Mohammed Kaabar The Real Numbers Sep. 6th, 2016
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* Before introducing the real numbers, we need to Know what's the meaning of set.

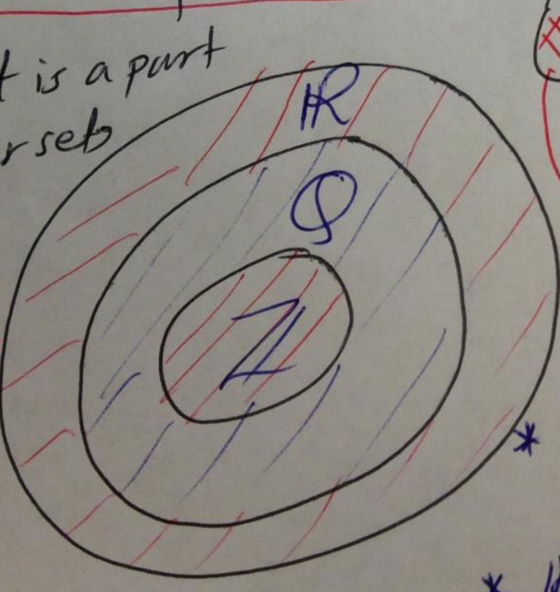
* A "set" is defined as a callection of several things (objects) inside one thing. This one thing that collects several things together is Known as the set. For this course, we will talk about "sets of numbers".

* The following figure represents the three main sets of numbers:

This is called roster notation {...}

Notations:

* If a set is a part of another set then it's called "Subset"



* $\mathbb{Z}$: Set of all integers
$\{\ldots, -3, -2, -1, 0, 1, 2, 3, \ldots$

* $\mathbb{Q}$: Set of all rational numbers

* $\mathbb{R}$: Set of all real numbe

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The Real Numbers

* $\mathbb{N}$: Set of natural numbers

* From the previous figure, we notice that the largest set is $\mathbb{R}$, while the smallest set is $\mathbb{Z}$. In addition, we know that a rational number is defined as an integer divided by a non-zero integer.

$\mathbb{R}$ = Set of real numbers = The set of all numbers that have points on the numberline including all rational and irrational numbers

Sets of Numbers

$\mathbb{N} = \{1, 2, 3, 4, \ldots\}$
Set of Natural numbers
"Always positive numbers"

Set of Whole Numbers, $\mathbb{Z}_{\geq 0}$
$= \boxed{0} + \boxed{\text{natural number}}$
$= \{\boxed{0}, 1, 2, 3, 4, 5, \ldots\}$

$\mathbb{Z} = \{\ldots, -3, -2, -1, 0, 1, 2, 3, 4, \ldots$
Set of integers "Negative + 0 + Positive nu

$\mathbb{Q}$ = set of rational numbers $= \dfrac{\boxed{\text{integer}}}{\boxed{\text{Non-zero Integer}}}$
terminates or repeat
3.5
$\frac{1}{3} = 0.3333$
$= 0.\bar{3}$

Set of irrational number $\sqrt{2}, \sqrt{3}, \pi, e^1$
(non-rational numbers)
numbers whose decimal part does not $\boxed{\text{terminate}}$ or $\boxed{\text{repeat}}$

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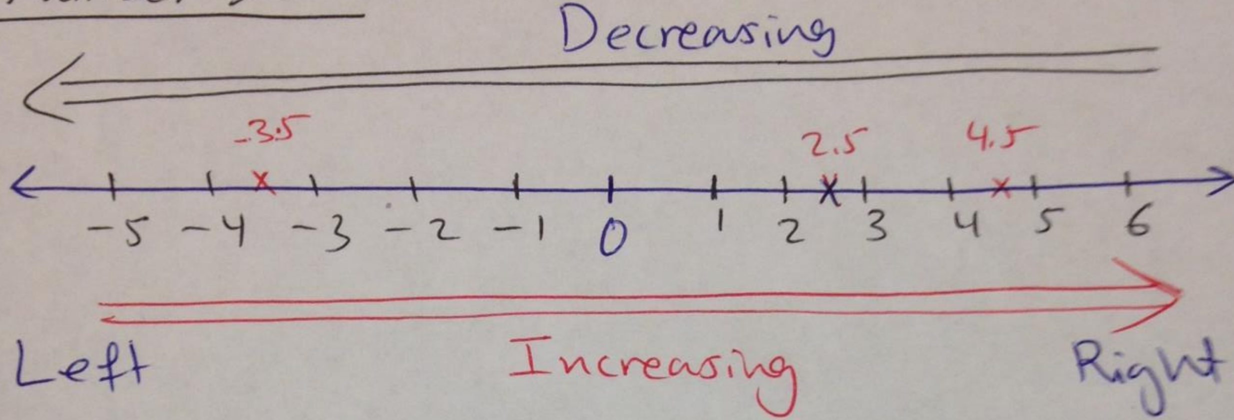
* Number line:



