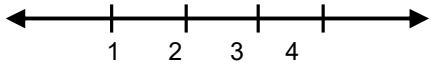
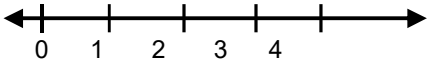
Math-2 HANDOUT 2-1 (Number Systems)

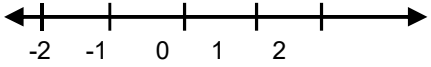
Natural numbers: the _____ numbers that are usually shown on a number line.



Whole numbers: the _____ numbers and the number _____.



Integers: the _____ numbers and the _____"counting" numbers.



When converting a rational number into its _____(using division) the decimal with either "terminate" (1/2 = 0.5) or repeat (2/3 = 0.66666…).

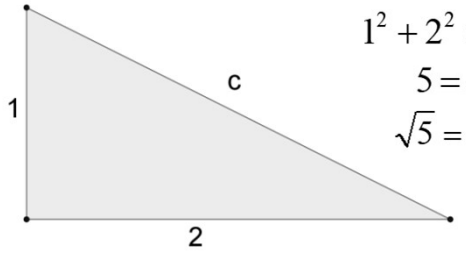
Write the integer -3 as a rational number.

Are these all the same thing? $\frac{-3}{1}, \frac{3}{-1}, -\frac{3}{1}, \frac{-3}{-1}$

Why is -3 not equal to $\frac{-3}{-1}$?

If the triangle below is a right triangle, how can we find length 'c' (the hypotenuse)?

_____Theorem: If it's a right triangle, then side lengths can be related by: $a^2 + b^2 = c^2$



$$1^2 + 2^2 = c^2$$
$$5 = c^2$$
$$\sqrt{5} = c$$

What numbers system does SQRT(5) number belong to?

Irrational numbers: cannot be written as a _____

The decimal version of an irrational number never_____and never_____. (0 = 5.13257306…).

If we see the radical symbol, the number is usually _____ (unless it is a "perfect square). $\sqrt{3}$

$$\sqrt{4} = 2\,(\text{rational \#})$$

Identify the number system

(1) $\frac{2}{3}$ (2) $\sqrt{7}$ (3) 5.25 (4) 26 (5) π

Natural
Whole
Integer
Rational
Irrational

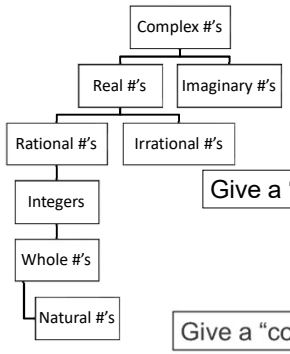
The square root of -1: $x = \sqrt{-1}$

really means, "_____".

$x^2 =$ ____ What real number when squared becomes a negative number ?

It _____ so it must be an "_____"

$$\sqrt{-3} = \sqrt{(-1)*3} = \sqrt{(-1)}*\sqrt{3} = i\sqrt{3}$$



$1 + 2 = 3$

natural + natural = natural

Is this always true?

$4 \div 2 = 2$

natural ÷ natural = natural

Is this always true?

Give a "counter example": _____

$3 - 1 = 2$

natural – natural = natural

Is this always true?

Give a "counter example": _____

$2 * 3 = 6$

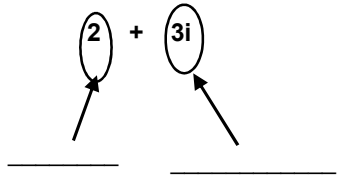
natural * natural = natural

Is this always true?

New number systems are needed when a number system is not "closed" for a particular operation (the square root of -1)

What number system is closed for all operations (except division)?

The Complex Number System. **a + bi**



_____ _____

Simplify:

(2 – 3i) – (-4 – 5i)

7i – (2 – 3i)

3i * 4i

a – 3i = 4 + bi
a = ?, b = ?

2(4 + 3i)

(4 + 2i)(3 + 5i)

Additional material

1. The reason why we want to use "i" instead of $\sqrt{-1}$ is because mathematical operations are much easier for letters than with $\sqrt{-1}$

2. Multiplication is "repeated addition". x + x + x = 3x
   'x' used as an addend 3 times is the same as 3 times 'x'.

3. Exponents are "repeated multiplication". $x*x*x*x = x^4$

'x' used as a factor 4 times is the same as 'x' with an exponent of '4'.

4. If we combine items 1 and 3 we have:

$$i^3 = i^2 * i = (-1) * i = -i$$

5. "touching" means multiplication. $2x * 3x = 2 * x * 3 * x$

6. Commutative Property (of multiplication or addition): the order of the addends doesn't matter. $2 + 3 = 3 + 2$

   the order of the factors doesn't matter $2 * 3 = 3 * 2$

   → You can rearrange the order if it makes it easier.

   $2x * 3x = 2 * x * 3 * x \ = 2 * 3 * x * x \ = 6x^2$

7. We an only multiply (or add) a pair of numbers in one step.

   $2 * 3 * 4 \ = (2 * 3) * 4 \ = 6 * 4 \ = 24$