DHS Algebra 1

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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.

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! This is where you'll build your Algebra toolkit — skills like working with integers, simplifying fractions, and following the order of operations.

You'll use these tools again and again to solve expressions, equations, and real-world problems throughout the year.

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
- Solve real-world problems using fractions, decimals, and percents
- Follow the correct order of operations to simplify expressions

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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 – Conversions
Convert between different number forms and compare them.

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

Solving Problems with Fractions, Decimals & Percents
Solve real-world problems using these different number forms.

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

Curious how much of this you know already? Try the Unit 1 pre-test!

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.

- ☐ I know how to read and use a number line
- ☐ I can find and describe the opposite of a number
- ☐ I can compare positive and negative numbers using >, <, and =
- ☐ I can add and subtract integers on a number line

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!

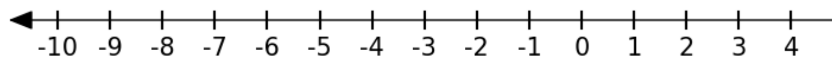
1. What number is exactly halfway between 3 and 9?
2. Which number is bigger: -4 or -9?
3. Which number is farther from 0: -7 or 5?

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.

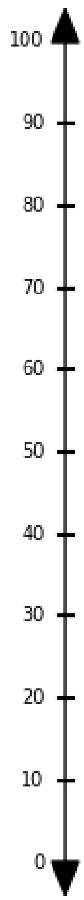
- Numbers to the **right** of zero are positive
- Numbers to the **left** of zero are negative

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?

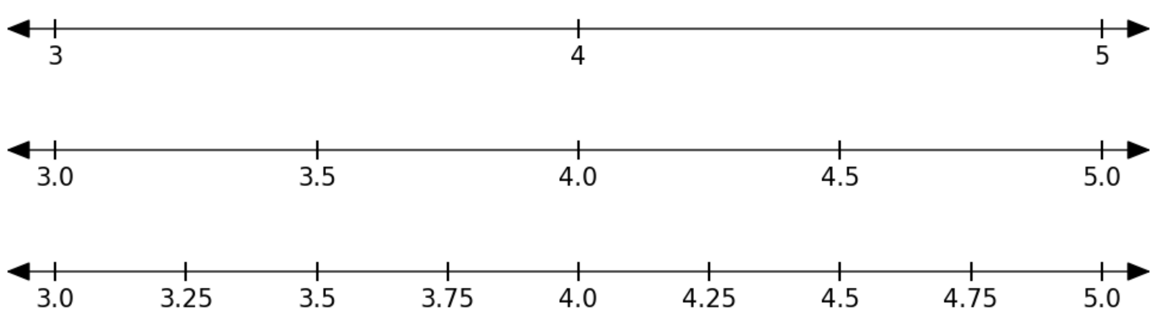
Yes! Number lines can be drawn over different ranges and scales. For example, here is a number line that counts from -10 to 25 in steps of 5.

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.



Example: How many numbers between 3 and 5?

If you are counting integers, there is 1 integer between 3 and 5 (just 4). But if you mean real numbers, there are infinitely many between 3 and 5. Here are some number lines that might help convince you.



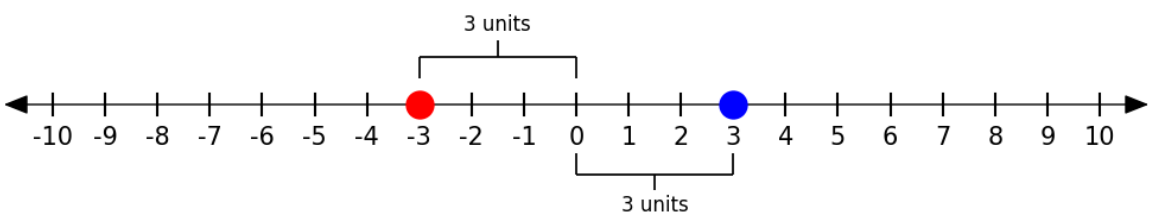
Here are a few examples:

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

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.

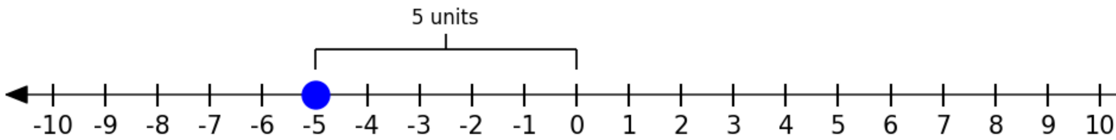


The opposite of zero is zero. Zero is the only number that is its own opposite!

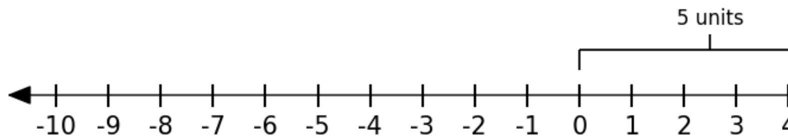
1.1.3 - What Is Absolute Value?

Absolute value measures the **distance from zero**. Absolute value is written as a number between two bars. For example, **the absolute value of -5** is written $|-5|$.

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

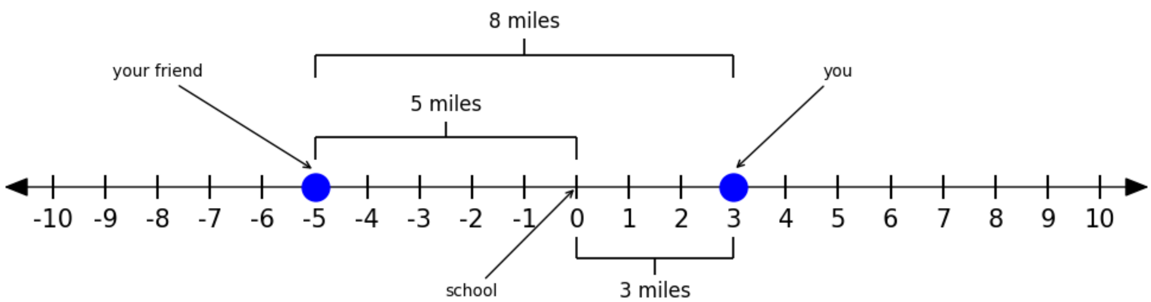


units away from zero.



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

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.

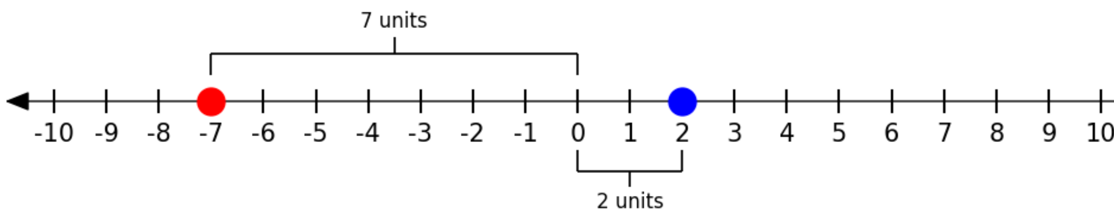


You can compute your distances by adding |-5| + |3|, by |-5 - 3|, or by |3 - (-5)|. All three of these give the same answer, 8 miles. What would change if we did not use absolute value?

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.



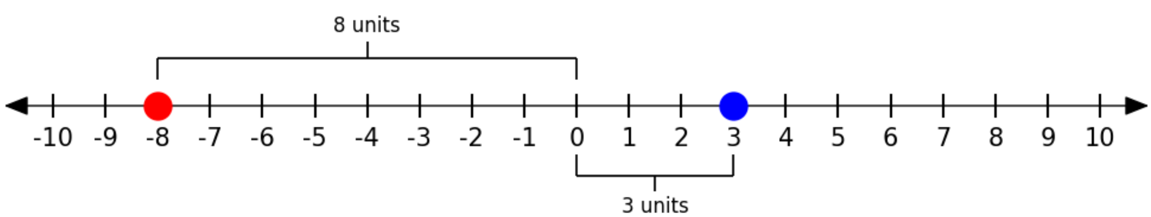
Let's compare 2 to -7.

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 farther from zero than 2 and so |-7| > |2|.

It is easy to get confused here. When we say which number is "bigger" (or greater than), we are asking which number is farther to the right on the number line. This is **not** the same as absolute value, which asks which one is furthest from zero.

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

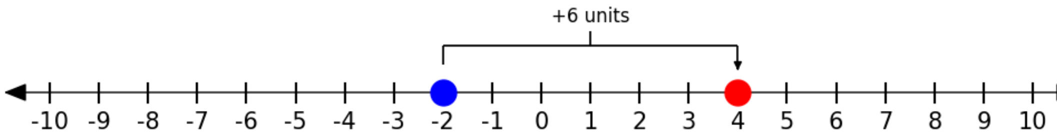


1.1.5 - Number Lines and Arithmetic

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

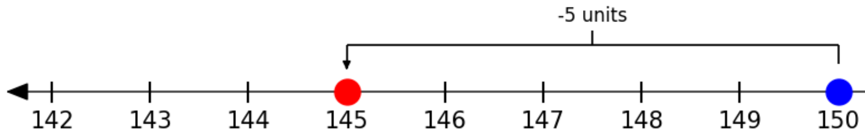
- To add a positive number, move **right**
- To add a negative number, move **left**

Examples:



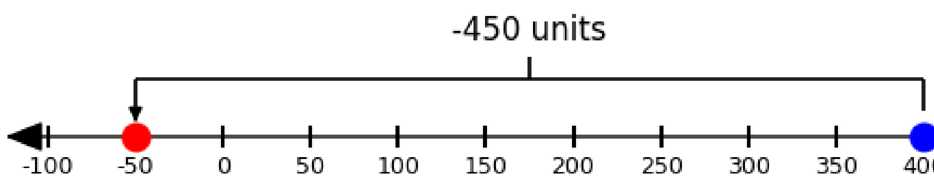
1. Addition: $-2+6=4$

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



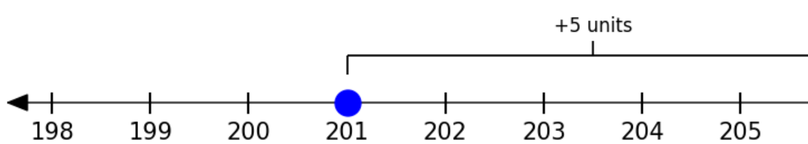
2. Adding a negative: $150+(-5)=145$

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



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

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



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

   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

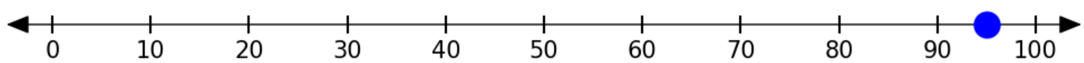
1. Draw a number line that shows:

   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

  a. The temperature was -12°F. It warms up by 20°. What is the new temperature?

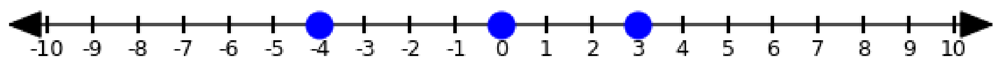
  b. A diver is 45 feet below sea level. She dives 30 feet deeper. How far down is she?

