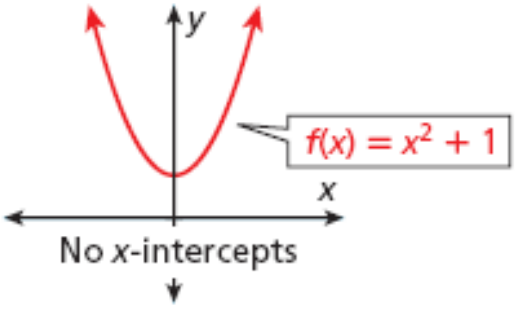
4.4 Notes Day 1

Objectives: What is an imaginary number. How to find square roots of negative numbers. Find products of imaginary numbers. Solve equations involving imaginary numbers.

You can see in the graph of $f(x) = x^2 + 1$ below that f has no real zeros. If you solve the corresponding equation $0 = x^2 + 1$, you find that $x = \pm\sqrt{-1}$, which has no *real* solutions.

However, you can find solutions if you define the square root of negative numbers, which is why *imaginary numbers* were invented. The imaginary unit i is defined as $\sqrt{-1}$. You can use the imaginary unit to write the square root of any negative number.



Imaginary Numbers

WORDS	NUMBERS	ALGEBRA
An **imaginary number** is the square root of a negative number.	$\sqrt{-1} = i$	If b is a positive real number, then $\sqrt{-b} = i\sqrt{b}$ and $\sqrt{-b^2} = bi$.
Imaginary numbers can be written in the form bi, where b is a real number and i is the imaginary unit.	$\sqrt{-2} = \sqrt{-1}\sqrt{2} = i\sqrt{2}$	
The square of an imaginary number is the original negative number.	$\sqrt{-4} = \sqrt{-1}\sqrt{4} = 2i$	
	$(\sqrt{-1})^2 = i^2 = -1$	$(\sqrt{-b})^2 = -b$

Express the number in terms of *i*.

Example A:

$\sqrt{-16}$ $\sqrt{-28}$ $3\sqrt{-24}$ $5\sqrt{-121}$

1) $\sqrt{-27}$ 2) $\sqrt{-216}$ 3) $\sqrt{-18}$

What does " *i* " equal? _____ So, what does " i^2 " equal? _____

$i^1 = i$	$i^2 = -1$	$i^3 = i^2 \cdot i$ or $-i$	$i^4 = (i^2)^2$ or 1
$i^5 = i^4 \cdot i$ or i	$i^6 = i^4 \cdot i^2$ or -1	$i^7 = i^4 \cdot i^3$ or $-i$	$i^8 = (i^2)^4$ or 1

Simplify $-6i^{14}$ **Simplify** $-5i \cdot 3i$ **Simplify** $\sqrt{-6} \cdot \sqrt{-15}$

4) i^{31} **5)** $3i \cdot 4i$ **6)** $\sqrt{-20} \cdot \sqrt{-12}$ **7)** $3\sqrt{-24} \cdot 2\sqrt{-18}$

Solve the following equations:

Ex. $x^2 = -144$ **Ex.** $x^2 + 48 = 0$ **Ex.** $25x^2 + 9 = 0$

8) $9x^2 + 25 = 0$ **9)** $4x^2 + 100 = 0$ **10)** $x^2 + 64 = 0$