

# **DHS Algebra 1**

Andy Ross

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# Welcome to Algebra 1

Welcome to Algebra 1 at Frederick Douglass High School!

This book will guide you through the most important math skills you'll need to succeed in high school and beyond. Algebra is more than just solving equations — it's a powerful way to understand patterns, solve problems, and think logically.

Whether you're reviewing old ideas or learning something brand new, this book is here to help you every step of the way.

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## What You'll Find in This Book

Each unit includes:

- Clear goals to help you focus
- Examples and explanations
- Practice problems
- Activities to explore and talk through ideas

We'll start with the basics — like working with numbers and fractions — and build up to more complex ideas like equations, graphs, and even quadratics.

You don't have to be a “math person” to do well here. Just bring your curiosity, a little patience, and the willingness to try.

Let's get started!

## **Part I**

# **Unit 1: Foundations**

# Introduction

Welcome to Unit 1! In this unit, we'll build the foundation you need to succeed in Algebra. Think of this as preparing your math toolkit.

You'll explore integers, factors, fractions, and the rules of simplification. These skills are the building blocks that will help you solve more complex problems with confidence — especially when working with expressions and equations in later units.

---

## What You'll Learn

By the end of this unit, you'll be able to:

- Work with positive and negative numbers on a number line
  - Use factor trees to find prime factorizations
  - Identify and use the greatest common factor (GCF)
  - Convert between fractions, decimals, and percents
  - Multiply, divide, and compare fractions
  - Follow the correct order of operations to simplify expressions
- 

## Topics in This Unit

**Integers & Number Lines** Understand and use positive and negative numbers, and how to place them on a number line.

**Factors, Multiples & Prime Factorization** Break numbers into their prime building blocks using factor trees.

**GCF & Simplifying Fractions** Use prime factorization to find the GCF and simplify fractions to their simplest form.

**Fractions, Decimals & Percents** Convert between different number forms and apply them in real-world problems.

**Multiply, Divide & Compare Fractions** Work with fractions in ways that actually show up in Algebra — simplify, multiply, divide, and compare.

**Order of Operations** Follow the rules (PEMDAS) to simplify numeric expressions with integers and fractions.

---

Let's build those Algebra muscles — you'll need them for everything that follows!

# 1.1 - Integers & Number Lines

Did you know that all of mathematics is actually built up from simple things like counting? Even advanced topics like [algebra](#) and [calculus](#) are just clever ways of organizing and extending basic ideas — like moving forward and backward on a [number line](#).

In this lesson, we'll use the number line not just to count, but to add, subtract, and compare [positive](#) and [negative](#) numbers. That might sound basic, but it's the foundation of nearly everything else you'll do in Algebra.

Negative numbers can be tricky, especially when the rules don't always match what your gut tells you. But if you can master the way they work on the number line — including things like [opposites](#), [absolute value](#), and comparison — you'll be setting yourself up for success in the rest of the course.

## Objectives

- ☐ Know what a number line represents
- ☐ Understand and identify opposite numbers
- ☐ Compare integers using greater than and less than
- ☐ Use a number line to perform addition and subtraction

## Vocabulary

[absolute value](#), [greater than](#), [integer](#), [less than](#), [number line](#), [negative](#), [opposite](#), [positive](#)

## Warm-Up

Answer as best you can – even if you aren't sure!

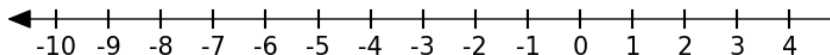
1. What is the opposite of 6?
2. Which is greater -4 or -9?
3. Which is farther from 0: -7 or 5?



## Learn Together

### 1.1.1 - The Number Line Is More Than Just Counting

You already know how to count — 0, 1, 2, 3, and so on. The **number line** extends that idea in both directions.



Let's draw a number line from -10 to 10

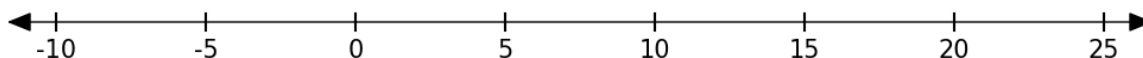
Here, every tick mark is an **integer** — a whole number.

- Numbers to the **right** of zero are **positive**
- Numbers to the **left** of zero are **negative**

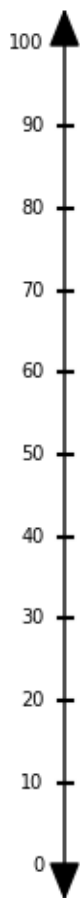
We can use this number line to *see* what happens when we add, subtract, or compare numbers.

**Are there other ways to draw a number line?**

Yes! Number lines can be drawn over different ranges and scales. For example, here is a number line that counts from -10 to 25 in steps of 5.



In fact, number lines don't even have to be **horizontal**. Here is a **vertical** number line that goes from 0 to 100 in steps of 10.



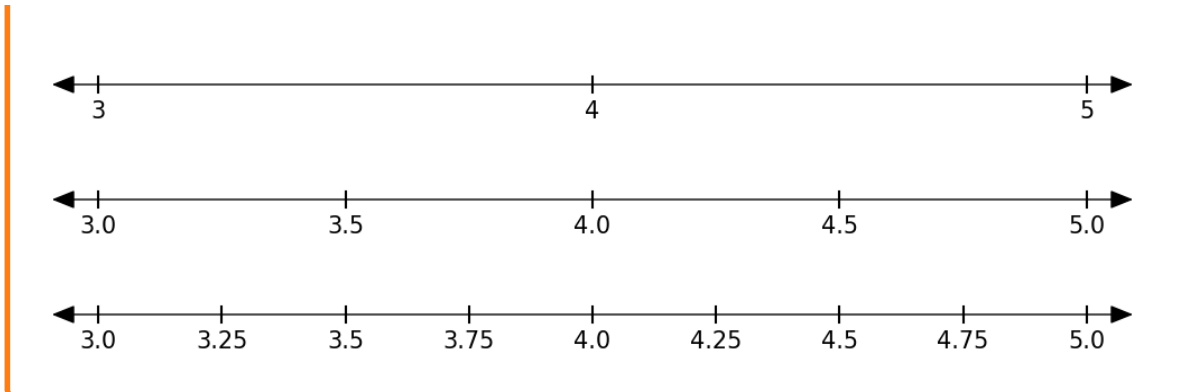
Can you think of any real world examples of number lines?

Here are a few examples:

- thermometer
- ruler
- timeline
- American football field
- volume slider on a phone

🔥 How many numbers are between 3 and 5?

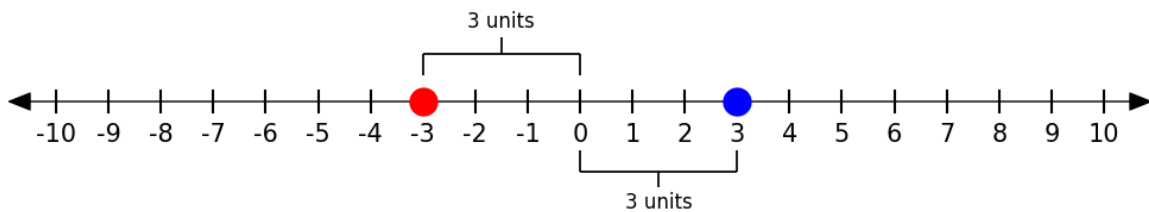
Though there are 2 **integers** between 3 and 5, the answer is not 2! There are infinitely many numbers between 3 and 5. Here are some number lines that might help convince you.



### 1.1.2 - Understanding Opposites

Let's look at a pair of numbers, 3 and -3.

These are called **opposite** numbers. They are the **same distance** from zero but on **opposite sides** of it.



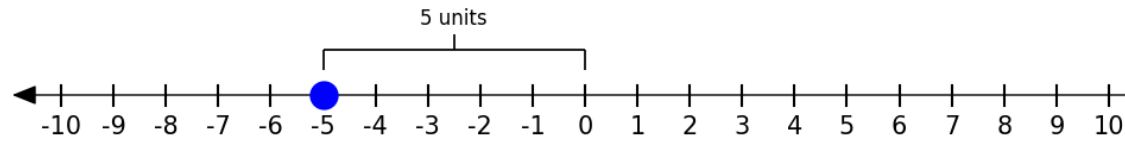
**What is the opposite of zero?**

The opposite of zero is zero. Zero is the only number that is its own opposite!

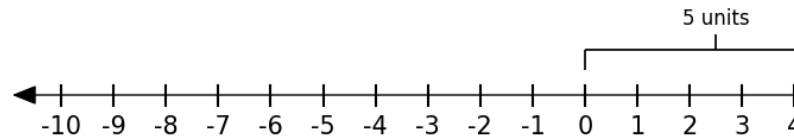
### 1.1.3 - What Is Absolute Value?

**Absolute value** ( $|number|$ ) measures the **distance from zero**, no matter the direction.

Take a look at the number -5. The number line shows that it's absolute value is 5 because it is 5



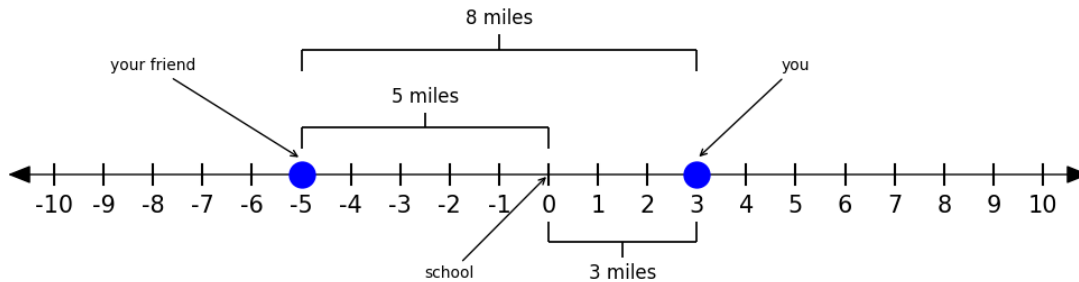
units away from zero.



You can see that  $|5|$  is also 5 for the same reason!