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

Warm-Up

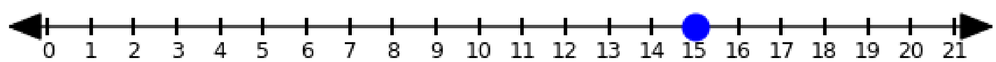
1. 6
2. -4
3. -7

Working With Number Lines

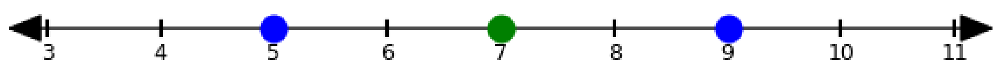


1. a.

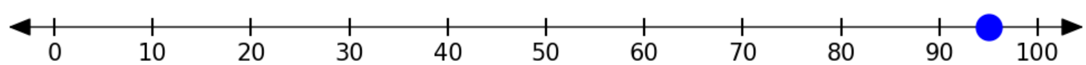
   b. *Answers vary. Here is what a 15-year-old would show:*



   c. 7



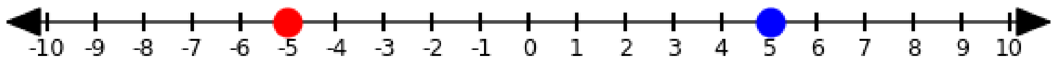
2. *Example question:* "What was the temperature on July 4th?"



Opposites

3. -42
4. 3

5. *Answers vary. Example:*



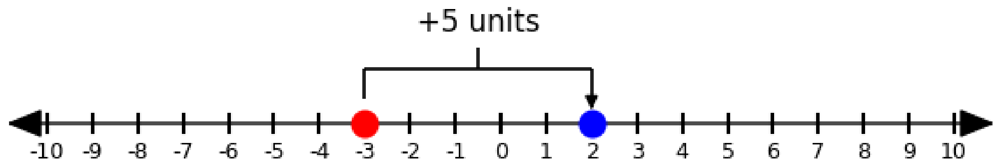
6. Yes — the opposite is -3.5

Comparing Numbers

7. 5 is greater (farther right on the number line)
8. -10 has the greater absolute value (10 > 5)
9. Yes — 28 is greater because it is to the right of -30
10. a. -11 > -13
    b. 7 > -2
    c. |-3| < |5| (3 < 5)
11. a. -4 > -5
    b. 3 > -7
    c. |-5| > |4| (5 > 4)
12. a. 2 > -7

    b. *Answers vary — for example, 2025 > 1985*

Addition and Subtraction


+5 units
-10
-9
-8
-7
-6
-5
-4
-3
-2
-1
0
1
2
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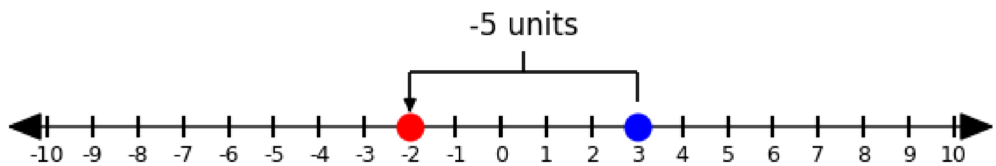
5
6
7
8
9
10

13. a.


-5 units
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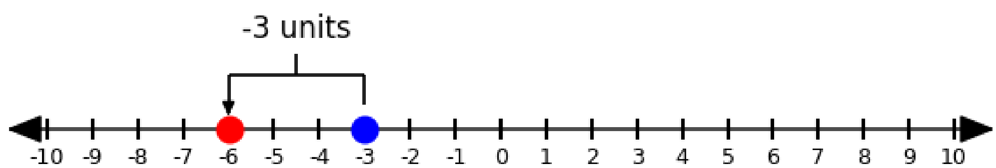
b.


-3 units
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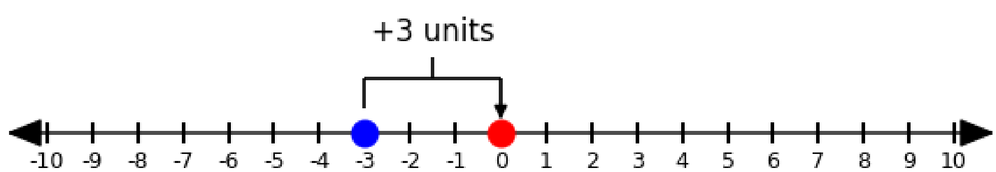
c.


+3 units
-10
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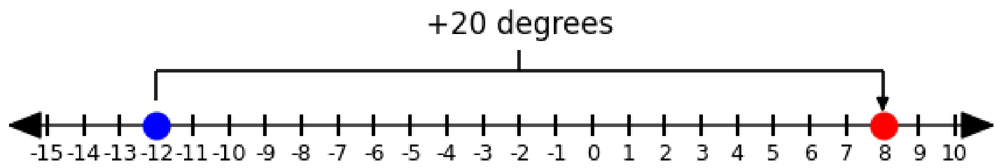
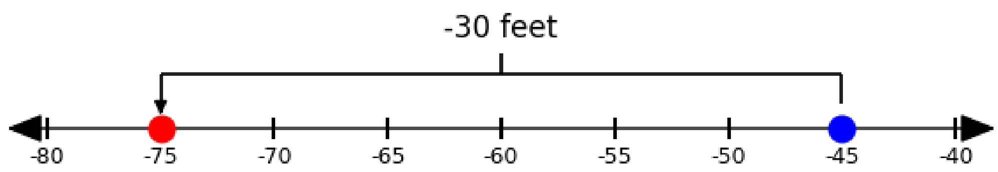
d.

Word Problems

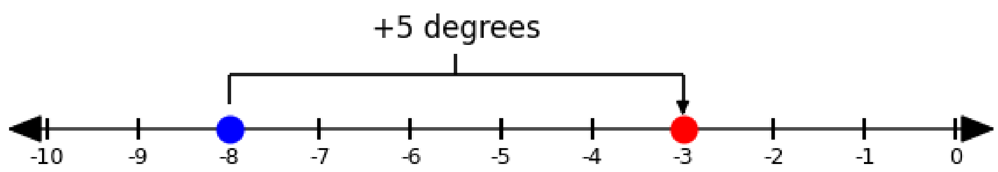
14. a. 8°F



b. 75 feet down



c. -$3



1.2 - Factors, Multiples & Prime Factorization

Have you ever had to split something up evenly — like slices of pizza or players on a team? That's really what factors are about: dividing numbers into equal parts.

In this lesson, you'll learn how to:

- Spot factors and multiples.
- Tell if a number is prime number or composite number.
- Break numbers into their basic building blocks using a factor tree.

You'll use these skills again and again — from simplifying fractions to solving equations.

☐ I can find the factors and multiples of integers
☐ I can tell if a number is prime or composite
☐ I can break numbers into prime factors using a factor tree

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

Warm-Up

1. How many different pairs of whole numbers can you multiply to get 36?
2. How many whole numbers can you multiply by 7 and still get a result less than 50?
3. Can you find more than one pair of whole numbers that multiply to make 13?

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 12

That's because:

$1 \times 12 = 12$

$2 \times 6 = 12$

$3 \times 4 = 12$

Only one number does: **1**. It only has itself as a factor!

1.2.2 - What Are Multiples?

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

Example:

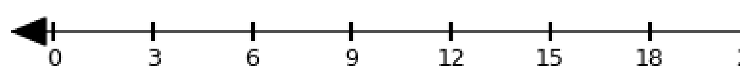
Here are the first few multiples of 5:

$5, 10, 15, 20, 25, 30, \ldots$

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.

If a bus comes every 15 minutes, the arrival times are multiples of 15.

1.2.3 - Prime vs. Composite

Some numbers can only be divided evenly two ways — others can be broken into many parts. Let's explore the difference between prime numbers and composite numbers.

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…

People around the world spend years searching for giant prime numbers. The largest ones we've found so far have over 24 million digits!

Why go to all that trouble?

Prime numbers are the secret behind modern encryption. They're used to protect everything from bank accounts to private messages. The bigger the primes, the harder they are to break — which is why finding huge ones is such a big deal.

It's like a global math scavenger hunt… with real-world consequences.

1.2.4 - Prime Factorization and Factor Trees

Every number can be broken into a product of prime numbers — sort of like breaking a LEGO® sculpture into individual bricks. These prime factors are the basic building blocks of all whole numbers.

We use **factor trees** to find these prime factors. This isn't just a fun trick — it builds your number sense: your ability to see patterns, understand how numbers are structured, and work confidently with them.

That number sense will come in handy later when you:

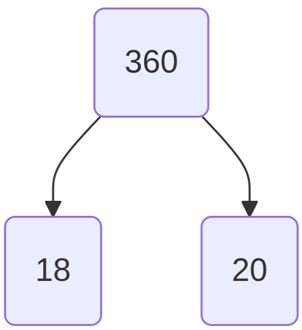
- Simplify fractions
- Solve equations
- Factor algebraic expressions

Let's build a factor tree for **360** to see how it works.

Steps to Make a Factor Tree

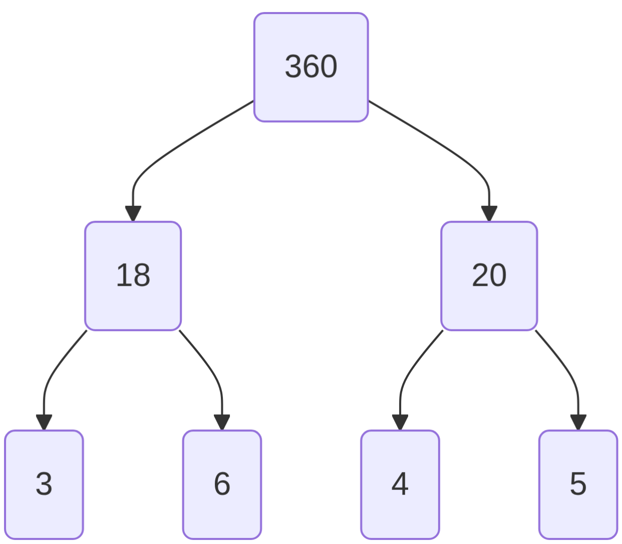
1. Start with a number:

2. Find any two numbers that multiply to give the number: $360 = 18 \times 20$

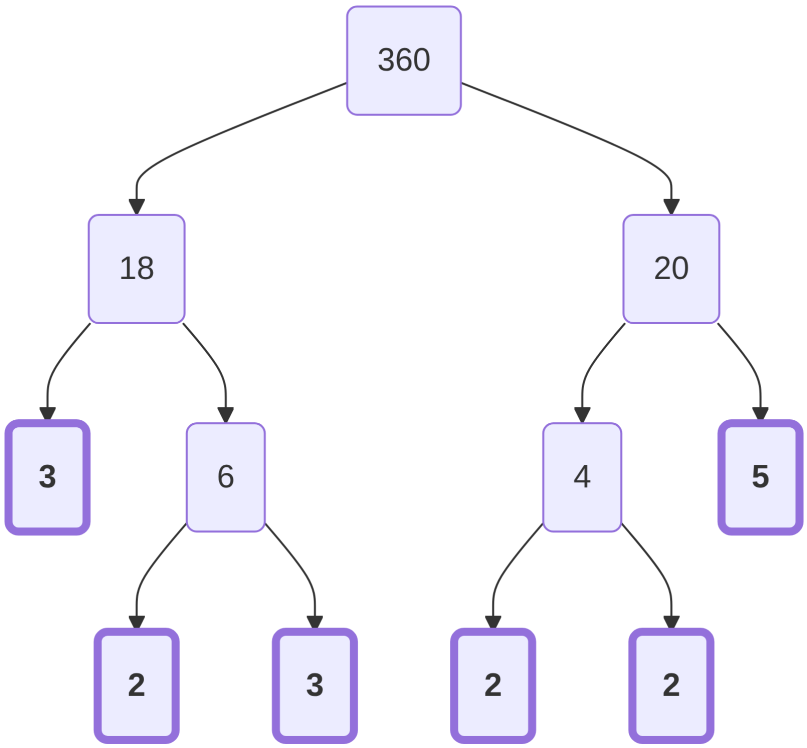


3. Break each of those numbers down further:

- $18 = 3 \times 6$
- $20 = 4 \times 5$



4. Keep going until all branches end in **prime numbers** (numbers that can't be factored anymore, like 2, 3, 5, 7…). We call the ends of the branches "leaves".



