm\sqrt{(0.7)^2-4(-2)(0.3)}}{2(-2)} \qquad \left[\begin{array}{l}\text{Replace } a \text{ by } -2,\ b \text{ by } 0.7,\\ c \text{ by } 0.3 \text{ and } x \text{ by } x\end{array}\right]$$

$$x=\frac{-0.7\pm\sqrt{0.49+2.4}}{-4}$$

$$x=\frac{-0.7\pm\sqrt{2.89}}{-4}$$

$$x=\frac{-0.7\pm\sqrt{(1.7)^2}}{-4}$$

$$x=\frac{-0.7\pm1.7}{-4}$$

$$x=\frac{-0.7+1.7}{-4} \quad \text{or} \quad x=\frac{-0.7-1.7}{-4}$$

$$x=\frac{1}{-4} \quad \text{or} \quad x=\frac{-2.4}{-4}$$

$$x=-0.25 \quad \text{or} \quad x=0.6$$

$$x=-0.3 \text{ (approximately)} \quad \text{or} \quad x=0.6$$

Check: Substitute for each value of x is the original equation $-2x^2+0.7x=-0.3$

$$-2x^2+0.7x=-0.3 \qquad \text{[original equation]}$$

$$-2(-0.3)^2+0.7(-0.3)=-0.3 \qquad \text{[Replace } x \text{ by } -0.3\text{]}$$

$$-2(0.9)+(-0.21)\stackrel{?}{=}-0.3$$

$$-0.18-0.21\stackrel{?}{=}-0.3$$

$$-0.1-0.2\stackrel{?}{=}-0.3 \text{ (Approximately)}$$

$$-0.3=-0.3 \text{ True}$$

$$-2x^2+0.7x=-0.3 \qquad \text{[original equation]}$$

$$-2(0.6)^2+0.7(0.6)=-0.3 \qquad \text{[Replace } x \text{ by } 0.6\text{]}$$

$$-2(0.36)+0.42\stackrel{?}{=}-0.3$$

$$-0.72+0.42\stackrel{?}{=}-0.3$$

$$-0.3=-0.3 \text{ True}$$

Hence, the solution set is $\boxed{\{-0.3, 0.6\}}$

Answer 30PA.

Consider the equation $2y^2 - \frac{5}{4}y = \frac{1}{2}$

Step:1 Rewrite the equation $2y^2 - \frac{5}{4}y = \frac{1}{2}$ is the standard form of the quadratic equation $ax^2 + bx + c = 0$, where $a \neq 0$

$$2y^2 - \frac{5}{4}y = \frac{1}{2} \qquad [\text{original equation}]$$

$$4\left(2y^2 - \frac{5}{4}y\right) = 4\left(\frac{1}{2}\right) \qquad [\text{Multiply 4 on both sides}]$$

$$4\cdot(2y^2) - 4\left(\frac{5}{4}\right)y = 4\left(\frac{1}{2}\right)$$

$$8y^2 - 5y = 2$$

$$8y^2 - 5y - 2 = 2 - 2 \qquad [\text{Substract 2 on both sides}]$$

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

Step: 2 Now, compare the equation $8y^2 - 5y - 2 = 0$ with the standard equation $ax^2 + bx + c = 0$, we get $a = 8, b = -2, c = -2$ and $x = y$

Use the formula "The solutions of a quadratic equation $ax^2 + bx + c = 0$, where $a \neq 0$ are given by the quadratic formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$"

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad [\text{Quadratic formula}]$$

$$y = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(8)(-2)}}{2(8)} \qquad \left[\begin{array}{l}\text{Replace } a \text{ by } 8,\ b \text{ by } -5,\\ c \text{ by } -2 \text{ and } x \text{ by } y\end{array}\right]$$

$$y = \frac{5 \pm \sqrt{25 + 64}}{16}$$

$$y = \frac{5 \pm \sqrt{89}}{16}$$

$$y = \frac{5 \pm 9.43}{16}$$

$$y = \frac{5 + 9.43}{16} \quad \text{or} \quad y = \frac{5 - 9.43}{16}$$

$$y = \frac{14.43}{16} \quad \text{or} \quad y = \frac{4.43}{16}$$

$$y = 0.9 \quad \text{or} \quad y = 0.28 \text{ (approximately)}$$

Check: Substitute for each value of *x* is the original equation $8y^2-5y-2=0$

$$8y^2-5y-2=0 \quad \text{[original equation]}$$

$$8(0.9)^2-5(0.9)-2=0 \quad \text{[Replace } y \text{ by 0.9]}$$

$$8(0.81)-(4.5)-2\overset{?}{=}0$$

$$6.48-45-2\overset{?}{=}0$$

$$6.48-6.5\overset{?}{=}0$$

$$0=0 \text{ True}$$

$$8y^2-5y-2=0 \quad \text{[original equation]}$$

$$8(-0.28)^2-5(-0.28)-2=0 \quad \text{[Replace } y \text{ by 0.9]}$$

$$8(0.0784)+1.4-2\overset{?}{=}0$$

$$2.0272-2\overset{?}{=}0$$

$$2-2\overset{?}{=}0$$

$$0=0 \text{ True}$$

Hence, the solution set is $\boxed{\{0.9,-0.28\}}$

Answer 31PA.

Consider the equation $\frac{1}{2}v^2-v=\frac{3}{4}$

Step:1 Rewrite the equation $\frac{1}{2}v^2-v=\frac{3}{4}$ is the standard form of the quadratic equation $ax^2+bx+c=0$, where $a\neq 0$

$$\frac{1}{2}v^2-v=\frac{3}{4} \quad \text{[original equation]}$$

$$2\left(\frac{1}{2}v^2-v\right)=2\left(\frac{3}{4}\right) \quad \text{[Multiply 2 on both sides]}$$

$$v^2-2v=\frac{3}{2} \quad \text{[Multiply 2 on both sides]}$$

$$2\left(v^2-2v\right)=2\cdot\frac{3}{2}$$

$$2v^2-4v=3 \quad \text{[Substract "3" on both sides]}$$

$$2v^2-4v-3=3-3$$

$$2v^2-4v-3=0$$

Step: 2 Now, compare the equation $2v^2-4v-3=0$ with the standard equation $ax^2+bx+c=0$, we get $a=2, b=-4, c=-3$ and $x=v$

Use the formula "The solutions of a quadratic equation $ax^2+bx+c=0$, where $a \neq 0$ are given by the quadratic formula $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$"

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a} \qquad [\text{Quadratic formula}]$$

$$v=\frac{-(-4)\pm\sqrt{(-4)^2-4(2)(-3)}}{2(2)} \qquad \left[\begin{array}{l}\text{Replace } a \text{ by } 2,\ b \text{ by } -4,\\ c \text{ by } -3 \text{ and } x \text{ by } v\end{array}\right]$$

$$v=\frac{4\pm\sqrt{16+24}}{4}$$

$$v=\frac{4\pm\sqrt{40}}{4}$$

$$v=\frac{4\pm 6.3}{4}$$

$$v=\frac{4+6.3}{4} \quad \text{or} \quad v=\frac{4-6.3}{4}$$

$$v=\frac{10.3}{4} \quad \text{or} \quad v=\frac{-2.3}{4}$$

$$v=2.575 \quad \text{or} \quad v=-0.575$$

$$v=2.6\ (\text{approximately}) \quad \text{or} \quad v=-0.6\ (\text{approximately})$$

Check: Substitute for each value of *x* is the original equation $\frac{1}{2}v^2-v=\frac{3}{4}$

$$\frac{1}{2}v^2-v=\frac{3}{4} \qquad [\text{original equation}]$$

$$\frac{1}{2}(2.6)^2-(2.6)=\frac{3}{4} \qquad [\text{Replace } v \text{ by } 2.6]$$

$$\frac{1}{2}(6.76)-2.6\stackrel{?}{=}\frac{3}{4}$$

$$3.38-2.6\stackrel{?}{=}\frac{3}{4}$$

$$0.78\stackrel{?}{=}0.75$$

$$0.78\approx 0.75 \text{ True}$$

$$\frac{1}{2}v^2 - v = \frac{3}{4} \qquad \text{[original equation]}$$

$$\frac{1}{2}(-0.6)^2 - (-0.6) = \frac{3}{4} \qquad [\text{Replace } v \text{ by } -0.6]$$

$$\frac{1}{2}(0.36) + 0.6 \stackrel{?}{=} \frac{3}{4}$$

$$0.18 + 0.6 \stackrel{?}{=} \frac{3}{4}$$

$$0.78 \stackrel{?}{=} 0.75$$

$$0.78 \approx 0.75 \text{ True}$$

Therefore, $v = 2.6$ and $v = -0.6$ satisfies the original equation $\frac{1}{2}v^2 - v = \frac{3}{4}$

Hence, the solution set is $\boxed{\{2.6, -0.6\}}$

Answer 32PA.

Let '*a*' be the length of the rectangle.

Let '*b*' be the breadth of the rectangle

The area of the rectangle $A = \text{Length} \times \text{breadth}$

$= ab$ square inches

The perimeter of the rectangle $S = 2[\text{length} + \text{breadth}]$

$= 2[a+b]$ inches

According to the problem

The area of the rectangle $A = 221$ square inches

The perimeter of the rectangle $S = 60$ inches

Therefore, $ab = 221$ and $2(a+b) = 60$

$ab = 221$ and $\frac{2\cdot(a+b)}{2} = \frac{60}{2}$

$ab = 221$ and $(a+b) = 30$

Use the formula $(a-b)^2 = (a+b)^2 - 4ab$

$$(a-b)^2 = (30)^2 - 4(221) \qquad [\text{Replace } (a+b) \text{ by 30 and } ab \text{ by 221}]$$

$$(a-b)^2 = 900 - 884$$

$$(a-b)^2 = 16$$

$$(a-b) = \pm\sqrt{16}$$

$$(a-b) = \pm 4$$

$$a - b = 4 \quad \text{or} \quad a - b = -4$$

Case I Suppose $a-b=4$

Solve the equation $a+b=30$ and $a-b=4$

$$\begin{array}{r} a+b=30 \\ a-b=4 \\ \hline 2a=34 \end{array}$$

$$\frac{2a}{2}=\frac{34}{2}$$

$$a=\boxed{17}$$

To find the value of *b*:

Now, substitute '*a*' value in $a-b=4$

$$\begin{aligned} a-b&=4 && \text{[original equation]} \\ 17-b&=4 && \text{[Replace } a \text{ by 17]} \\ -17+17-b&=4-17 \\ -b&=-13 \end{aligned}$$

$$b=\boxed{13}$$

The length of the rectangle is $\boxed{17}$ inches

The breadth of the rectangle is $\boxed{13}$ inches.

Case II: Suppose $a-b=-4$

Solve the equation $a+b=30$ and $a-b=-4$

Now add the equations $a+b=30$ and $a-b=4$

$$\begin{array}{r} a+b=30 \\ a-b=4 \\ \hline 2a=26 \end{array}$$

$$\frac{2a}{2}=\frac{26}{2}$$

$$a=\boxed{13}$$

To find the value of '*b*'.

Now, substitute '*a*' value in $a-b=-4$

$$\begin{aligned} a-b&=-4 && \text{[original equation]} \\ 13-b&=-4 && \text{[Replace } a \text{ by 13]} \\ -13+13-b&=-4-13 && \text{[Substract 13 on both sides]} \\ -b&=-17 \end{aligned}$$

$$b=\boxed{17}$$

The length of the rectangle is $\boxed{13}$ inches

The breadth of the rectangle is $\boxed{17}$ inches

Answer 33PA.

Let '*a*' centimeters be the length of the rectangle *ABCD*

Let '*b*' centimeters be the breadth of the rectangle *ABCD*

The area of the rectangle *ABCD* is $A = \text{Length} \times \text{breadth}$

$= ab$ square inches

The perimeter of the rectangle *ABCD* is $S = 2[\text{length} + \text{breadth}]$

$= 2[a+b]$ inches

According to the problem

The area of the rectangle *ABCD* is 80 square inches

The perimeter of the rectangle *ABCD* is 42 centimeters

Therefore, $ab = 80$ and $2(a+b) = 42$

$ab = 80$ and $\dfrac{2\cdot(a+b)}{2} = \dfrac{42}{2}$

$ab = 80$ and $(a+b) = 21$

Use the formula $(a-b)^2 = (a+b)^2 - 4ab$

$$(a-b)^2 = (21)^2 - 4(80) \qquad [\text{Replace } (a+b) \text{ by } 21 \text{ and } ab \text{ by } 80]$$

$$(a-b)^2 = 441 - 320$$

$$(a-b)^2 = 121$$

$$(a-b) = \pm\sqrt{121}$$

$$a-b = \pm\sqrt{11^2}$$

$$a-b = \pm 11$$

$$a-b = 11 \qquad \text{or} \qquad a-b = -11$$

<u>Case I</u> Suppose $a-b=11$

Solve the equation $a+b=21$ and $a-b=11$

$$\begin{array}{r} a+b=21 \\ a-b=11 \\ \hline 2a=32 \end{array}$$

$$\frac{2a}{2}=\frac{32}{2}$$

$$a=\boxed{16}$$

To find the value of *b*:

Now, substitute '*a*' value in $a-b=11$

$$\begin{aligned} a-b&=11 && \text{[original equation]} \\ 16-b&=11 && \text{[Replace } a \text{ by 16]} \\ -16+16-b&=11-16 && \text{[Substract 16 on both sides]} \\ -b&=-5 \end{aligned}$$

$$b=\boxed{5}$$

The length of the rectangle is $\boxed{16}$ centimeters

The breadth of the rectangle is $\boxed{5}$ centimeters.

