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Now, we can Take the Square Root of both sides to get:

**Example:** Find the solution(s) to:

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$$\sqrt{(x-\frac{-b}{2a})^2}=\sqrt{\frac{b^2-4ac}{4a^2}}$$

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$$\sqrt{(x - \frac{-b}{2a})^2} = \sqrt{\frac{b^2 - 4ac}{4a^2}} = \frac{\sqrt{b^2 - 4ac}}{\sqrt{4a^2}}$$

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As before, we need to write this in the form:  $a(x-h)^2 + k$ To solve for x in:  $a(x - \frac{-b}{2a})^2 + \frac{4ac - b^2}{4a} = 0$  we have to undo 4 operations: Subtract  $\frac{4ac-b^2}{4ac}$ Subtract  $\frac{-b}{2a}$ Square it Divide by a Multiply by a Take the Square Root Add  $\frac{4ac-b^2}{4ac}$ Add  $\frac{-b}{2a}$ Subtracting  $\frac{4ac-b^2}{4ac}$  from both sides gives us:  $a(x - \frac{-b}{2a})^2 = a(x - \frac{-b}{2a})^2 + \frac{4ac - b^2}{4ac - b^2} = 0 - \frac{4ac - b^2}{4ac} = \frac{b^2 - 4ac}{4ac}$ Now, we need to Divide by a to get:  $\left(x - \frac{-b}{2a}\right)^2 = \frac{a(x - \frac{-b}{2a})^2}{a} = \frac{1}{a} \cdot \frac{b^2 - 4ac}{4a} = \frac{b^2 - 4ac}{4a^2}$ Now, we can Take the Square Root of both sides to get:

$$\sqrt{(x - \frac{-b}{2a})^2} = \sqrt{\frac{b^2 - 4ac}{4a^2}} = \frac{\sqrt{b^2 - 4ac}}{\sqrt{4a^2}} = \frac{\sqrt{b^2 - 4ac}}{2a}$$

**Example:** Find the solution(s) to:

 $a(x - \frac{-b}{2a})^2 + \frac{4ac - b^2}{4a} = ax^2 + bx + c = 0$ 

As before, we need to write this in the form:  $a(x-h)^2 + k$ To solve for x in:  $a(x - \frac{-b}{2a})^2 + \frac{4ac - b^2}{4a} = 0$  we have to undo 4 operations: Subtract  $\frac{4ac-b^2}{4c}$ Subtract  $\frac{-b}{2a}$ Square it Divide by a Multiply by a Take the Square Root Add  $\frac{4ac-b^2}{4ac-b^2}$ Add  $\frac{-b}{2}$ Subtracting  $\frac{4ac-b^2}{b}$  from both sides gives us:  $a(x - \frac{-b}{2a})^2 = a(x - \frac{-b}{2a})^2 + \frac{4ac - b^2}{4ac - b^2} = 0 - \frac{4ac - b^2}{4ac} = \frac{b^2 - 4ac}{4ac}$ Now, we need to Divide by a to get:  $\left(x - \frac{-b}{2a}\right)^2 = \frac{4(x - \frac{-b}{2a})^2}{4} = \frac{1}{a} \cdot \frac{b^2 - 4ac}{4a} = \frac{b^2 - 4ac}{4a^2}$ Now, we can Take the Square Root of both sides to get: (why?)  $\left| x - \frac{-b}{2a} \right| = \sqrt{\left( x - \frac{-b}{2a} \right)^2} = \sqrt{\frac{b^2 - 4ac}{4a^2}} = \frac{\sqrt{b^2 - 4ac}}{\sqrt{a^2}} = \frac{\sqrt{b^2 - 4ac}}{2a}$ 

**Example:** Find the solution(s) to:

 $a(x - \frac{-b}{2a})^2 + \frac{4ac - b^2}{4a} = ax^2 + bx + c = 0$ 

As before, we need to write this in the form:  $a(x-h)^2 + k$ To solve for x in:  $a(x - \frac{-b}{2a})^2 + \frac{4ac-b^2}{4a} = 0$  we have to undo 4 operations: Subtract  $\frac{-b}{2a}$ Subtract  $\frac{4ac-b^2}{4ac}$ Square it Divide by a Multiply by a Take the Square Root Add  $\frac{4ac-b^2}{4ac-b^2}$ Add  $\frac{-b}{2a}$ Subtracting  $\frac{4ac-b^2}{4a}$  from both sides gives us:  $a(x - \frac{-b}{2})^2 = a(x - \frac{-b}{2})^2 + \frac{4ac - b^2}{4ac - b^2} = 0 - \frac{4ac - b^2}{4ac - b^2} = \frac{b^2 - 4ac}{4ac - b^2}$ Now, we need to Divide by a to get:  $\left(x - \frac{-b}{2a}\right)^2 = \frac{p(x - \frac{-b}{2a})^2}{4a} = \frac{1}{2} \cdot \frac{b^2 - 4ac}{4a} = \frac{b^2 - 4ac}{4a^2}$ Now, we can Take the Square Root of both sides to get: (why?)  $\left| x - \frac{-b}{2a} \right| = \sqrt{\left( x - \frac{-b}{2a} \right)^2} = \sqrt{\frac{b^2 - 4ac}{4a^2}} = \frac{\sqrt{b^2 - 4ac}}{\sqrt{4a^2}} = \frac{\sqrt{b^2 - 4ac}}{2a}$ Since  $\left|x - \frac{-b}{2a}\right| = \frac{\sqrt{b^2 - 4ac}}{2a}$ , we know that  $x - \frac{-b}{2a} = \pm \frac{\sqrt{b^2 - 4ac}}{2a}$ 