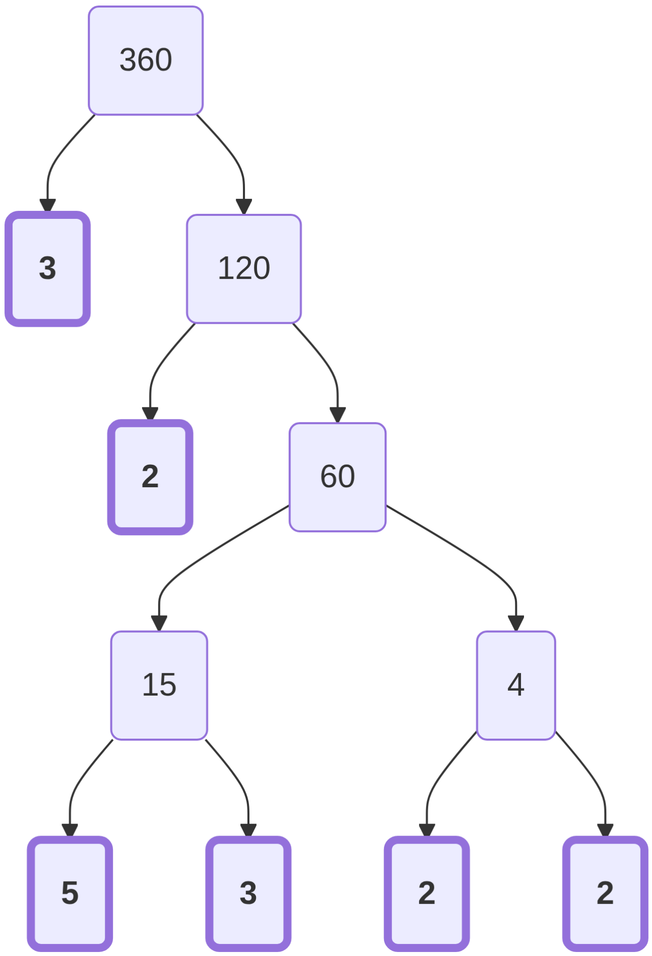
5. The prime factorization is the product of the leaves of the tree:

$$2 * 2 * 2 * 3 * 3 * 5 = 360$$

This can be written more compactly by using the factor counts as exponents. There are three 2s and two 3s in this case and so we get…

$$2^3 * 3^2 * 5 = 360$$

There are *many* factor trees for the number 360. For example, you could also have started with $360 = 3 * 120$.



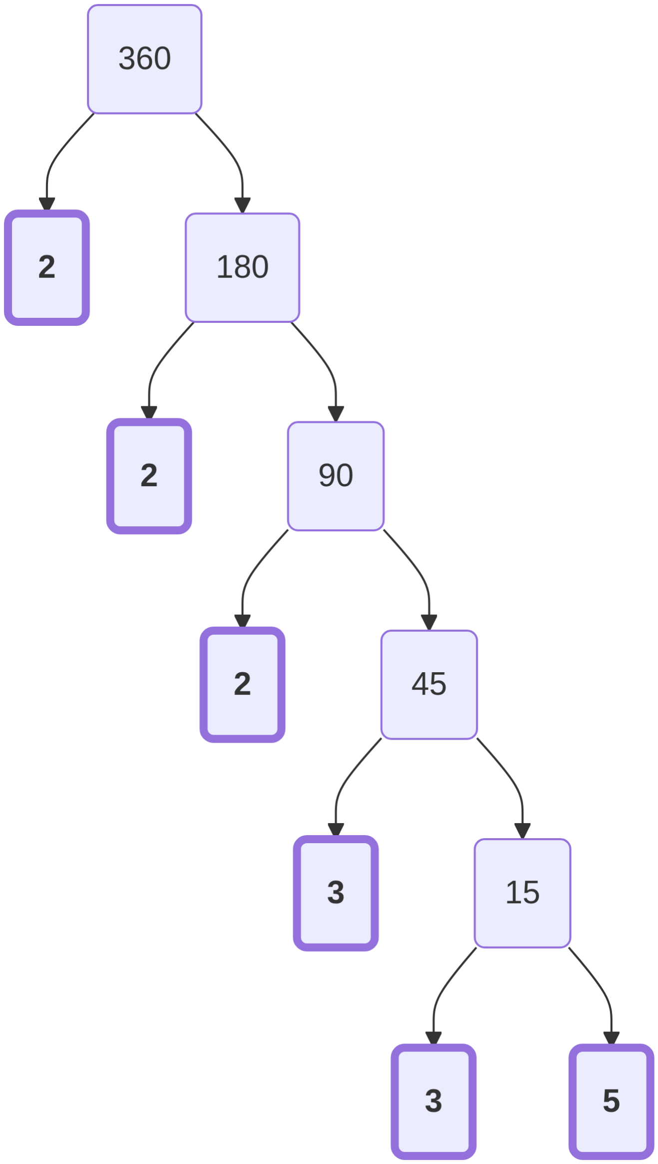
There are still three 2s, two 3s, and one 5, so the prime factorization does not change!

$$2^3 * 3^2 * 5 = 360$$

As long as you end up with the same prime numbers, the tree is correct!

Which factors should I start with?

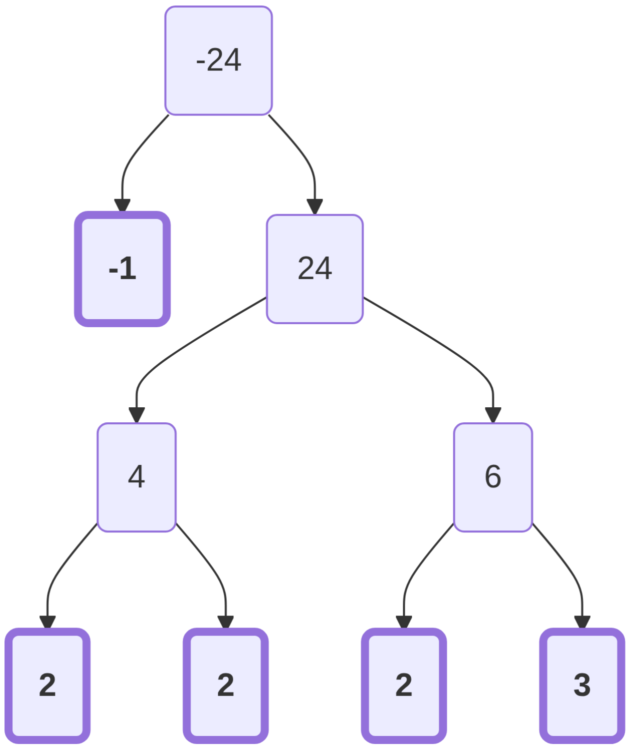
There is no one right answer to this question. It depends on your goal. If your goal is finding easy numbers, you might start small. Notice that 360 is even, that means it is divisible by 2. We could divide by 2 and keep going that way.



When you divide by the smallest (or biggest) factors, the tree tends to become deep. If you want smaller trees, you should start with factor pairs that are closer together like we did with the first factor tree for 360, splitting first with 18 and 20.

What About Negative Numbers?

If the number is negative, factor out a -1 first. Here is one possible factor tree for -24:



So, the prime factorization of -24 is…

$$-1 * 2^3 * 3 = -24$$

This will come in handy later when we factor algebraic expressions like $-x^2 + 4x$. It's often helpful to pull out a negative first!

Feeling overwhelmed?

If you struggle to come up with the factors for a number, you should check out the factor chart in the resources section of this book. It shows all of the factor pairs for many composite numbers!

I have only shown you 3 of the 60 unique factor trees for 360!

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

Complete the Factor Tree

4. Fill in the missing numbers.

   a.

b.

Factor Trees & Prime Factorization

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

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

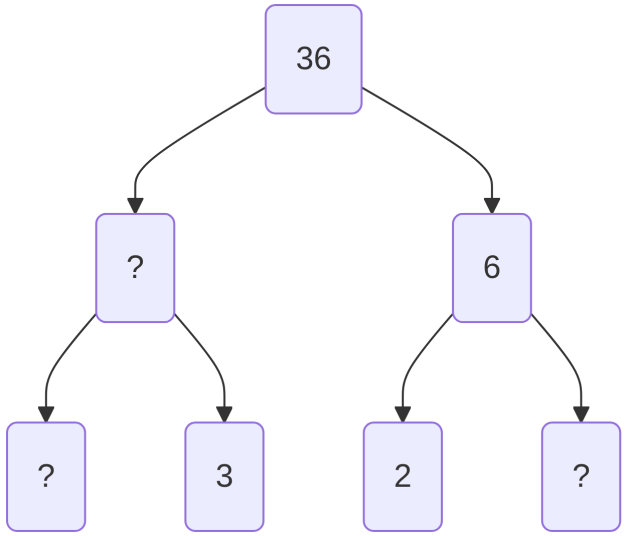


Figure 1

Challenge

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

Warm-Up

1. **5** (1, 36), (2, 18), (3, 12), (4,9), (6, 6)
2. 8 (if we count zero, which is a whole number)
3. No, 13 is prime

Factors & Multiples

1. a. 1, 2, 4, 8, 16
   b. 1, 2, 3, 6, 9, 18
   c. 1, 3, 9, 27
2. a. 4, 8, 12, 16, 20

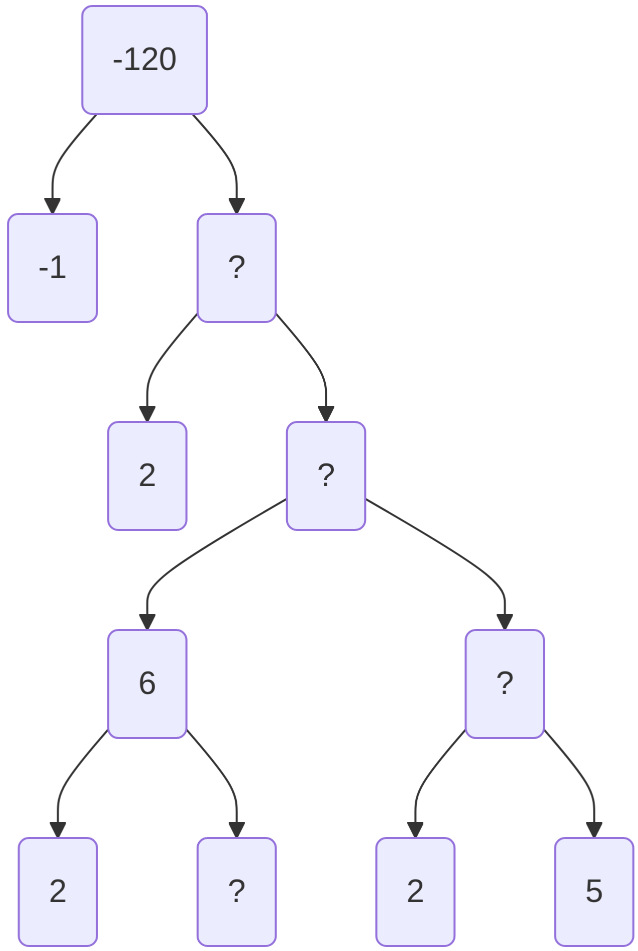


Figure 2

b. 9, 18, 27, 36, 45
c. 12, 24, 36, 48, 60

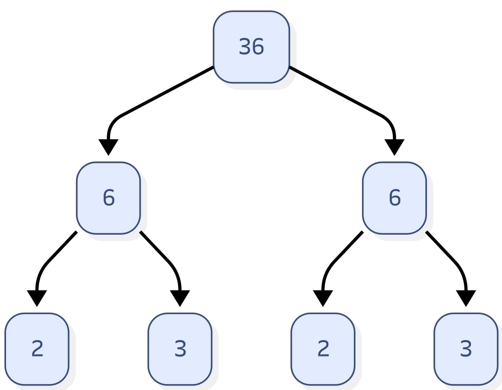
Prime or Composite?