### In the Real World

Absolute value is often used for describing the distance between two points. Suppose you live 3 miles to the east of the school and your best friend lives 5 miles to the west. How far apart are your houses? This is easy to see with a number line.



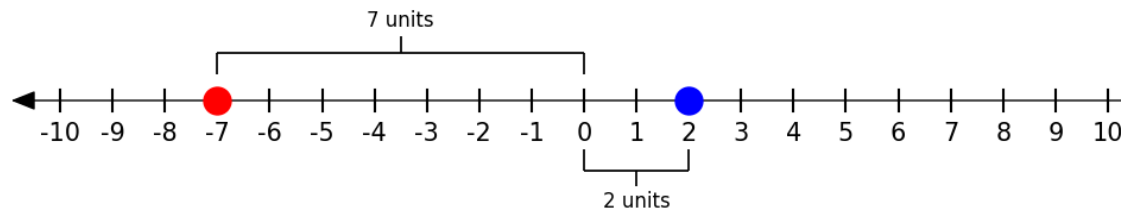
You can compute your distances by adding  $|-5| + |3|$ , by  $|-5 - 3|$ , or by  $|3 - (-5)|$ . All three of these give the same answer, 8 miles. What would change if we did not use absolute value?

### Can the absolute value ever be negative?

Absolute value is **never** negative, because distance is never negative.

### 1.1.4 - Comparing Integers

We can also use the number line to compare values.



Let's compare 2 to -7.

You can see from the number line that 2 is greater than ( $>$ ) -7 because 2 is to the right of -7.

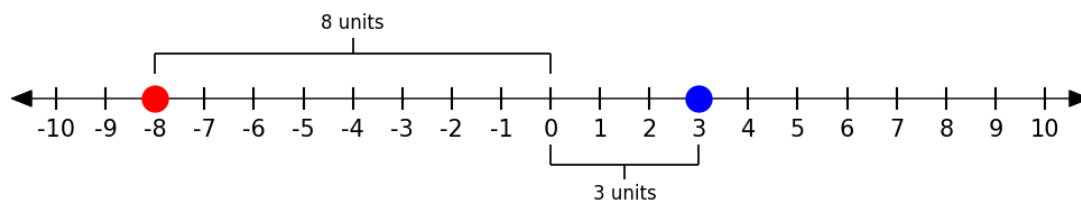
You can also see that -7 is further from zero than 2 and so  $|-7| > |2|$ .

#### Which is **bigger**?

It is easy to get confused here. When we say which is “bigger” we are asking which number is further to the right on the number line, **not** which one is furthest from zero.

#### Try comparing 3 to -8 using a number line.

$3 > -8$  because it is farther to the right but  $|-8| > |3|$  because -8 is further from zero.

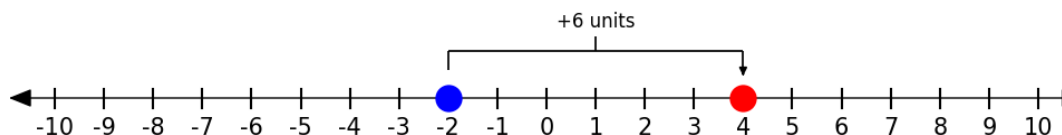


### 1.1.5 - Number Lines and Arithmetic

We can also use the number line to model **adding and subtracting** integers.

- To add a **positive** number, move **right**
- To add a **negative** number, move **left**

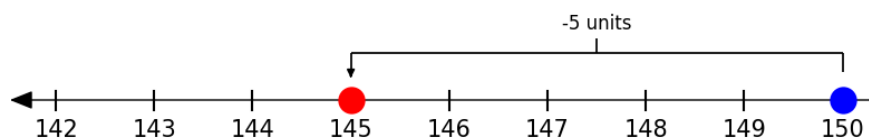
Examples:



1. Addition:  $-2+6 = 4$

In the Real World

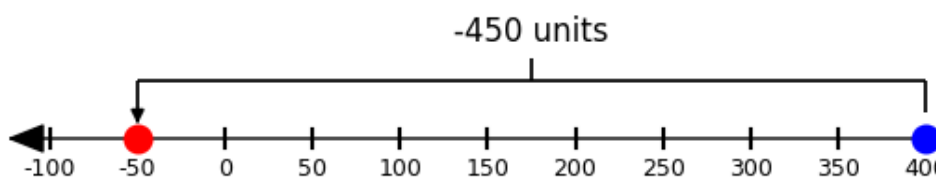
Imagine that you are \$2 in debt. If someone pays you \$6 you can pay off the debt and have \$4 left over.



2. Adding a negative:  $150+(-5) = 145$

In the Real World

You have \$150 in the bank. The bank ads a fee for being under their \$200 minimum balance. You now have \$145.



3. Subtraction:  $400-450 = -50$

### In the Real World

If you only have \$400 but spend \$450 on a credit card. You are now \$50 in debt.



4. Subtracting a negative:  $201 - (-5) = 206$

**Can You think of a real-world example for the previous example?**

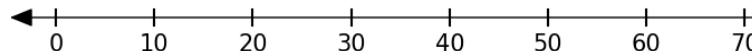
Example: The bank made a mistake, you had \$201 in your account so they took off the \$5 fee. Now you have \$206.

---

## Practice On Your Own

### Working With Number Lines

1. Draw a number line that shows:
  - a. -4, 0, and 3.
  - b. Your age
  - c. The number halfway between 5 and 9.



2. What question could match this number line?

---

### Opposites

3. What is the opposite of 42?
4. What is the opposite of -3?

5. Draw a number line with two numbers that are opposites.
  6. Does 3.5 have an opposite? If yes, what is it?
- 

### Comparing Numbers

7. Which number is **greater**, 5 or -10?
  8. Which number has the greater absolute value, 5 or -10?
  9. Is 28 bigger than -30?
  10. Use ( $>$ ) or ( $<$ ) to compare:
    - a.  $-11$  \_\_\_\_\_  $-13$
    - b.  $7$  \_\_\_\_\_  $-2$
    - c.  $|-3|$  \_\_\_\_\_  $|5|$
  11. Which is bigger?
    - a. -4 or -5
    - b. 3 or the opposite of 7
    - c.  $|-5|$  or  $|4|$
  12. Use a number line to compare:
    - a. -7 to 2.
    - b. The year you were born and the current year
- 

### Addition and Subtraction

13. Show these on a number line:
  - a.  $-3 + 5$
  - b.  $3 - 5$
  - c.  $-3 + (-3)$
  - d.  $3 - (-3)$



---

## Word Problems

14. Solve using a number line

- The temperature was  $-12^{\circ}\text{F}$ . It warms up by  $20^{\circ}$ . What is the new temperature?
  - A diver is 45 feet below sea level. She dives 30 feet deeper. How far down is she?
  - Your bank account is at  $-\$8$ . You deposit  $\$5$ . What is your new balance?
- 

### Answer key

#### Working With Number Lines

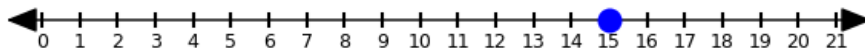
1. Draw a number line that shows:

- 4, 0, and 3.



- Your age

*Answers vary. Here is what a 15 year old would show*



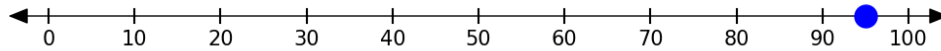
- The number halfway between 5 and 9.



*The answer is 7*

2. What question could match this number line?

*Answers vary. We could say "Plot the temperature on July 4th"*



### Opposites

3. What is the opposite of 42?

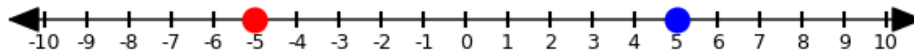
-42

4. What is the opposite of -3?

3

5. Draw a number line with two numbers that are opposites.

*Answers vary. Here is an example:*



6. Does 3.5 have an opposite? If yes, what is it?

Yes! The opposite is -3.5.

### Comparing Numbers

7. Which number is **greater**, 5 or -10?

5 is greater

8. Which number has the greater absolute value, 5 or -10?

-10 has a greater absolute value

9. Is 28 bigger than -30?

Yes, because it is further from zero

10. Use ( $>$ ) or ( $<$ ) to compare:

a.  $-11$  \_\_\_\_  $-13$

$-11 > -13$

b.  $7$  \_\_\_\_  $-2$

$7 > -2$

c.  $|-3|$  \_\_\_\_  $|5|$

$|-3| < |5|$

11. Which is bigger?

a.  $-4$  or  $-5$

$-4$  is bigger because it is further to the right

b.  $3$  or the opposite of  $7$

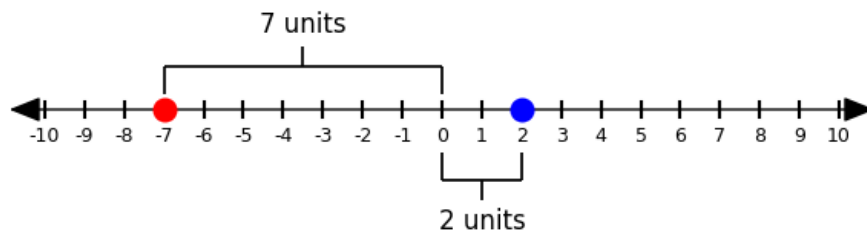
$3$  is bigger. The opposite of  $7$  is  $-7$  and  $3$  is further to the right.

c.  $|-5|$  or  $|4|$

$|-5|$  is bigger.  $|-5|$  is  $5$  which is further to the right than  $|4|$  which is  $4$ .

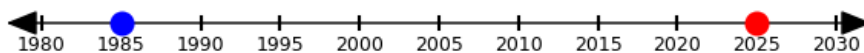
12. Use a number line to compare:

a.  $-7$  to  $2$ .



b. The year you were born and the current year

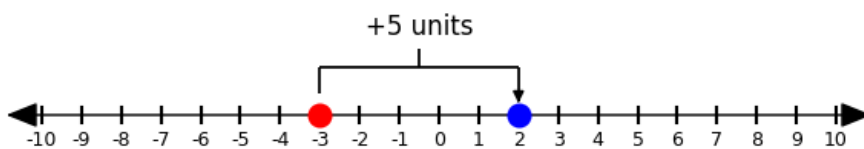
Answers vary. I was born in 1982. The current year is 2025.



