= Suggestion
= problem working

Chapter P
Section P.1

Notation
We will begin by refreshing your knowledge of College Algebra (Math 111) quickly. First, a reminder of some terms:

Definitions
A **set** is a collection of objects or **elements**. The set containing the numbers 1,2, and 3 is written as {1,2,3}. If there is an obvious pattern, we use three dots $\{1, 2, 3, \cdots\}$.

Natural Numbers

$$\mathbb{N} = \{1, 2, 3, \cdots\}$$

Whole Numbers

$$\mathbb{W} = \{0, 1, 2, 3, \cdots\}$$

Integers

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

Rationals

$$\mathbb{Q} = \left\{ \frac{a}{b} \mid a \text{ and } b \text{ are integers with } b \neq 0 \right\}$$

Irrationals: Any number on a number line that can not be expressed as a rational number.

Real Numbers: Everything on a number line, i.e. every rational and irrational number. The notation for the real numbers is $\mathbb{R}$.

Note: Any number in decimal notation that is terminating or repeating is a rational number. The irrational numbers are infinite, non-repeating numbers.

Task 1. Write all of the above sets that contain the following numbers.

i. 0
ii. -5
iii. $\frac{3}{-7}$
iv. $\frac{\pi}{7}$
v. $\sqrt{2}$
vi. $0.\bar{3}$

Task 2. Of the sets described above, which sets contain which other sets?

Using the names we have just reviewed...
Fill in the following with all applicable names:

1. Every Whole Number is also a _____ (Number)
2. Every Integer is also a _____ (Number)
3. Every Rational is also a _____ (Number)
4. Every Irrational Number is also a _____ (Number)
5. Every Real Number is also a _____ (Number)

Task 3. Let us practice a few of our numerical operations to make sure we understand. Without using a calculator, determine if the following are equal.

i. $1 - (2 - 3) = (1 - 2) - 3$ True

ii. 2-7= -(7-2) True

iii. a-b= -(b-a) True

iv. $(1 \div 2) \div 3 = 1 \div (2 \div 3)$ False

v. $(3 + 4)^2 = 9 + 16$ False

vi. $(a + b)^2 = a^2 + b^2$ False

Absolute Value

The **absolute value** of a (written $|a|$) can be thought of as the distance from a to 0 on the number line. Symbolically we define the absolute value as

$$|a| = \begin{cases} a & : a \geq 0 \\ -a & : a < 0 \end{cases}$$

So this
- definition
- property
- problem

} structure is what you call "College Math"

Properties of Absolute Value: For any real numbers a and b

i. $|a| \geq 0$

ii. $|-a| = |a|$

iii. $|a \cdot b| = |a| \cdot |b|$

iv. $\left|\frac{a}{b}\right| = \frac{|a|}{|b|}$ provided $b \neq 0$

Distance between Two Points on the Number Line: If a and b are any two points on the number line, then the distance between a and b is $|a-b|$. In symbols, $d(a,b) = |a-b|$.
Example: Find the distance between -3 and 5 on the number line.

Task 4. For any real numbers a and b, is it true that $|a-b| = a-b$? Why or why not?

Not True

$|2-3| = |-1| = 1 \neq 2-3 = -1$

Problem 1. As review, add, subtract, multiply, or divide the rational numbers as indicated. Write answers in lowest terms.

(a) $\frac{8}{15} + \frac{4}{15} = \frac{12}{15} = \frac{4}{5}$

(b) $\frac{5}{6} - \frac{8}{9} = \frac{15-16}{18} = \frac{-1}{18}$

(c) $\frac{3}{4} - \frac{5}{6} = \frac{9-10}{12} = \frac{-1}{12}$

(d) $\frac{3}{10} - \frac{7}{15} = \frac{9-14}{30} = \frac{-5}{30} = \frac{-1}{6}$

(e) $\frac{4}{21} \cdot \frac{7}{10} = \frac{2}{15}$

(f) $\frac{5}{9} \cdot \frac{12}{25} = \frac{4}{15}$

(g) $\frac{5}{6} \div \frac{14}{15} = \frac{5}{6} \cdot \frac{15}{14} = \frac{25}{28}$

(h) $\frac{2}{3} \div \frac{8}{9} = \frac{2}{3} \cdot \frac{9}{8} = \frac{3}{4}$