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

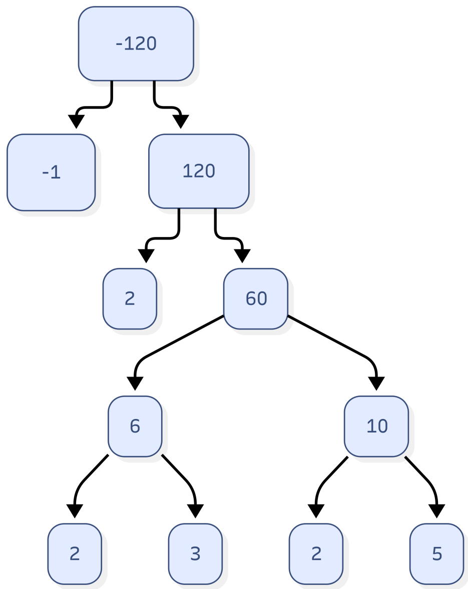
Complete the Factor Tree

4.

a.



b.



Factor Trees and Prime Factorization

5. 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. $3 \times 3 \times 3 \times 3 = 3$
   e. $2 \times 2 \times 2 \times 3 \times 3 = 2^3 \times 3^2$

Challenge

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

1.3 - GCF & Simplifying Fractions

Suppose you're making snack packs and have 20 bags of chips and 35 cookies. What's the greatest number of identical packs you can make with no leftovers? To figure that out, you'd use something called the greatest common factor (GCF).

In this lesson, you'll learn how to use prime factorization to find the GCF — and how that can help you simplify fractions. Finding the GCF makes numbers easier to work with, whether you're making snack packs or solving math problems.

- ☐ I can find the GCF using factor trees
- ☐ I can simplify fractions using the GCF
- ☐ I can solve real-world problems using the GCF

equivalent, greatest common factor, prime factorization, relatively prime, simplify

---

Warm-Up

1. Which number do you *think* has the most prime factors? What makes you think so?

   a. 20

   b. 30

   c. 45

   d. 53

2. What's the largest number that you think might divide **both** 12 and 18 evenly?

3. Here are four fractions. Which one doesn't belong and why?

   a. $\frac{12}{18}$

   b. $\frac{4}{9}$

   c. $\frac{2}{3}$

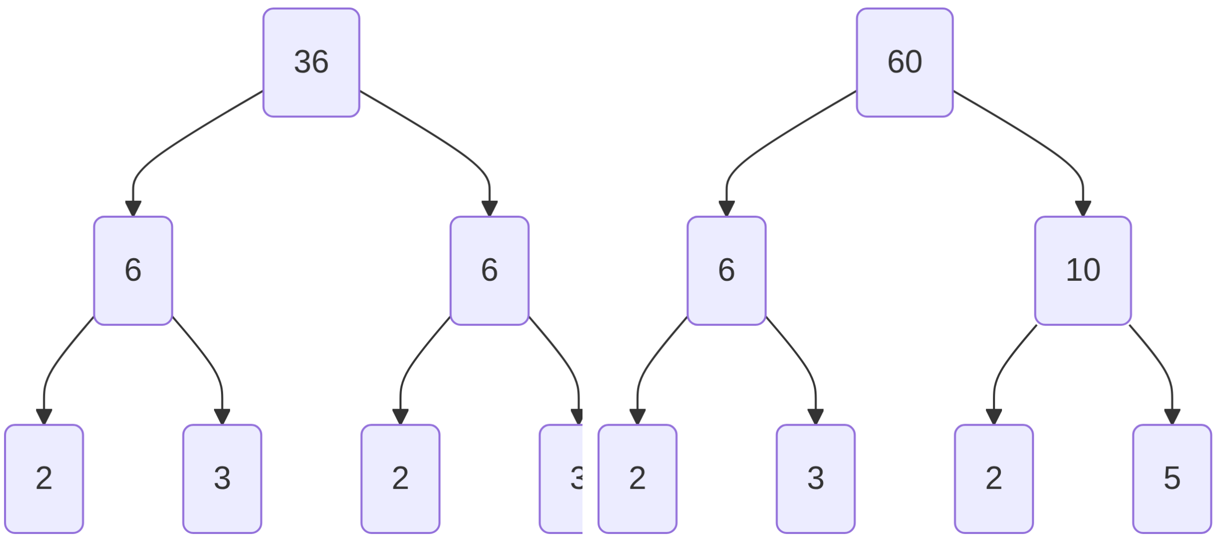
d. $\frac{24}{36}$

Learn Together

1.3.1 - Finding the GCF Using Factor Trees

To find the GCF, we can break numbers into their **prime factors** using factor trees.

Let's try it with 36 and 60:



Now that we have the factor trees, we can use them to easily find the GCF by circling leaves that they both share.

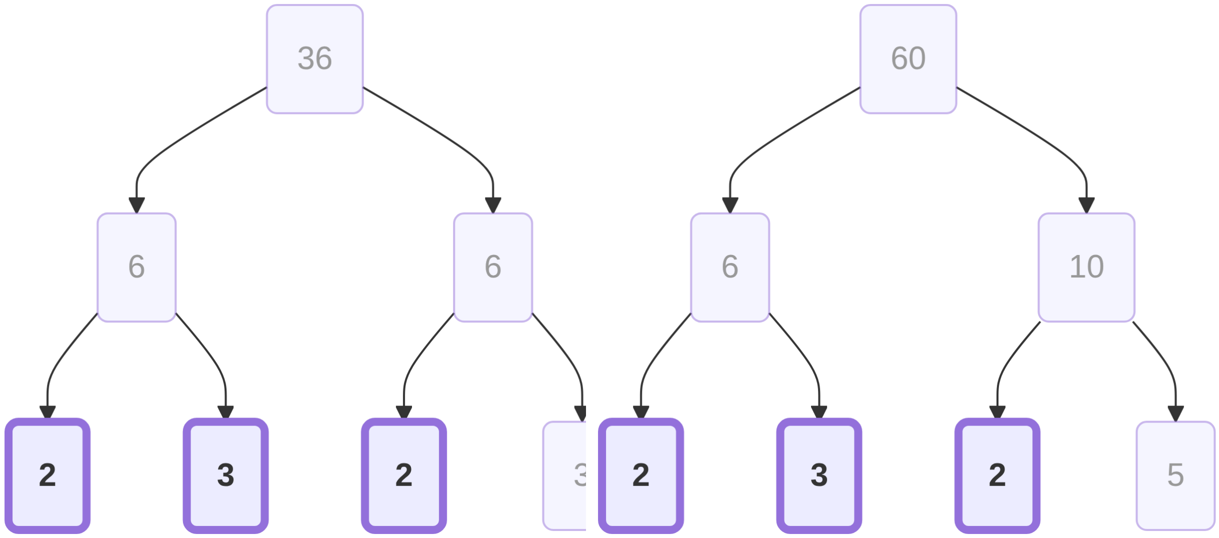
The numbers 36 and 60 share two 2s and one 3. We find the GCF by multiplying those shared factors.

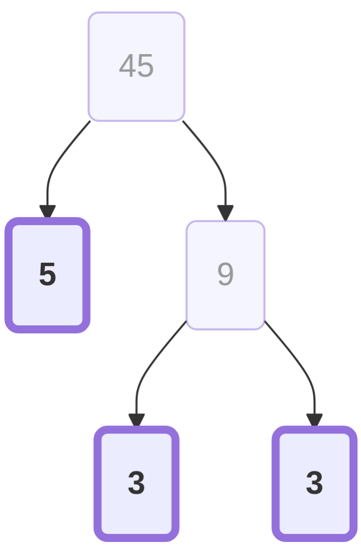
$$2 * 2 * 3 = 12$$

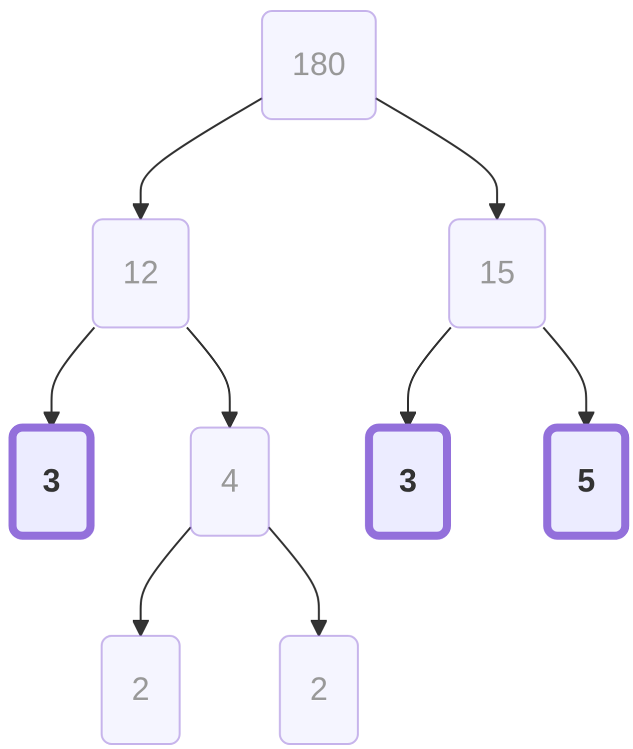
The GCF for 36 and 60 is 12!

