



Number Properties

- Section P.1
- One focus of this class will be to determine mathematical models for real world data. The models will be equations consisting of variables. The variables represent real numbers. So we begin by insuring we understand the real numbers.



Automobile Expenses

- In returning to school this semester you may have driven your car. If the cost of gas per gallon is \$1.48, determine gas costs c for your drive of m miles back to college.
 - Variable: letter representing varying values such as c for cost and m for miles
 - Mathematical Model: equation representing the problem. If your gas mileage is 20 miles per gallon, then $c = 1.48 (m/20)$



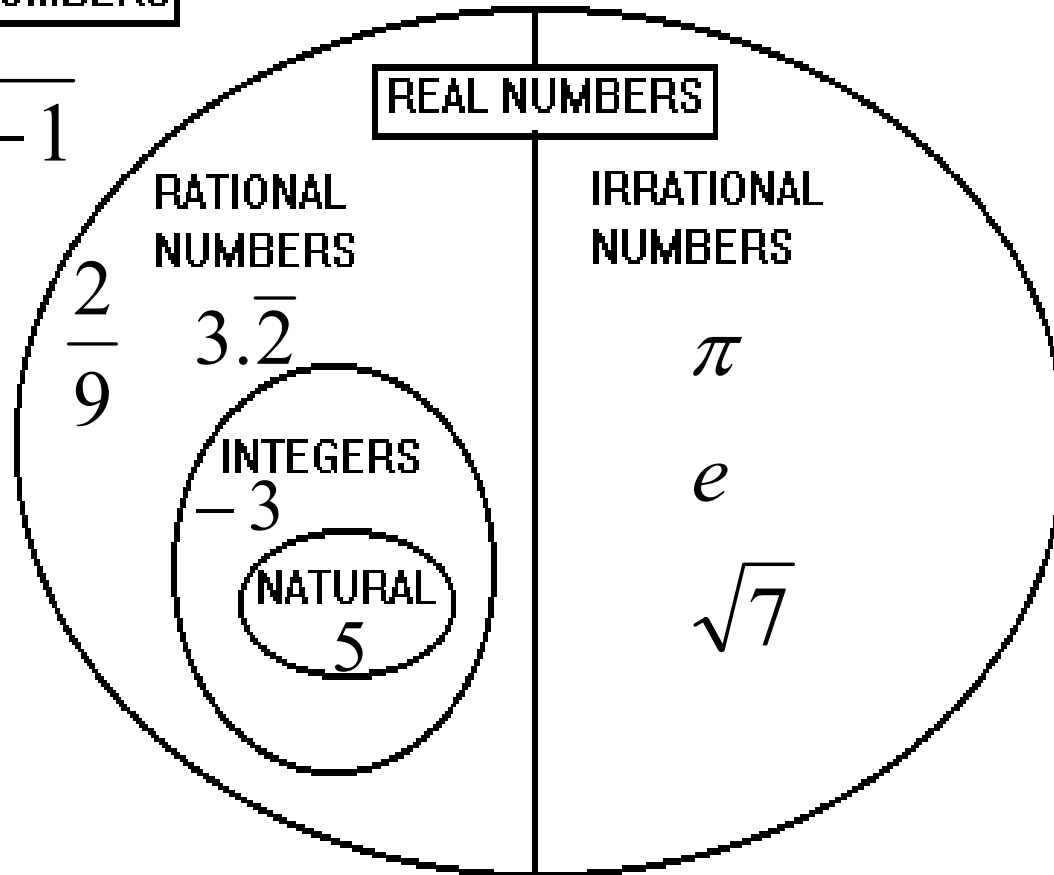
Number Systems

- We substitute into models with numbers to make predictions, such as letting miles $m = 62$.
 - $c = 1.48 (62/20) = 4.59$ So cost is \$4.59.
- We will use the Real numbers as the replacement set of numbers for variables

Real Number System

COMPLEX NUMBERS

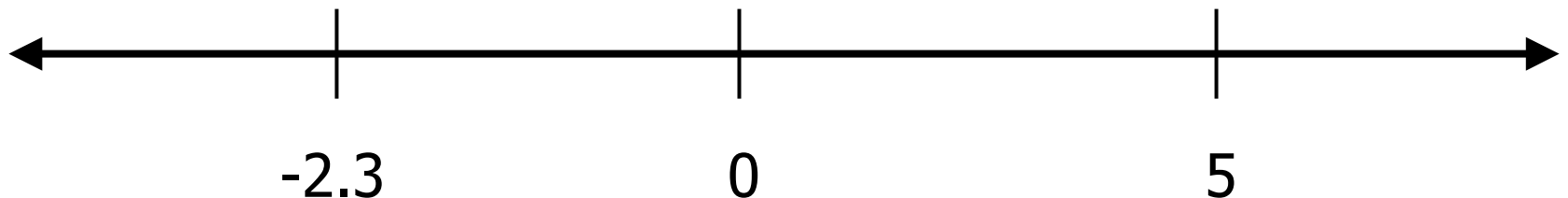
$$2 + 3\sqrt{-1}$$





Real Number Line

- One-to-one correspondence between the Real numbers and points on a line
- Real numbers can be ordered: $a < b$ implies a is to the left of b on the number line



Field Properties of the Real Numbers

PROPERTIES OF REAL NUMBERS

Let a , b and c be any real numbers

Addition Properties

Closure: $a+b$ is a real number

Identity: $a+0 = 0+a = a$

Inverse: $a+(-a) = 0$

Commutative: $a+b = b+a$

Associative: $a+(b+c) = (a+b)+c$

Multiplication Properties

Closure: $a \cdot b$ is a real number

Identity: $a \cdot 1 = 1 \cdot a = a$

Inverse: $a \cdot (1/a) = 1$, a not 0

Commutative: $a \cdot b = b \cdot a$

Associative: $a \cdot (b \cdot c) = (a \cdot b) \cdot c$

Distributive: $a \cdot (b+c) = a \cdot b + a \cdot c$



Definition of – and /

- Subtraction: $a - b = a + (-b)$

- Division: $a \div b = a \cdot \frac{1}{b}$



Properties of Negation

- Determine the rules for the following.
 - $-(-a) = a$
 - $(-a)b = -(ab)$
 - $(-a)(-b) = ab$
 - $-(a+b) = (-a) + (-b)$



Properties of Zero

- Determine the rules for the following.
 - $a - 0 = a$
 - $a \cdot 0 = 0$
 - $0/a = 0$
 - $a/0 = \textit{undefined}$
 - If $a \cdot b = 0$, then what do we know about either a or b ?
$$a = 0 \textit{ or } b = 0$$



Skills Practice

- Provide the property that supports each step in the following simplification.
 - $a + c = b + c$
 - $(a+c)+(-c) = (b+c)+(-c)$
 - $a + (c - c) = b + (c - c)$
 - $a + 0 = b + 0$
 - $a = b$
- This is the Cancellation Property of Addition



Cartesian Coordinate System

- Rene Descartes (1596-1650) combined two number lines to create a system of graphing in two dimensions.
- Legend tells he developed the system while lying in bed watching a fly crawl across the ceiling.

Cartesian Coordinate System

