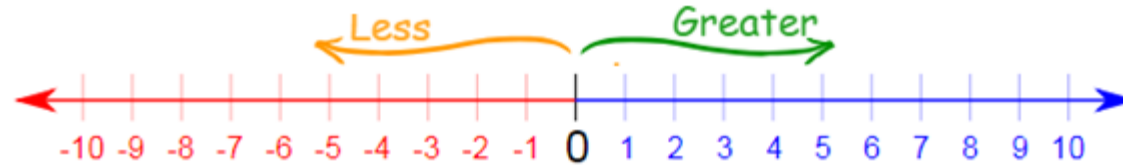# Lesson 1 – Negative Numbers, PEMDAS, LCM, Fractions

Comparing Negative Numbers

A number to the left is less than a number to the right.

Which is larger: –2 or –5 ?

–2½ or –2¾ ?

Adding and Subtracting Negative Numbers

Position yourself at the first number. Then use the second number to go left or right.

What is   2 – 5 ?   **THINK MONEY:** If you had $2, and owed someone $5, and gave them

What is –2 – 5 ?   what you had, how much would you still owe?

Remember these two rules:

* **Adding** a negative number is the same as **subtracting**.   5 + –2 = 5 – 2

* **Subtracting** a negative number is the same as **adding**.   5 – –2 = 5 + 2

What is   2 + – 5 ?   2 – – 5 ?   –2 – – 5 ?

Multiplying and Dividing Negative Numbers

A positive multiplied by or divided by a negative is negative.   3 · –2 = –6   20 ÷ –4 = –5

A negative multiplied by or divided by a negative is positive.   –3 · –2 = 6   –20 ÷ –4 = 5

What is   4 · –3 ?   –4 · –3 ?   15 ÷ –3 ?   –15 ÷ –3 ?

PEMDAS
aka Order Of Operations

$$4 \times 4 - 3 \times 3 - 16 \div 4$$

$$4 - 3[4 - 2(6 - 3)] \div 2$$

$$3 \times 6 + 5 - (4 - 2) - 1$$

$$\left(6 - \left(3 + 1^2\right)\right)(1 + 3)$$

3,20,7,8,70,sub,3.97

$(14 \div 2)^2 + ((18 - 6) + 3^2)$

Theresa bought three containers of tennis balls at $2.98 each. She had a coupon for $1 off. Her mom paid for half of the remaining cost.
(1) Create an expression to represent this situation.
(2) How much did her mom pay?

Using PEMDAS, which is the last operation you should perform to evaluate this expression?

$(1 \cdot 2.5) + (52 \div 13) + (5 - 6.7)^2 - (98 + 8)$

Enter these on your calculator.

Least Common Multiple (LCM): The smallest positive number that is a multiple of two or more numbers.
When it's used to add or subtract fractions, it's called the **Least Common Denominator** (LCD).

Least Common Multiple of 3 and 5:

● List the **Multiples** of each number,

   The multiples of **3** are 3, 6, 9, 12, 15, 18, ... etc
   The multiples of **5** are 5, 10, 15, 20, 25, ... etc

● Find the first **Common** (same) value:

          The **Least Common Multiple** of 3 and 5 is **15**

   (15 is a common multiple of 3 and 5, and is the smallest, or least, common multiple)

What's the LCM of 4 and 12?

   Of 4 and 10?

   Of 4 and 6?

   Of 10 and 12?

   Of 8 and 9?

Out of the 4 operations for fractions, multiplication is the simplest.
Just multiply numerator times numerator, over denominator times denominator.

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

$$\frac{2}{3} \times 5$$

Make 5 into $\frac{5}{1}$: $\frac{2}{3} \times \frac{5}{1} = \frac{2 \times 5}{3 \times 1} = \frac{10}{3}$

This is the same as: What is one-half **of** two-fifths?
("OF" means Multiplication)

This is the same as: What is ⅔ **of** 5?

$$\frac{3}{4} \text{ of } 12 \qquad \frac{8}{9} \text{ of } 81 \qquad \frac{3}{5} \cdot \frac{1}{3} \qquad \frac{7}{8} \cdot \frac{7}{8} \qquad \frac{9}{10} \cdot \frac{5}{9} \qquad \frac{5}{12} \cdot \frac{4}{15}$$

Cross-Simplify

Adding or subtracting fractions when the denominator is the same: Add or subtract the numerator.

$$\frac{1}{4} + \frac{1}{4} = \frac{1+1}{4} = \frac{2}{4} \qquad\qquad \frac{7}{8} - \frac{3}{8} \qquad\qquad \frac{3}{8} - \frac{7}{8}$$

Adding or subtracting fractions when the denominator is NOT the same:
1) Find the LCM
2) Make that the new denominator for both. Convert both so they use that.
2) Add or subtract like before.