Both 45 and 180 share two 3s and one 5. So the GCF for 45 and 180 is:

$$3 * 3 * 5 = 45$$

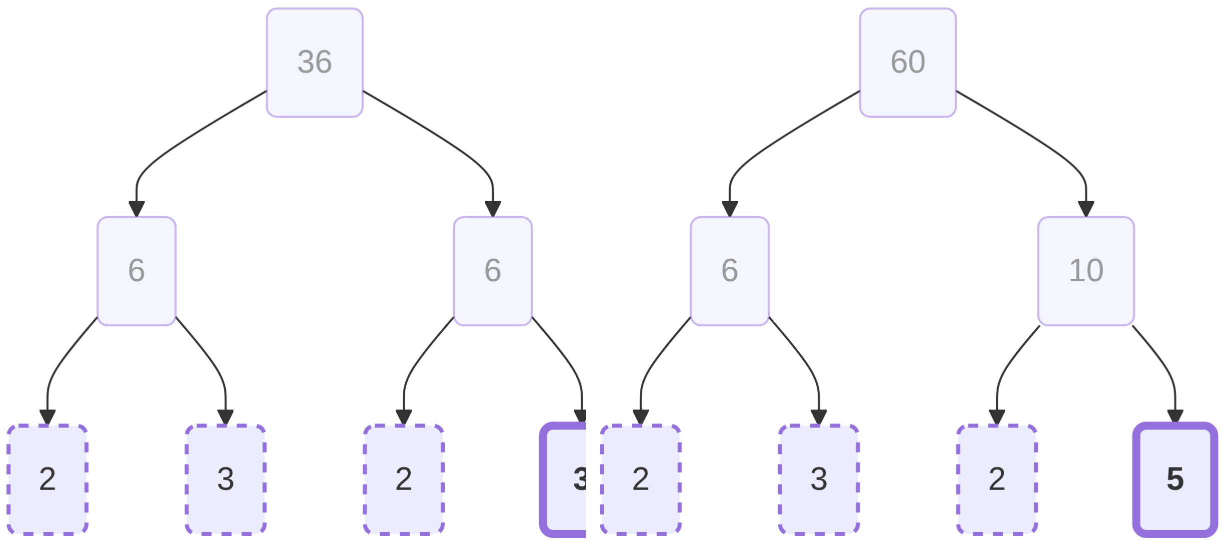

36
6
6
2
3
2
60
6
10
2
3
2
5


45
5
9
3
3


180
12
15
3
4
3
5
2
2

1.3.2 - Using Factor Trees to Divide

You might have noticed that we did not circle **all** of the prime factors for 36 and 60 when finding their GCF of 12. What did we leave behind and what does that mean?

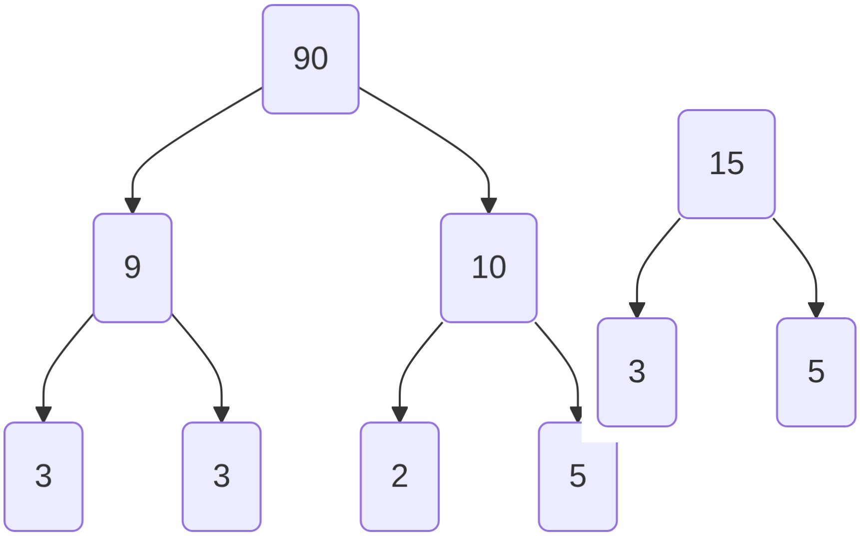


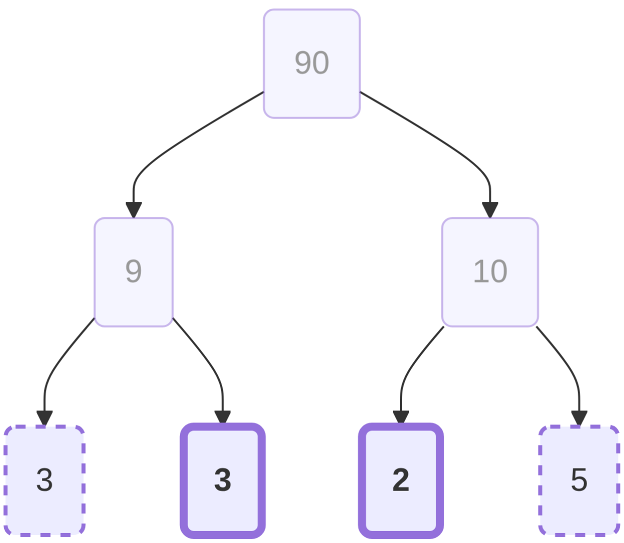
For 36 we left behind a 3 and for 60 we left behind a 5. What this means is that $36 \div 12$ is 3 and $60 \div 12$ is 5!"

Let's try another one

This time we will divide 90 by 15. Here are some factor trees to help us.

The number 15 has prime factors 3 and 5. We can divide 90 by 15 by crossing out those shared factors and multiplying what is left.



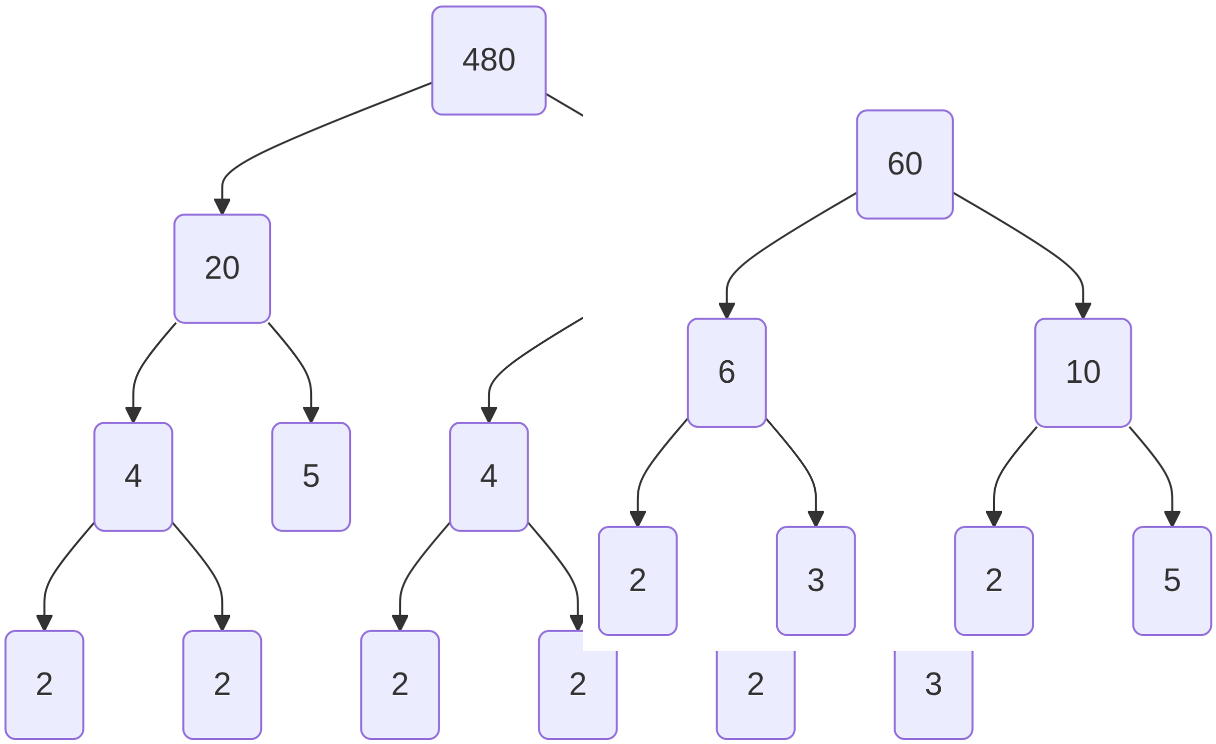


After crossing out 3 and 5 (the factors of 15) we are left with one 3 and one 2. This gives us…

$$90 \div 15 = 3 * 2 = 6$$

1. Find the factor trees for each number

2. Cross out the prime factors 480 shares with 60


480
60
20
6
10
4
5
4
2
3
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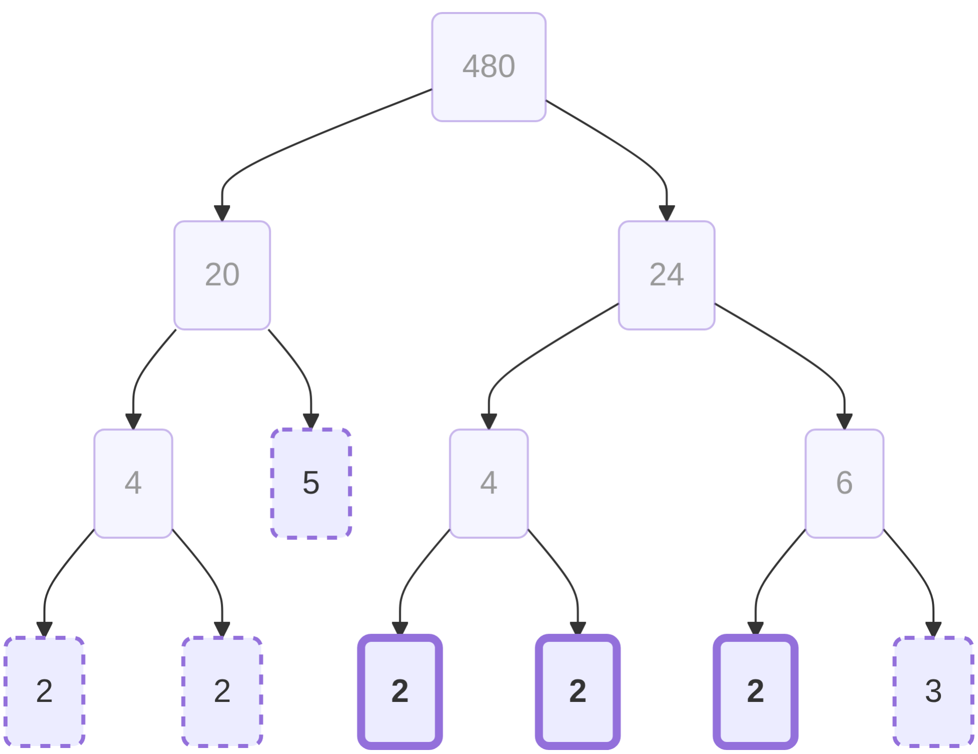
5
2
2
2
2
2
3


480
20
24
4
5
4
6
2
2
2
2
2
3

3. Multiply the remaining prime factors to get the answer.

$$2 * 2 * 2 = 8$$

1.3.3 - Simplifying Fractions with the GCF

In the last section, dividing two numbers showed how to "cancel out" or eliminate shared factors. This is helpful when you want to simplify a fraction!

Simplifying a fraction means rewriting it in its simplest form. This makes a fraction as "small" or "basic" as possible without changing its value. To do that, we divide both the numerator and the denominator by their GCF. When a fraction is in its simplest form, the numerator and denominator don't share any factors other than 1.

Let's go back to one we've already seen:

$$\frac{36}{60}$$

We found earlier that the GCF of 36 and 60 is 12. So to simplify, we divide both the numerator and denominator by 12:

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

This is just like the division you saw in the factor trees. We canceled out the factors they both had — two 2s and one 3 — and kept what was left.

Here's another:

$$\frac{90}{15}$$

We know that 15 is the GCF of 90 and 15. So:

$$\frac{90 \div 15}{15 \div 15} = \frac{6}{1} = 6$$

This tells us the fraction $\frac{90}{15}$ is just another way to write the number 6.

In other words:

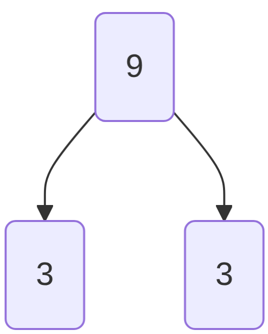
> Simplifying a fraction is just dividing the numerator and denominator by their greatest common factor.

