Key Concepts: Solving Quadratic Equations using the Square Root Principle Completing the Square *i* yi yi!

The Square Root Principle

For $k \neq 0$, there are two solutions to $u^2 = k$: $\sqrt{k}$ and $-\sqrt{k}$.

The only solution to $u^2 = 0$ is 0.

Examples

Find all solutions to each equation – completely simplify the solutions

$(2t+1)^2 = 9$

$(6x-4)^2 = 72$

$x^2 - 8x + 16 = 12$

$t^2 - 6t + 2 = 0$

$y^2 + 20y + 80 = 0$

Examples

Find the x-intercepts on each parabola.

$y = 2x^2 - 20x + 8$

$y = 3x^2 - 18x + 27$

i Carumba!

The positive square root of -1 is defined to be the number i.

$$\sqrt{-1} = i \text{ and } -\sqrt{-1} = -i$$

Example

Find all solutions to $g(x) = 0$ where $g(x) = x^2 + 4x + 7$; completely simplify the solutions.

Example

Find all solutions to $(4y - 12)^2 = -18$; completely simplify the solutions.

True or False

$\sqrt{-4}\sqrt{-9} = \sqrt{(-4)(-9)}$?

Example

Completely simplify each expression

$(-3i)(-7i)$

$\sqrt{6}\sqrt{-6}$

$\sqrt{-10}\sqrt{-5}$

The Complex Numbers

The Real Numbers

Any number that is represented as a point on the real number line.

The Imaginary Numbers

Any number that is equivalent to a square root of a negative real number

Numbers with a real number part and an imaginary part

Specifically, numbers that can be written in the form $a+bi$ where both a and b are real numbers. This is the standard form in which we write a number that has both a real number part and an imaginary number part.

Example

Perform each operation and write the result in standard complex number form.

$(2+3i)-(7-2i)$

$(9-2i)(3+4i)$

$(4+i)^2$

$(9-i)(10+3i)$

5 divided by $2-3i$

$3+2i$ divided by $3-2i$

$$\frac{72}{2i}$$

$$\frac{5-8i}{4i}$$

Example

Complete the following.

$i^1 =$	$i^5 = i^4 \cdot i =$	$i^9 =$
$i^2 = i^1 \cdot i =$	$i^6 = i^5 \cdot i =$	$i^{10} =$
$i^3 = i^2 \cdot i =$	$i^7 = i^6 \cdot i =$	$i^{11} =$
$i^4 = i^3 \cdot i =$	$i^8 = i^7 \cdot i =$	$i^{12} =$

Find each of the following.

i^{103}

$-i^{894}$