TOPIC A: TYPES OF NUMBERS

Types of Numbers is the first topic of the BC Pre-Calculus 11 curriculum. The symbol for integers $\mathbb{Z}$ is based on the German word "Zahlen." BC students do not have to worry about complex numbers but BC math students who are interested in studying in the US should learn that $i = \sqrt{-1}$.

- Real number classification

1. Provide the mathematical symbol and examples of the following types of numbers:
    a. Natural
    $\mathbb{N}$ $x \in \{1, 2, 3 \ldots\}$

    b. Whole
    $\mathbb{W}$ $x \in \{0, 1, 2, 3, \ldots\}$

    c. Integers
    $\mathbb{Z}$ $x \in \{\ldots, -3, 2, -1, 0, 1, 2, 3, \ldots\}$

    d. Rational
    Numbers that can be expressed in the form $\frac{a}{b}$ where a and b are integers.
    $\mathbb{Q}$ ex. $\frac{2}{3}$, $\sqrt{9}$, 0, 1.2, etc.

    e. Real
    $\mathbb{R}$: Includes all rational numbers but also irrational numbers such as: $\sqrt{2}, \pi, e$
    $\mathbb{R}$ ex. $\sqrt{2}$, π, -3, $\frac{2}{3}$, etc.

    f. Enrichment: What is a complex number?
    $\mathbb{C}$ $a + bi$ ex. $2 + 3i$
    Definition: $i = \sqrt{-1}$, thus $i^2 = -1$

2. Rational or irrational?
    a. $\sqrt{5}$
    I

    b. $\sqrt{16}$
    R

    c. $\sqrt{\frac{25}{9}}$
    R

    d. π
    I

    e. 0
    R

f. $1.\overline{6}$
R

g. 0.02
R

h. 2.5
R

i. $\sqrt{1.21}$
R

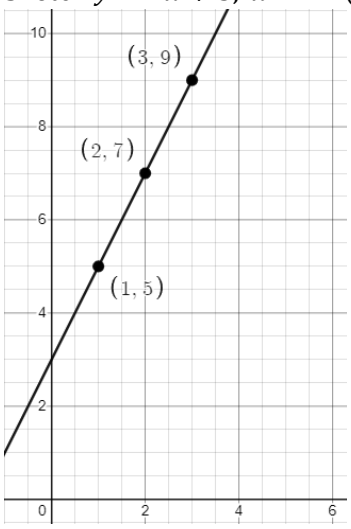
j. e
$e \approx 2.718281828459045235360287471352 7 \ldots$
like π, this constant is also irrational
I

3. Show that 0.4 is rational.
$\frac{0.4}{1} = \frac{4}{10}$ (integer divided by integer means rational)

4. Show that $\sqrt{\frac{121}{4}}$ is rational.
$\frac{\sqrt{121}}{\sqrt{4}} = \frac{11}{2}$ (rational)

5. Rank from least to greatest: $2.5, \sqrt{9}, -100, \frac{8}{3}, 3.\overline{3}, \infty, 200\%$
$-100, 200\%, 2.5, \frac{8}{3}, \sqrt{9}, 3.\overline{3}, \infty$

6. Sketch $y = 2x + 3,\ x \in \mathbb{Z}^+$ (positive integer)



Do not draw the line (it is only a guide) – the points matter.

7. Enrichment:
    a. List the four prime numbers
    2, 3, 5, 7

    b. List the first four positive perfect squares
    1, 4, 9, 16

    c. List the first four positive perfect cubes
    1, 8, 27, 64

    d. Challenge: 1, 4, 9, 16, 25 …
    What is the value of the n^{th} term?
    n^2

8. Challenge: Show that $1.\overline{23}$ is a rational number
    Let $x = 0.\overline{23}$
    $100x = 23.\overline{23}$
    $x = 0.\overline{23}$
    Subtract
    $99x = 23$
    $x = \frac{23}{99}$
    But remember to add the initial 1
    $1 + \frac{23}{99} = \frac{99}{99} + \frac{23}{99} = \frac{122}{99}$