

Content and Language Objective:

Students will learn the process for dealing with negative numbers under a square root and understand the meaning of a complex number and be able to explain the process for working with complex numbers.

Warm-Up

Find the x-intercepts of the following quadratic

1. $y = x^2 + 4x - 5$

$$\frac{-4 \pm \sqrt{4^2 - 4(1)(-5)}}{2}$$

$$\frac{-4 \pm \sqrt{36}}{2}$$

$$\frac{-4 \pm 6}{2}$$

$$x = 1$$

$$x = -5$$

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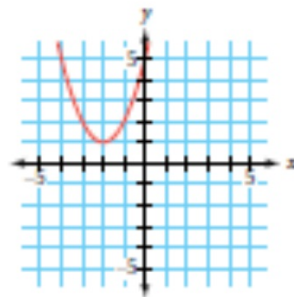
We have looked at several ways to solve quadratic equations.

We can find the x-intercepts on a graph, we can solve by completing the square, or we can use the quadratic formula.

What happens if we try to use the quadratic formula on an equation whose graph has no x-intercepts?

The graph of $y = x^2 + 4x + 5$ is shown at the right.

This graph tells us that this function has no x-intercepts.



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Try using the quadratic formula to find the x-intercepts of the equation,
 $y = x^2 + 4x + 5$

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

$$a = 1 \quad b = 4 \quad c = 5$$

$$x = \frac{-4 \pm \sqrt{-4}}{2}$$

$$x = \frac{-4 \pm \sqrt{4^2 - 4(1)(5)}}{2(1)}$$

$$x = \frac{-4 \pm \sqrt{16 - 20}}{2}$$

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We have a rule that allows us to take the square root of negative numbers.

When we have the square root of a negative number it is called a **COMPLEX NUMBER**.

How do we take the square root of a negative number? The two numbers are not like any numbers that we have use all year.

$\frac{-4 + \sqrt{-4}}{2}$ and $\frac{-4 - \sqrt{-4}}{2}$ are NON-REAL, but they are still numbers.

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To help us when we are using square roots of negative numbers we use an imaginary unit called i , defined by $i^2 = -1$ or $i = \sqrt{-1}$.

We can rewrite $\sqrt{-4}$ as $\sqrt{4} \cdot \sqrt{-1}$, or $2i$.

So when we look at our two solutions from above, $\frac{-4+2i}{2}$ and $\frac{-4-2i}{2}$

We can write them as $-2+i$ and $-2-i$.

These two solutions are called a **conjugate pair**. This means that one solution is in the form of $a + bi$, and the other solution is in the form of $a - bi$. The two numbers in a complex pair are **complex conjugates**.