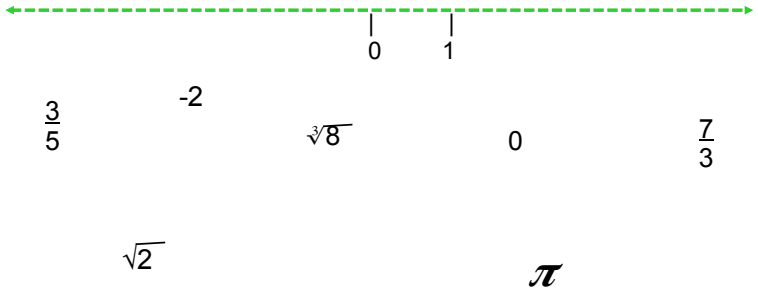
MATH 1010 ~ Intermediate Algebra Chapter 1 Fundamentals of Algebra

Section 1.1: Sets and Real Numbers

Objectives:

- Understand the set of real numbers and the subsets of real numbers.
- Order numbers on the real number line.
- Determine the distance between two numbers on the real number line.
- Determine the absolute value of a real number.



The Real Number System

Natural numbers $= \mathbb{N} = \{1, 2, 3, \ldots\}$

Whole numbers $= \mathbb{W} = \{0, 1, 2, 3, \ldots\}$

Integers $= \mathbb{Z} = \{\ldots, -3, -2, -1, 0, 1, 2, 3, \ldots\}$

Rational numbers $\rightarrow \mathbb{Q} = \left\{ \frac{a}{b} \mid a, b \in \mathbb{Z}, b \neq 0 \right\}$

Irrational numbers $\rightarrow \mathbb{R} - \mathbb{Q}$

Real numbers $\rightarrow$ everything on the number line

such that element of

ex $5 = \frac{5}{1} = \frac{10}{2}$

$\approx$ means approximately equal to.

ex irrational number

$\pi, \sqrt{2}, \sqrt{5}, \sqrt[3]{6}$

$\pi \approx 3.14$

$\sqrt{2} \approx 1.414$

Decimal form

(1) Terminating ex $0.75 = \frac{3}{4}$

rational

(2) Non-terminating, repeating ex $0.333\ldots = 0.\overline{3} = \frac{1}{3}$

rational

(3) Non-terminating, non-repeating

irrational

ex $0.12112111211112\ldots$

$\pi$

①Example:

To which set(s) do each of these numbers belong?

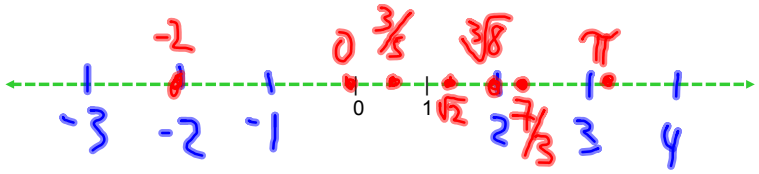
$\frac{3}{5}$ -2 $\sqrt[3]{8}$ $\pi$ $\sqrt{2}$ 0 $\frac{7}{3}$

d. c. $=2$ e. e. b. d.

a.

a. Natural
b. Whole
c. Integers
d. Rational
e. Irrational

② Example: Put each of the numbers above on this number line.

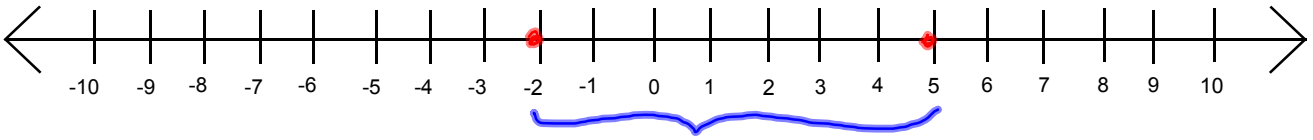



a< b means: "a is less than b"

a > b means: "a is greater than b"
($\Leftrightarrow$ "b is less than a")

$-2 < 0 < \frac{3}{5} < \sqrt{2} < \sqrt[3]{8} < \frac{7}{3} < \pi$

The distance between two points: (1-d)

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distance between -2 and 5 is what?

(don't care about direction)

$d = 5-(-2) = |5-(-2)| = |-2-5|$

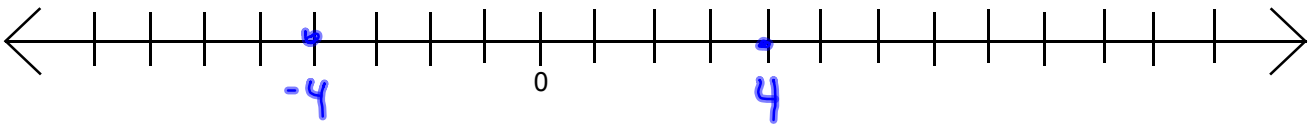
The opposite of a number:

$-$ ① subtraction $5-3$

② negative $-2$

③ opposite $-(-(-3))$

opposite negative




opposite of 4 is $-4$

opposite of $-4$ is 4

The absolute value of a number:

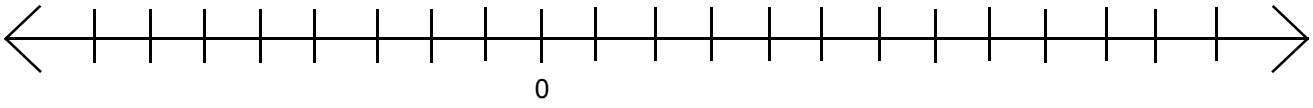
$|a| = a$ if $a \geq 0$

$|a| = -a$ if $a < 0$

opposite

$|3| = 3$ $\quad |-3| = 3$

$\hookrightarrow -(-3)$




③ Example: a) $|-5| = 5$

b) $-|5| = -5$

c) $|5| = 5$

d) $-|5| = -5$

④ Example: Find the opposite of each number and the absolute value of each number.

a) -32 $\quad$ opp: 32 $\quad |-32| = 32$

b) 17 $\quad$ opp: -17 $\quad |17| = 17$