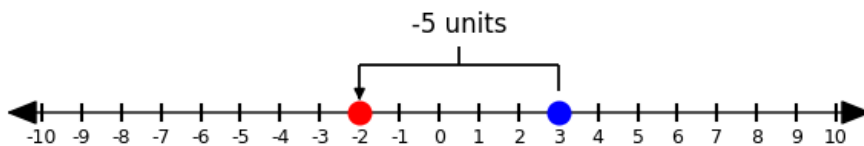
### Addition and Subtraction

13. Show these on a number line:

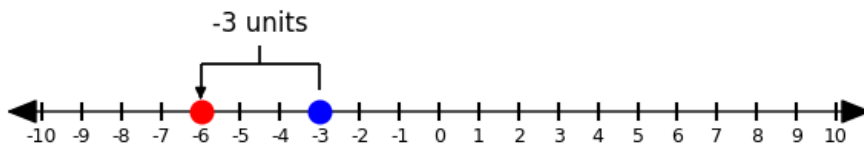
a.  $-3 + 5$



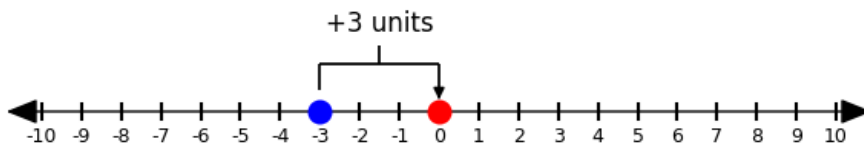
b.  $3 - 5$



c.  $-3 + (-3)$



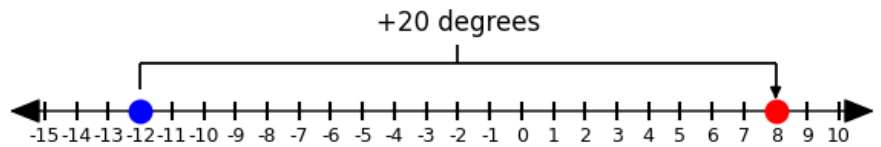
d.  $3 - (-3)$



### Word Problems

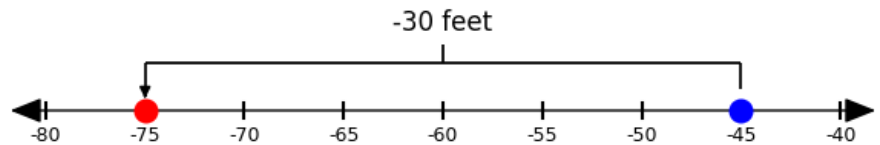
14. Solve using a number line

- a. The temperature was  $-12^{\circ}\text{F}$ . It warms up by  $20^{\circ}$ . What is the new temperature?



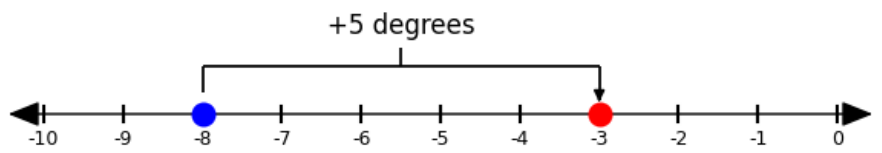
It is now 8 degrees

- b. A diver is 45 feet below sea level. She dives 30 feet deeper. How far down is she?



She is now 75 feet down.

- c. Your bank account is at  $-\$8$ . You deposit  $\$5$ . What is your new balance?



You now have -\$3.

## 1.2 – Factors, Multiples & Prime Factorization

Have you ever tried to split something up evenly — like dividing pizza slices or organizing teams? That’s really what **factors** are all about: breaking numbers into equal parts.

In this lesson, you’ll learn how to identify factors and multiples — and how to break numbers into their prime building blocks using a tool called a factor tree. This may sound simple, but it is one of the most important tools you’ll use later when solving equations and factoring algebraic expressions.

### Objectives

- ☐ Identify factors and multiples of whole numbers
- ☐ Determine whether a number is prime or composite
- ☐ Use factor trees to find the prime factorization of a number

### Vocabulary

composite number, factor, factor tree, multiple, prime factorization, prime number

### Warm-Up

1. List all the whole-number factors of 12.
  2. What’s a multiple of 7 that is less than 50?
  3. Is 11 a prime number? How do you know?
- 

### Learn Together

#### 1.2.1 – What Are Factors?

A **factor** of a number is a whole number that divides it evenly — with no **remainder**.

**Example:**

The factors of 12 are: 1, 2, 3, 4, 6 and 2

That's because:

$$1 \times 12 = 12$$

$$2 \times 6 = 12$$

$$3 \times 4 = 12$$

**Can a number have just one factor?**

Only one number does: **1**. It only has itself as a factor. That's why it's not considered prime *or* composite!

---

### 1.2.2 – What Are Multiples?

A **multiple** is what you get when you multiply a number by 1, 2, 3, 4...

**Example:**

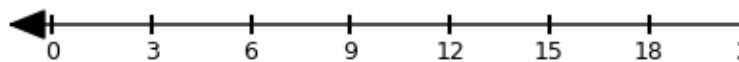
Here are the first few multiples of 5:

5, 10, 15, 20, 25, 30, ...

Multiples are useful when finding common denominators or common multiples later in algebra.

**Where have we seen this before?**

Multiples show up all over the place. When you skip count, you are using multiples. In the previous lesson, we used multiples to construct number lines!

**Example:**

Here is a number line that shows multiples of three.

---



### 1.2.3 – Prime vs. Composite

A **prime number** has only 2 factors: 1 and itself. Examples: 2, 3, 5, 7, 11, 13...

A **composite number** has more than 2 factors. Examples: 4, 6, 8, 9, 10...

#### In the Real World

Prime numbers play a big role in **encryption**, which keeps your data safe when you shop or message online.

---

### 1.2.4 – Prime Factorization and Factor Trees

Every number can be written as a **product of prime numbers**.

Let's try 36.

Start with any two factors: 36    6 6    2 3 2 3

So the prime factorization is:  $2 \times 2 \times 3 \times 3$  or  $2^2 \times 3^2$

This is called a **factor tree**. It doesn't matter how you split the number at the start — you'll always end up with the same prime pieces.

---

### 1.2.5 – Why Do Prime Factors Matter?

Later on, you'll use prime factorization to:

- Simplify fractions
- Find the **greatest common factor**
- Factor algebraic expressions
- Solve equations

So this isn't just about numbers — it's about developing tools that will unlock Algebra.

## Practice On Your Own

### Factors & Multiples

1. List all the factors of:

- a. 16
- b. 18
- c. 27

2. List the first 5 multiples of:

- a. 4
  - b. 9
  - c. 12
- 

### Prime or Composite?

3. Label each number as **prime**, **composite**, or **neither**:

- a. 7
  - b. 15
  - c. 1
  - d. 19
  - e. 21
- 

### Factor Trees & Prime Factorization

4. Use a factor tree to find the prime factorization of:

- a. 24
  - b. 60
  - c. 100
  - d. 81
  - e. 72
- 

### Challenge

5. Can two different numbers have the same prime factorization? Why or why not?

---

### Answer Key

#### 1. Factors

- a. 1, 2, 4, 8, 16
  - b. 1, 2, 3, 6, 9, 18
  - c. 1, 3, 9, 27
- 

#### 2. Multiples

- a. 4, 8, 12, 16, 20
  - b. 9, 18, 27, 36, 45
  - c. 12, 24, 36, 48, 60
- 

#### 3. Prime or Composite

- a. Prime
  - b. Composite
  - c. Neither
  - d. Prime
  - e. Composite
- 

#### 4. Prime Factorization

- a.  $2 \times 2 \times 2 \times 3 = 2^3 \times 3$
  - b.  $2 \times 2 \times 3 \times 5 = 2^2 \times 3 \times 5$
  - c.  $2 \times 2 \times 5 \times 5 = 2^2 \times 5^2$
  - d.  $3 \times 3 \times 3 \times 3 = 3^4$
  - e.  $2 \times 2 \times 2 \times 3 \times 3 = 2^3 \times 3^2$
- 

#### 5. Challenge

No. Each number has a **unique** prime factorization. This is called the **Fundamental Theorem of Arithmetic**.

## 1.3 – GCF & Simplifying Fractions

Ever tried to share something fairly — like splitting snacks or organizing teams into equal groups? That’s the idea behind the **greatest common factor**, or GCF. It tells us how much we can evenly divide into *two or more* numbers.

In this lesson, you’ll learn how to use **prime factorization** to find the GCF, and how that can help us **simplify fractions**. These aren’t just number tricks — they help you write expressions in cleaner, simpler ways so they’re easier to work with.

### Objectives

- ☐ Find the GCF using prime factorization
- ☐ Apply GCF to simplify fractions
- ☐ Solve problems involving shared quantities

### Vocabulary

greatest common factor, simplify, equivalent fractions, prime factorization

---

### Warm-Up

1. List the prime factorization of:
  - a. 20
  - b. 45
2. What’s the largest number that divides **both** 12 and 18 evenly?
3. Write a fraction equal to  $\frac{12}{20}$  using smaller numbers.

## Learn Together

### 1.3.1 – What Is the Greatest Common Factor?

The **greatest common factor (GCF)** is the **biggest number** that divides evenly into *two or more* numbers.

Let's look at 18 and 24.

Factors of 18: 1, 2, 3, 6, 9, 18 Factors of 24: 1, 2, 3, 4, 6, 8, 12, 24 The GCF is **6** — it's the largest factor they both share.

---

### 1.3.2 – Use Prime Factorization to Find the GCF

We can also find the GCF using **prime factorization**.

Let's try 36 and 60.

Prime factorization:  $36 = 2 \times 2 \times 3 \times 3$   $60 = 2 \times 2 \times 3 \times 5$

The GCF is the product of the **shared prime factors**:  $2 \times 2 \times 3 = \mathbf{12}$

This method works even when the numbers are large or hard to list out.

