

Title: Solving Quadratic Equations using Square Roots

Class: Math 107

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Instructions to tutor: Read instructions and follow all steps for each problem exactly as given.

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Solving Quadratic Equations using Square Roots

Purpose:

This is intended to refresh your knowledge about solving quadratic equations using square roots.

Recall that a **quadratic equation** is an equation that can be written in the form $ax^2 + bx + c = 0$, with $a \neq 0$. For example, $3x^2 + 4x - 7 = 0$, $6 - x^2 = 2x$, and $x(x + 6) = 14$ are all quadratic equations. Note that the second two equations would require a couple algebraic steps to be put into the form shown above.

We can solve $x^2 - 9 = 0$ by factoring; $(x - 3)(x + 3) = 0$ and so $x = -3, 3$.

In certain situations, namely when a quadratic equation does not appear to have an x term, we can solve the quadratic equation by isolating the squared term and taking the square root of both sides.

Example: Solve $x^2 - 9 = 0$ using square roots.

This time, we isolate the squared term. So $x^2 - 9 = 0 \Rightarrow x^2 = 9$.

Now we will take the square root of each side to solve for x .

$$x^2 - 9 = 0 \Rightarrow x^2 = 9 \Rightarrow \sqrt{x^2} = \pm\sqrt{9} \Rightarrow x = \pm 3$$

You should note the inclusion of the \pm sign on the right hand side of the equation, after the square root is applied. This is because when you square -3 or 3 , you obtain 9 for the result.

Here is a summary of this method.

Solving Quadratic Equations using the Root Method:

1. Isolate the squared term.
2. Take the square root of both sides; remember to use \pm .
3. Solve.

Example: Now it's your turn. Solve $5t^2 - 125 = 0$.

First you need to isolate the squared term:

Do you now have $t^2 = 25$? If not, first add 125 to each side and then divide both sides by 5.

Now take the square root of each side.

Did you obtain $t = \pm 5$? If you only got one solution, what can you do to correct this?

This method will work with more complicated squared terms as well.

Example: Solve $(x + 4)^2 = 169$.

As the squared term is already isolated, we are ready to take the square root of each side.

$$(x + 4)^2 = 169 \Rightarrow \sqrt{(x + 4)^2} = \pm\sqrt{169} \Rightarrow x + 4 = \pm 13$$

Now we can solve for x by subtracting 4 from each side: $x = -4 \pm 13$

So we obtain the solutions $x = 9$ and $x = -17$.

Try the following on your own.

1. Solve each equation using square roots.

(a) $x^2 - 81 = 0$

(b) $4a^2 - 13 = 3$

(c) $(2y - 3)^2 - 25 = 0$

(d) $(x + 1)^2 - 8 = 0$

Check your answers – If you did not get these, consult a tutor for help.

1. (a) $x = \pm 9$ (b) $a = \pm 2$ (c) $y = -1, 4$ (d) $x = -1 \pm 2\sqrt{2}$