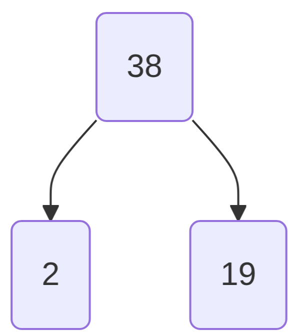
Factor trees help you *see* why this works by breaking the numbers into their building blocks.

If the numerator and denominator of a fraction share no common factors (besides 1) the two numbers are called relatively prime. In this case, the fraction cannot be simplified.

Example:

Simplify $\frac{9}{38}$.





Since 9 and 38 share no factors, $\frac{9}{38}$ is already in simplest form.

The GCF of 30 and 90 is 30.

$$\frac{30}{90} = \frac{30 \div 30}{90 \div 30} = \frac{1}{3}$$

1.3.4 – Application: Simplifying with Recipes

Imagine you're following a recipe that makes a giant batch of cookies — way more than you need. You decide to cut the recipe down to a smaller size, but the measurements are a little awkward.

Here's what the recipe says:

- 36 cups of flour
- 60 cups of sugar

You don't want to bake that much — just a smaller, simpler version of the same cookie. But how do you shrink the recipe without changing how the cookies taste?

Let's treat the ingredients like a ratio:

$$\frac{\text{36 cups of flour}}{\text{60 cups of sugar}}$$

This **ratio** tells us how much flour to use per amount of sugar. But the numbers are too big — and a little messy.

Just like with fractions, we can simplify this ratio by dividing both parts by their GCF. We already know the GCF of 36 and 60 is 12.

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

So for every 3 cups of flour, you need 5 cups of sugar.

Now you can make a smaller batch that keeps the same balance by finding multiples of the numerator and denominator. For example:

- 3 cups of flour
- 5 cups of sugar

Or double that:

- 6 cups of flour
- 10 cups of sugar

Simplifying the original recipe helped you find a cleaner ratio — one that's easier to scale up or down, depending on how many cookies you want.

Simplifying isn't just a math trick — it helps you work with numbers more easily in the real world. Whether you're adjusting recipes, mixing paint, or scaling blueprints, understanding fractions and simplifying them makes life easier.

Practice On Your Own

GCF Practice

1. Find the greatest common factor (GCF) of each pair:

   a. 20 and 30
   b. 36 and 45
   c. 18 and 48
   d. 30 and 42
   e. 50 and 65
   f. 72 and 90
   g. 81 and 108

2. Two numbers have a GCF of 6. One of the numbers is 18. What could the other number be? Give two possible answers.

3. Two numbers have a GCF of 1. What does that mean? Give an example.

Simplifying Fractions

4. Simplify each fraction:

   a. $\frac{18}{27}$
   b. $\frac{50}{100}$
   c. $\frac{14}{49}$
   d. $\frac{48}{60}$
   e. $\frac{84}{36}$
   f. $\frac{75}{90}$
   g. $\frac{99}{121}$
   h. $\frac{16}{40}$

5. Can a fraction be simplified if the GCF is 1? Explain your answer and give an example.

Word Problems

6. You have 72 juice boxes and 60 cookies. You want to make snack packs with the **same number** of each. You must use **all** the items.

   a. What's the greatest number of snack packs you can make?
   b. How many juice boxes and cookies go in each pack?

7. A store is making bundles using 108 pairs of socks and 144 shirts. Each bundle must have the same number of socks and the same number of shirts. There should be no leftovers.

   a. What is the greatest number of bundles they can make?
   b. How many socks and shirts will go in each bundle?

8. A painter mixes 84 ounces of red paint and 36 ounces of blue paint. He wants to pour the paint into small jars that are all the same. Each jar must have the same mix of red and blue paint.

   a. What is the greatest number of jars he can make with no paint left over?
   b. How many ounces of red and blue paint will go in each jar?

Challenge Problems

9. Two numbers multiply to make 180. Their GCF is 6. What could the numbers be?

10. A teacher has 150 pencils and 100 pens. She will make gift bags that all have the same number of pencils and the same number of pens. Each bag must have **2 more pencils than pens**. She will use **all** the items. How many bags can she make, and what goes in each bag?

Warm-Up

1. Which number do you *think* has the most prime factors? What makes you think so?

   a. 20

b. 30

c. 45

d. 53

2. What's the largest number that you think might divide **both** 12 and 18 evenly?
3. Here are four fractions. Which one doesn't belong and why?

a. $\frac{12}{18}$

b. $\frac{4}{9}$

c. $\frac{2}{3}$

d. $\frac{24}{36}$

GCF Practice

1. a. 10
   b. 9
   c. 6
   d. 6
   e. 5
   f. 18
   g. 27
2. Examples: 30 or 42
3. The numbers are relatively prime. For example: 8 and 15.

Simplifying Fractions

4. a. $\frac{2}{3}$
   b. $\frac{1}{2}$
   c. $\frac{2}{7}$
   d. $\frac{4}{5}$
   e. $\frac{7}{3}$
   f. $\frac{5}{6}$
   g. $\frac{9}{11}$
   h. $\frac{2}{5}$

5. No. The numerator and denominator are relatively prime and so nothing can cancel out.

Word Problems

6. a. 12 snack packs
   b. 6 juice boxes and 5 cookies
7. a. 36 bundles
   b. 3 pairs of socks and 4 shirts
8. a. 12 jars
   b. 7 ounces of red paint and 3 ounces of blue paint

Challenge Problems

9. 30 and 6 or -30 and -6
10. 25 gift bags; each bag has 6 pencils and 4 pens. (Check: $25 \times 6 = 150$ pencils, $25 \times 4 = 100$ pens; and $6 - 4 = 2$.)

1.4 – Fractions, Decimals & Percents: Conversions

Fractions, decimals, and percents are just different ways of showing the same thing — a part of a whole. Whether you're splitting a pizza, measuring a distance, or shopping during a sale, these numbers are everywhere.

In this lesson, you'll learn how to move between these forms and understand how they relate to each other. This will be an important skill for solving many types of problems that involve parts of a whole.

- ☐ I can convert between fractions, decimals, and percents.
- ☐ I can recognize repeating and terminating decimals and write them as fractions.
- ☐ I can compare and order fractions, decimals, and percents in real-world situations.

fraction, decimal, percent, convert, equivalent, place value

Warm-Up

1. Which one doesn't belong?

   a. $\frac{1}{2}$
   b. 0.25
   c. 50%
   d. 0.5

   (Explain your reasoning. There's more than one right answer.)

2. Which two of these do you think are closest in value?

   a. $\frac{2}{3}$
   b. 70%
   c. 0.25
   d. $\frac{3}{4}$

Learn Together

1.4.1 – What Are Fractions, Decimals, and Percents?

Fractions, decimals, and percents are all ways of showing a **part of a whole**.

A **fraction** shows how many parts out of a total. We often use them when:

- Measuring ingredients: “Add $\frac{2}{3}$ of a cup of milk.”
- Position in a ranking: “She ranked 2 out of 350 or $\frac{2}{350}$.”
- Splitting or sharing something: “We each got $\frac{3}{8}$ of the pizza.”

A **decimal** uses place value and powers of 10. Decimals can be used for:

- Dealing with money: “This costs $4.75.”
- Measuring length or weight: “The board is 2.5 feet long.”
- Reporting data or averages: “The average was 3.6 stars.”

A **percent** means “per 100”. Percents are used when:

- Talking about sales or discounts: “It’s 20% off!”
- Describing test scores: “She got 95% on the quiz.”
- Comparing populations or change: “Unemployment dropped by 2%.”

We think about and visualize fractions, decimals, and percents differently too. Here is the same number shown in three different ways!

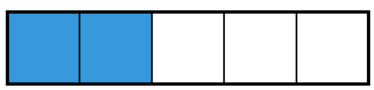


Figure 3: The fraction $\frac{2}{5}$

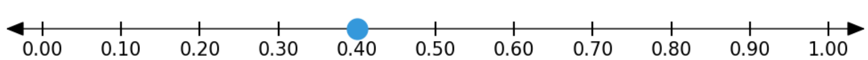


Figure 4: The decimal 0.4

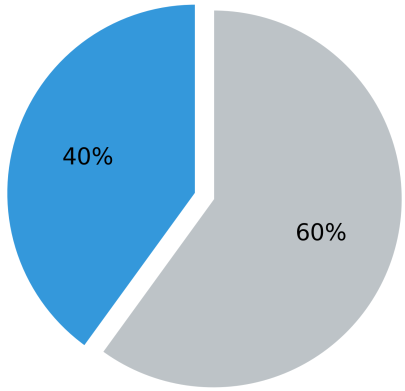


Figure 5: The percentage 40%

Fractions, decimals, and percents all show the same thing in different ways. You can change one form into another. Choose the form that fits the situation. In the next sections, you'll learn how to switch between them.

1.4.2 – Converting Fractions to Decimals

Have you ever wondered why the division symbol (÷) looks the way it does? It has two dots separated by a bar because it represents a fraction! This is because fractions are just a different way to show division. To convert a fraction to a decimal, all we have to do is **divide** the numerator by the denominator.

Let's try:

$$\frac{3}{4} = 3 \div 4 = 0.75$$

When we convert to a decimal, we will see that some decimals **end**, and some **repeat forever**.

Fraction	Decimal
$\frac{1}{4}$	0.25
$\frac{1}{3}$	0.333...
$\frac{2}{3}$	0.666...
$\frac{1}{5}$	0.2

If the decimal repeats, we write a bar over the repeating part: $\frac{1}{3} = 0.\overline{3}$

When you use a calculator to turn a fraction into a decimal, the result might look like it stops, but that can be misleading!

Some fractions have repeating decimals that go on forever — but calculators round or cut them off.

For example:

$\frac{2}{3}$ really equals $0.\overline{6}$ (0.6666...) but your calculator might show 0.6666666667

This can cause small errors if you're not careful — especially when comparing values or converting back to fractions.

Tip: If the decimal looks like it's repeating (like 0.6666666667 or 0.14285714286...), it probably is!

> What fractions have repeating decimals?
>
> After you simplify the fraction, look at the denominator. If it's made only from 2s and/or 5s (like 2, 4, 5, 8, 10, 20), the decimal ends. If it has any other factor (like 3 or 7), the decimal repeats.
> **Example 1:**
> The fraction $\frac{3}{10}$ has a denominator with factors 2 and 5. It ends and gives 0.3.
> **Example 2**
> The fraction $\frac{2}{6}$ has a denominator with factors 2 and 3. It repeats and gives $0.\overline{3}$.

Using a calculator, we find that...

$$\frac{2}{5} = 2 \div 5 = 0.4$$

1.4.3 - Converting Fractions and Decimals to Percents

Turning a decimal into a percent is easy. We simply move the decimal point to the right twice (the same as multiplying by 100) and then add a % sign.

Example: Convert 0.234 to a percent

To do this, we move the decimal two places to the right and then add a % sign. This gives us 23.4%.

$$0.234 = 23.4\%$$

But what if there isn't a digit in the hundredths place? When we don't have enough digits to the right of the decimal, we just fill them in with zeros.

Example: Convert 0.4 to a percent.

$$0.40 = 40\%$$

But what if the number is bigger than 1? When the number is bigger than 1.0, we do exactly the same thing and end up with a percentage that is larger than 100%!