---

### 1.3.3 – Simplifying Fractions with the GCF

Let's say you have the fraction  $\frac{36}{60}$ . Both numbers share a GCF of **12**, so:

$$\frac{36 \div 12}{60 \div 12} = \frac{3}{5}$$

You've **simplified** the fraction — but it still means the same thing.

This is called an **equivalent fraction**.

#### Why Not Just Divide by 2?

You *can* simplify step-by-step, but using the **GCF** gets the job done in **one move**.

---

### 1.3.4 – Real-World Example

Suppose you're planning gift bags. You have **60 pencils** and **36 erasers** and want to make **identical bags** with no extras.

What's the most you can make?

Find the GCF of 60 and 36  $\rightarrow$  **12**

You can make **12 bags**, each with:  $60 \div 12 = 5$  pencils  $36 \div 12 = 3$  erasers

---

## Practice On Your Own

### GCF Practice

1. List the factors of:

- a. 20 and 30
- b. 36 and 45
- c. 18 and 48

2. Find the GCF of:

- a. 20 and 30
  - b. 36 and 45
  - c. 18 and 48
- 

### Simplifying Fractions

3. Simplify each fraction using the GCF:

- a.  $\frac{18}{27}$
- b.  $\frac{50}{100}$
- c.  $\frac{14}{49}$
- d.  $\frac{48}{60}$

4. Create your own fraction and simplify it.

---

## Word Problem

5. You have 72 juice boxes and 60 cookies. You want to create snack packs with the **same number** of each, using **everything**.
- What's the greatest number of snack packs you can make?
  - How many juice boxes and cookies go in each?
- 

### Answer Key

#### 1. Factors

- 20: 1, 2, 4, 5, 10, 20 30: 1, 2, 3, 5, 6, 10, 15, 30
  - 36: 1, 2, 3, 4, 6, 9, 12, 18, 36 45: 1, 3, 5, 9, 15, 45
  - 18: 1, 2, 3, 6, 9, 18 48: 1, 2, 3, 4, 6, 8, 12, 16, 24, 48
- 

#### 2. GCFs

- $\text{GCF}(20, 30) = 10$
  - $\text{GCF}(36, 45) = 9$
  - $\text{GCF}(18, 48) = 6$
- 

#### 3. Simplified Fractions

- $\frac{18}{27} = \frac{2}{3}$
  - $\frac{50}{100} = \frac{1}{2}$
  - $\frac{14}{49} = \frac{2}{7}$
  - $\frac{48}{60} = \frac{4}{5}$
- 

#### 5. Word Problem

- $\text{GCF}(72, 60) = \mathbf{12}$
- Each snack pack has:  $72 \div 12 = 6$  juice boxes  $60 \div 12 = 5$  cookies

## 1.4 – Fractions, Decimals & Percents

Did you know that  $\frac{1}{2}$ , 0.5, and 50% are all the same amount?

In real life, we use **fractions**, **decimals**, and **percents** to describe parts of a whole — whether it's sale prices, test scores, or how much of a task is finished.

In this lesson, you'll learn how to convert between these forms and use them in real-world problems. Being able to move between them will make you faster, more flexible, and more confident in math.

### Objectives

- ☐ Convert between fractions, decimals, and percents
- ☐ Use benchmark values to estimate and reason
- ☐ Solve real-world problems involving these number forms

### Vocabulary

[fraction](#), [decimal](#), [percent](#), [equivalent](#), [benchmark](#), [ratio](#)

## Warm-Up

1. What is  $\frac{1}{2}$  as a decimal? As a percent?
  2. Which is more: 0.75 or  $\frac{2}{3}$ ?
  3. What percent is the same as  $\frac{3}{4}$ ?
- 

## Learn Together

### 1.4.1 – What Are These Numbers Really Saying?

All three number types describe a **part of a whole**:



Fraction	Decimal	Percent
$\frac{1}{2}$	0.5	50%
$\frac{1}{4}$	0.25	25%
$\frac{3}{4}$	0.75	75%
$\frac{1}{10}$	0.1	10%

They look different, but they mean the same thing.

---

## 1.4.2 – Converting Between Forms

### Fraction → Decimal

Divide the top by the bottom Example:  $\frac{3}{4} \rightarrow 3 \div 4 = \mathbf{0.75}$

### Decimal → Percent

Move the decimal two places to the right ( $\times 100$ )  $0.75 \rightarrow \mathbf{75\%}$

### Percent → Decimal

Move the decimal two places left ( $\div 100$ )  $25\% \rightarrow \mathbf{0.25}$

### Decimal → Fraction

Say the number out loud  $0.6 = \text{“six tenths”} = \frac{6}{10} \rightarrow \text{simplify to } \mathbf{\frac{3}{5}}$

---

Fraction	Decimal	Percent
----------	---------	---------

### 1.4.3 – Benchmarks Help You Think Fast

These values come up a lot — **know them by heart**:

Fraction	Decimal	Percent
$\frac{1}{2}$	0.5	50%
	0.333...	~33%
$\frac{1}{4}$	0.25	25%
$\frac{3}{4}$	0.75	75%
$\frac{1}{5}$	0.2	20%

If you can picture these in your head, you'll be able to **estimate, compare, and calculate faster**.

### 1.4.4 – Real-Life Uses

You'll see these forms all the time:

- **Shopping:** 20% off = pay 80% of the price
- **Grades:** 17 out of 20 = 85%
- **Weather:** 30% chance of rain
- **Data:** 40% of students passed =  $4/10 = 0.4$

#### In the Real World

A store is having a 25% off sale. That means you only pay 75% of the price. If a jacket costs \$60, then:

$60 \times 0.75 = \$45 \rightarrow$  That's your sale price.

## Practice On Your Own

### Conversions

1. Convert the following:
    - a.  $\frac{1}{2}$   $\rightarrow$  decimal  $\rightarrow$  percent
    - b.  $0.3 \rightarrow$  fraction  $\rightarrow$  percent
    - c.  $12.5\% \rightarrow$  decimal  $\rightarrow$  fraction
    - d.  $\frac{3}{4} \rightarrow$  decimal (rounded)  $\rightarrow$  percent (rounded)
- 

### Real-World Problems

2. You scored 18 out of 20 on a quiz. What is your:
    - a. Fraction score
    - b. Decimal score
    - c. Percent score
  3. A survey says 0.6 of people prefer vanilla. What is this as a:
    - a. Fraction
    - b. Percent
  4. You get 30% off a \$50 pair of shoes. What do you pay?
- 

### Benchmarks & Estimation

5. Which is bigger?
    - a.  $\frac{1}{2}$  or 60%
    - b.  $\frac{1}{2}$  or 0.4
    - c. 70% or  $\frac{1}{2}$
  6. Estimate whether each is closer to 0%, 25%, 50%, 75%, or 100%:
    - a. 0.68
    - b.  $\frac{9}{10}$
    - c. 0.22
-

## Answer Key

### 1. Conversions

- a.  $\rightarrow 0.8 \rightarrow 80\%$
  - b.  $0.3 \rightarrow 3/10 \rightarrow 30\%$
  - c.  $12.5\% \rightarrow 0.125 \rightarrow 1/8$
  - d.  $\rightarrow 0.125 \rightarrow 12.5\%$
- 

### 2. Quiz Score

- a.  $18/20 \rightarrow 9/10$
  - b. 0.9
  - c. 90%
- 

### 3. Survey

- a.  $0.6 = 3/5$
  - b. 60%
- 

### 4. Discount

30% of 50 =  $0.30 \times 50 = 15$  You pay:  $50 - 15 = \mathbf{\$35}$

---

### 5. Compare

- a. Equal (  $= 60\%$  )
  - b. 0.4 is bigger
  - c. 70% is slightly more than
- 

### 6. Estimate

- a.  $\sim 75\%$
- b.  $\sim 100\%$
- c.  $\sim 25\%$

## 1.5 – Multiply, Divide & Compare Fractions

In Algebra, you'll work with fractions all the time — but not usually adding and subtracting them. What matters most is knowing how to **multiply**, **divide**, and **simplify** fractions to make expressions easier to work with.

In this lesson, you'll learn how to multiply and divide fractions with confidence, and how to compare them logically. These are skills you'll use throughout Algebra — especially when solving equations and simplifying rational expressions.

### Objectives

- ☐ Multiply and divide fractions and mixed numbers
- ☐ Simplify results using the GCF
- ☐ Compare fractions using multiplication or benchmarks

### Vocabulary

multiply, divide, fraction, reciprocal, simplify, compare

### Warm-Up

1. What's  $\frac{1}{3}$  of 12?
  2. What's the reciprocal of  $\frac{4}{5}$ ?
  3. Is  $\frac{3}{4}$  greater than  $\frac{1}{2}$ ? How do you know?
- 

### Learn Together

#### 1.5.1 – Multiplying Fractions

Multiply straight across:

**Numerators × Numerators Denominators × Denominators**

Example:

$$\frac{2}{3} \times \frac{5}{6} = \frac{2 \times 5}{3 \times 6} = \frac{10}{18}$$

Simplify:  $10/18 \rightarrow \mathbf{5/9}$

If possible, **simplify before multiplying**:

$$\frac{4}{5} \times \frac{10}{12} = \frac{2}{5} \times \frac{5}{6} = \frac{2 \times 5}{5 \times 6} = \frac{10}{30} = \frac{1}{3}$$

---

### 1.5.2 – Multiplying Mixed Numbers

**Step 1:** Convert to improper fractions **Step 2:** Multiply **Step 3:** Simplify if needed

Example:  $1\frac{1}{2} \times \frac{2}{3} \rightarrow 1\frac{1}{2} = \frac{3}{2} \rightarrow \frac{3}{2} \times \frac{2}{3} = \frac{6}{6} = \mathbf{1}$

---

### 1.5.3 – Dividing Fractions

To divide fractions, **multiply by the reciprocal** (flip the second fraction):

Example:

$$\frac{3}{4} \div \frac{2}{5} = \frac{3}{4} \times \frac{5}{2} = \frac{15}{8}$$

Mixed number: **1**



Don't flip the first fraction!

Only flip the second fraction — the one you're dividing by.