<u>Case II:</u> Suppose $a-b=-11$

Solve the equation $a+b=30$ and $a-b=-4$

Now add the equations $a+b=21$ and $a-b=-11$

$$\begin{array}{r} a+b=21 \\ a-b=-11 \\ \hline 2a=10 \end{array}$$

$$\frac{2a}{2}=\frac{10}{2}$$

$$a=\boxed{5}$$

To find the value of '*b*'.

Now, substitute '*a*' value in $a-b=-11$

$$\begin{aligned} a-b&=-11 && \text{[original equation]} \\ 5-b&=-11 && \text{[Replace } a \text{ by 5]} \\ -5+5-b&=-11-5 && \text{[Substract 5 on both sides]} \\ -b&=-16 \end{aligned}$$

$$b=\boxed{16}$$

The length of the rectangle is $\boxed{5}$ centimeters

The breadth of the rectangle is $\boxed{16}$ centimeters

Answer 34PA.

Let $(2x-1)$ and $(2x+1)$ be the two consecutive add integers.

The product of the two consecutive add integers is $(2x-1)(2x+1)$

According to the problem, the product of the two consecutive add integers is 255

i.e.

$$(2x-1)(2x+1)=255$$

$$(2x)^2-(1)^2=255 \qquad \left[\text{Use the rule } (a+b)(a-b)=a^2-b^2\right]$$

$$2^2x^2-1^2=255 \qquad \left[\text{Use the rule } (ab)^m=a^mb^m\right]$$

$$4x^2-1=255$$

$$4x^2-1+1=255+1 \qquad [\text{Add 1 on both side}]$$

$$4x^2=256$$

$$\frac{4x^2}{4}=\frac{256}{4} \qquad [\text{Divided by 4 on each side}]$$

$$x^2=\frac{64\cdot 4}{1\cdot 4}$$

$$x^2=64$$

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

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

$$x=\pm 8$$

$$x=8 \text{ or } x=-8$$

<u>Case I:-</u> Suppose $x=8$

The first odd number is $(2x-1)=(2\cdot(8)-1)=\boxed{15}$

The second odd number is $(2x+1)=(2\cdot(8)+1)=\boxed{17}$

Therefore, the two consecutive odd integers is $\boxed{15}$ and $\boxed{17}$

<u>Case II:-</u> Suppose $x=-8$

The first odd number is $(2x-1)=(2\cdot(-8)-1)=-17$

The second odd number is $(2x+1)=(2\cdot(-8)+1)=-15$

Therefore, the two consecutive odd integers is $\boxed{-17}$ and $\boxed{-15}$

Answer 35PA.

Let $(2x-1)$ and $(2x+1)$ be the two consecutive odd number.

The sum of the squares of two consecutive odd numbers is $\left[(2x-1)^2+(2x+1)^2\right]$

According to the problem

The sum of the squares of two consecutive odd numbers is 130

i.e.

$$\left[(2x-1)^2+(2x+1)^2\right]=130$$

$$2\cdot(2x)^2+2(1)^2=130 \qquad \left[\text{Use the rule } (a+b)^2+(a-b)^2=2a^2-2b^2\right]$$

$$2\left[4x^2\right]+2(1)=130$$

$$8x^2+2=130$$

$$8x^2+2-2=130-2 \qquad [\text{Substract '2' on each side}]$$

$$8x^2=128$$

$$\frac{8x^2}{8}=\frac{128}{8} \qquad [\text{Divide 8 on each side}]$$

$$\frac{8}{8}x^2=\frac{16\cdot 8}{1\cdot 8}$$

$$x^2=16$$

$$x=\pm\sqrt{16}$$

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

$$x=\pm 4$$

$$x=4 \text{ or } x=-4$$

Case I:- Suppose $x=4$

The first odd number is $(2x-1)=(2\cdot 4-1)$

$$=8-1$$
$$=7$$

The second odd number is $(2x+1)=(2\cdot 4+1)$

$$=8+1$$
$$=9$$

Therefore, the two consecutive odd numbers is $\boxed{7}$ and $\boxed{9}$

Case II:- Suppose $x=-4$

The first odd number is $(2x-1)=(2\cdot(-4)-1)$

$=-8-1$

$=-97$

The second odd number is $(2x+1)=(2\cdot(-4)+1)$

$=-8+1$

$=-7$

Therefore, the two consecutive odd number is $\boxed{-9}$ and $\boxed{-7}$

Answer 36PA.

Consider the function $f(x)=4x^2-9x+4$

Claim:- To find the *x* – intercept of the graph of the function $f(x)=4x^2-9x+4$

i.e. To find the *x* intercept put $f(x)=0$

$$\begin{aligned} &4x^2-9x+4=f(x) && [\text{original function}] \\ &4x^2-9x+4=0 && [\text{Replace } f(x) \text{ by } 0] \end{aligned}$$

Step 1: Now, solve the equation $4x^2-9x+4=0$

Now, compare the equation $4x^2-9x+4=0$ with the standard form of the quadratic equation $ax^2+bx+c=0$ $ax^2+bx+c=0$.

We have $a=4, b=-9$ and $c=4$. Use the formula

"The solution of the quadratic equation $ax^2+bx+c=0$ are given by the quadratic formula

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

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a} \qquad \text{[Quadratic formula]}$$

$$x=\frac{-(-9)\pm\sqrt{(-9)^2-4(4)(4)}}{2(4)} \qquad \left[\begin{array}{l}\text{Replace } a \text{ by } 4,\ b \text{ by } -9\\ \text{and } c \text{ by } 4\end{array}\right]$$

$$x=\frac{9\pm\sqrt{81-64}}{8}$$

$$x=\frac{9\pm\sqrt{17}}{8}$$

$$x=\frac{9+\sqrt{17}}{8} \quad \text{or} \quad x=\frac{9-\sqrt{17}}{8}$$

$$x=\frac{9+4.12}{8} \quad \text{or} \quad x=\frac{9-4.12}{8} \qquad \left[\sqrt{17}=4.12 \text{ approximately}\right]$$

$$x=\frac{13.12}{8} \quad \text{or} \quad x=\frac{4.88}{8}$$

$$x=1.64 \quad \text{or} \quad x=0.61$$

Therefore, the graph $f(x)=4x^2-9x+4$ cuts at x –axis is $(1.64,0)$ and $(0.61,0)$

Hence, the x – intercept of the graph $f(x)=4x^2-9x+4$ is $(1.64,0)$ and $(0.61,0)$

Answer 37PA.

Consider the function $f(x)=13x^2-16x-4$

Claim:- To find the *x* intercept of the graph of the function $f(x)=13x^2-16x-4$

i.e. to find the *x* – intercept put $f(x)=0$

$$13x^2-14x-4=f(x) \quad \text{[original equation]}$$
$$13x^2-16x-4=0 \quad \left[\text{Replace } f(x)\right]$$

Step 1: Now solve the equation $13x^2-16x-4=0$

Now, compare the equation $13x^2-16x-4=0$ with the standard form of the quadratic equation $ax^2+bx+c=0$. We have $a=13, b=-16, c=-4$

Use the formula "The solution of the quadratic equation $ax^2+bx+c=0$ are given by the quadratic formula $x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$"

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a} \quad \text{[Quadratic formula]}$$

$$x=\frac{-(-16)\pm\sqrt{(-16)^2-4(13)(-4)}}{2(13)} \quad \left[\begin{array}{l}\text{Replace } a \text{ by } 13,\ b \text{ by } -16 \\ \text{and ,} c \text{ by } -4\end{array}\right]$$

$$x=\frac{16\pm\sqrt{256+208}}{26}$$

$$x=\frac{16\pm 21.5}{26}$$

$$x=\frac{16+21.5}{26} \quad \text{or} \quad x=\frac{16-21.5}{26}$$

$$x=\frac{37.5}{26} \quad \text{or} \quad x=\frac{-5.5}{26}$$

$$x=1.4 \quad \text{or} \quad x=-0.21$$

Therefore, the graph $f(x)=13x^2-16x-4$ cutes at *x* –axis is $(1.4,0)$ and $(-0.21,0)$

Hence, the *x* – intercept of the graph $f(x)=13x^2-16x-4$ is $\boxed{(1.4,0)}$ and $\boxed{(-0.21,0)}$

Answer 38PA.

Consider the equation $x^2+3x-4=0$

Claim:- To find the discriminate of the equation $x^2+3x-4=0$

Now, compare the equation $x^2+3x-4=0$ with the standard equation $ax^2+bx+c=0$, we obtain $a=1, b=3, c=-4$

Use the formula "The discriminate of the quadratic equation $ax^2+bx+c=0$ are given by the $\Delta=b^2-4ac$"

$$\Delta=b^2-4ac \qquad [\text{Discriminant formula}]$$

$$\Delta=(3)^2-4(1)(-4) \qquad [\text{Replace } a \text{ by } 1,\ b \text{ by } 3 \text{ and } c \text{ by } -4]$$

$$=9+16$$

$$\Delta=25$$

Therefore, the discriminate of the equation $x^2+3x-4=0$ is $\boxed{25}$.

Since the discriminate is positive.

The equation $x^2+3x-4=0$ has $\boxed{\text{two}}$ roots

Answer 39PA.

Consider the equation $y^2+3y+1=0$

Claim:- To find the discriminate of the equation $y^2+3y+1=0$

Now, compare the equation $y^2+3y+1=0$ with the standard equation $ax^2+bx+c=0$, we obtain $a=1, b=3, c=1$

Use the formula "The discriminate of the quadratic equation $ax^2+bx+c=0$ are given by the $\Delta=b^2-4ac$"

$$\Delta=b^2-4ac \qquad [\text{Discriminant formula}]$$

$$\Delta=(3)^2-4(1)(1) \qquad [\text{Replace } a \text{ by } 1,\ b \text{ by } 3, c \text{ by } 1 \text{ and } x \text{ by } y]$$

$$=9-4$$

$$\Delta=5$$

Therefore, the discriminate of the equation $y^2+3y+1=0$ is $\boxed{5}$. Since the discriminate is positive.

The equation $y^2+3y+1=0$ has $\boxed{\text{two}}$ roots

Answer 40PA.

Consider the equation $4p^2+10p=-6.25$

Step 1: Rewrite the equation $4p^2+10p=-6.25$ is the standard form of the quadratic equation $ax^2+bx+c=0$, where $a \neq 0$.

$$4p^2+10p=-6.25 \quad \text{[original equation]}$$

$$4p^2+10p+6.25=-6.25+6.25 \quad \text{[Add '6.25' on both sides]}$$

$$4p^2+10p+6.25=0$$

Step 2: To find the discriminate of the equation $4p^2+10p+6.25=0$

Now, compare the equation $4p^2+10p+6.25=0$ with the standard equation $ax^2+bx+c=0$, we obtain $a=4, b=10, c=6.25$ and $x=p$

Use the formula "The discriminate of the quadratic equation $ax^2+bx+c=0$ are given by the $\Delta=b^2-4ac$"

$$\Delta=b^2-4ac \quad \text{[Discriminant formula]}$$

$$\Delta=(10)^2-4(4)(6.25) \quad \text{[Replace } a \text{ by 4, } b \text{ by 10,} c \text{ by 6.25 and } x \text{ by } p\text{]}$$

$$=100-100$$

$$\Delta=0$$

Therefore, the discriminate of the equation $4p^2+10p+6.25=0$ is $\boxed{0}$.

Since the discriminate is zero.

The equation $y^2+3y+1=0$ has $\boxed{\text{one real root}}$

Answer 41PA.

Consider the equation $1.5m^2+m=-3.5$

Step 1: Rewrite the equation $1.5m^2+m=-3.5$ is the standard form of the quadratic equation $ax^2+bx+c=0$, where $a \neq 0$.

$$1.5m^2+m=-3.5 \quad \text{[original equation]}$$

$$1.5m^2+m+3.5=-3.5+3.5 \quad \text{[Add '3.5' on both sides]}$$

$$1.5m^2+m+3.5=0$$

Step 2: To find the discriminate of the equation $1.5m^2+m+3.5=0$

Now, compare the equation $1.5m^2+m+3.5=0$ with the standard equation $ax^2+bx+c=0$, we obtain $a=1.5, b=1, c=3.5$ and $x=m$

Use the formula "The discriminate of the quadratic equation $ax^2+bx+c=0$ are given by the $\Delta=b^2-4ac$"

$$\Delta=b^2-4ac \qquad [\text{Discriminant formula}]$$

$$\Delta=(1)^2-4(1.5)(3.5) \; [\text{Replace } a \text{ by } 1.5,\ b \text{ by } 1, c \text{ by } 3.5 \text{ and } x \text{ by } m]$$

$$=1-21$$

$$\Delta=-20$$

Therefore, the discriminate of the equation $1.5m^2+m+3.5=0$ is $\boxed{-20}$. Since the discriminate is negative.

The equation $1.5m^2+m+3.5=0$ has $\boxed{\text{no real solution}}$

Answer 42PA.

