4.2 Solving with Square Roots

When you are asked to solve an equation, you might want to consider solving by taking a square root. This strategy is best used when the only x that is in your equation is squared.

Important Reminder: When solving with a square root, you must have ± on your answer

1) Solve the following equations:

a) $\sqrt{x^2} = \sqrt{25}$

$x = \pm 5$

means $x = 5, -5$

b) $\sqrt{x^2} = \sqrt{28}$

$4 \cdot 7$

$2 \cdot 2$

$x = \pm 2\sqrt{7}$

c) $\sqrt{x^2} = \sqrt{-10}$

$x = \pm i\sqrt{10}$

2) Solve the following equations:

a) $\frac{5x^2}{5} = \frac{125}{5}$

$\sqrt{x^2} = \sqrt{25}$

$x = \pm 5$

b) $\frac{6x^2}{6} = \frac{12}{6}$

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

$x = \pm\sqrt{2}$

c) $\frac{4x^2}{4} = \frac{-4}{4}$

$\sqrt{x^2} = \sqrt{-1}$

$x = \pm i$

3) Solve the following equations:

a) $\sqrt{(x-2)^2} = \sqrt{49}$

$x - 2 = \pm 7$

$+2 \quad +2$

$x = 2 \pm 7$

$2 + 7 = 9$

$2 - 7 = -5$

b) $\sqrt{(x+3)^2} = \sqrt{18}$ $9 < 3$, 2, 3

$x + 3 = \pm 3\sqrt{2}$

$-3 \quad -3$

$x = -3 \pm 3\sqrt{2}$

c) $\sqrt{(x+1)^2} = \sqrt{-4}$

$x + 1 = \pm 2i$

$-1 \quad -1$

$x = -1 \pm 2i$

4) Solve the following equations:

a) $(x-8)^2 - 5 = -1$

$+5 \quad +5$

$\sqrt{(x-8)^2} = \sqrt{4}$

$x - 8 = \pm 2$

$+8 \quad +8$

$x = 8 \pm 2$

$8 + 2 = 10$

$8 - 2 = 6$

b) $3x^2 - 10 = 152$

$+10 \quad +10$

$\frac{3x^2}{3} = \frac{162}{3}$

$\sqrt{x^2} = \sqrt{54}$

$9 \cdot 6$

$3 \cdot 3 \cdot 2 \cdot 3$

$x = \pm 3\sqrt{6}$

c) $4(x+4)^2 + 5 = 21$

$-5 \quad -5$

$\frac{4(x+4)^2}{4} = \frac{16}{4}$

$\sqrt{(x+4)^2} = \sqrt{4}$

$x + 4 = \pm 2$

$-4 \quad -4$

$x = -4 \pm 2$

$-4 + 2 = -2$

$-4 - 2 = -6$

Big idea of solving using a square root: Get the squared term by itself, then take a square root

4) Solve each equation.

a) $(x+10)^2 - 225 = 0$

$+225 \quad +225$

$\sqrt{(x+10)^2} = \sqrt{225}$

$x+10 = \pm 15$

$-10 \quad -10$

$x = -10 \pm 15$

$-10+15 = \boxed{5}$

$-10-15 = \boxed{-25}$

b) $(x-1)^2 + 6 = 26$

$-6 \quad -6$

$\sqrt{(x-1)^2} = \sqrt{20}$

$4 \cdot 5$

$(2 \cdot 2)$

$x-1 = \pm 2\sqrt{5}$

$+1 \quad +1$

$\boxed{x = 1 \pm 2\sqrt{5}}$

c) $9x^2 + 80 = 81$

$-80 \quad -80$

$\frac{9x^2}{9} = \frac{1}{9}$

$\sqrt{x^2} = \sqrt{\frac{1}{9}} = \frac{\sqrt{1}}{\sqrt{9}}$ *

$\boxed{x = \pm \frac{1}{3}}$

d) $5(x-7)^2 - 25 = 10$

$+25 \quad +25$

$\frac{5(x-7)^2}{5} = \frac{35}{5}$

$\sqrt{(x-7)^2} = \sqrt{7}$

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

$+7 \quad +7$

$\boxed{x = 7 \pm \sqrt{7}}$

e) $x^2 - 3 = 37$

$+3 \quad +3$

$\sqrt{x^2} = \sqrt{40}$

$4 \cdot 10$

$(2 \cdot 2) \cdot 2 \cdot 5$

$\boxed{x = \pm 2\sqrt{10}}$

f) $4(x+6)^2 - 5 = 12$

$+5 \quad +5$

$\frac{4(x+6)^2}{4} = \frac{17}{4}$

$\sqrt{(x+6)^2} = \sqrt{\frac{17}{4}} = \frac{\sqrt{17}}{\sqrt{4}}$ *

$x+6 = \pm \frac{\sqrt{17}}{2}$

$-6 \quad -6$

$\boxed{x = -6 \pm \frac{\sqrt{17}}{2}}$

As you go through these problems, the most important thing you can do is ask yourself, "Which term is being squared?" Once you have identified that, your goal is to get that term by itself.

* Square root of a fraction is square root of top over square root bottom

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