Order

- ">" greater than
- "<" less than
- "=" equal to

*Note: ">" and "<" with numbers lik $3>2$ or $-1<0$, we call them "inequalities"

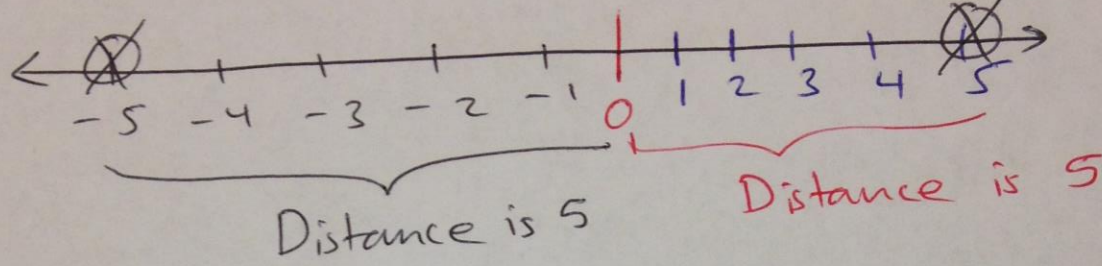
*Note: "$\geq$" is greater than $\boxed{\text{or}}$ equal

"$\leq$" is less then $\boxed{\text{or}}$ equal

For example: $-3 \leq 1$ is true because -3 is less than 1 although

$$-3 \neq 1.$$

* Absolute Value



Both -5 and 5 have the same distance from zero on the above number line.

* The notation for Absolute Value is as follows: $\left|\boxed{?}\right|$

If the number inside is negative then it becomes positive.

any number inside

If it's positive or zero, it stays the same (No change).

Examples:

$|-10| = 10$

$|-5| = 5$

$|1| = 1$

$|0| = 0$

$|-3.5| = 3.5$

$\left|\frac{-1}{3}\right| = \frac{1}{3}$

, $\left|\frac{-2}{5}3\right| = \left|3\frac{-2}{5}\right| = 3\frac{+2}{5}$

* In math course, we define <u>Absolute Value</u> as follows:

For any real number, say x, then we have:

$$|x| = \begin{cases} x & \text{if } x \geq 0 \\ -x & \text{if } x < 0 \end{cases}$$

<u>Note:</u>

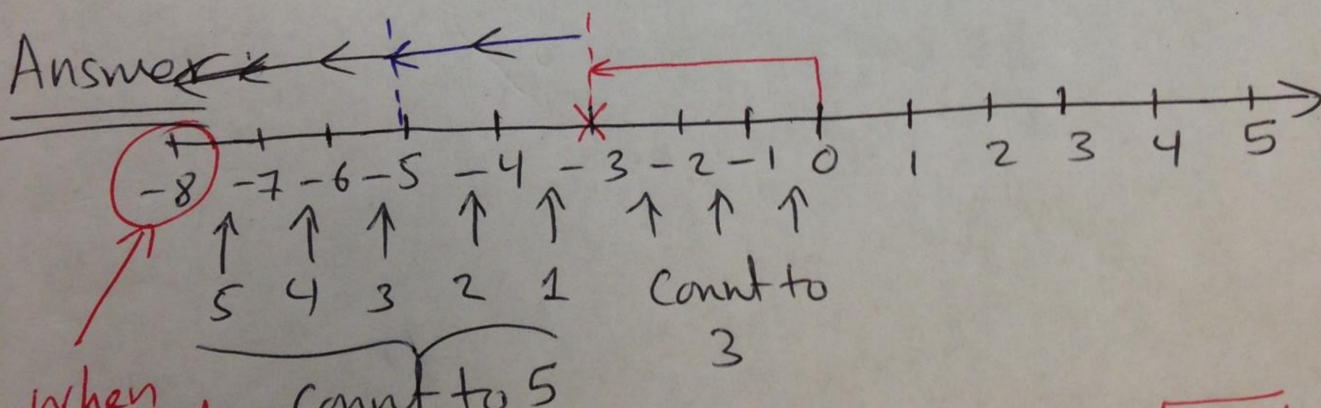
* We will talk about this definition when we reach "Equations"

* How to add on the <u>Number line</u>?

Ex] <u>Add the following on the Number line</u>:-

$(-3) + (-5)$

<u>Answer</u>



when reached the last number, then it's <u>solution</u>

So, $(-3) + (-5) = \boxed{-8}$