Consider the equation $2r^2=\frac{1}{2}r-\frac{2}{3}$

Step 1: Rewrite the equation $2r^2=\frac{1}{2}r-\frac{2}{3}$ is the standard form of the quadratic equation $ax^2+bx+c=0$, where $a\neq 0$.

$$2r^2=\frac{1}{2}r-\frac{2}{3} \qquad [\text{original equation}]$$

$$2r^2-\frac{1}{2}r=\frac{1}{2}r-\frac{2}{3}-\frac{1}{2}r \qquad \left[\text{Substract }'-\frac{1}{2}r'\text{ on both sides}\right]$$

$$2r^2-\frac{1}{2}r=-\frac{2}{3}+\frac{1}{2}r-\frac{1}{2}r$$

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

$$2r^2-\frac{1}{2}r+\frac{2}{3}=-\frac{2}{3}+\frac{2}{3} \qquad \left[\text{Add }'\frac{2}{3}'\text{ on both sides}\right]$$

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

Step 2: To find the discriminate of the equation $2r^2 - \frac{1}{2}r + \frac{2}{3} = 0$ with the standard equation $ax^2 + bx + c = 0$, we obtain $a = 2, b = -\frac{1}{2}, c = \frac{2}{3}$ and $x = r$

Use the formula "The discriminate of the quadratic equation $ax^2 + bx + c = 0$ are given by the $\Delta = b^2 - 4ac$"

$$\Delta = b^2 - 4ac \quad [\text{Discriminant formula}]$$

$$\Delta = \left(-\frac{1}{2}\right)^2 - 4(2)\left(\frac{2}{3}\right) \left[\text{Replace } a \text{ by } 2,\ b \text{ by } -\frac{1}{2}, c \text{ by } \frac{2}{3} \text{ and } x \text{ by } m\right]$$

$$= \frac{1}{4} - \frac{16}{3}$$

$$= \frac{3 - (16)(4)}{12}$$

$$= \frac{3 - 64}{12}$$

$$= \frac{-61}{12}$$

$$\Delta = -5.083$$

Therefore, the discriminate of the equation $2r^2 = \frac{1}{2}r - \frac{2}{3}$ is $\boxed{-5.083}$.

Since the discriminate is negative.

The equation has $\boxed{\text{no real solution}}$

Answer 43PA.

Consider the equation $\frac{4}{3}n^2 + 4n = -3$

Step 1: Rewrite the equation $\frac{4}{3}n^2 + 4n = -3$ is the standard form of the quadratic equation $ax^2 + bx + c = 0$, where $a \neq 0$.

$$\frac{4}{3}n^2 + 4n = -3 \quad [\text{original equation}]$$

$$\frac{4}{3}n^2 + 4n + 3 = -3 + 3 \quad [\text{Add '3' on both sides}]$$

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

Step 2: To find the discriminate of the equation $\frac{4}{3}n^2+4n+3=0$ with the standard equation $ax^2+bx+c=0$, we obtain $a=\frac{4}{3}, b=4, c=3$ and $x=n$

Use the formula "The discriminate of the quadratic equation $ax^2+bx+c=0$ are given by the $\Delta=b^2-4ac$"

$$\Delta=b^2-4ac \quad \text{[Discriminant formula]}$$

$$\Delta=(4)^2-4\left(\frac{4}{3}\right)(3) \quad \left[\text{Replace } a \text{ by } \frac{4}{3}, b \text{ by } 4, c \text{ by } 3 \text{ and } x \text{ by } n\right]$$

$$=16-16$$

$$=0$$

Therefore, the discriminate of the equation $\frac{4}{3}n^2+4n+3=0$ is $\boxed{0}$.

Since the discriminate is zero.

The equation has $\boxed{\text{one real root}}$

Answer 44PA.

Consider the function $f(x)=7x^2-3x-1$

Claim:- To find the *x* intercept of the graph of the function $f(x)=7x^2-3x-1$

i.e. to find the *x* – intercept put $f(x)=0$

$$f(x)=7x^2-3x-1 \quad \text{[we obtain the } x-\text{intercept]}$$

$$7x^2-3x-1=f(x) \quad \text{[original equation]}$$

$$7x^2-3x-1=0 \quad \text{[Replace } f(x) \text{ by } 0]$$

Step 1: Now solve the equation $7x^2-3x-1=0$

Now, compare the equation $7x^2-3x-1=0$ with the standard form of the quadratic equation $ax^2+bx+c=0$. We have $a=7, b=-3, c=-1$

Use the formula "The solution of the quadratic equation $ax^2+bx+c=0$ where $a\neq 0$ are given by the quadratic formula $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$"

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a} \quad \text{[Quadratic formula]}$$

$$x=\frac{-(-3)\pm\sqrt{(-3)^2-4(7)(-1)}}{2(7)} \quad \left[\begin{array}{l}\text{Replace } a \text{ by } 7,\ b \text{ by } -3 \\ \text{and } ,c \text{ by } -1\end{array}\right]$$

$$x=\frac{3\pm\sqrt{9+28}}{14}$$

$$x=\frac{3\pm\sqrt{37}}{14}$$

$$x=\frac{3+\sqrt{37}}{14} \quad \text{or} \quad x=\frac{3-\sqrt{37}}{14}$$

$$x=\frac{3+6.08}{14} \quad \text{or} \quad x=\frac{3-6.08}{14}$$

$$x=\frac{9.08}{14} \quad \text{or} \quad x=\frac{-3.08}{14}$$

$$x=0.65 \quad \text{or} \quad x=-0.22$$

Therefore, $x=0.65$ or $x=-0.22$

Therefore, the graph $f(x)=7x^2-3x-1$ cutes at x –axis is $(0.65,0)$ and $(-0.22,0)$

Hence, the x – intercept of the graph $f(x)=7x^2-3x-1$ is $\boxed{(0.65,0)}$ and $\boxed{(-0.22,0)}$

Answer 45PA.

Consider the function $f(x)=x^2+4x+7$

Claim:- To find the x intercept of the graph of the function $f(x)=x^2+4x+7$

i.e. to find the x – intercept put $f(x)=0$

$$f(x)=x^2+4x+7 \quad \text{[we obtain the } x-\text{intercept]}$$

$$x^2+4x+7=f(x) \quad \text{[original equation]}$$

$$x^2+4x+7=0 \quad \text{[Replace } f(x) \text{ by } 0]$$

Step 1: Now solve the equation $x^2+4x+7=0$, we obtain the x – intercept.

Now, compare the equation $x^2+4x+7=0$ with the standard form of the quadratic equation $ax^2+bx+c=0$. We have $a=1, b=4, c=7$

Use the formula "The solution of the quadratic equation $ax^2+bx+c=0$ where $a\neq 0$ are given by the quadratic formula $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$"

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad \text{[Quadratic formula]}$$

$$= \frac{-(4) \pm \sqrt{(4)^2 - 4(1)(7)}}{2(1)} \qquad \begin{bmatrix} \text{Replace } a \text{ by 1, } b \text{ by 4} \\ \text{and ,} c \text{ by 7} \end{bmatrix}$$

$$= \frac{-4 \pm \sqrt{16 - 28}}{2}$$

$$= \frac{-4 \pm \sqrt{-12}}{2}$$

$$= \frac{-4 \pm \sqrt{-1 \cdot 12}}{2}$$

$$= \frac{4 \pm \sqrt{-1} \cdot \sqrt{12}}{2}$$

$$= \frac{-4 \pm i\sqrt{12}}{2}$$

Therefore, the function $f(x) = x^2 + 4x + 7 = 0$ has no real roots.

Hence, the function $f(x) = x^2 + 4x + 7 = 0$ is not meets at x –axis.

Answer 47PA.

Darius is Sking down a ski scope; Jorge is on the chair left on the same slope the Jarge and attempts to toss a disposable camera up to him. If the camera is thrown with an initial velocity of 35 feet per second, the sine equation for the height of the camera

$$h = -16t^2 + 35t + 5$$

Where

'h' represents the height in feet and

't' represents the time is second

Claim: To find the time taken by the camera to hit the ground.

i.e. when the camera is hit the height between camera and ground must be zero.

Therefore,

We have to find 't' and $h = 0$

Step 1: Now we can substitute $h = 0$ in the original equation

$$h = -16t^2 + 35t + 5$$

$$h = -16t^2 + 35t + 5$$

Original equation replaces 'h' by '0'

$$0 = -16t^2 + 35t + 5$$

$$-16t^2 + 35t + 5 = 0$$

<u>Step 2:</u> Solve the equation $-16t^2+35t+5=0$

Now, comparing the equation $-16t^2+35t+5=0$ with the standard equation $ax^2+bx+c=0$

We obtain,

$a=-16, b=35, c=5$ and $x=t$

Use the formula,

The solution of the quadratic equation $ax^2+bx+c=0$ where $a\neq 0$ are given by the quadratic formula $x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$,

$$t=\frac{-35\pm\sqrt{(35)^2-4(-16)(5)}}{2(-16)} \qquad \left[\begin{array}{l}\text{Replace } 'x' \text{ by } t, a \text{ by } -16,\\ b \text{ by } 35 \text{ and } c \text{ by } 5\end{array}\right]$$

$$=\frac{-35\pm\sqrt{1225+320}}{-32}$$

$$=\frac{-35\pm\sqrt{1545}}{-32}$$

$$=\frac{-35\pm\sqrt{1545}}{-32}$$

$$=\frac{-35\pm 39.3}{-32}$$

$$t=\frac{-35+39.3}{-32} \quad \text{or} \quad t=\frac{-35+39.3}{-32}$$

$$t=\frac{4.3}{-32} \quad \text{or} \quad t=\frac{-74.3}{-32}$$

$$t=-0.13 \quad \text{or} \quad t=2.3$$

Since the time '*t*' is always positive, we neglect the negative term.

Therefore,

$t=2.3$ sec

Hence, after $\boxed{2.3\text{ sec}}$ the camera to hit the ground.

Answer 48PA.

A projectile is shot vertically up in the air from ground level. Its distance 's' in feet t second is given by $s = 96t - 16t^2$

Claim: To find the values of 't' when $s = 96$ feet

Step 1: Substitute $s = 96$ in the original equation

$$s = 96t - t^2$$

$$s = 96t - t^2 \quad \text{[original equation]}$$

$$96 = 96t - t^2 \quad \text{[Replace 's' by 96]}$$

$$96 - 96 = 96t - t^2 - 96 \quad \text{[Subtract 96 on each side]}$$

$$96t - t^2 - 96 = 0$$

$$-t^2 + 96t - 96 = 0$$

$$(-1)(-t^2 + 96t - 96) = -1 \cdot 0 \quad \text{[Multiply } -1 \text{ on each side]}$$

$$t^2 - 96t + 96 = 0$$

Step 2: Solve the equation $t^2 - 96t + 96 = 0$

Now, comparing the equation $t^2 - 96t + 96 = 0$ with the standard equation $ax^2 + bx + c = 0$

We obtain,

$a = 1, b = -96, c = 96$ and $x = t$

Use the formula,

The solution of the quadratic equation $ax^2 + bx + c = 0$ where $a \neq 0$ are given by the quadratic formula $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

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

$$t = \frac{-(-96) \pm \sqrt{(-96)^2 - 4(1)(-96)}}{2(1)} \quad \left[\begin{array}{l}\text{Replace 'x' by } t, a \text{ by } 1, \\ b \text{ by } -96 \text{ and } c \text{ by } 96\end{array}\right]$$

$$= \frac{96 \pm \sqrt{9216 - 384}}{2}$$

$$= \frac{96 \pm \sqrt{8832}}{2}$$

$$= \frac{96 \pm 94}{2} \quad \left[\sqrt{8822} = 93.978 \approx 94\right]$$

$$t = \frac{96 + 94}{2} \quad \text{or} \quad t = \frac{96 - 94}{2}$$

$$t = \frac{190}{2} \quad \text{or} \quad t = \frac{2}{2}$$

$$t = 95 \quad \text{or} \quad t = 1$$

Therefore,

$t = 95$ second approximately and $t = 1$ sec approximately when $s = 96$ feet

Hence,

A projectile is shot vertically up in the air from ground level.

Its distance's' in feet.

After't' seconds is given by $s = 96t - t^2$. The value of't' is 95 seconds and 1 second when's' is 96 feet.

The solution set is $\boxed{\{1, 95\}}$

Answer 49PA.

Cox's formula for measuring velocity of water draining from a reservoir through a horizontal pipe is $4v^2 + 5v - 2 = \frac{1200\ \text{HP}}{\text{L}}$

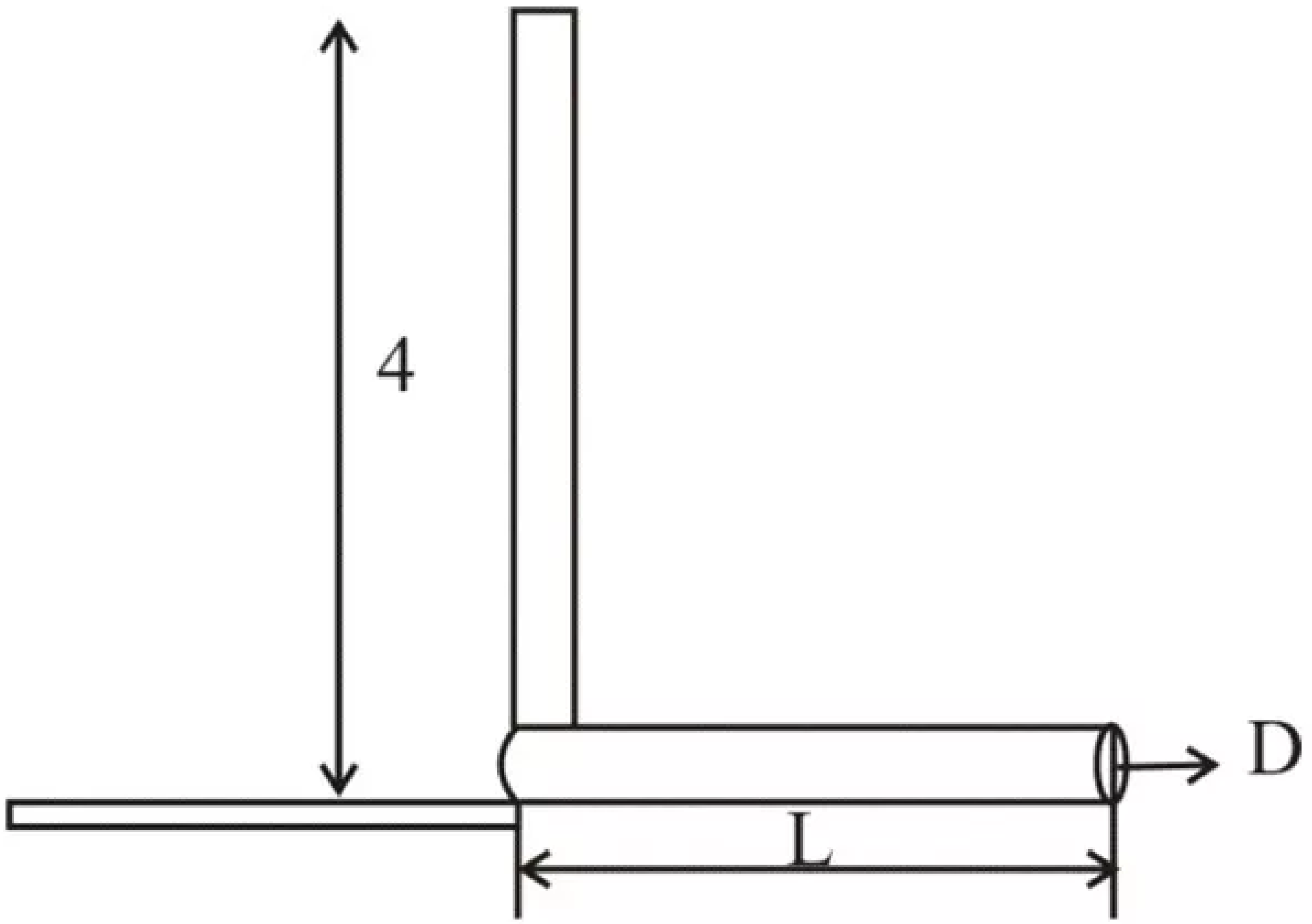
Where,

'*v*' represent the velocity of the water in feet per second.