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As before, we need to write this in the form:  $a(x-h)^2 + k$ To solve for x in:  $a(x - \frac{-b}{2a})^2 + \frac{4ac - b^2}{4a} = 0$  we have to undo 4 operations: Subtract  $\frac{-b}{2a}$ Subtract  $\frac{4ac-b^2}{4ac}$ Square it Divide by a Multiply by a Take the Square Root Add  $\frac{4ac-b^2}{4ac-b^2}$ Add  $\frac{-b}{2a}$ Subtracting  $\frac{4ac-b^2}{4a}$  from both sides gives us:  $a(x - \frac{-b}{2})^2 = a(x - \frac{-b}{2})^2 + \frac{4ac - b^2}{4ac - b^2} = 0 - \frac{4ac - b^2}{4ac - b^2} = \frac{b^2 - 4ac}{4ac - b^2}$ Now, we need to Divide by a to get:  $(x - \frac{-b}{2a})^2 = \frac{a(x - \frac{-b}{2a})^2}{a} = \frac{1}{a} \cdot \frac{b^2 - 4ac}{4a} = \frac{b^2 - 4ac}{4a^2}$ Now, we can Take the Square Root of both sides to get: (why?)  $\left| x - \frac{-b}{2a} \right| = \sqrt{\left( x - \frac{-b}{2a} \right)^2} = \sqrt{\frac{b^2 - 4ac}{4a^2}} = \frac{\sqrt{b^2 - 4ac}}{\sqrt{a^2}} = \frac{\sqrt{b^2 - 4ac}}{2a}$ Since  $\left|x - \frac{-b}{2a}\right| = \frac{\sqrt{b^2 - 4ac}}{2a}$ , we know that  $x - \frac{-b}{2a} = \pm \frac{\sqrt{b^2 - 4ac}}{2a}$ Adding  $\frac{-b}{2a}$  to both sides gives:  $x = \frac{-b}{2a} \pm \frac{\sqrt{b^2-4ac}}{2a}$ 

**Example:** Find the solution(s) to:

 $a(x - \frac{-b}{2a})^2 + \frac{4ac - b^2}{4a} = ax^2 + bx + c = 0$ 

As before, we need to write this in the form:  $a(x-h)^2 + k$ To solve for x in:  $a(x - \frac{-b}{2a})^2 + \frac{4ac-b^2}{4a} = 0$  we have to undo 4 operations: Subtract  $\frac{-b}{2a}$ Subtract  $\frac{4ac-b^2}{4ac}$ Square it Divide by a Multiply by a Take the Square Root Add  $\frac{4ac-b^2}{4ac}$ Add  $\frac{-b}{2a}$ Subtracting  $\frac{4ac-b^2}{4a}$  from both sides gives us:  $a(x - \frac{-b}{2})^2 = a(x - \frac{-b}{2})^2 + \frac{4ac - b^2}{4ac - b^2} = 0 - \frac{4ac - b^2}{4ac - b^2} = \frac{b^2 - 4ac}{4ac - b^2}$ Now, we need to Divide by a to get:  $(x - \frac{-b}{2a})^2 = \frac{a(x - \frac{-b}{2a})^2}{a} = \frac{1}{a} \cdot \frac{b^2 - 4ac}{4a} = \frac{b^2 - 4ac}{4a^2}$ Now, we can Take the Square Root of both sides to get: (why?)  $\left| x - \frac{-b}{2a} \right| = \sqrt{\left( x - \frac{-b}{2a} \right)^2} = \sqrt{\frac{b^2 - 4ac}{4a^2}} = \frac{\sqrt{b^2 - 4ac}}{\sqrt{a^2}} = \frac{\sqrt{b^2 - 4ac}}{2a}$ Since  $\left|x - \frac{-b}{2a}\right| = \frac{\sqrt{b^2 - 4ac}}{2a}$ , we know that  $x - \frac{-b}{2a} = \pm \frac{\sqrt{b^2 - 4ac}}{2a}$ Adding  $\frac{-b}{2a}$  to both sides gives:  $x = \frac{-b}{2a} \pm \frac{\sqrt{b^2 - 4ac}}{2a} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ 

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Using this, we can now compute solutions to quadratic equations very quickly!