Example: Convert 3.2 to a percent.

$$3.20 = 320\%$$

We multiply by 100 (move the decimal to the right twice) and add a % sign. This gives...

$$1.342 \times 100 = 134.2\%$$

To convert a fraction to a percent, we first convert the fraction to a decimal.

Example: Convert $\frac{3}{5}$ to a percent.

$$\frac{3}{5} \Rightarrow 3 \div 5 = 0.6$$

Now we convert the decimal to a percent.

$$0.6 \Rightarrow 60\%$$

First convert to a decimal:

$$\frac{2}{3} \Rightarrow 2 \div 3 = 0.\overline{6}$$

Now convert to a percent:

$$0.\overline{6} \Rightarrow 66.\overline{6}\%$$

1.4.4 Converting Decimals to Fractions

What if we want to go the other direction and convert a decimal to a fraction? The key to doing this is understanding place value.

Suppose we have the number 123.456. The following table shows the place value for each digit.

Place	Value	Explanation
Hundreds	1	1 hundred = 100
Tens	2	2 tens = 20
Ones	3	3 ones = 3
Decimal Point	.	Separates whole from part
Tenths	4	4 tenths = $\frac{4}{10}$
Hundredths	5	5 hundredths = $\frac{5}{100}$
Thousandths	6	6 thousandths = $\frac{6}{1000}$

Place value helps us say the number differently. Instead of saying "123 **point** 456" we could say "123 **and** 456 **thousandths**". This is the trick to converting decimals to fractions.

Example 1:

Say we want to convert 0.75 to a fraction. We could say this is "zero **point** seven five" but it is more useful to say this is "75 hundredths". This gives us our fraction!

$$0.75 = 75 \text{ hundredths} \Rightarrow \frac{75}{100} = \frac{3}{4}$$

Example 2

Let's convert 0.1 into a fraction.

$$0.1 = 1 \text{ tenth} \Rightarrow \frac{1}{10}$$

What if we have a number bigger than one?

If the number is bigger than one (like we saw with 4.23) we do the same thing, but we end up with a mixed number.

$$4.23 = 4 \text{ and } 23 \text{ hundredths} \Rightarrow 4\frac{23}{100}$$

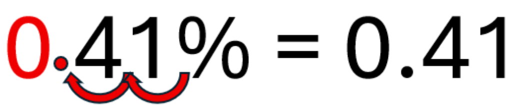
> **Tip**
>
> If you struggle with words like "hundredths" here is another way to think about it. To convert a decimal to a fraction, count the number of digits to the **right** of the decimal. You will divide by 1 with that many zeros after it.
> **Example:** 0.5431
> There are 4 digits to the right of the decimal point and so we divide by 1 with 4 zeros:
>
> $$0.5431 = \frac{5431}{10000}$$

$$0.51 = 51 \text{ hundredths} \Rightarrow \frac{51}{100}$$

1.4.5 – Converting Percents to Decimals and Fractions

To convert a percent to a decimal simply move the decimal two places left (the same as dividing by 100).

For example, here is what it looks like to convert 41% to a decimal. Notice that we sometimes have to add zeros to the left so the decimal has a place to go. Also notice that if there is no decimal, we put it just after the number before moving to the left.



Here are some more examples:

- $3.4\% \rightarrow 0.034$
- $75\% \rightarrow 0.75$
- $251\% \rightarrow 2.51$
- $0.2\% \rightarrow 0.002$

We move the decimal to the left twice and remove the % sign. This gives...

$$35\% = 0.35$$

To write a percent as a fraction, first convert to a decimal and then convert to a fraction, simplifying if possible:

- $3.4\% \rightarrow 0.034 \rightarrow \frac{34}{1000} \rightarrow \frac{17}{500}$
- $75\% \rightarrow 0.75 \rightarrow \frac{75}{100} \rightarrow \frac{3}{4}$
- $251\% \rightarrow 2.51 \rightarrow \frac{251}{100}$
- $0.2\% \rightarrow 0.002 \rightarrow \frac{2}{1000} \rightarrow \frac{1}{500}$

First, convert to a decimal and then to a fraction.

$$35\% = 0.35 \Rightarrow 35 \text{ hundredths} \Rightarrow \frac{35}{100} = \frac{7}{20}$$

1.4.6 – Bringing It All Together

Now that you've seen how to convert between fractions, decimals, and percents, here's a summary table to help you remember the steps:

From	To	How to Convert
Fraction	Decimal	Divide the numerator by the denominator
Fraction	Percent	First convert to a decimal then convert to a percent
Decimal	Fraction	Use place value (write the fraction as you would say it)
Decimal	Percent	Move the decimal two places right and add % sign
Percent	Decimal	Move the decimal two places left and remove % sign
Percent	Fraction	First convert to a decimal and then convert to a fraction

Some conversions are so common that it helps to **memorize** them. These are called **benchmark values**:

Fraction	Decimal	Percent
$\frac{1}{2}$	0.5	50%
$\frac{1}{4}$	0.25	25%
$\frac{3}{4}$	0.75	75%
$\frac{1}{3}$	0.333...	33.3...%
$\frac{1}{5}$	0.2	20%
$\frac{1}{8}$	0.125	12.5%
$\frac{1}{9}$	0.111...	11.1%
$\frac{1}{10}$	0.1	10%

Practice On Your Own

Conversions Practice

1. Convert each fraction to a decimal:

    a. $\frac{1}{2}$
    b. $\frac{3}{5}$
    c. $\frac{3}{4}$
    d. $\frac{1}{8}$
    e. $\frac{2}{3}$
    f. $2\frac{2}{9}$

2. Convert each decimal to a percent:

    a. 0.42
    b. 0.1
    c. 0.125
    d. 0.01
    e. 0.005
    f. 5.03

3. Convert each percent to a decimal:

    a. 15%
    b. 30%
    c. 0.5%
    d. 66%
    e. 3.5%
    f. 132%

4. Convert each percent to a fraction (in simplest form):

    a. 50%
    b. 25%
    c. 80%
    d. 12.5%
    e. 0.5%
    f. 275%

Comparison Questions

5. Show the following numbers on the same number line

    - 0.25

- $\frac{4}{5}$
- 10%

6. Which is greatest? *(Explain how you know.)*

   a. 0.65
   b. 65%
   c. $\frac{2}{3}$
   d. $\frac{13}{20}$

7. A test has 100 points. Which student did the best?

   - Kai scored $\frac{4}{5}$ of the points
   - Aaliyah scored 78%
   - Zoe scored 0.76

Challenge Problems

8. Which is closest to $\frac{3}{4}$ (show your reasoning)?

   a. 70%
   b. 0.72
   c. $\frac{4}{5}$
   d. 0.68

9. A science quiz has 20 questions. Three students earned the following scores:

   - Emily got 15 correct
   - Omar got 75% correct
   - Jalen got $\frac{14}{20}$ correct

   Who had the highest score and who had the lowest?

Warm-Up

1. *Answers vary*

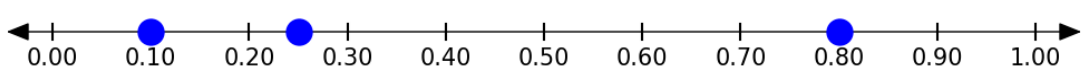
   Example: 0.25 because all of the rest are equal to each other.

2. b and d are closest

Conversions Practice

1. a. 0.5
   b. 0.6
   c. 0.75
   d. 0.125
   e. $0.\overline{6}$
   f. $2.\overline{2}$
2. a. 42%
   b. 10%
   c. 12.5%
   d. 1%
   e. 0.5%
   f. 503%
3. a. 0.15
   b. 0.3
   c. 0.005
   d. 0.66
   e. 0.035
   f. 1.32
4. a. $\frac{1}{2}$
   b. $\frac{1}{4}$
   c. $\frac{4}{5}$
   d. $\frac{1}{8}$
   e. $\frac{1}{200}$
   f. $2\frac{3}{4}$

Comparison Questions

5. 

6. $\frac{2}{3}$ is greatest because it equals $0.\overline{6}$ all of the others are equal to 0.65.

7. Kai because he scored 80% and the others scored 78% and 76%.

Challenge Problems

8. B. $\frac{3}{4} = 0.75$. 0.72 is only 0.03 units away from 0.75. The rest are farther away.

9. Both Emily and Omar tied for highest at 75%. Jalen got the lowest at 70%.

1.5 – Multiplying & Dividing Fractions

In previous lessons, you've learned how fractions, decimals, and percents relate to each other. But to solve real-world problems—like adjusting recipes, calculating discounts, or determining grades—you also need to multiply and divide these numbers.

In this lesson, you'll learn how to multiply and divide fractions and mixed numbers. We'll explore why multiplying fractions is actually simpler than it seems, and why dividing by a fraction is the same as multiplying by something called a reciprocal. These skills will help you tackle percent problems and practical applications in upcoming lessons.

- ☐ I can multiply fractions and mixed numbers.
- ☐ I can divide fractions by using reciprocals.
- ☐ I can explain what a reciprocal is and why it's useful.

divisor, improper fraction, mixed number, reciprocal

Warm-Up

1. What is half of a half?
2. What happens when you multiply two, positive numbers that are smaller than 1?
3. If you divide 1 by $\frac{1}{2}$, will the answer be bigger or smaller?

Learn Together

1.5.1 – Multiplying Fractions

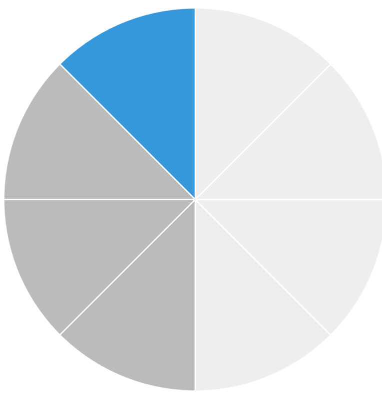
Multiplying by a fraction means finding a fraction **of** something else. In other words, you're finding a **part of a part**.

Example: $\frac{1}{4} \times \frac{1}{2}$

This means:

one-fourth of one-half

Here is what it looks like to find how many fourths are in one half:



That blue slice shows one of the four parts of the darker half.
Since there are 8 total pieces, and only 1 is blue, the answer is $\frac{1}{8}$ of the whole.

Drawing pie charts every time we multiply would take forever—so here's the shortcut:

- Multiply numerators together.
- Multiply denominators together.

$$\frac{1}{4} \times \frac{1}{2} = \frac{1 \times 1}{4 \times 2} = \frac{1}{8}$$

$$\frac{3}{5} \times \frac{4}{7} = \frac{3 \times 4}{5 \times 7} = \frac{12}{35}$$

Multiplying Whole Numbers by Fractions

No denominator? No problem! Just put a 1 underneath:

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

$$3 \times \frac{2}{5} = \frac{3}{1} \times \frac{2}{5} = \frac{6}{5}$$

$$5 \times \frac{3}{4} = \frac{5}{1} \times \frac{3}{4} = \frac{5 \times 3}{1 \times 4} = \frac{15}{4}$$

Simplifying After Multiplying

The smaller the numbers are, the easier they are to work with. Always simplify fractions when you can.