'*H*' represents the height of the reservoir in feet

D is represents the diameter of the pipe in inches

'*t*' represent the length of the pipe in feet.



Claim: How fast is water flowing through a pipe 20 feet long with a diameter of 6 inches that is draining a swimming pool with depth of 10 feet

Step 1: Substitute $L = 20, D = 6$ and $H = 10$ in the original equation $4v^2 + 5v - 2 = \frac{1200HD}{L}$

$$4v^2 + 5v - 2 = \frac{1200HD}{L} \quad \text{[original equation]}$$

$$4v^2 + 5v - 2 = \frac{(1200)(10)(6)}{20} \quad [\text{Replace } H = 10, D = 6, L = 20]$$

$$4v^2 + 5v - 2 = \frac{1200 \times 10 \times 2 \times 3}{2 \times 10} \quad \begin{bmatrix}\text{Cancelling common factor in the} \\ \text{numerator and denominator}\end{bmatrix}$$

$$4v^2 + 5v - 2 = 1200 \times 3$$

$$4v^2 + 5v - 2 = 3600 \quad \text{[Subtract 3600 on both sides]}$$

$$4v^2 + 5v - 2 - 36000 = 3600 - 3600$$

$$4v^2 + 5v - 3602 = 0$$

Step 2: Solve the equation $4v^2 + 5v - 3602 = 0$

Now, comparing the equation $4v^2 + 5v - 3602 = 0$ with the standard quadratic equation $ax^2 + bx + c = 0$ we obtain $a = 4, b = 5$ and $c = -3602$, $x = v$

Use the rule,

The solution of the quadratic equation $ax^2 + bx + c = 0$ where $a \neq 0$ are given by the quadratic formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{20}$.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{20} \quad \text{[Quadratic formula]}$$

$$v = \frac{-5 \pm \sqrt{5^2 - 4(4)(-3602)}}{2(4)} \quad [\text{Replace } x = v, b = 5, c = -3602, a = 4]$$

$$v = \frac{-5 \pm \sqrt{25 + 57632}}{8}$$

$$v = \frac{-5 \pm \sqrt{57657}}{8}$$

$$v = \frac{-5 \pm 240}{8} \quad \left[\sqrt{57657} \approx 240\right]$$

$$v \approx \frac{-5 + 240}{8} \quad \text{or} \quad v \approx \frac{-5 - 240}{8}$$

$$v \approx \frac{235}{8} \quad \text{or} \quad v \approx \frac{-245}{8}$$

$$v \approx 29.3 \quad \text{or} \quad v = -30.625$$

Since, the velocity of the water is always positive, we neglect the negative value.

Hence, the velocity of the water is $\boxed{29.3 \text{ feet per second}}$ when $D = 6, H = 10, L = 20$

Answer 50PA.

Consider the function $f(x) = ax^2 + 10x + 3$

Claim: To find the value of 'a' if the graph of the function $f(x) = ax^2 + 10x + 3$ intersect the x –axis in two place.

Note that,

The graph of $f(x) = ax^2 + 10x + 3$ intersect the x –axis *i.e.* $f(x) = 0$

Step 1: Substitute $f(x) = 0$ in the original equation $f(x) = ax^2 + 10x + 3$

$$f(x) = ax^2 + 10x + 3$$
$$0 = ax^2 + 10x + 3$$
$$ax^2 + 10x + 3 = 0$$

Step 2: Now, we have to find the discriminate of the equation $ax^2 + 10x + 3 = 0$

Now, comparing the equation $ax^2 + 10x + 3 = 0$ with the standard quadratic equation $ax^2 + bx + c = 0$, where $a \neq 0$ we obtain $a = a, b = 10, c = 3$

Use the formula,

The discriminate of the quadratic equation $ax^2 + bx + c = 0$ are given by $\Delta = b^2 - 4ac$"

$$\Delta = b^2 - 4ac$$
$$\Delta = (10)^2 - 4(a)(3) \quad [\text{Replace } a \text{ by } 10, b \text{ by } a \text{ and } c \text{ by } 3]$$
$$= 100 - 12a$$

Step 3

Use the rule,

The graph $f(x) = ax^2 + 10x + 3$ where a to intersect the x –axis in two place , if the discriminate of $ax^2 + bx + c = 0$ is positive *i.e.* $\Delta > 0$"

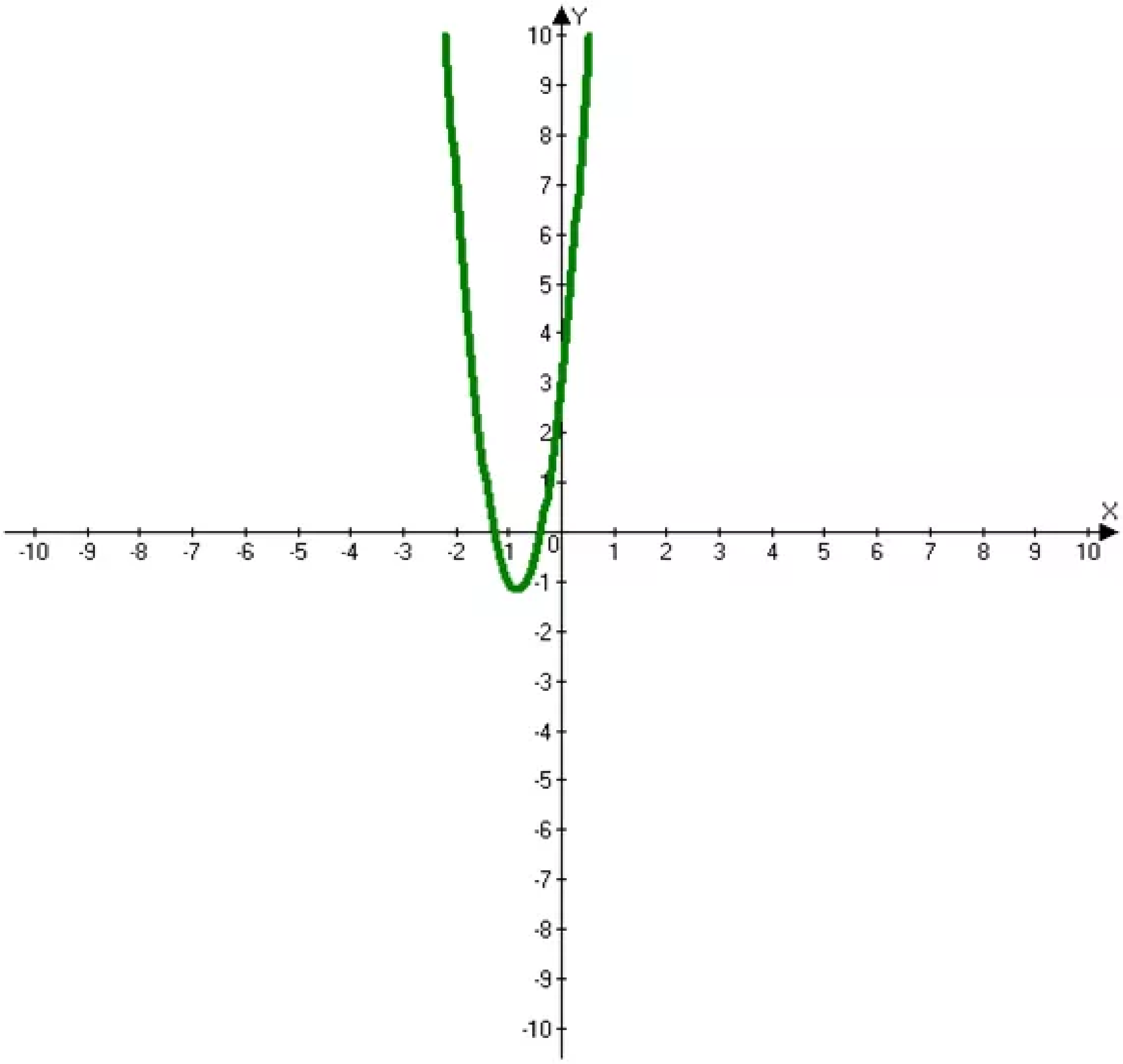
$\Delta > 0$ Discriminate is positive

$$100 - 12a > 0 \quad [\text{Replace } \Delta = 100 - 12a]$$
$$100 - 12a + 12a > 0 + 12a \quad [\text{Add } 12a \text{ on both sides}]$$
$$100 > 12a$$
$$12a < 100$$
$$\frac{12a}{12} < \frac{100}{12} \quad [\text{dividing '12' on both sides}]$$
$$a < 8.3$$

Therefore,

$\boxed{a < 8.3}$, the graph $f(x) = 8.3x^2 + 10x + 3$ intersects the x –axis in two places.

For example, if a=6 then the graph of the function is shown below.



Answer 51PA.

A decrease in smoking in the United States has resulted in lower death rates caused by cancer. In 1965, 42% of adults smoked compared with less than 25% in 1995. The number of death per 1000,000 people *y* can be approximated by

$$y = -0.048x^2 + 1.87x + 154$$

Where,

'*x*' represents the number of years after 1970.

Claim: Solve the equation $y = -0.048x^2 + 1.87x + 154$ when $y = 150$

Step 1: Substitute $y = 150$ in the original equation $y = -0.048x^2 + 1.87x + 154$

$$y = -0.048x^2 + 1.87x + 154 \quad \text{[original equation]}$$
$$150 = -0.048x^2 + 1.87x + 154 \quad \text{[Replace } y = 150\text{]}$$
$$150 - 150 = -0.048x^2 + 1.87x + 154 - 150 \quad \text{[Subtract '150' on both sides]}$$
$$0 = -0.048x^2 + 1.87x + 4$$
$$-0.048x^2 + 1.87x + 4 = 0$$

Step 2: Now, solve the equation $-0.048x^2+1.87x+4=0$

Comparing the equation $-0.048x^2+1.87x+4=0$ with the standard quadratic equation $ax^2+bx+c=0$ we obtain $a=-0.048, b=1.87, c=4$

Use the rule,

The solution of the quadratic equation $ax^2+bx+c=0$ where $a\neq 0$ are given by the quadratic formula $x=\frac{-b\pm\sqrt{b^2-4ac}}{20}$.

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{20} \quad \text{[Quadratic formula]}$$

$$=\frac{-1.87\pm\sqrt{(1.87)^2-4(-0.048)(4)}}{2(-0.048)} \quad [\text{Replace } a=-0.048, b=1.87, c=4]$$

$$=\frac{-1.87\pm\sqrt{3.4969+0.768}}{-0.096}$$

$$=\frac{-1.87\pm\sqrt{4.2649}}{-0.096}$$

$$=\frac{-1.87\pm 2.06}{-0.096} \quad \left[\sqrt{4.2649}\approx 2.06\right]$$

$$x\approx\frac{-1.87+2.06}{-0.096} \quad \text{or} \quad x\approx\frac{-1.87-2.06}{-0.096}$$

$$x\approx\frac{0.19}{-0.096} \quad \text{or} \quad x\approx\frac{-3.93}{-0.096}$$

$$x\approx -2 \quad \text{or} \quad x=41$$

Since, the years '*x*' always positive, so we neglect the negative value of '*x*'

Therefore, the death rate of $y=-0.048x^2+1.87x+154$ is $\boxed{x=41 \text{ years}}$ when $y=150$

Answer 52PA.

A decrease in smoking in the United States has resulted in lower death rates caused by cancer. In 1965, 42% of adults smoked compared with less than 25% in 1995. The number of death per 1000,000 people *y* can be approximated by

$$y = -0.048x^2 + 1.87x + 154$$

Where,

'*x*' represents the number of years after 1970.

