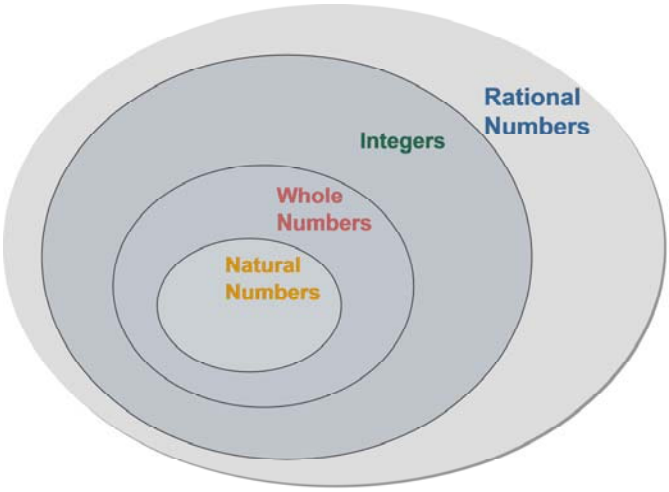
03: The Real Number System

Key Terms

- **Integer:** any whole number, its opposite, or zero; {…-3, -2, -1, 0, 1, 2, 3, …}.
- **Irrational number:** a number that cannot be written as the ratio of two integers.
- **Natural number:** the counting numbers; {1, 2, 3, …}.
- **Rational number:** a number that can be written as the ratio of two integers a and b, $\frac{a}{b}$, where $b \neq 0$.
- **Real number:** a number that can be represented with a point on the real number line; either rational or irrational.
- **Subset:** a mathematical set whose elements are contained in another set.
- **Whole number:** any nonnegative integer; {0, 1, 2, 3, …}.

Rational Number Subsets



Addition Rule: Like Signs

When adding numbers with like signs, add the absolute values of the numbers and keep the sign.

Example:

$-3 - 9 = -(3 + 9) = -12$

Addition Rule: Unlike Signs

When adding numbers with unlike signs, subtract the smaller absolute value from the larger absolute value. Keep the sign of the number with the larger absolute value.

Example:

$2 + (-6) = -(6 - 2) = -4$

Multiplication / Division Rule: Like Signs

When multiplying or dividing two numbers with like signs, the result will be positive.

Example:

$-15 \div (-5) = 3$

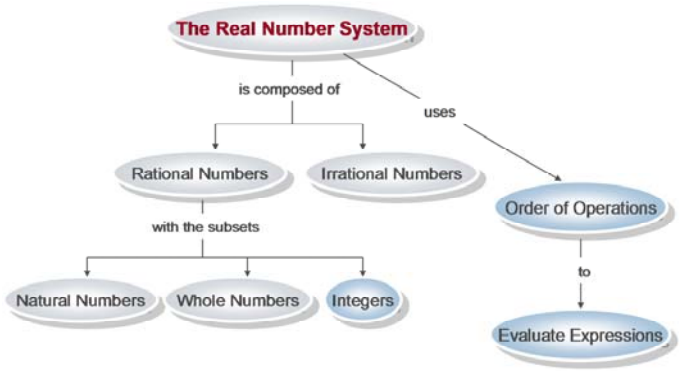
Multiplication / Division Rule: Unlike Signs

When multiplying or dividing two numbers with unlike signs, the result will be negative.

Example:

$7(-2) = -14$

Concept Map



Order of Operations (PEMDAS)

- **P**arentheses
- **E**xponents
- **M**ultiplication
- **D**ivision
- **A**ddition
- **S**ubtraction

*"**P**lease **E**xcuse **M**y **D**ear **A**unt **S**ally"*

Example: Order of Operations

Evaluate the math expression $2(7 - 3)^2 \div 8 + 9$.

$2(7 - 3)^2 \div 8 + 9$	
$= 2(4)^2 \div 8 + 9$	Parentheses: $7 - 3 = 4$
$= 2(4)(4) \div 8 + 9$	
$= 2(16) \div 8 + 9$	Exponent: $4^2 = 4(4) = 16$
$= 32 \div 8 + 9$	Multiplication/Division: $2(16) = 32$
$= 4 + 9$	Multiplication/Division: $32 \div 8 = 4$
$= 13$	Addition/Subtraction: $4 + 9 = 13$

Reminders and Shortcuts

- The decimal approximation of an irrational number does not terminate or repeat.
- The decimal equivalent of a rational number will either terminate or repeat.
- A line over digits behind a decimal point indicates those digits repeat infinitely.
- An integer can be written as a ratio by putting the integer over 1 in a fraction.
- Adding a negative number is the same as subtracting that number: $a + (-b) = a - b$.
- Addition and multiplication are commutative: the value of the expression will not change when the terms are reordered.
- The product (or quotient) of numbers with the same sign is positive.
- The product (or quotient) of numbers with different signs is negative.
- Use the acronym PEMDAS to remember the correct order of operations.
- Perform multiplication and division from left to right.
- Perform addition and subtraction from left to right.

How to Use This Cheat Sheet: These are the key concepts related this topic. Try to read through it carefully twice then rewrite it out on a blank sheet of paper. Review it again before the exam.