Example: $\dfrac{1}{3} + \dfrac{1}{5}$

1) The LCM is 15

2) They become: $\dfrac{?}{15} + \dfrac{?}{15}$

3) For the first: $\dfrac{1}{3} = \dfrac{?}{15}$ 3 times what is 15? 5. So multiply top and bottom by 5 to get $\dfrac{5}{15}$

For the second: $\dfrac{1}{5} = \dfrac{?}{15}$ 5 times what is 15? 3. So multiply top and bottom by 3 to get $\dfrac{3}{15}$

4) Add them: $\dfrac{5}{15} + \dfrac{3}{15} = \dfrac{8}{15}$

$$\dfrac{5}{6} + \dfrac{1}{12}$$

$$\dfrac{1}{2} + \dfrac{3}{8}$$

$$\dfrac{2}{3} + \dfrac{3}{8}$$

$$\dfrac{3}{4} + \dfrac{2}{9}$$

Dividing fractions:

Keep the first fraction

Change it from a division to a multiplication

Flip the second fraction (into the reciprocal)

$$\frac{1}{2} \div \frac{1}{6} = \frac{1}{2} \times \frac{6}{1} = \frac{1 \times 6}{2 \times 1} = \frac{6}{2}$$

$$5 \div \frac{2}{3}$$

$$\frac{2}{3} \div 5 \qquad \text{Make 5 into } \frac{5}{1} : \quad \frac{2}{3} \times \frac{1}{5} = \frac{2 \times 1}{3 \times 5} = \frac{2}{15}$$

$$\frac{1}{2} \div \frac{1}{2}$$

Greatest Common Factor (GCF): The highest number that divides exactly into two or more numbers.

Greatest Common Factor of 12 and 16

- Find all the **Factors** of each number,
- Circle the **Common** factors,
- Choose the **Greatest** of those

Factors of 12: ①, ②, 3, ④, 6, 12

Factors of 16: ①, ②, ④, 8, 16

Common Factors

④ is the Greatest Common Factor

What's the GCF of...

12, 30

45, 75

56, 63, 81

The **GCF** is useful in reducing (simplifying) fractions. Once you've found it, divide both the numerator and denominator by that.

Example: How can we simplify $\dfrac{12}{30}$?

The **GCF** of 12 and 30 is 6, so we divide both the numerator and denominator by that.

$\div 6$

$\dfrac{12}{30} = \dfrac{2}{5}$

$\div 6$

And so $\dfrac{12}{30}$ can be simplified to $\dfrac{2}{5}$

$\dfrac{9}{81}$ $\qquad$ $\dfrac{8}{60}$ $\qquad$ $\dfrac{15}{100}$ $\qquad$ $\dfrac{60}{8}$ $\qquad$ $\dfrac{6}{63}$

There are 3 types of fractions:

Smaller → **3**
Larger → **5**
Proper Fraction

Larger (or equal) → **9**
Smaller (or equal) → **5**
Improper Fraction

2⅓
Mixed Fraction

$1\dfrac{3}{4}$

$\dfrac{7}{4}$

Converting Mixed to Improper

Example: Convert $3\dfrac{2}{5}$ to an improper fraction.

Multiply the whole number part by the denominator: ➡ $3 \times 5 = 15$

Add that to the numerator: ➡ $15 + 2 = 17$

Then write that result above the denominator: $\dfrac{17}{5}$

$2\dfrac{2}{3}$

$3\dfrac{3}{4}$

Converting Improper to Mixed

Example: Convert $\dfrac{11}{4}$ to a mixed fraction.

Divide: ➡ $11 \div 4 = 2$ with a remainder of 3

Write down the 2 and then write down the remainder (3) above the denominator (4). Answer: $2\dfrac{3}{4}$

$\dfrac{14}{4}$

$\dfrac{113}{3}$

How do you **add**, **subtract**, **multiply**, or **divide** Mixed Fractions?

1) Convert them to Improper Fractions
2) Follow the rules of A/S/M/D
3) Convert result back to Mixed Fraction

Example: What is $2\frac{3}{4} + 3\frac{1}{2}$?

Convert to Improper Fractions: $\quad 2\frac{3}{4} = \frac{11}{4} \qquad\qquad 3\frac{1}{2} = \frac{7}{2}$

Common denominator of 4: $\quad \frac{11}{4}$ stays as $\frac{11}{4} \qquad \frac{7}{2}$ becomes $\frac{14}{4}$

(by multiplying top and bottom by 2)

Now Add: $\quad \frac{11}{4} + \frac{14}{4} = \frac{25}{4}$

Convert back to Mixed Fractions: $\quad \frac{25}{4} = 6\frac{1}{4}$

$2\frac{2}{3} + 3\frac{3}{4}$

$3\frac{3}{4} + 4\frac{4}{5}$

$4\frac{4}{5} + 5\frac{5}{6}$