Claim: In what year would you except the death rate from cancer to be 15 per 1000,000 unit write

Step 1: Substitute $y = 150$ in the original equation $y = -0.048x^2 + 1.87x + 154$

$$y = -0.048x^2 + 1.87x + 154 \quad [\text{original equation}]$$

$$150 = -0.048x^2 + 1.87x + 154 \quad [\text{Replace } y = 150]$$

$$150 - 150 = -0.048x^2 + 1.87x + 154 - 150 \quad [\text{Subtract '150' on both sides}]$$

$$0 = -0.048x^2 + 1.87x + 4$$

$$-0.048x^2 + 1.87x + 4 = 0$$

Step 2: Now, solve the equation $-0.048x^2+1.87x+4=0$

Comparing the equation $-0.048x^2+1.87x+4=0$ with the standard quadratic equation $ax^2+bx+c=0$ we obtain $a=-0.048, b=1.87, c=4$

Use the rule,

The solution of the quadratic equation $ax^2+bx+c=0$ where $a\neq 0$ are given by the quadratic formula $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$.

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a} \quad \text{[Quadratic formula]}$$

$$=\frac{-1.87\pm\sqrt{(1.87)^2-4(-0.048)(4)}}{2(-0.048)} \quad [\text{Replace } a=-0.048, b=1.87, c=4]$$

$$=\frac{-1.87\pm\sqrt{3.4969+0.768}}{-0.096}$$

$$=\frac{-1.87\pm\sqrt{4.2649}}{-0.096}$$

$$=\frac{-1.87\pm 2.06}{-0.096} \quad \left[\sqrt{4.2649}\approx 2.06\right]$$

$$x\approx\frac{-1.87+2.06}{-0.096} \quad \text{or} \quad x\approx\frac{-1.87-2.06}{-0.096}$$

$$x\approx\frac{0.19}{-0.096} \quad \text{or} \quad x\approx\frac{-3.93}{-0.096}$$

$$x\approx -2 \quad \text{or} \quad x=41$$

Since, the years '*x*' always positive, so we neglect the negative value of '*x*'

Therefore, the death rate of $y=-0.048x^2+1.87x+154$ is $\boxed{x=41 \text{ years}}$ when $y=150$

Step 3 The death rate from cancer to be 150 per 1000,000 is $(1970+41)$ years2011

Therefore, $\boxed{2011 \text{ years}}$ would year accept the death rate from cancer to be 150 per 1000,000

Answer 53PA.

A decrease in smoking in the United States has resulted in lower death rates caused by cancer. In 1965, 42% of adults smoked compared with less than 25% in 1995. The number of death per 1000,000 people *y* can be approximated by

$y = -0.048x^2 + 1.87x + 154$

Where,

'*x*' represents the number of years after 1970.

Claim: To find the death rate from cancer be 0 per 1000,000.

i.e. substitute *y* by 0 in the original quadratic function $y = -0.048x^2 + 1.87x + 154$

Step 1: Substitute $y = 0$ in the original equation $y = -0.048x^2 + 1.87x + 154$

$$y = -0.048x^2 + 1.87x + 154 \quad [\text{original equation}]$$
$$0 = -0.048x^2 + 1.87x + 154 \quad [\text{Replace } y = 0]$$

$-0.048x^2 + 1.87x + 154 = 0$

Step 2: Now, solve the equation $-0.048x^2 + 1.87x + 154 = 0$

Comparing the equation $-0.048x^2 + 1.87x + 154 = 0$ with the standard quadratic equation $ax^2 + bx + c = 0$ we obtain $a = -0.048, b = 1.87, c = 154$

Use the rule,

The solution of the quadratic equation $ax^2 + bx + c = 0$ where $a \neq 0$ are given by the quadratic formula $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{20}$.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{20} \quad [\text{Quadratic formula}]$$
$$= \frac{-1.87 \pm \sqrt{(1.87)^2 - 4(-0.048)(154)}}{2(-0.048)} \quad [\text{Replace } a = -0.048, b = 1.87, c = 154]$$
$$= \frac{-1.87 \pm \sqrt{3.4969 + 29.568}}{-0.096}$$
$$= \frac{-1.87 \pm \sqrt{33.0649}}{-0.096}$$
$$= \frac{-1.87 \pm 5.75}{-0.096} \quad [\sqrt{33.0649} \approx 5.75]$$
$$x \approx \frac{-1.87 + 5.75}{-0.096} \quad \text{or} \quad x \approx \frac{-1.87 - 5.75}{-0.096}$$
$$x \approx \frac{3.88}{-0.096} \quad \text{or} \quad x \approx \frac{-7.62}{-0.096}$$
$$x \approx -40 \quad \text{or} \quad x \approx 79$$

Since, the years '*x*' always positive, so we neglect the negative value of '*x*'

Therefore, the death rate of $y = -0.048x^2 + 1.87x + 154$ is $\boxed{x = 79 \text{ years}}$ when $y = 0$

Hence, the death rate from cancer to 0 per 1000,000 is $(1970 + 79)$ years $= \boxed{2049 \text{ years}}$

Answer No, the death rate from cancer will never be '0' unless a cure is found.

Answer 54PA.

Consider the quadratic equation

$$15 = 0.0055t^2 - 0.0796t + 5.2810$$

Claim: Solve the equation $15 = 0.0055t^2 - 0.0796t + 5.2810$ if solve the equation $15 = 0.0055t^2 - 0.0796t + 5.2810$ in following steps

1. Rewrite the equation in standard form

2. Solve the equation by using quadratic formula

Step 1: Re write the equation $15 = 0.0055t^2 - 0.0796t + 5.2810$ in standard quadratic equation $ax^2 + bx + c = 0$ from $15 = 0.0055t^2 - 0.0796t + 5.2810$ original equation subtract '15' on both sides

$$\begin{aligned} 15 &= 0.0055t^2 - 0.0796t + 5.2810 && [\text{original equation}] \\ 15 - 15 &= 0.0055t^2 - 0.0796t + 5.2810 - 15 && [\text{Subtract 15 on both sides}] \\ 0 &= 0.0055t^2 - 0.0796t - 9.719 \end{aligned}$$

$$0.0055t^2 - 0.0796t - 9.719 = 0$$

Step 2: Now, solve the equation $0.0055t^2 - 0.0796t - 9.719 = 0$

Comparing the equation $-0.048x^2 + 1.87x + 154 = 0$ with the standard quadratic equation $ax^2 + bx + c = 0$ we obtain $a = 0.0055, b = -0.0796, c = -9.719$

Use the rule,

The solution of the quadratic equation $ax^2 + bx + c = 0$ where $a \neq 0$ are given by the quadratic formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{20}$.

$$\begin{aligned} x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{20} && [\text{Quadratic formula}] \\ &= \frac{-(-0.0796) \pm \sqrt{(-0.0796)^2 - 4(0.0055)(-9.719)}}{2(0.0055)} \\ & && [\text{Replace } a = 0.0055, b = -0.0796, c = -9.719] \\ &= \frac{0.0796 \pm \sqrt{0.00633616 + 0.213818}}{0.011} \\ &= \frac{0.0796 \pm \sqrt{0.22015416}}{0.011} \\ x &= \frac{0.0796 \pm 0.47}{0.011} && [\sqrt{0.22015416} \approx 0.47] \end{aligned}$$

$$x \approx \frac{0.0796 + 0.47}{0.011} \quad \text{or} \quad x \approx \frac{0.0796 - 0.47}{0.011}$$

$$x \approx \frac{0.5496}{0.011} \quad \text{or} \quad x \approx \frac{-0.3904}{0.011}$$

$$x \approx 50 \quad \text{or} \quad x \approx -35.5$$

$x = 50$ or $x \approx -35.5$

The solution set is $\{-35.5, 50\}$

The quadratic formula difficult to solve the equation.

Other methods may be use in some cases but the quadratic formula always gives accurate solution. It is easy to find roots of any quadratic equation.

Answer 55PA.

Consider the equations $x^2 - 5x + 8 = 0$

Claim: To determine the discriminate of the equation $x^2 - 5x + 8 = 0$

Now, compare the equation $x^2 - 5x + 8 = 0$ with the standard quadratic equation $ax^2 + bx + c = 0$ with the obtain $a = 1, b = -5, c = 8$

Use the formula,

"The discriminate of the equation $ax^2 + bx + c = 0$ where $a \neq 0$ are given by $\Delta = b^2 - 4ac$

$$\Delta = b^2 - 4ac \qquad [\text{Discriminent formula}]$$

$$\begin{aligned}\Delta &= (-5)^2 - 4(1)(8) \\ &= 25 - 32 \\ &= -7\end{aligned}$$

$$\Delta = -7$$

Step 2: To determine the number of solution of $x^2 - 5x + 8 = 0$

Use the rule,

"The discriminate of the quadratic equation $ax^2 + bx + c = 0$ are given by $\Delta = b^2 - 4ac$. Suppose the discriminate $\Delta = b^2 - 4ac$ is positive the equation has tow roots. Suppose the discriminate is zero, the equation has one root. Suppose the discriminate is negative, the equation has no real solution.

Note, that the discriminate of $x^2 - 5x + 8 = 0$ is -7, we observe that the discriminate of $x^2 - 5x + 8 = 0$ is negative. The equation has no real root.

Hence, the number of real solutions of $x^2 - 5x + 8 = 0$ is $\boxed{0}$

Answer, $\boxed{A}$

Answer 56PA.

Consider the equations $2x^2 + 5x + 1 = 0$

Claim: Solve the equation $2x^2 + 5x + 1 = 0$

Now, compare the equation $2x^2 + 5x + 1 = 0$ with the standard quadratic equation $ax^2 + bx + c = 0$ with the obtain $a = 2, b = 5, c = 1$

Use the formula,

"The solution of the quadratic equation $ax^2 + bx + c = 0$ where $a \neq 0$ are given by the quadratic formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad [\text{Quadratic formula}]$$

$$x = \frac{-5 \pm \sqrt{(5)^2 - 4(2)(1)}}{2(2)} \qquad [\text{Replace } a = 2, b = 5 \text{ and } c = 1]$$

$$= \frac{-5 \pm \sqrt{25 - 8}}{4}$$

$$= \frac{-5 \pm \sqrt{17}}{4}$$

Therefore, the solution of the equation $2x^2 + 5x + 1 = 0$ is $\boxed{x = \frac{-5 \pm \sqrt{17}}{4}}$

Answer $\boxed{C}$

Answer 57PA.

Consider the equations $x^2 - 8x = -7$

Claim Solve the equation $x^2 - 8x = -7$

Step 1: Rewrite the equation $x^2 - 8x = -7$ in standard quadratic equation $ax^2 + bx + c = 0$ form

$$x^2 - 8x = -7 \qquad [\text{original equation}]$$

$$x^2 - 8x + 7 = -7 + 7$$

$$x^2 - 8x + 7 = 0$$

Step 2: Now, solve the equation $x^2-8x+7=0$ by Quadratic formula

Now, compare the equation $x^2-8x+7=0$ with the standard Quadratic equation $ax^2+bx+c=0$ where $a\neq 0$. We obtain, $a=1, b=-8, c=7$

Use the formula

"The solution of the Quadratic equation $ax^2+bx+c=0$ where $a\neq 0$ are given by the quadratic formula $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$"

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a} \quad \text{[Quadratic formula]}$$

$$x=\frac{-(-8)\pm\sqrt{(-8)^2-4(1)(7)}}{2(1)} \quad \text{[Replace } a=1, b=-8 \text{ and } c=7\text{]}$$

$$=\frac{8\pm\sqrt{64-28}}{2}$$

$$=\frac{8\pm\sqrt{36}}{2}$$

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

$$x=\frac{8+6}{2} \quad \text{or} \quad x=\frac{8-6}{2}$$

$$x=\frac{14}{2} \quad \text{or} \quad x=\frac{2}{2}$$

$$x=7 \quad \text{or} \quad x=1$$

Therefore, the solution set is $\boxed{\{1,7\}}$

Answer 58PA.

Consider the equations $a^2+2a+5=20$

Claim Solve the equation $a^2+2a+5=20$

Step 1: Rewrite the equation $a^2+2a+5=20$ in standard quadratic equation $ax^2+bx+c=0$ form

$$a^2+2a+5=20 \quad \text{[original equation]}$$

$$a^2+2a+5-20=20-20 \quad \text{[Subtract 20 on both sides]}$$

$$a^2+2a-15=0$$

Step 2: Now, solve the equation $a^2+2a-15=0$ by Quadratic formula

Now, compare the equation $a^2+2a-15=0$ with the standard Quadratic equation $ax^2+bx+c=0$ where $a \neq 0$. We obtain, $a=1, b=2, c=-15$

Use the formula

"The solution of the Quadratic equation $ax^2+bx+c=0$ where $a \neq 0$ are given by the quadratic formula $x=\frac{-b \pm \sqrt{b^2-4ac}}{2a}$"

$$x=\frac{-b \pm \sqrt{b^2-4ac}}{2a} \qquad \text{[Quadratic formula]}$$

$$x=\frac{-(2) \pm \sqrt{(2)^2-4(1)(-15)}}{2(1)} \qquad \text{[Replace } a=1, b=2 \text{ and } c=-15\text{]}$$

$$=\frac{-2 \pm \sqrt{4+60}}{2}$$

$$=\frac{-2 \pm \sqrt{64}}{2}$$

$$=\frac{-2 \pm 8}{2}$$

$$x=\frac{-2+8}{2} \quad \text{or} \quad x=\frac{-2-8}{2}$$

$$x=\frac{6}{2} \quad \text{or} \quad x=\frac{-10}{2}$$

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

Therefore, the solution set is $\boxed{\{-5,3\}}$

Answer 59PA.

Consider the equations $x^2-12x=5$

Claim Solve the equation $x^2-12x=5$

Step 1: Rewrite the equation $x^2-12x=5$ in standard quadratic equation $ax^2+bx+c=0$ form

$$x^2-12x=5 \qquad \text{[original equation]}$$

$$x^2-12x-5=5-5 \qquad \text{[Subtract 5 on both sides]}$$

$$x^2-12x-5=0$$

Answer 59PA.

