SOLVING Quadratics BY SQUARE ROOTS

Quadratic Equations of the form $ax^2+c=0$ **can be solved using the Square Root Property:**

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

1	Isolate x^2
2	take $\sqrt{\ }$ of both sides
3	simplify radical → ± to indicate both answers

1. Solve $2x^2 + 9 = 13$

$2x^2 = 4$

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

$x = \pm\sqrt{2}$

2. Solve $7x^2 - 10 = 35$

$7x^2 = 45$

$\sqrt{x^2} = \sqrt{\frac{45}{7}}$

$x = \pm\frac{\sqrt{45}\sqrt{7}}{\sqrt{7}\sqrt{7}} = \boxed{\pm\frac{3\sqrt{35}}{7}}$

Solve the equations below by factoring the left hand side and then using the square root property.

3. $x^2 + 14x + 49 = 4$

$(x+7)(x+7) = 4$

$\sqrt{(x+7)^2} = \sqrt{4}$

$x+7 = \pm 4$

$x+7 = 4$ → $x = -3$

$x+7 = -4$ → $x = -11$

$\boxed{x = -3, -11}$

4. $x^2 - 6x + 9 = 20$

$(x-3)(x-3) = 20$

$\sqrt{(x-3)^2} = \sqrt{20}$

$x-3 = \pm\sqrt{20}$

$x-3 = \pm 2\sqrt{5}$

$x-3 = 2\sqrt{5}$ → $\boxed{x = 3+2\sqrt{5}}$

$x-3 = -2\sqrt{5}$ → $\boxed{x = 3-2\sqrt{5}}$

COMPLETING THE SQUARE

It is possible to take any quadratic equation, create a perfect square trinomial, and solve it in a similar way. This method is called completing the square.

1	**REWRITE** as $ax^2 + bx = c$ move "c"
2	**DIVIDE** both sides by "a" so it becomes $x^2 + bx = c$ if "a" ≠ 1
3	**COMPLETE THE SQUARE** by taking half of b, square it, and **ADD IT TO BOTH SIDES** of the equation $b =$ $b/2 =$ $(b/2)^2 =$
4	**FACTOR** the perfect square trinomial (the left side)
5	Take the **SQUARE ROOT** of both sides. This will create two cases because a square root has both a positive and negative value.
6	**SOLVE** both equations. **SIMPLIFY** all irrational answers.

5. $x^2 - 18x + 56 = 0$

$x^2 - 18x = -56$

$b = -18$

$\frac{b}{2} = -9$

$(\frac{b}{2})^2 = 81$

$x^2 - 18x + 81 = -56 + 81$

$\sqrt{(x-9)^2} = \sqrt{25}$

$x - 9 = \pm\sqrt{25}$

$x - 9 = 5$ $\quad x - 9 = -5$

$x = 14$ $\quad x = 4$

6. $x^2 - 12x + 7 = 0$

$x^2 - 12x = -7$

$b = -6$

$\frac{b}{2} = -6$

$(\frac{b}{2})^2 = 36$

$x^2 - 12x + 36 = -7 + 36$

$\sqrt{(x-6)^2} = \sqrt{29}$

$x - 6 = \pm\sqrt{29}$

$\boxed{x = 6 \pm \sqrt{29}}$

7. $2x^2 + 2 - 9 = 0$

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

$x^2 + x = 9/2$

$b = 1$ $\quad x^2 + x + 1/4 = 9/2 + 1/4$

$\frac{b}{2} = 1/2$ $\quad \sqrt{(x+1/2)^2} = \sqrt{19/4}$

$(\frac{b}{2})^2 = 1/4$ $\quad x + 1/2 = \pm\frac{\sqrt{19}}{2}$

$x = -\frac{1}{2} \pm \frac{\sqrt{19}}{2}$

8. $\frac{2x^2 - 16x = -30}{2}$

$x^2 - 8x = -15$

$b = -8$ $\quad x^2 - 8x + 16 = -15 + 16$

$b/2 = -4$ $\quad \sqrt{(x-4)^2} = \sqrt{1}$

$(b/2)^2 = 16$ $\quad x - 4 = \pm 1$

$x - 4 = 1$ $\quad x - 4 = -1$

$x = 5$ $\quad x = 3$

Writing an equation in Vertex Form by Completing the Square comp sq, stop before √

9. What is $y = x^2 - 6x + 3$ in vertex form?

$y = x^2 - 6x \boxed{+9} + 3 \boxed{-9}$

$b = -6$ $\quad y = (x-3)^2 - 6$

$b/2 = -3$

$(b/2)^2 = 9$ $\quad V: (3, -6)$

10. What is $y = x^2 + 2x - 2$ in vertex form?

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

$b = 2$

$b/2 = 1$ $\quad y = (x+1)^2 - 3$

$(b/2)^2 = 1$ $\quad (-1, -3)$

11. What is $y = 2x^2 + 4x - 5$ in vertex form?

$\frac{y}{2} = \frac{2x^2 + 4x - 5}{2}$

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

$b = 2$

$\frac{b}{2} = 1$ $\quad \frac{y}{2} = (x+1)^2 - 7/2$

$(\frac{b}{2})^2 = 1$ $\quad y = 2(x+1)^2 - 7$

$(-1, -7)$

12. What is $y = x^2 + 10x + 19$ in vertex form?

$y = x^2 + 10x \boxed{+25} + 19 \boxed{-25}$

$b = 10$ $\quad (x+5)^2 - 6$

$\frac{b}{2} = 5$

$(\frac{b}{2})^2 = 25$ $\quad y = (x+5)^2 - 6$

$(-5, -6)$