---

## 1.5.4 – Comparing Fractions

### Method 1: Use Benchmarks

Estimate which is closer to  $\frac{1}{2}$ ,  $\frac{2}{3}$ , or 1.

### Method 2: Use Common Denominators

Compare  $\frac{2}{3}$  and  $\frac{3}{4} \rightarrow \frac{2}{3} = 8/12 \rightarrow \frac{3}{4} = 9/12$  So  $\frac{3}{4}$  is greater.

### Method 3: Cross Multiply

$$\frac{3}{5} \text{ vs. } \frac{2}{3} \quad 3 \times 3 = 9 \quad 5 \times 2 = 10 \quad \text{Since } 10 > 9, \frac{2}{3} > \frac{3}{5}$$

---

## 1.5.5 – Why This Matters in Algebra

You'll use fraction multiplication and division when:

- Solving equations with fractional coefficients
- Simplifying rational expressions
- Finding slope
- Working with proportions

### In the Real World

You're painting a wall. The can says it covers  $\frac{1}{3}$  of a room. You buy 3 cans. How much will it cover?

$3 \times \frac{1}{3} = 1 \rightarrow$  Enough for **1 room**

---

## Practice On Your Own

### Multiplying Fractions

1. Multiply:

- a.  $\frac{2}{3} \times \frac{3}{5}$
  - b.  $\frac{4}{7} \times \frac{14}{15}$
  - c.  $1\frac{1}{2} \times$
  - d.  $\frac{3}{10} \times \frac{5}{6}$
- 

### Dividing Fractions

2. Divide:

- a.  $\frac{3}{4} \div \frac{1}{2}$
  - b.  $\frac{2}{5} \div \frac{3}{4}$
  - c.  $1 \div$
  - d.  $\frac{9}{10} \div \frac{3}{5}$
- 

### Compare the Fractions

3. Use any method to compare. Write  $>$ ,  $<$ , or  $=$ :

- a.  $\frac{\quad}{\quad} \frac{3}{4}$
  - b.  $\frac{3}{5} \frac{\quad}{\quad} \frac{2}{3}$
  - c.  $\frac{5}{6} \frac{\quad}{\quad} \frac{10}{12}$
  - d.  $\frac{7}{10} \frac{\quad}{\quad} \frac{2}{3}$
- 

### Challenge

- 4. A recipe uses  $\frac{3}{4}$  cup of flour for one batch. You want to make  $2\frac{1}{2}$  batches. How much flour will you need?
  - 5. A board is  $\frac{5}{6}$  meter long. You cut it into 3 equal pieces. How long is each piece?
-



## Answer Key

### 1. Multiplication

- a.  $6/15 = 2/5$
  - b.  $4/7 \times 14/15 \rightarrow \text{cancel } 7 \text{ \& } 14 \rightarrow 4 \times 2/1 \times 15 = 8/15$
  - c.  $3/2 \times 4/5 = 12/10 = 6/5 \text{ or } 1$
  - d.  $15/60 = 1/4$
- 

### 2. Division

- a.  $3/4 \div 1/2 = 3/4 \times 2/1 = 6/4 = 1\frac{1}{2}$
  - b.  $2/5 \times 4/3 = 8/15$
  - c.  $4/3 \div 2/3 = 4/3 \times 3/2 = 12/6 = 2$
  - d.  $9/10 \div 3/5 = 9/10 \times 5/3 = 45/30 = 3/2 = 1\frac{1}{2}$
- 

### 3. Comparisons

- a.  $< 3/4$
  - b.  $3/5 < 2/3$
  - c.  $5/6 = 10/12$
  - d.  $7/10 > 2/3$
- 

### 4. Recipe

$$3/4 \times 2\frac{1}{2} = 3/4 \times 5/2 = 15/8 = 1 \text{ cups}$$

### 5. Cutting the board

$$5/6 \div 3 = 5/6 \times 1/3 = 5/18 \text{ meter per piece}$$

## 1.6 – Order of Operations

What does this equal?

$$6 + 2 \times 3$$

If you said 24 — you’re not alone. But that’s **not** the correct answer. Math has rules for what to do first. These rules are called the **order of operations**, and they’re essential for simplifying expressions the right way.

In this lesson, you’ll learn to follow those rules consistently — even when negatives, fractions, and grouping are involved.

### Objectives

- ☐ Apply the correct order of operations (PEMDAS)
- ☐ Evaluate expressions involving integers and fractions
- ☐ Recognize common mistakes and avoid them

### Vocabulary

expression, order of operations, parentheses, exponent, multiply, divide, add, subtract

### Warm-Up

1. Simplify:  $3 + 6 \times 2$
2. True or False:  $(4 + 3) \times 2 = 4 + (3 \times 2)$
3. What does  $\frac{1}{2} \times (4 + 2)$  equal?

---

## Learn Together

### 1.6.1 – The Order Matters

The correct order is:

**P** – Parentheses **E** – Exponents **MD** – Multiply or Divide (left to right) **AS** – Add or Subtract (left to right)

This is often remembered as **PEMDAS**.

Multiply doesn't always come before divide. Same with add and subtract. You go **left to right** when they appear together.

---

### 1.6.2 – Basic Examples

1.

$$5 + 3 \times 2 = 5 + 6 = 11$$

2.

$$(5 + 3) \times 2 = 8 \times 2 = 16$$

3.

$$8 - 12 \div 3 = 8 - 4 = 4$$

---

### 1.6.3 – Include Negatives & Fractions

Watch how signs and simplification interact:

**Example 1:**


$$-3 \times (4 - 7) = -3 \times (-3) = 9$$

**Example 2:**

$$\frac{1}{2} \times (6 + 2) = \frac{1}{2} \times 8 = 4$$

**Example 3:**

$$\frac{3 + 5}{2} = \frac{8}{2} = 4$$

 Be careful with negatives!

$-3^2$  means  $-(3^2) = -9$  but  $(-3)^2 = 9$

---

### 1.6.4 – Complex Expressions

Put it all together:

**Example:**

$$4 + \frac{1}{2} \times (6 - 2)^2$$

Step 1: Parentheses  $\rightarrow (6 - 2) = 4$  Step 2: Exponents  $\rightarrow 4^2 = 16$  Step 3: Multiply  $\rightarrow \frac{1}{2} \times 16 = 8$  Step 4: Add  $\rightarrow 4 + 8 = \mathbf{12}$

## 1.6.5 – Why This Matters in Algebra

Later, expressions will include:

- Variables
- Distributive property
- Combining like terms

If students can't simplify numbers correctly, the algebra won't work either.

### In the Real World

You get a 25% off coupon and a \$10 gift card. The item costs \$40. Which should be applied first?

**25% of 40 = \$10 → pay \$30, then gift card = \$20 But  $40 - 10 = 30$ , then 25% off = \$22.50**

The order changes the result!

---

## Practice On Your Own

### Basic Order of Operations

1. Simplify:

- $4 + 6 \times 2$
- $(4 + 6) \times 2$
- $12 \div 4 \times 3$
- $12 \div (4 \times 3)$

---

### Include Negatives & Fractions

2. Simplify:

- $-2 \times (3 - 5)$
- $\frac{1}{2} \times (8 + 4)$
- $(6 - 2)^2 \div 2$
- $(3 + 5) \div 2$

---

### Expression Breakdown

3. Simplify:

- a.  $5 + 2 \times (6 - 1)$
  - b.  $(12 - 4)^2 \div 4$
  - c.  $10 - 3 \times (2 + 1)$
  - d.  $\frac{3}{4} \times (12 - 4)$
- 

### Challenge

4. Show two different ways to simplify:

$$8 - 3 + 2$$

Which is correct, and why?

5. Simplify:

$$\frac{4 + 6 \div 3}{2}$$

---

### Answer Key

#### 1. Basic

- a. 16
  - b. 20
  - c. 9
  - d. 1
- 

#### 2. Negatives/Fractions

- a.  $-2 \times (-2) = 4$
- b.  $\frac{1}{2} \times 12 = 6$

- c.  $(4)^2 \div 2 = 16 \div 2 = 8$   
d.  $8 \div 2 = 4$
- 

### 3. Expressions

- a.  $5 + 2 \times 5 = 5 + 10 = 15$   
b.  $8^2 \div 4 = 64 \div 4 = 16$   
c.  $10 - 3 \times 3 = 10 - 9 = 1$   
d.  $\frac{3}{4} \times 8 = 6$
- 

### 4. Challenge

$8 - 3 + 2 = (8 - 3) + 2 = 5 + 2 = \mathbf{7} \rightarrow$  This is correct because subtraction and addition go **left to right**

---

### 5. Final Problem

$6 \div 3 = 2 \rightarrow 4 + 2 = 6 \rightarrow 6 \div 2 = \mathbf{3}$

## **Part II**

# **Unit 2: Algebraic Expressions**



# Introduction

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## 2.1 Evaluating Expressions

You'll learn how to evaluate algebraic expressions by substituting values for variables.

### Objectives

- ☐ Evaluate expressions with one or more variables
- ☐ Use correct substitution and order
- ☐ Check your work for accuracy

### Vocabulary

expression, evaluate, substitute, variable

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## 2.2 Inputs, Outputs & Function Machines (Intro)

This introductory lesson explains how functions work using simple input-output models. This is the foundation for understanding functions throughout the course.

### Objectives

- ☐ Understand the concept of a function
- ☐ Match inputs with outputs
- ☐ Identify function rules from patterns

### Vocabulary

input, output, function, function rule

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## **Part III**

# **Unit 3: Solving Equations**

# Introduction

This unit is where Algebra really begins to feel like solving puzzles. You'll learn how to isolate variables, understand balance, and make sense of problems that come up in everyday life.

---

## What You'll Learn

By the end of this unit, you'll be able to:

- Solve one- and two-step equations using inverse operations
  - Distribute and combine like terms in multi-step equations
  - Move variables to one side of the equation
  - Identify when equations have no or infinite solutions
  - Write and solve equations from word problems and contexts
- 

## Topics in This Unit

### 3. Solving One- and Two-Step Equations

Use inverse operations to find solutions.