Step 2: Now, solve the equation $x^2-12x-5=0$ by Quadratic formula

Now, compare the equation $x^2-12x-5=0$ with the standard Quadratic equation $ax^2+bx+c=0$ where $a\neq 0$. We obtain, $a=1, b=-12, c=-5$

Use the formula

"The solution of the Quadratic equation $ax^2+bx+c=0$ where $a\neq 0$ are given by the quadratic formula $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$"

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a} \quad \text{[Quadratic formula]}$$

$$x=\frac{-(-12)\pm\sqrt{(-12)^2-4(1)(-5)}}{2(1)} \quad [\text{Replace } a=1, b=-12 \text{ and } c=-5]$$

$$=\frac{12\pm\sqrt{144+20}}{2}$$

$$=\frac{12\pm\sqrt{164}}{2}$$

$$=\frac{12\pm 12.8}{2} \quad [\sqrt{164}\approx 12.8]$$

$$x=\frac{12+12.8}{2} \quad \text{or} \quad x=\frac{12-12.8}{2}$$

$$x\approx\frac{24.8}{2} \quad \text{or} \quad x\approx\frac{-0.8}{2}$$

$$x\approx 12.4 \quad \text{or} \quad x\approx -0.4$$

Therefore, the solution set is $\boxed{\{-0.4, 12.4\}}$

Answer 60MYS.

Consider the equations $x^2-x=6$

Claim Solve the equation $x^2-x=6$

Step 1: Rewrite the equation $x^2-x=6$ in standard quadratic equation $ax^2+bx+c=0$ form

$$x^2-x=6 \quad \text{[original equation]}$$

$$x^2-x-6=6-6 \quad \text{[Subtract 6 on both sides]}$$

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

Step 2: Now, solve the equation $x^2 - x - 6 = 0$ by using graphing

Let,

$y = x^2 - x - 6$

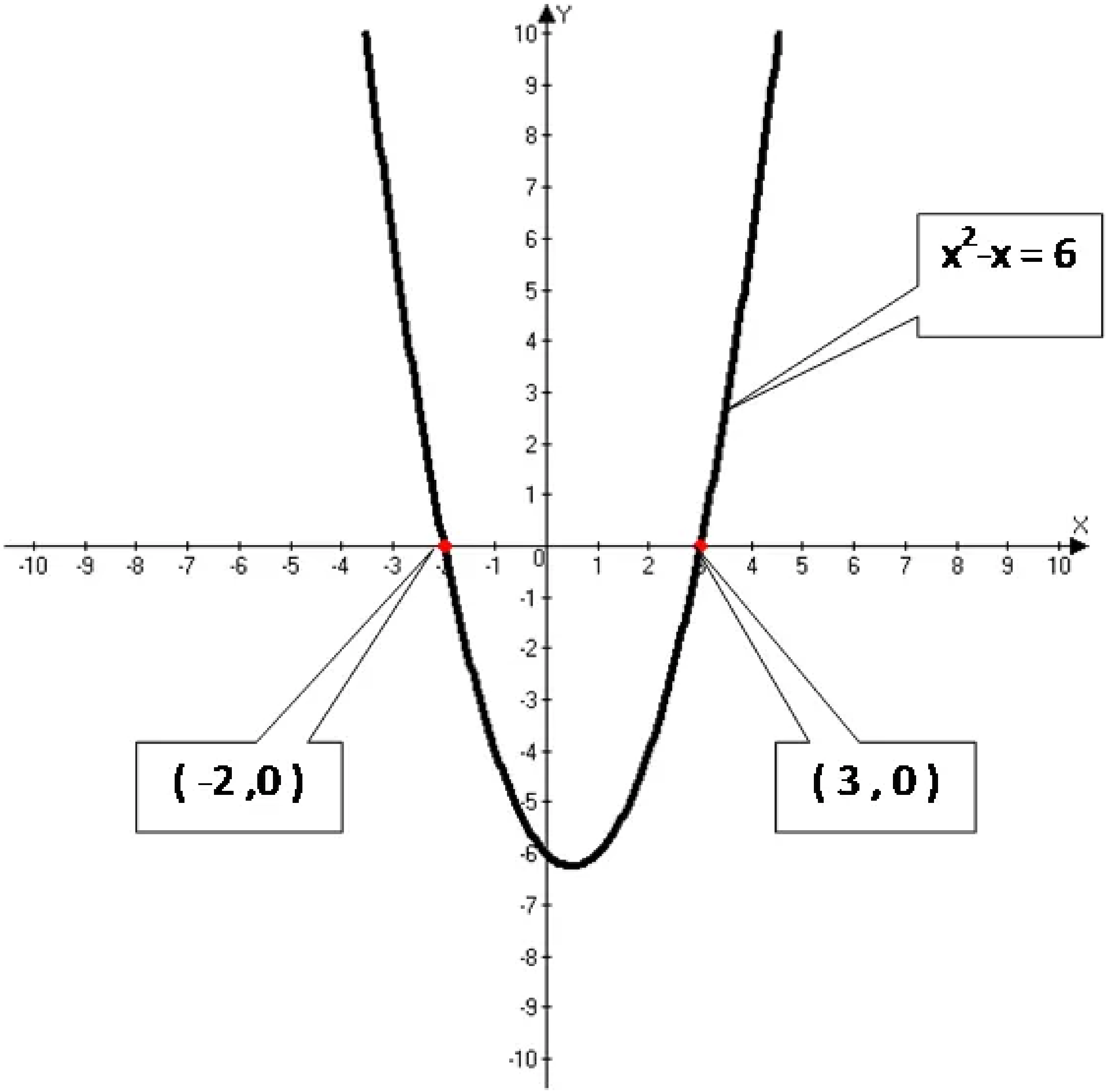
Now we can substitute the different values of 'x' in $y = x^2 - x - 6$ we get the *y* values. Plotting these all ordered pairs and connect them we get a smooth curve.

Table $y = x^2 - x - 6$

x	$y = x^2 - x - 6$	y	(x, y)
-3	$(-3)^2 - (-3) - 6$	6	$(-3, 6)$
-2	$(-2)^2 - (-2) - 6$	0	$(-2, 0)$
-1	$(-1)^2 - (-1) - 6$	-4	$(-1, -4)$
0	$(0)^2 - (0) - 6$	-6	$(0, -6)$
1	$(1)^2 - (1) - 6$	-6	$(1, -6)$
2	$(2)^2 - (2) - 6$	-4	$(2, -4)$
3	$(3)^2 - (3) - 6$	-0	$(3, 0)$
4	$(4)^2 - 4 - 6$	6	$(4, 6)$

Now, add these all ordered we get, a parabola opened upward. This parabola intersect at *x* – axis is $(-2,0)$ and $(3,0)$

Hence, the solution of $x^2 - x - 6 = 0$ is $\boxed{\{2,3\}}$



Answer 61MYS.

Consider the equations $2x^2+x=2$

Claim Solve the equation $2x^2+x=2$ by graphing

Step 1: Rewrite the equation $2x^2+x=2$ in standard form of $ax^2+bx+c=0$ where $a\neq 0$

$$2x^2+x=2 \quad [\text{original equation}]$$

$$2x^2+x-2=2-2 \quad [\text{Subtract 2 on both sides}]$$

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

Step 2: Now, solve the equation $2x^2+x-2=0$ by using graphing

Let,

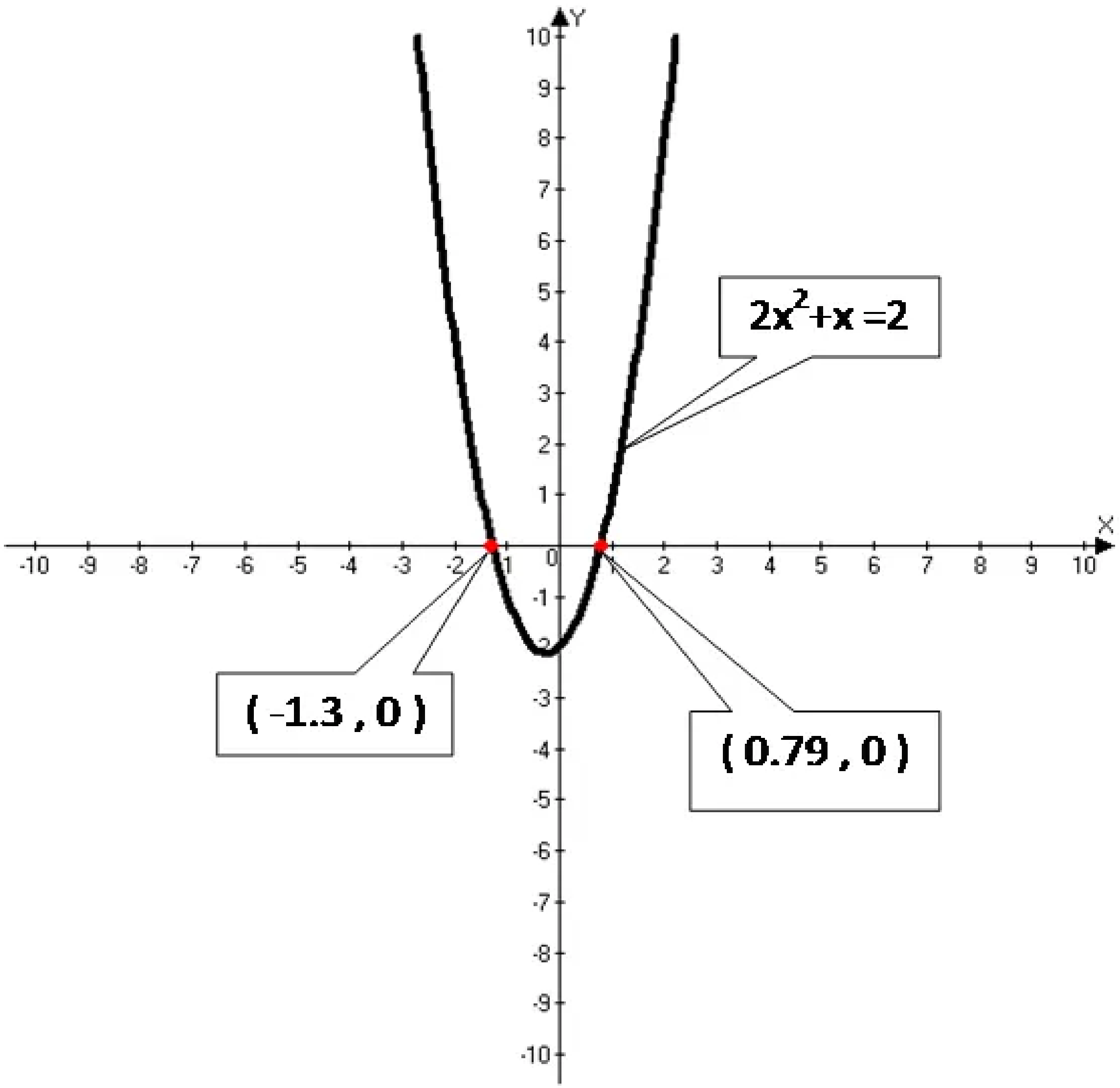
$$y=2x^2+x-2$$

Now we can substitute the different values of 'x' in $y=2x^2+x-2$ we get the *y* values. Plotting these all ordered pairs and connect them we get a smooth curve.

x	$2x^2+x-2$	y	(x,y)
-3	$2(-3)^2+(-3)-2$	13	$(-3,13)$
-2	$2(-2)^2+(-2)-2$	4	$(-2,4)$
-1	$2(-1)^2+(-1)-2$	-1	$(-1,-1)$
-1.3	$2(-1.3)^2+(-1.3)-2$	0	$(-1.3,0)$
0	$2(0)^2+(0)-2$	-2	$(0,-2)$
0.79	$2(0.79)^2+(0.79)-2$	0	$(0.79,0)$
1	$2(1)^2+(1)-2$	1	$(1,1)$
2	$2(2)^2+(2)-2$	8	$(2,8)$
3	$2(3)^2+(3)-2$	19	$(3,19)$
4	$2(4)^2+(4)-2$	34	$(4,34)$

Now, add these all ordered we get, a parabola opened upward. This parabola is intersect at *x* – axis is $(-1.3,0)$ and $(0.79,0)$

Hence, the solution set of $2x^2+x=2$ is $\{-1.3,0.79\}$



Answer 62MYS.

