Complex Numbers:

any number that can be written in the form: a + bi → Standard Form of a Complex Number

Real Part

Imaginary Part

Examples of Imaginary #'s:

10 - 7i or 13i

## Complex Numbers

a + bi a and b are real numbers

| Real Numbers | Imaginary Numbers |
| --- | --- |
| b must be 0 | $b \neq 0$<br>a can be any real number - even 0 |

The terms Complex Number and Imaginary Number are quite often used interchangeably. But shouldn't be.

Every Imaginary Number is a Complex Number

but the Converse is not true.

Not every Complex Number is an Imaginary Number

Get a

- small white board
- dry-erase marker
- rag to wipe board

## Write each as a Complex Number in Standard Form

$a+bi$

1. $2+\sqrt{-9}$

$= 2+3i$

2. $\sqrt{-12}-5$

$\sqrt{-1\cdot 4\cdot 3}$

$= 2i\sqrt{3}-5$

$= -5+2i\sqrt{3}$

## Simplify.

1. $(6-5\sqrt{-64})+(7+\sqrt{-49})$

$-5\cdot 8i$

first simplify square roots

$= (6-40i)+(7+7i)$

$= 13-33i$

then combine like terms

2. $(-11+\sqrt{-9})-(6-\sqrt{144})$

1ST simplify square roots

$= (-11+3i)-(6-12)$

$= (-11+3i)-(-6)$

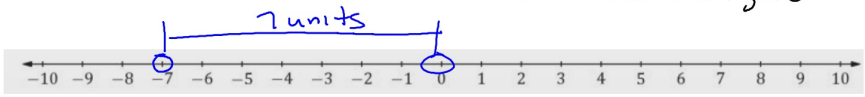
Now combine like terms

$= -5+3i$

## Absolute Value:

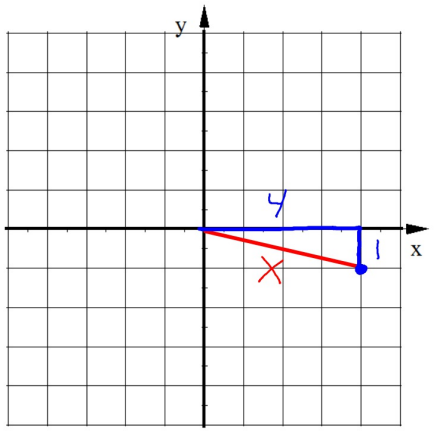
Distance from zero.

$|-7| = 7$ because $-7$ is 7 units from zero



What could the absolute value of an ordered pair mean?

$|(4, -1)| = ?$ it's the distance (4,-1) is from the origin in the x-y Coordinate Plane.




You can use the Pythagorean Theorem to find x (the hypotenuse).

$Leg^2 + Leg^2 = Hypotenuse^2$

$4^2 + 1^2 = x^2$

$16 + 1 = x^2$

$\sqrt{17} = \sqrt{x^2}$

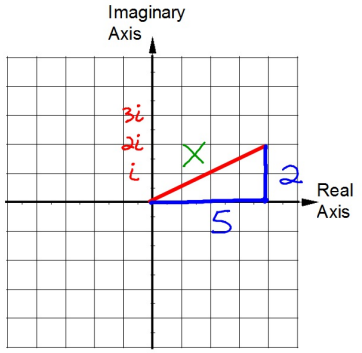
$x = \pm\sqrt{17}$

but $-\sqrt{17}$ can't be a hypotenuse so the answer is only

$x = \sqrt{17}$

What could the absolute value of a Complex Number mean?

$|5 + 2i| = ?$ it's the distance 5+2i is from the origin in the Complex Number Plane.




$2^2 + 5^2 = x^2$

$4 + 25 = x^2$

$\sqrt{29} = \sqrt{x^2}$

$x = \sqrt{29}$

The Absolute Value of a Complex Number:

$$|a + bi| = \sqrt{a^2 + b^2}$$

Find the absolute value of this complex number.

$|3 - 7i| = |3 + -7i|$ (a = 3, b = −7)

$= \sqrt{(3)^2 + (-7)^2} = \sqrt{9 + 49}$

$= \sqrt{58}$

Find the absolute value of this complex number.

$|6i| = |0 + 6i|$ (a = 0, b = 6)

$= \sqrt{0^2 + 6^2}$

$= \boxed{6}$

You can now do Hwk #15. Sec 5-6

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Problems 6-8, 17, 18, 20, 21, 59, 60

$i = \sqrt{-1}$

$i^2 = \left(\sqrt{-1}\right)^2 = -1$

This means that every time you run across $i^2$ you can replace it with -1. You may be able to continue simplifiying.

Simplify each:

1. $4i(3 + 6i)$

$= 12i + 24i^2$

$= 12i + 24(-1)$

$= 12i - 24$

$= \boxed{-24 + 12i}$

2. $(2 + 3i)(1 - 5i)$

| | 2 | +3i |
|---|---|---|
| 1 | 2 | +3i |
| -5i | -10i | $-15i^2$ |

$-15i^2 = -15(-1) = +15$

$= 2 + 15 - 10i + 3i$

$= \boxed{17 - 7i}$