### 3. Multi-Step Equations with Distribution

Distribute, simplify, and solve more complex equations.

### 3. Equations with Variables on Both Sides

Move all variable terms to one side, then solve.

### **3. No Solution vs. Infinite Solutions**

Learn to recognize when an equation has no solution or all numbers work.

### **3. Writing Equations from Contexts**

Translate real-world problems into equations.

### **3. Solving with Tables, Graphs & Rules**

Connect functions to equations and problem-solving.

---

## **How to Use This Unit**

You'll find plenty of examples, visuals, and practice to help you develop confidence in solving equations from both numbers and words!

## 3.1 Solving One-Step & Two-Step Equations

In this lesson, students will learn how to solve one-step and two-step equations using inverse operations. This foundational skill sets the stage for solving more complex equations in future lessons.

### Objectives

- ☐ Use inverse operations to isolate the variable
- ☐ Solve one-step and two-step equations involving addition, subtraction, multiplication, or division
- ☐ Check solutions by substitution

### Vocabulary

equation, inverse operations, solution, variable

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## 3.2 Multi-Step Equations with Distribution

This lesson extends equation solving to multi-step problems, including those that require the distributive property and combining like terms.

### Objectives

- ☐ Apply the distributive property to simplify equations
- ☐ Combine like terms before solving
- ☐ Solve multi-step equations with multiple operations

### Vocabulary

distributive property, like terms, combine, simplify

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.



## 3.3 Equations with Variables on Both Sides

Students will learn how to solve equations where variables appear on both sides of the equals sign, reinforcing the concept of balancing and simplifying equations.

### Objectives

- ☐ Move variable terms to one side of the equation
- ☐ Simplify both sides before solving
- ☐ Identify equations with no or infinite solutions

### Vocabulary

combine like terms, variable, no solution, infinite solutions

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## 3.4 No Solution vs. Infinite Solutions

This lesson focuses on identifying when equations have no solution or infinitely many solutions and how to justify those conclusions.

### Objectives

- ☐ Recognize inconsistent equations with no solution
- ☐ Identify dependent equations with infinite solutions
- ☐ Justify solutions using substitution or reasoning

### Vocabulary

identity, contradiction, solution set, consistent, inconsistent

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## 3.5 Writing Equations from Real-Life Contexts

Students will translate real-world scenarios into algebraic equations, helping them understand the connection between math and everyday problem solving.

### Objectives

- ☐ Identify quantities and relationships in word problems
- ☐ Write algebraic equations to represent situations
- ☐ Solve and interpret solutions in context

### Vocabulary

context, representation, translate, real-world

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## 3.6 Solving with Tables, Graphs & Rules (Function Tie-In)

This lesson introduces multiple representations of relationships — including tables, graphs, and rules — to show how equations can be connected to functions.

### Objectives

- ☐ Solve equations by analyzing input-output tables
- ☐ Interpret relationships from graphs and equations
- ☐ Connect equations to real-world patterns

### Vocabulary

input, output, table, function, rule, graph

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## **Part IV**

### **Unit 4: Graphs and Patterns**

# Introduction

In this unit, we'll use visual and numerical patterns to understand how algebraic relationships behave. This helps us prepare for graphing and working with functions in more depth.

---

## What You'll Learn

- Recognize and extend arithmetic and geometric patterns
  - Build and interpret tables
  - Graph expressions and equations
  - Compare linear models using graphs
- 

## Topics in This Unit

### 4. Graphing Expressions with Tables

Use input-output tables to generate points.

### 4. Interpreting Graphs in Context

Make sense of graphs in stories and real-life settings.

### 4. Arithmetic vs. Geometric Patterns

Identify whether change is constant or multiplicative.

#### **4. Linear Modeling & Rate of Change**

Build linear functions and interpret slope in context.

#### **4. Estimating and Checking with Graphs**

Use visuals to verify solutions.

---

### **How to Use This Unit**

Graphing builds a strong link between abstract algebra and concrete understanding. Let's get visual!

## 4.1 Graphing Expressions with Tables

In this lesson, students will learn how to create tables of values for algebraic expressions and plot them on a coordinate plane. This builds foundational understanding of how algebraic rules connect to visual patterns.

### Objectives

- ☐ Generate tables of values from algebraic expressions
- ☐ Graph ordered pairs on the coordinate plane
- ☐ Recognize linear patterns in tables and graphs

### Vocabulary

expression, table, ordered pair, coordinate plane, input, output

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.



## 4.2 Interpreting Graphs in Context

Students will examine graphs that represent real-world scenarios and learn how to describe the relationships shown. Emphasis is placed on labeling axes, identifying trends, and understanding what changes in slope mean.

### Objectives

- ☐ Identify variables and units from graph labels
- ☐ Describe trends in linear graphs
- ☐ Interpret slope and intercepts in context

### Vocabulary

x-axis, y-axis, slope, intercept, context, trend

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## 4.3 Arithmetic vs. Geometric Patterns

Students will compare arithmetic and geometric patterns and recognize how they grow. This helps build pattern recognition and introduces exponential growth.

### Objectives

- ☐ Identify arithmetic patterns using constant differences
- ☐ Identify geometric patterns using constant ratios
- ☐ Generate sequences and compare their growth

### Vocabulary

arithmetic, geometric, sequence, common difference, common ratio, pattern

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## 4.4 Linear Modeling & Rate of Change

This lesson focuses on creating linear models from real-life data. Students will identify constant rates of change and use equations to model situations.

### Objectives

- ☐ Recognize and describe constant rate of change
- ☐ Write linear equations to represent situations
- ☐ Interpret slope and intercepts from data

### Vocabulary

linear model, rate of change, slope, intercept, data

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## 4.5 Estimating and Checking with Graphs

Students will use graphs to estimate values and verify solutions to equations. This lesson ties visual reasoning to algebraic work.

### Objectives

- ☐ Estimate input or output values from a graph
- ☐ Use a graph to verify equation solutions
- ☐ Analyze how accurate a graph-based solution is

### Vocabulary

estimate, graph, solution, verify, input, output

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## **Part V**

# **Unit 5: Inequalities**

# Introduction

Sometimes in life, it's not about finding the exact number — it's about knowing what's greater or less. In this unit, you'll explore how to express and graph inequalities.

---

## What You'll Learn

- Solve and graph inequalities on number lines
  - Write inequalities from real-world contexts
  - Understand “greater than” and “less than” symbols
  - Explore compound inequalities (optional)
- 

## Topics in This Unit

### 5. One- and Two-Step Inequalities

Use similar steps as equations to isolate variables.

### 5. Graphing on a Number Line

Use open and closed circles to represent solutions.

### 5. Writing Inequalities from Situations

Turn words into math using inequality symbols.

## **5. Interpreting Graphs with Constraints**

Match real-world limits to graphs.

## **5. Compound Inequalities (Optional)**

Handle ranges like “between 2 and 5”.

---

## **How to Use This Unit**

Use drawings and comparisons to make inequality concepts more concrete and real-world focused.

## 5.1 One- and Two-Step Inequalities

In this lesson, students will learn how to solve one-step and two-step inequalities and graph the solutions on a number line.

### Objectives

- ☐ Solve one-step inequalities using addition, subtraction, multiplication, and division
- ☐ Solve two-step inequalities
- ☐ Graph the solution sets on a number line

### Vocabulary

inequality, solution, greater than, less than, number line

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.



## 5.2 Graphing on a Number Line

Students will practice representing solutions to inequalities by graphing them on a number line, including open and closed circles.

### Objectives

- ☐ Understand the use of open and closed circles on a number line
- ☐ Graph simple inequalities
- ☐ Interpret solution sets visually

### Vocabulary

number line, open circle, closed circle, graph, solution set

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## 5.3 Writing Inequalities from Situations

This lesson teaches students to write inequalities based on verbal descriptions and real-world contexts.

### Objectives

- ☐ Translate real-world problems into inequalities
- ☐ Identify keywords that signal inequality relationships
- ☐ Solve and interpret contextual inequalities

### Vocabulary

verbal model, inequality, context, translate, interpret

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## 5.4 Interpreting Graphs with Constraints

Students will explore how to read and make sense of graphs that include constraints or limited domains and ranges.

### Objectives

- ☐ Analyze graphs that include limited domains or ranges
- ☐ Interpret constraints in real-world situations
- ☐ Relate inequalities to graphical representations

### Vocabulary

constraint, domain, range, graph, inequality

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## 5.5 Compound Inequalities (Optional)

Students will be introduced to compound inequalities, learning how to solve and graph problems with two connected inequalities.

### Objectives

- ☐ Understand compound inequalities using ‘and’ and ‘or’
- ☐ Solve compound inequalities
- ☐ Graph compound inequalities on a number line

### Vocabulary

compound inequality, and, or, solution set, number line

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## **Part VI**

# **Unit 6: Linear Relationships**

# Introduction

Linear equations are a powerful way to describe change. Whether it's cost, speed, or growth, this unit shows how lines help us understand the world.

---

## What You'll Learn

- Graph lines using slope and intercepts
  - Interpret slope as a rate of change
  - Write equations from tables, graphs, or situations
  - Compare different linear situations
- 

## Topics in This Unit

### 6. Coordinate Plane & Graphing

Plot ordered pairs and recognize axes.

### 6. Understanding Slope

Learn how steepness shows change.

### 6. Slope-Intercept Form

Graph and write lines using  $y = mx + b$ .

## **6. Writing Equations from Graphs or Words**

Use information to build your own equations.

## **6. Comparing Models**

See how different lines behave and what they represent.

## **6. Applications**

Use linear models for real-world math.

---

## **How to Use This Unit**

This unit brings it all together — tables, equations, and graphs help us tell a full story.

# 6.1 The Coordinate Plane and Graphing from Tables

This lesson introduces the coordinate plane and helps students practice plotting points and graphing from tables.

## Objectives

- ☐ Identify and label the x- and y-axes
- ☐ Plot ordered pairs on the coordinate plane
- ☐ Graph data from tables

## Vocabulary

coordinate plane, x-axis, y-axis, origin, ordered pair

## Warm-Up

Coming soon.

## Learn Together

Coming soon.

## Practice On Your Own

Coming soon.