Consider the equations $-x^2+3x+6=0$

<u>Claim</u> Solve the equation $-x^2+3x+6=0$ by graphing

<u>Step 1:</u> Rewrite the equation $-x^2+3x+6=0$ in standard form of $ax^2+bx+c=0$ where $a\neq 0$

$$-x^2+3x+6=0 \qquad [\text{original equation}]$$

$$(-x^2+3x+6)(-1)=(-1)(0) \qquad [\text{Multiply with } -1 \text{ on both sides}]$$

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

Step 2: Now, solve the equation $x^2 - 3x - 6 = 0$ by using graphing

Let,

$y = x^2 - 3x - 6$

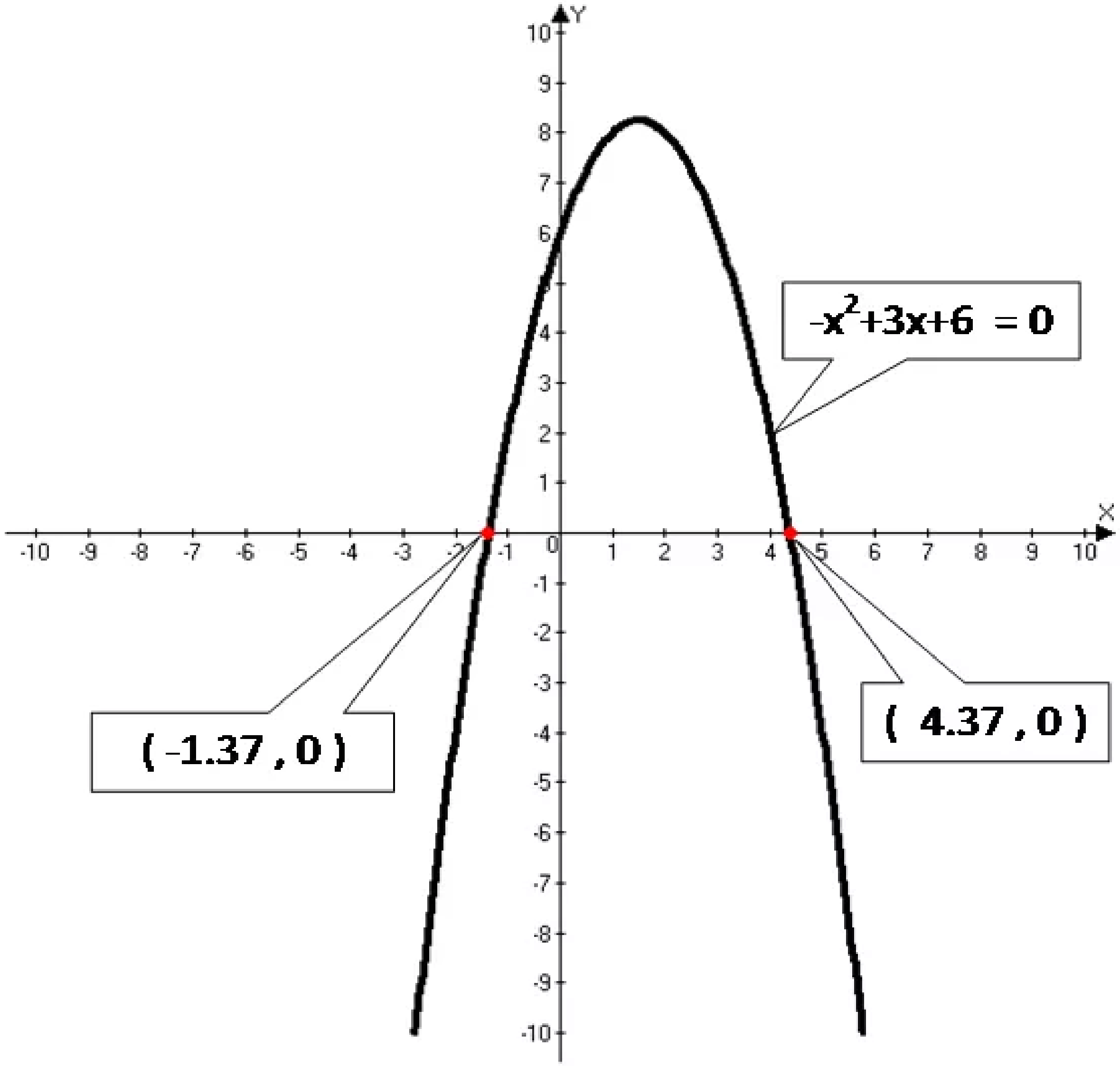
Now we can substitute the different values of '*x*' in $y = x^2 - 3x - 6$ we get the *y* values. Plotting these all ordered pairs and connect them we get a smooth curve.

Table $y = x^2 - 3x - 6$

x	$x^2 - 3x - 6$	y	(x, y)
-3	$(-3)^2 - 3(-3) - 6$	12	$(-3, 12)$
-2	$(-2)^2 - 3(-2) - 6$	4	$(-2, 4)$
-1	$(-1)^2 - 3(-1) - 6$	-2	$(-1, -2)$
0	$(0)^2 - 3(-0) - 6$	-6	$(0, -6)$
1	$(1)^2 - 3(1) - 6$	-8	$(1, -8)$
2	$(2)^2 - 3(2) - 6$	-8	$(2, -8)$
3	$(3)^2 - 3(3) - 6$	-6	$(3, -6)$
4	$(4)^2 - 3(4) - 6$	-2	$(4, -2)$
1.5	$(1.5)^2 - 3(1.5) - 6$	-8.25	$(1.5, -8.25)$
4.3	$(4.3)^2 - 3(4.3) - 6$	0	$(4.3, 0)$
-1.3	$(-1.3)^2 - 3(-1.3) - 6$	0	$(-1.3, 0)$

Now, add these all ordered we get, a parabola opened upward. This parabola is intersect at x – axis is $(4.3, 0)$ and $(-1.3, 0)$

Hence, the solution set of $x^2 - 3x - 6 = 0$ is $\{-1.3, 4.3\}$



Answer 63MYS.

Consider the polynomial $15xy^3 + y^4$

$$15xy^3 + y^4 = 15y^3 + y^{3+1}$$

$$15xy^3 + y^4 = 15xy^3 + y^3 \cdot y \qquad [\text{use the rule, } a^{m+n} = a^m \cdot a^n]$$

$$= y^3(15x + y) \qquad [\text{Use the distribution property}]$$

$$15xy^3 + y^4 = y^3(15x + y)$$

Answer 64MYS.

Consider the polynomial $2ax+6xc+ba+3bc$

$$\begin{aligned}2ax+6xc+ba+3bc &= 2\cdot x\cdot a+6\cdot x\cdot c+b\cdot a+3\cdot b\cdot c\\ &= 2\cdot x\cdot a+2\cdot x\cdot 3\cdot c+b\cdot a+3\cdot b\cdot c\\ &= 2x(a+3c)+b(a+3c) \qquad [\text{Use the distribution property}]\\ &= (2x+b)(a+3c)\end{aligned}$$

$$2ax+6xc+ba+3bc=(2x+b)(a+3c)$$

Answer 65MYS.

Consider the mass of proton is

0.000000000000000000001672

Claim: To write this number scientific notation

0.000000000000000000001672 = 1.672×10^{-21}

Hence, the scientific notation of

0.000000000000000000001672 is $\boxed{1.672\times 10^{-21}}$

Answer 66MYS.

Consider the inequality $x\le 2$

$y+4\ge 5$

Claim: Graph each inequality $x\le 2$ and $y+4\ge 5$

Step 1: Solve for $y+4\ge 5$

$$\begin{aligned}y+4&\ge 5 &&[\text{original inequality}]\\ y+4-4&\ge 5-4 &&[\text{Subtract '4' on both sides}]\\ y&\ge 1\end{aligned}$$

Step 2: Graph the inequality $x\le 2$ and $y\ge 1$

Now, we can graph lines $x=2$ and $y=1$

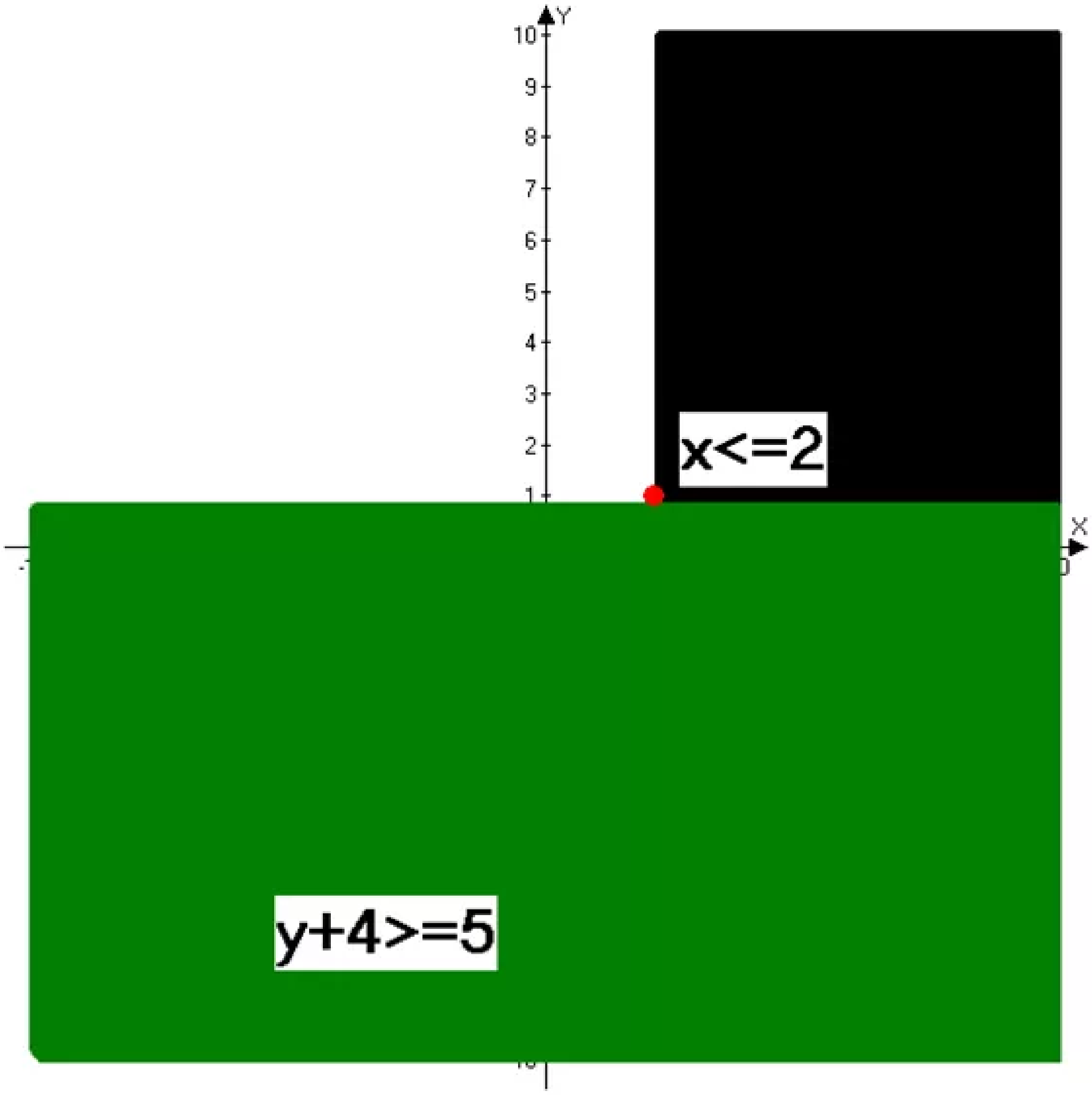
Use the rule,

The equation $x=k$ is a straight the and parallel to y –axis and $y=k$ is a straight line and parallel to x –axis.

Now we observe that these two lines $x=2$ and $y=1$ is lines parallel to x and y –axis respectively.

These two lines intersect the point is $(2,1)$.

Hence, the solution set $\boxed{\{(2,1)\}}$



Y
10
9
8
7
6
5
4
3
2
1
X
x<=2
y+4>=5

Answer 67MYS.

Consider the inequality $x+y>2$

$x-y\le 2$

Claim: Solve the equation $x+y>2$ and $x-y\le 2$

Step 1: Solve for *y* in the inequality $x+y>2$

$$x+y>2 \quad \text{[original inequality]}$$
$$x+y-x>2-x \quad \text{[Subtract 'x' on both sides]}$$
$$y\ge 2-x$$

Step 2: Solve for *y* in the inequality $x-y\le 2$

$$x-y\le 2 \quad \text{[original inequality]}$$
$$-x+x-y\le 2-x \quad \text{[Subtract 'x' on both sides]}$$
$$-y\ge -2+x$$
$$(-1)(-y)\ge(-1)(2-x) \quad \text{[Multiply } (-1) \text{ on both sides]}$$
$$y\ge -2+x$$

