Objective: Solve Quadratic Equations Using the Square Root Property.

Fundamental Theorem of Algebra

A non-constant, single-variable polynomial equation with complex coefficients **will have at least one complex root/solution.**

Linear Equation (degree = 1)

$2x-3=15$

$2x^1-3=15$

the equation has1 solution

Quadratic Equation (degree = 2)

$6x^2-3x-15=0$

the equation has 2 solutions

Cubic Equation (degree = 3)

$x^3-5x^2+10x+5=0$

the equation has 3 solutions

Quartic Equation (degree = 4)

$2x^4+x^3-5x^2+10x+5=0$

the equation has 4 solutions

Objective: Solve Quadratic Equations Using the Square Root Property.

Concept

Square Root Property

If $x^2 = n$,

then $\sqrt{x^2} = \pm\sqrt{n}$

and $x = -\sqrt{n}$ or $x = \sqrt{n}$

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Concept

Steps to Solve a Quadratic Equation Using The Square Root Property

1. Isolate x^2 using algebra.
2. Take the square root of both sides. Remember $\pm$.
3. Simplify as much as possible and state the solutions.

Properties of Square Roots

$$\sqrt{ab} = \sqrt{a} \cdot \sqrt{b}$$

$$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$$

Objective: Solve Quadratic Equations Using the Square Root Property.

Ex) Solve each equation. Simplify solutions as much as possible.

① $x^2 = 16$

② square root property $\sqrt{x^2} = \pm\sqrt{16}$

$x = -\sqrt{16}, \sqrt{16}$

③ simplify $x = -4, 4$

Objective: Solve Quadratic Equations Using the Square Root Property.

Ex) Solve each equation. Simplify solutions as much as possible.

① $x^2 = 24$

② square root property $\sqrt{x^2} = \pm\sqrt{24}$

③ simplify $x = -\sqrt{24}, \sqrt{24}$

$\sqrt{4}\cdot\sqrt{6}$ $\sqrt{4}\cdot\sqrt{6}$

$x = -2\sqrt{6}, 2\sqrt{6}$

Objective: Solve Quadratic Equations Using the Square Root Property.

Ex) Solve each equation. Simplify solutions as much as possible.

$$8x^2 - 10 = 0$$

$+10 \quad +10$

① isolate x^2

$$\frac{8x^2}{8} = \frac{10}{8}$$ reduce

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

② square root property

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

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

③ simplify

$\sqrt{4} = 2$

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

Objective: Solve Quadratic Equations Using the Square Root Property.

Ex) Solve each equation. Simplify solutions as much as possible.

$$-3x^2 - 15 = 0$$

① isolate x^2

$+15 \quad +15$

$$\frac{-3x^2}{-3} = \frac{15}{-3}$$

$$x^2 = -5$$

② square root property

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

③ simplify

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

$$x = \pm\sqrt{5} \cdot \sqrt{-1} \quad (\sqrt{-1} = i)$$

$$x = -\sqrt{5}\,i,\ \sqrt{5}\,i$$

Objective: Solve Quadratic Equations Using the Square Root Property.

Ex) Solve each equation. Simplify solutions as much as possible.

$$6x^2 - 11 = 0$$

$+11 \quad +11$

① isolate x^2

$$\frac{6x^2}{6} = \frac{11}{6}$$

$$x^2 = \frac{11}{6}$$

② square root property

$$\sqrt{x^2} = \pm\sqrt{\frac{11}{6}}$$

③ simplify

$$x = \pm\frac{\sqrt{11}}{\sqrt{6}} \cdot \frac{\sqrt{6}}{\sqrt{6}}$$

rationalize the denominator

$$= \pm\frac{\sqrt{66}}{\sqrt{36}} = \pm\frac{\sqrt{66}}{6}$$

$$x = -\frac{\sqrt{66}}{6}, \frac{\sqrt{66}}{6}$$

Objective: Solve Quadratic Equations Using the Square Root Property.

Ex) Solve each equation. Simplify solutions as much as possible.

① $(x-7)^2 = 36$

② square root property $\sqrt{(x-7)^2} = \pm\sqrt{36}$

③ $x - 7 = -6, 6$

$+7 \quad +7 \quad +7$

$x = 1, 13$

$x = 1, 13$

Objective: Solve Quadratic Equations Using the Square Root Property.

Ex) Solve each equation. Simplify solutions as much as possible.

① $(x+4)^2 = -18$

② square root property $\sqrt{(x+4)^2} = \pm\sqrt{-18}$

$x+4 = \pm\sqrt{18}\cdot\sqrt{-1}$

$\pm\sqrt{9}\cdot\sqrt{2}\cdot\sqrt{-1}$

③ $x+4 = \pm 3\sqrt{2}\,i$

$-4 \quad -4$

$x = -4 \pm 3\sqrt{2}\,i$

$x = -4 - 3\sqrt{2}\,i,\ -4 + 3\sqrt{2}\,i$

Objective: Solve Quadratic Equations Using the Square Root Property.

Ex) Solve each equation. Simplify solutions as much as possible.

$$3(x+5)^2 - 9 = 12$$

① isolate $(x+5)^2$

$+9 \quad +9$

$$\frac{3\cdot(x+5)^2}{3} = \frac{21}{3}$$

$$(x+5)^2 = 7$$

② square root property

$$\sqrt{(x+5)^2} = \pm\sqrt{7}$$

③

$$x+5 = \pm\sqrt{7}$$

$-5 \quad -5$

$$x = -5 \pm \sqrt{7}$$

$$x = -5-\sqrt{7},\ -5+\sqrt{7}$$

Objective: Solve Quadratic Equations Using the Square Root Property.

Ex) Solve each equation. Simplify solutions as much as possible.

$$-2(x-1)^2+8=20$$

① isolate $(x-1)^2$

$$-8 \quad -8$$

$$\frac{-2\cdot(x-1)^2}{-2}=\frac{12}{-2}$$

$$(x-1)^2=-6$$

② square root property

$$\sqrt{(x-1)^2}=\pm\sqrt{-6}$$

$$\sqrt{6}\cdot\sqrt{-1}$$

③

$$x-1=\pm\sqrt{6}\,i$$

$$+1 \quad +1$$

$$x=1\pm\sqrt{6}\,i$$

$$x=1-\sqrt{6}\,i,\ 1+\sqrt{6}\,i$$