## 6.2 Understanding Slope as Rate of Change

Students will explore slope as a measure of how one quantity changes in relation to another, using graphs and real-world contexts.

### Objectives

- ☐ Define slope as a rate of change
- ☐ Interpret slope from a graph or context
- ☐ Calculate slope using tables or graphs

### Vocabulary

slope, rate of change, rise, run, linear relationship

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## 6.3 Slope-Intercept Form

This lesson introduces the slope-intercept form of a linear equation and how to use it to graph lines.

### Objectives

- ☐ Understand the form  $y = mx + b$
- ☐ Identify slope and y-intercept
- ☐ Graph a line using slope and intercept

### Vocabulary

slope-intercept form, slope, y-intercept, linear equation

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## 6.4 Writing Equations from Graphs or Words

Students learn to write linear equations from graphs, tables, or written descriptions of relationships.

### Objectives

- ☐ Write linear equations from graphs or data
- ☐ Translate real-world relationships into equations
- ☐ Use slope and intercept in context

### Vocabulary

linear equation, slope, y-intercept, context, model

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## 6.5 Comparing Linear Models from Graphs or Data

Students compare multiple linear models by analyzing graphs and data sets.

### Objectives

- ☐ Compare different linear relationships
- ☐ Analyze graphs and tables for patterns
- ☐ Interpret slope and intercept in context

### Vocabulary

linear model, compare, rate of change, initial value

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## 6.6 Applications: Cost, Speed, Growth

This lesson applies linear modeling to real-life contexts like cost, speed, and growth.

### Objectives

- ☐ Apply linear equations to real-life situations
- ☐ Create and interpret graphs in context
- ☐ Understand the meaning of slope and intercept in real-life problems

### Vocabulary

cost, speed, growth, context, linear relationship

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## **Part VII**

### **Unit 7: Exponents and Powers**

# Introduction

Exponents let us write repeated multiplication more easily. In this unit, you'll learn the rules for working with exponents to simplify expressions.

---

## What You'll Learn

- Multiply and divide expressions with exponents
  - Apply exponent rules (no scientific notation)
  - Understand zero and negative exponents
- 

## Topics in This Unit

### 7. Multiplying with Exponents

Use the product rule.

### 7. Dividing with Exponents

Use the quotient rule.

### 7. Power of a Power

Apply powers to powers.

## 7. Zero & Negative Exponents

Learn their meaning and use them simply.

---

### How to Use This Unit

Use guided examples and repetition to get comfortable with patterns in exponent rules.



## 7.1 Multiplying with Exponents

In this lesson, you'll learn how to multiply expressions that contain exponents. This is a key part of working with powers and simplifying expressions efficiently.

### Objectives

- ☐ Multiply powers with the same base
- ☐ Understand and apply the product of powers rule
- ☐ Simplify expressions with exponents

### Vocabulary

exponent, base, product of powers rule

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## 7.2 Dividing with Exponents

This lesson focuses on how to divide expressions with the same base using exponents. You'll build on what you know about multiplication and simplify complex expressions.

### Objectives

- ☐ Divide powers with the same base
- ☐ Apply the quotient of powers rule
- ☐ Simplify expressions involving division and exponents

### Vocabulary

quotient, base, exponent

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## 7.3 Power of a Power

You'll learn how to raise an exponent to another exponent. This is useful for simplifying more complex expressions and working with formulas.

### Objectives

- ☐ Use the power of a power rule
- ☐ Simplify nested exponents
- ☐ Combine exponent rules to simplify expressions

### Vocabulary

exponent, power of a power, simplify

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## 7.4 Zero and Negative Exponents (Intro only)

This lesson introduces zero and negative exponents. You'll explore what these mean and how they behave in expressions.

### Objectives

- ☐ Understand and apply the zero exponent rule
- ☐ Explore the meaning of negative exponents
- ☐ Simplify expressions with zero and negative exponents

### Vocabulary

zero exponent, negative exponent, reciprocal

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## **Part VIII**

# **Unit 8: Quadratic Thinking**

# Introduction

Quadratic equations make parabolas, not lines! This unit introduces key forms and solution methods, especially factoring and the quadratic formula.

---

## What You'll Learn

- Identify quadratic forms
  - Factor simple trinomials
  - Solve quadratics by factoring and formula
  - Compare graphs of quadratics and lines
- 

## Topics in This Unit

### 8. Recognizing Quadratics

Understand what makes an equation quadratic.

### 8. Factoring

Break expressions into binomials.

### 8. Solving by Factoring

Set equal to zero and find solutions.

## **8. Quadratic Formula (Intro)**

Use the formula to solve when factoring is hard.

## **8. Graphing Parabolas**

See how the shape differs from linear graphs.

---

## **How to Use This Unit**

This unit prepares students for what's tested and what's useful long-term.

## 8.1 Recognizing Quadratic Equations

In this lesson, students will learn to identify quadratic equations by their standard form and understand what makes them different from linear equations.

### Objectives

- ☐ Recognize quadratic equations in standard form:  $ax^2 + bx + c$
- ☐ Identify the key features that make an equation quadratic
- ☐ Distinguish between linear and quadratic relationships

### Vocabulary

quadratic, parabola, standard form, coefficient

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.



## 8.2 Factoring Simple Quadratics

This lesson introduces the process of factoring quadratic expressions where the leading coefficient is 1.

### Objectives

- ☐ Factor simple quadratic expressions of the form  $x^2 + bx + c$
- ☐ Use factoring to find the roots of a quadratic equation
- ☐ Check factored expressions by expanding

### Vocabulary

factor, root, binomial, quadratic expression

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## 8.3 Solving by Factoring

Students will learn how to solve quadratic equations by factoring and setting each factor equal to zero.

### Objectives

- ☐ Solve quadratic equations using factoring
- ☐ Apply the zero product property
- ☐ Interpret solutions in context

### Vocabulary

zero product property, solution, quadratic equation

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## 8.4 The Quadratic Formula (Intro)

This lesson introduces the quadratic formula as a method for solving any quadratic equation, especially when factoring is not straightforward.

### Objectives

- ☐ Identify the components of the quadratic formula
- ☐ Use the quadratic formula to solve quadratic equations
- ☐ Understand when the formula is useful compared to factoring

### Vocabulary

quadratic formula, discriminant, solution, standard form

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## 8.5 Graphing Parabolas by Table & Comparing with Linear

Students will use tables to graph quadratic functions and compare their shapes and behaviors with linear functions.

### Objectives

- ☐ Graph quadratic functions using input-output tables
- ☐ Identify the vertex and axis of symmetry from a graph
- ☐ Compare quadratic and linear graphs

### Vocabulary

vertex, axis of symmetry, parabola, table of values

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## **Part IX**

# **Unit 9: Systems of Equations**

# Introduction

Sometimes two equations work together. A system shows how two relationships interact. This unit is optional but powerful.

---

## What You'll Learn

- Understand what a system is
  - Solve systems by graphing or substitution
  - Apply systems to real-life problems
- 

## Topics in This Unit

### 9. What Is a System?

Understand the idea of two equations and one solution.

### 9. Solving by Graphing

Find where lines intersect.

### 9. Substitution (Optional)

Plug one equation into another to find solutions.

## **9. Word Problems with Systems**

Use systems to model stories or scenarios.

---

### **How to Use This Unit**

Best taught after mastery of equations and graphing — use visuals and pair work!

## 9.1 What Is a System?

This lesson introduces the concept of a system of equations—two or more equations that share variables. Students learn how solutions to systems represent points that satisfy all equations involved.

### Objectives

- ☐ Define what a system of equations is
- ☐ Identify solutions to systems from graphs and tables
- ☐ Understand consistent vs. inconsistent systems

### Vocabulary

system of equations, solution, consistent, inconsistent

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.



## 9.2 Solving by Graphing

Students learn to solve systems of equations by graphing each equation and identifying the intersection point. This visual approach builds on prior graphing skills and deepens conceptual understanding.

### Objectives

- ☐ Graph linear equations
- ☐ Determine the solution to a system by finding where two lines intersect
- ☐ Interpret real-world meaning from the graph

### Vocabulary

graphing, intersection, solution, coordinate

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## 9.3 Substitution Method (Optional)

This lesson introduces substitution as an algebraic method to solve systems of equations. Students practice solving one equation for a variable and substituting into the other.

### Objectives

- ☐ Solve one equation for one variable
- ☐ Substitute expressions to solve systems algebraically
- ☐ Check solutions for accuracy

### Vocabulary

substitution, isolate, expression, solution

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## 9.4 Word Problems with Systems

Students apply their knowledge of systems of equations to solve word problems. They learn to represent real-life situations with systems and interpret their solutions in context.

### Objectives

- ☐ Translate real-world scenarios into systems of equations
- ☐ Solve using graphing or substitution
- ☐ Interpret solutions in context

### Vocabulary

system, context, real-world, model

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## **Part X**

# **Unit 10: Cumulative Review and Projects**

# Introduction

The final unit ties everything together. Reflect, review, and show what you know through projects and EOC practice.

---

## What You'll Learn

- Use vocabulary and concepts from the whole course
  - Create graphs, tables, and equations for real-world data
  - Review core topics for the final exam or state test
- 

## Topics in This Unit

### 10. Vocabulary Review

Define and use terms from the course.

### 10. Real-World Projects

Apply math to something meaningful.

### 10. Presentations

Explain your thinking visually and clearly.

## **10. Final Review or EOC Practice**

Practice key problems to prepare for success.

---

### **How to Use This Unit**

Encourage creativity and depth of understanding. Show off what you've learned!

# 10.1 Vocabulary Review

In this lesson, we'll review the key vocabulary from this course and reinforce understanding through matching, definitions, and real-world examples.

## Objectives

- ☐ Review and define key algebra vocabulary terms
- ☐ Apply vocabulary in math contexts and explanations
- ☐ Recognize terms in problems and relate them to math operations

## Vocabulary

term, coefficient, constant, expression, equation, solution, function

## Warm-Up

Coming soon.

## Learn Together

Coming soon.

## Practice On Your Own

Coming soon.