Step 3: Now, solve for inequality $y>2-x$ and $y\ge -2+x$

Now, we can construct the table for $y=2-x$ and $y=-2+x$

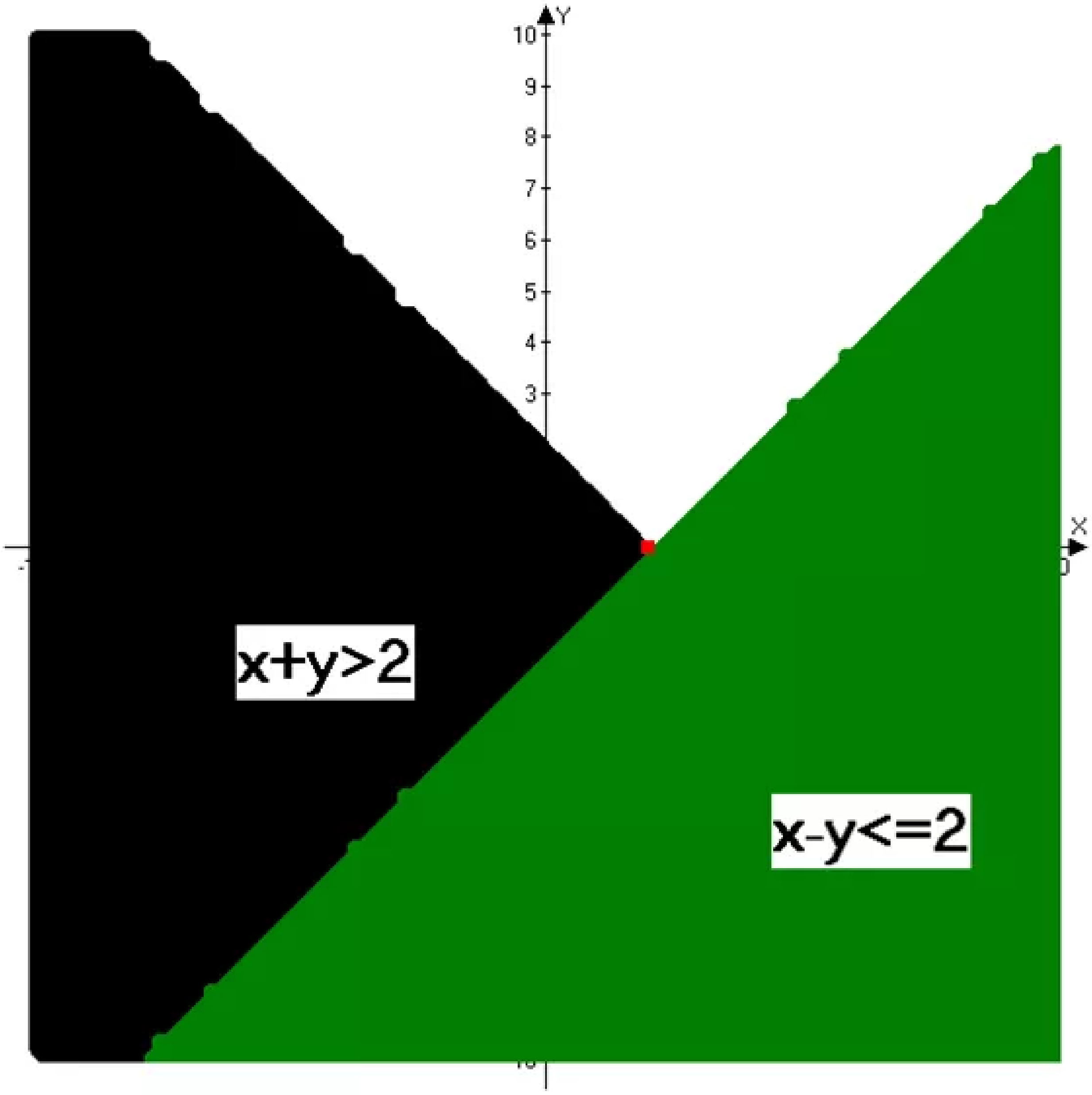
Now, we can substitute different values of *x* in the original equation, we get different *y* values plotting these all ordered pair and connect them, we get a smooth curve.

x	$2-x$	y	(x,y)
-3	$2-(-3)$	5	$(-3,5)$
-2	$2-(-2)$	4	$(-2,4)$
-1	$2-(-1)$	3	$(-1,3)$
0	$2-(0)$	2	$(0,2)$
1	$2-1$	1	$(1,1)$
2	$2-2$	0	$(2,0)$
3	$2-3$	-1	$(3,-1)$

x	$-2+x$	y	(x,y)
-3	$-2+(-3)$	-5	$(-3,-5)$
-2	$-2+(-2)$	-4	$(-2,-4)$
-1	$-2+(-1)$	-3	$(-1,-3)$
0	$-2+(0)$	-2	$(0,-2)$
1	$-2+1$	-1	$(1,-1)$
2	$-2+2$	0	$(2,0)$
3	$-2+3$	-1	$(3,1)$

Now, add these all ordered pairs we get a straight lines. These lines are intersect the point is $(2,0)$.

Hence, the solution set is $\{(2,0)\}$



Answer 68MYS.

Consider the inequality $y > x$

$y \leq x + 4$

Claim: Solve the equation $y > x$ and $y \leq x + 4$

Solve for *y* in the inequality $y > x$ and $y \leq x + 4$

Now, we can construct the table for $y = x$ and $y = x + 4$

Now, we can substitute different values of *x* in the original equation, we get different *y* values plotting these all ordered pair and connect them, we get a smooth curve.

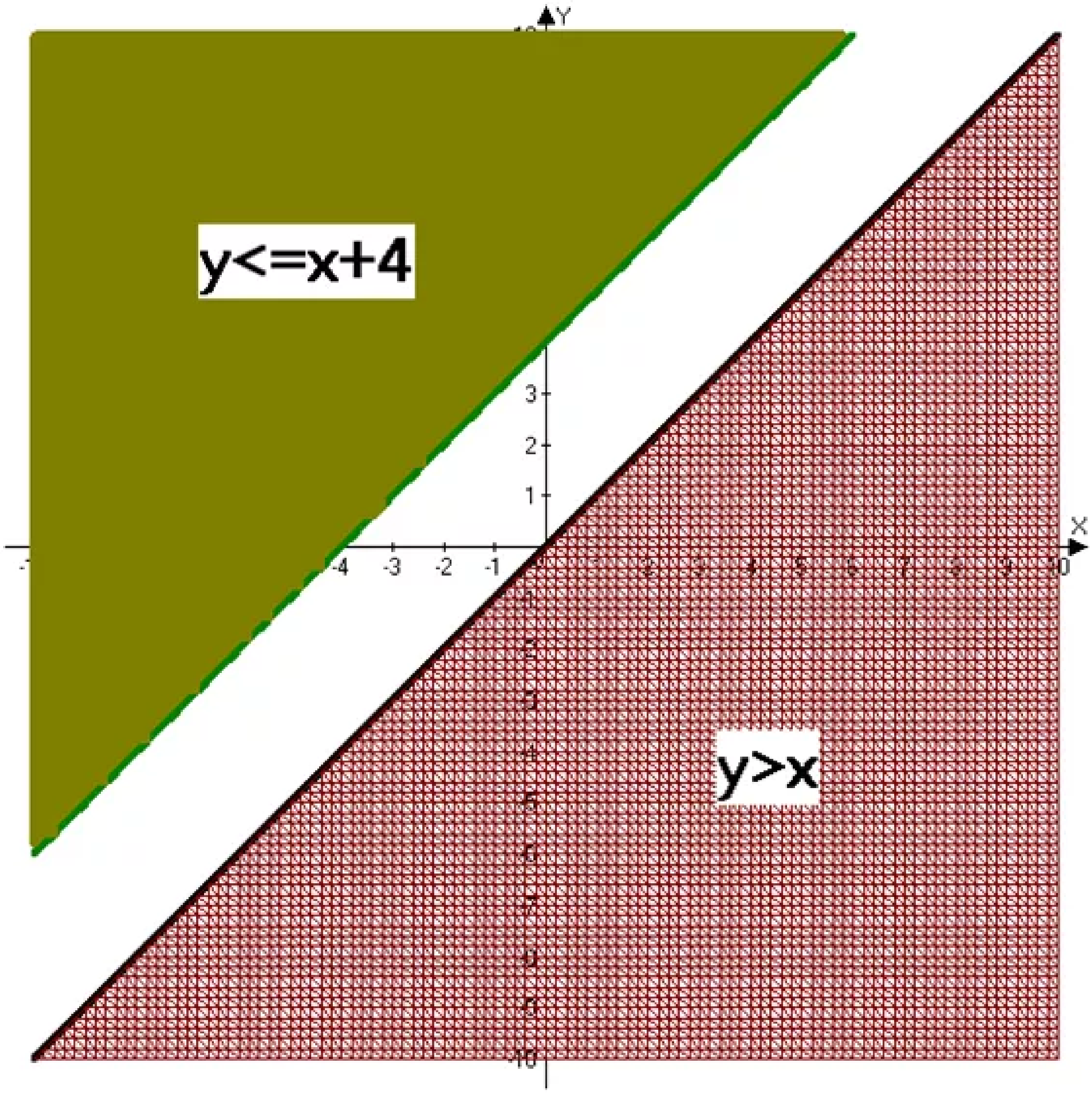
x	x	y	(x, y)
-3	-3	1	$(-3, -3)$
-2	-2	-2	$(-2, -2)$
-1	-1	-1	$(-1, -1)$
0	0	0	$(0, 0)$
1	1	1	$(1, 1)$
2	2	2	$(2, 2)$
3	3	3	$(3, 3)$

x	$x+4$	y	(x,y)
-3	$-3+4$	1	$(-3,1)$
-2	$-2+4$	2	$(-2,2)$
-1	$-1+4$	3	$(-1,3)$
0	$0+4$	4	$(0,4)$
1	$1+4$	5	$(1,5)$
2	$2+4$	6	$(2,6)$
3	$3+4$	7	$(3,7)$

Now, add these all ordered pairs we get a straight lines.

Therefore, the two straight lines are parallel

i.e. empty solution the solution is empty.



Answer 69MYS.

Consider the inequality $2m+7>17$

Claim: Solve the inequality $2m+7>17$

Step 1: Subtract '7' and divide by '2' on both sides in $2m+7>17$ we obtain in value

$$2m+7>17 \quad \text{[original inequality]}$$
$$2m+7-7>17-7 \quad \text{[Subtract '7' on both sides]}$$
$$2m>1 \quad \text{[Divide '2' on both sides]}$$
$$\frac{2m}{2}>\frac{10}{2}$$
$$m>5$$

Step 2: Now, we can choose the value from if $m>5$

Do substitute each value of *m* if $m>5$ in the original equality $2m+7>17$

Now, we can choose the value of $m=6$ if $6<5$ True.

$$2m+7>17 \quad \text{[original inequality]}$$
$$2(6)+7\overset{?}{>}17$$
$$12+7\overset{?}{>}17$$
$$19>17 \text{ True}$$

The solution of $2m+7>17$ is $m>5$

Hence, the solution set is $\{m \mid m>5\}$

Answer 70MYS.

Consider the inequality $-2-3x\geq 2$

Claim: Solve the inequality $-2-3x\geq 2$

Step 1: Add '2' and divide by '-3' on both sides in $-2-3x\geq 2$ we obtain in value

$$-2-3x\geq 2 \quad \text{[original inequality]}$$
$$-2-3x+2\geq 2+2 \quad \text{[Add '2' on both sides]}$$
$$-3x\geq 4 \quad \text{[Divide '}-3\text{' on both sides]}$$
$$\frac{-3x}{-3}\leq\frac{4}{-3}$$
$$x\leq\frac{-4}{3}$$

Step 2: Substitute each value of *x* if $x \le \frac{-4}{3}$ the original inequality $-2-3x \ge 2$

Now, we can choose $x=-2$ if $-2 \le \frac{-4}{3}$

$$-2-3x \ge 2 \quad \text{[original inequality]}$$

$$-2-3(-2) \overset{?}{\ge} 2 \quad \text{[Replace } x=-2\text{]}$$

$$-2+6 \overset{?}{\ge} 2$$

$$4 \overset{?}{\ge} 2 \text{ True}$$

The solution of $-2-3x \ge 2$ is $x \le \frac{-4}{3}$

Hence, the solution set is $\boxed{\left\{x \mid x \le \frac{-4}{3}\right\}}$

Answer 71MYS.

Consider the inequality $-20 \ge 8+7k$

Claim: Solve the inequality $-20 \ge 8+7k$

(add 20 and divided by)

Step 1: Subtract '8' and divided by 7 in the inequality $-20 \ge 8+7k$ we obtain *x* value

$$-20 \ge 8+7k \quad \text{[original inequality]}$$

$$-20-8 \ge 8+7k-8 \quad \text{[Subtract '8' on both sides]}$$

$$-28 \ge 7k \quad \text{[Divide '7' on both sides]}$$

$$\frac{-28}{-4} \ge \frac{7k}{7}$$

$$-4 \ge k$$

Step 2: do substitute each value of *x* if $k \le -4$ the original inequality $-20 \ge 8+7k$

Now, we can choose $k=-5$ if $-2 \le -4$

$$-20 \ge 8+7k \quad [\text{original inequality}]$$
$$-20 \ge 8+7(-5) \quad [\text{Replace } k=-5]$$
$$-20 \ge 8-35$$
$$-20 \ge -27 \quad [\text{Multiply with } (-1) \text{ on both sides}]$$
$$-(-20) \ge -(-27)$$
$$20 \le 27 \text{ True}$$

The solution of $-20 \ge 8+7k$ is $k \le -4$

Hence, the solution set is $\boxed{\{k \mid k \le -4\}}$

Answer 72MYS.

Consider the formula $c \cdot (a^x)$

Claim To determine the value of $c \cdot (a^x)$ when $a=2; c=1$ and $x=4$

Now, substitute *a* by 2; *c* by 1 and *x* by 4 in $c \cdot a^x$

Replace $c=1; a=2$ and $x=4$

$$c \cdot a^x = 1 \cdot 2^4$$
$$= 2^4$$
$$= 2 \cdot 2 \cdot 2 \cdot 2$$
$$= 16$$

$\boxed{c \cdot a^x = 16}$ when $a=2, x=4$ and $c=1$

Answer 73MYS.

Consider the formula $c \cdot (a^x)$

Claim To determine the value of $c \cdot (a^x)$ when $a=7; c=3$ and $x=2$

Now, substitute *a* by 7; *c* by 3 and *x* by 2 in $c \cdot a^x$

Replace $a=7, c=3$ and $x=2$

$$c \cdot a^x = 3 \cdot 7^2$$
$$= 3 \cdot 7 \cdot 7$$
$$= 147$$

$\boxed{c \cdot a^x = 147}$ when $a=7, c=3$ and $x=2$

Answer 74MYS.

Consider the formula $c \cdot a^x$

<u>Claim</u> To determine the value of $c \cdot a^x$ when $a = 5; c = 2$ and $x = 3$

Now, substitute *a* by 5; *c* by 2 and *x* by 3 in $c \cdot a^x$

Replace $a = 5, c = 2$ and $x = 3$

$$\begin{aligned} c \cdot a^x &= 2 \cdot 5^3 \\ &= 2 \cdot 5 \cdot 5 \cdot 5 \\ &= 250 \end{aligned}$$

$\boxed{c \cdot a^x = 250}$ when $a = 5, c = 2$ and $x = 3$