## 10.2 Real-World Projects (Graphs + Tables + Equations)

This lesson applies everything we've learned to real-world situations using data, graphs, tables, and equations to make connections and solve problems.

### Objectives

- ☐ Interpret and analyze real-world data
- ☐ Represent situations with tables, graphs, and equations
- ☐ Explain connections between different representations

### Vocabulary

data, table, graph, equation, relationship, pattern

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.



## 10.3 Group Presentations or Visual Reports

Students will collaborate on a final presentation or report to demonstrate their learning, using mathematical vocabulary, visuals, and examples.

### Objectives

- ☐ Create a visual or oral presentation using math content
- ☐ Work collaboratively to explain mathematical ideas
- ☐ Use accurate vocabulary and representations in communication

### Vocabulary

presentation, visual, explanation, evidence, support

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

## 10.4 Final Assessment or EOC Practice

This lesson offers a chance to show mastery of key Algebra concepts through a final assessment or EOC-style practice problems.

### Objectives

- ☐ Demonstrate understanding of major Algebra concepts
- ☐ Solve a variety of equations and interpret representations
- ☐ Apply skills learned to novel and test-like problems

### Vocabulary

equation, function, graph, solution, expression

### Warm-Up

Coming soon.

### Learn Together

Coming soon.

### Practice On Your Own

Coming soon.

**Part XI**

**Supplemental**

# Supplemental Materials

Welcome to the **Supplemental Materials** section of this course! This is where you'll find all the fun, extra, and just plain interesting math content that doesn't quite fit into the main units — but still helps build understanding, spark curiosity, or offer a little challenge.

Use these resources to: - Practice your skills in new and creative ways - Explore math puzzles and logic games - Reinforce key concepts from class - Take a brain break with something still mathy (but fun!)

## Math Games & Puzzles

Number grids, logic puzzles, equation word searches, and more.

## Extra Practice Worksheets

Targeted drills and alternative problem sets.

## Challenge Problems

For students who want to push their thinking further.

## Math Activities

Open-ended or interactive things to try out

---

Happy exploring!

# Math Games and Puzzles

Explore these fun and challenging math activities! Click on any worksheet to open the PDF.

---

## Hidden Math Problems

**Practice:** Arithmetic operations, pattern recognition

**How it works:** Find groups of 3 numbers in the grid. Add, subtract, multiply, or divide the first two to get the third. Problems may be horizontal, vertical, or diagonal.

[Download Worksheet](#)

---

Want to suggest an activity or submit your own? Let me know!

# Glossary

## Absolute value

The distance a number is from zero on a number line, always expressed as a positive number or zero.

Example: The **absolute value** of  $-7$  is  $7$ .

---

## Algebra

Algebra is a branch of math that uses letters and symbols to represent numbers and relationships.

It lets us describe patterns, write rules, and solve problems that work in many different situations.

---

## Calculus

Calculus is a branch of math that helps us understand change and motion.

It's used to study how fast things move, how things grow or shrink, and how to find exact areas or curves.

---

## Composite number

A composite number has more than two factors.

That means it can be divided evenly by numbers other than 1 and itself.

Example: 12 is composite because 2, 3, 4, and 6 all divide it evenly.

---

## Denominator

The denominator is the **bottom number** in a fraction. It tells **how many equal parts** the whole is divided into.

Example: In the fraction  $\frac{3}{4}$ , the **denominator** is 4.

---

## Equation

An equation is a math sentence that says two things are equal.

It has an equals sign (=) and shows a relationship between numbers or expressions.

Examples:  $2 + 3 = 5$  and  $x + 1 = 7$

---

## Expression

An expression is a math phrase made of numbers, variables, or both — but it doesn't have an equals sign.

Examples:  $3x + 2$   $7 - y$   $5(a - 1)$

---

## Factor

A factor is a whole number that divides another number evenly — with no remainder.

If you can split something into equal groups with no leftovers, the group size is a factor.

Example: 3 is a factor of 12 because  $3 \times 4 = 12$ .

---

## Factoring

Factoring means breaking something down into smaller parts that multiply together to make it.

Examples:

- Factoring a number: 12 can be factored into  $3 \times 4$  or  $2 \times 6$ .
  - Factoring an expression:  $x^2 + 5x + 6$  can be factored into  $(x + 2)(x + 3)$ .
- 

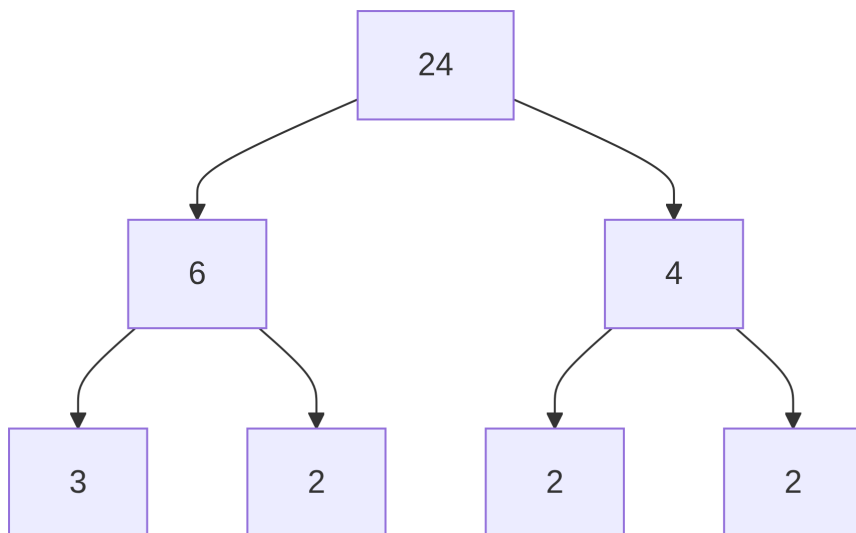
## Factor tree

A factor tree is a way to break a number into its smallest building blocks — the prime numbers that multiply to make it.

You keep splitting the number into smaller factors until you can't go any further.

Example: Here is a factor tree for 24:





This tells us that the **prime factorization** of 24 is  $2^3 \cdot 3$ .

---

## Fraction

A fraction shows a part of a whole. It has a **numerator** (top number) and a **denominator** (bottom number).

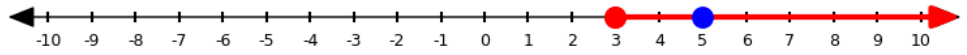
The denominator tells how many equal parts the whole is divided into, and the numerator tells how many of those parts you have.

Example: In  $\frac{3}{4}$ , the fraction means **3 out of 4** equal parts.

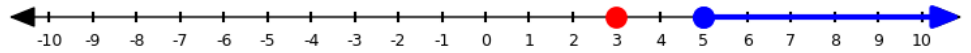
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## Greater than

A number is greater than ( $>$ ) another number if it is further to the right on the number line.



Example:  $5 > 3$  is true

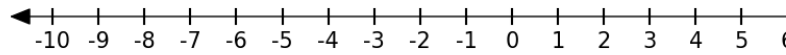


but  $3 > 5$  is false

---

## Horizontal

Side to side, like the horizon. Level ground is horizontal.



Example: This is a horizontal number line.

---

## Integer

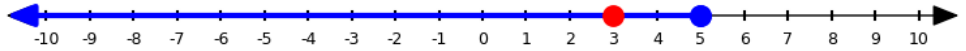
An integer is a whole number (not a fraction or decimal) that can be positive, negative, or zero.

Examples: -3, 0, 5, 100

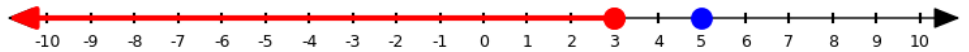
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## Less than

A number is less than ( $<$ ) another number if it is further to the left on the number line.



Example:  $3 < 5$  is true



but  $5 < 3$  is false

---

## Multiple

A multiple is what you get when you multiply a number by 1, 2, 3, and so on.

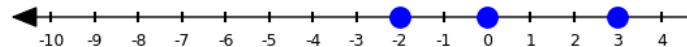
Example: 5, 10, 15, and 20 are all multiples of 5.

---

## Number line

A straight line used to show numbers in order. It usually has zero in the middle, with positive numbers to the right and negative numbers to the left.

Number lines help you visualize math operations and compare values.



Example: -2, 0, and 3 are all on the number line.

---

## Numerator

The numerator is the **top number** in a fraction. It tells **how many parts** you have.

Example: In the fraction  $\frac{3}{4}$ , the **numerator** is 3.

---

## Negative

A number is negative if it is less than zero.

On a number line, negative numbers are to the left of zero.

Example: -4 is a negative number.

---

## Opposite

Two numbers that are the same distance from zero on a number line, but on opposite sides.

Their sum is always zero.

Example: -3 and 3 are opposites.

---

## Positive

A number is positive if it is greater than zero.

On a number line, positive numbers are to the right of zero.

Example: 5 is a positive number.

---

## Prime number

A prime number has exactly two factors: 1 and itself.

Examples: 2, 3, 5, 7, 11

---

## Prime factorization

Prime factorization means writing a number as a product of prime numbers.

Example:  $18 = 2 \times 3 \times 3$  or  $2 \times 3^2$

These are the prime building blocks of 18.

---

## Product

A product is the **result of multiplying** two or more numbers.

Example: The product of 4 and 6 is 24, because  $4 \times 6 = 24$ .

---

## Quotient

A quotient is the **result of dividing** one number by another.

Example: The quotient of 20 divided by 5 is 4, because  $20 \div 5 = 4$ .

---

## Remainder

A remainder is what's left over after dividing when the number doesn't go in evenly.

Example:  $10 \div 3 = 3$  with a remainder of 1, because  $3 \times 3 = 9$  and there's 1 left.

---

## Sum

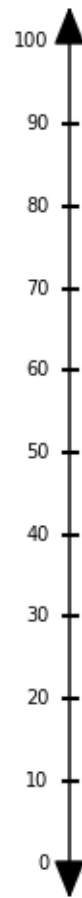
A sum is the **result of adding** two or more numbers.

Example: The sum of 7 and 8 is 15, because  $7 + 8 = 15$ .

---

## Vertical

Up and down, like a flagpole.



Example: This is a vertical number line.