Example: $\frac{2}{3} \times \frac{9}{4}$

$$\frac{2}{3} \times \frac{9}{4} = \frac{2 \times 9}{3 \times 4} = \frac{18}{12}$$

Cancel out any common factors:

$$\frac{18}{12} = \frac{\cancel{2} \times (3 \times \cancel{3})}{\cancel{3} \times (\cancel{2} \times 2)} = \frac{3}{2}$$

> **Tip**
>
> If you factor before you multiply, you get to skip a step.
>
> $$\frac{2}{3} \times \frac{9}{4} = \frac{2 \times 9}{3 \times 4} = \frac{\cancel{2} \times (3 \times \cancel{3})}{\cancel{3} \times (\cancel{2} \times 2)} = \frac{3}{2}$$

$$\frac{8}{9} \times \frac{3}{4} = \frac{8 \times 3}{9 \times 4} = \frac{(\cancel{2} \times \cancel{2} \times 2) \times \cancel{3}}{(\cancel{3} \times 3) \times (\cancel{2} \times \cancel{2})} = \frac{2}{3}$$

1.5.2 – Multiplying Mixed Numbers

A mixed number is a number that has a whole part and a fraction part, like $4\frac{2}{3}$. Before multiplying, we first need to convert to an improper fraction.

Example: Multiply $4\frac{2}{3} \times \frac{5}{6}$

We have 2 thirds, but how many thirds are in 4? To find out, multiply the whole number by the denominator:

$$4 \times 3 = 12$$

Then add the numerator:

$$12 + 2 = 14$$

Now we know that there are 14 thirds in $4\frac{2}{3}$.

$$4\tfrac{2}{3} = \frac{14}{3}$$

Now we are ready to multiply:

$$\frac{14}{3} \times \frac{5}{6} = \frac{35}{9}$$

Sometimes we need to **convert back** to a mixed number. Here is how we do that:

First, **divide**:

$$35 \div 9 = 3 \text{ remainder } 8$$

Now we know we have 3 wholes and 8 remaining ninths. Together that is $3\frac{8}{9}$.

Another Example: $2\frac{1}{4} \times \frac{4}{5}$

Step 1: Convert the mixed number.

$$2 \times 4 = 8, \quad 8 + 1 = 9 \Rightarrow 2\tfrac{1}{4} = \frac{9}{4}$$

Step 2: Multiply:

$$\frac{9}{4} \times \frac{4}{5} = \frac{9 \times \cancel{4}}{\cancel{4} \times 5} = \frac{9}{5} = 1\frac{4}{5}$$

Mixed numbers show up often, especially in cooking. If a recipe for 12 needs $3\frac{1}{2}$ cups of flour, and we only want half (for 6 servings), we multiply:

$$3\frac{1}{2} \times \frac{1}{2} = \frac{7}{2} \times \frac{1}{2} = \frac{7}{4}$$

Instead of measuring 7 times with a $\frac{1}{4}$ cup, convert back to a mixed number:

$$\frac{7}{4} = 1\frac{3}{4} \text{ cups}$$

$$3\tfrac{2}{3} \times 4\tfrac{1}{2} = \frac{11}{3} \times \frac{9}{2} = \frac{11 \times (\cancel{3} \times 3)}{\cancel{3} \times 2} = \frac{33}{2} = 16\frac{1}{2}$$

1.5.3 – Division & Reciprocals

Dividing fractions? Easy—meet the reciprocal. It flips fractions upside down!

- Reciprocal of $\frac{3}{4}$ is $\frac{4}{3}$
- Reciprocal of 5 is $\frac{1}{5}$

To divide fractions, multiply by the reciprocal of the divisor:

Example: $\frac{2}{3} \div \frac{1}{4}$

$$\frac{2}{3} \div \frac{1}{4} = \frac{2}{3} \times \frac{4}{1} = \frac{8}{3}$$

Dividing by $\frac{1}{4}$ asks, "How many fourths are there in $\frac{2}{3}$?"

Dividing fractions is as easy as 1-2-3:

1. **Keep** the first fraction.
2. **Change** the division sign to multiplication.
3. **Flip** the second fraction (use the reciprocal).

Zero has no reciprocal (you can't divide by 0). For mixed numbers, convert to an improper fraction before taking the reciprocal.

Practice On Your Own

Multiply and Divide Fractions

1. Multiply:
   a. $\frac{2}{5} \times \frac{3}{4}$
   b. $3 \times \frac{4}{7}$
   c. $\frac{5}{6} \times \frac{1}{2}$
   d. $\frac{3}{8} \times \frac{4}{9}$
2. Multiply (mixed numbers):
   a. $1\frac{1}{2} \times \frac{2}{3}$
   b. $2\frac{2}{5} \times 3$
   c. $1\frac{3}{4} \times \frac{2}{3}$
   d. $5\frac{2}{9} \times 4\frac{3}{8}$
3. Divide:
   a. $\frac{3}{4} \div \frac{1}{2}$
   b. $2 \div \frac{2}{5}$
   c. $\frac{5}{6} \div \frac{1}{3}$
   d. $\frac{7}{8} \div \frac{7}{8}$

Word Problems

4. Answer these questions using what you've learned:
   a. You have $\frac{3}{4}$ of a pie. If you give everyone $\frac{1}{8}$ of a pie, how many people can you serve?
   b. A recipe calls for $\frac{2}{3}$ cup of flour. If you're making only $\frac{1}{2}$ of the recipe, how much flour will you need?

c. A board is 6 feet long. Each shelf needs $\frac{3}{4}$ feet. How many shelves can you make?

Challenge Problems

5. What two fractions multiply to give exactly $\frac{3}{8}$ if one of them is $\frac{3}{4}$?
6. A pancake recipe calls for $2\frac{1}{4}$ cups of sugar per batch. If you have exactly 9 cups of sugar, what is the greatest number of full batches you can make?

Warm-Up

1. $\frac{1}{4}$
2. Their product is smaller than either number (closer to zero).
3. Bigger, the answer will be 2.

Multiply and Divide Fractions

1. Multiply:

   a. $\frac{3}{10}$
   b. $\frac{12}{7}$
   c. $\frac{5}{12}$
   d. $\frac{1}{6}$

2. Multiply (mixed numbers):

   a. 1
   b. $\frac{36}{5} = 7\frac{1}{5}$
   c. $\frac{7}{6} = 1\frac{1}{6}$
   d. $\frac{1645}{72} = 22\frac{61}{72}$

3. Divide:

   a. $\frac{3}{2}$
   b. 5
   c. $\frac{5}{2}$

d. 1

Word Problems

4. a. 6
   b. $\frac{1}{3}$
   c. 8

Challenge

5. $\frac{3}{4}$ and $\frac{1}{2}$
6. 4

1.6 – Solving Problems With Fractions, Decimals & Percents

Now that you know how to multiply and divide fractions, you're ready to apply those skills to real-life problems.

Fractions, decimals, and percents all show parts of a whole — but they're used in different ways. We see them every day: in grades, prices, sales, surveys, and more.

In this lesson, you'll practice choosing the right form for the situation, estimating or calculating accurately, and solving common problems like "What percent of this is that?" or "What do I need to score on the test to get an A?"

- ☐ I can use fractions, decimals, and percents to solve real-world problems.
- ☐ I can find a part, a whole, or a percent.
- ☐ I can use percents to solve problems involving grades, sales, and survey results.

discount, equivalent, grade, markup, part, percent, proportion, rate, survey, whole

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Warm-Up

Use mental math if you can!

1. Is 10% of 60 bigger or smaller than 30?
2. Is 21 out of 35 a good score on a test?
3. What does it mean to say something is on sale for 25% off?

Learn Together

1.6.1 – What's the Part, Whole, or Percent?

In many real-world problems, you're given some information and need to find what's missing. Maybe you know the total price and the discount, and you want to know how much money you saved. Or you know how many questions you got right on a quiz, and you want to figure out your percent score.

These types of problems usually involve three pieces:

- part (how much you have),
- whole (the total or full amount),
- percent (the portion out of 100).

If you know two of them, you can figure out the third. This formula helps:

$$\text{part} = \text{percent} \times \text{whole}$$

You can also rearrange it to solve for the percent or the whole. We'll walk through all three types of problems step by step.

Convert the percent to a decimal first!

Example 1 – Finding the Part

What is 15% of 80?

You're looking for a small part of 80 — just 15 out of every 100. That's what 15% means.

We can turn this into a math sentence by translating the words:

- "is" becomes equals (=)
- "of" becomes times (×)

So:

what	is	15%	of	80?
?	=	0.15	×	80

Now solve it:

$$0.15 \times 80 = 12$$

So **12** is 15% of 80.

Turn it into a math sentence:

what	is	10%	of	50?
?	=	0.10	$\times$	50

Then multiply:

$$0.10 \times 50 = 5$$

Answer: 5

Example 2 – Finding the Percent

Out of 50 students, 30 say they like soccer. **What percent is that?**

The phrase **out of** tells us that 50 is the **whole** and 30 is the **part**. We can write that as a fraction, then convert it into a percent.

$$\frac{\text{part}}{\text{whole}} = \frac{30}{50} = 0.6 = 60\%$$

So **60%** of students like soccer.

$$\frac{3}{75} = 0.04 = 4\%$$

So only 4% of students get enough sleep!

Example 3 – Finding the Whole

25% of a number is 10. What is the number?

We're told that 10 is **25% of the total**. That means 10 is just a piece — one-fourth — of the whole. (Since $25\% = \frac{1}{4}$.)

If one-fourth of something is 10, then we can picture the whole as being made up of **4 equal parts** of 10:

$$10 + 10 + 10 + 10 = 40$$

So the whole is **40**.

But what if the fractions are harder to think about than $\frac{1}{4}$? Here's a trick:

25% as a decimal is 0.25. If we want to know,

> "25% of what number gives me 10?"

we can work backward by **dividing**:

$$10 \div 0.25 = 40$$

So the total is still **40** — it is just another way to get the same answer.

Start by thinking:

$20\% = \frac{1}{5} \rightarrow$ So if one-fifth is 12, then the whole must be:

$$12 \times 5 = 60$$

Or use division:

$$12 \div 0.2 = 60$$

Answer: 60

1.6.2 – Real-Life Examples

Grades

Your teacher hands you back your Unit 1 quiz. You got 19 out of 20 points! **What is your grade?**

Grades are given as percentages so we want to figure out what $\frac{19}{20}$ is as a percent.

$$\frac{19}{20} = 0.95 = 95\%$$

You got **95%** on that assignment, that's an A!

$$\frac{20}{25} = 0.8 = 80\%$$

John got an 80% which is a B.

Sales & Discounts

A clothing store is having a back-to-school sale. A $60 jacket is on sale for 25% off.

What's the new price?

First, find the discount by asking "What is 25% of $60?":

what	is	25%	of	$60?
?	$=$	0.25	$\times$	60

$$0.25 \times 60 = 15$$

This tells us we will **save** $15. To find the new price we subtract:

$$60 - 15 = 45$$

The jacket now costs **$45**.

Find the discount:

what	is	65%	of	$300?
?	$=$	0.65	$\times$	300

$$0.65 \times 300 = 195$$

Now subtract to get the sale price:

$$300 - 195 = 105$$

Swanhilda pays $105 for the dress. What a steal!

Surveys & Data

A survey of teachers asked whether they prefer cookies or cake. The survey found that 75% prefer cookies. If 120 of the teachers preferred cookies, how many teachers were surveyed?

Here we want to know the **whole** when we have a percent. First, convert 75% to a decimal:

$$75\% = 0.75$$

Then divide:

$$120 \div 0.75 = 160$$

160 teachers were surveyed.

> Tip
>
> To help avoid silly mistakes, ask yourself first, **"What answer do I expect?"**. This will help you decide if the answer you get makes sense.

First, convert to a decimal:

$$55\% = 0.55$$

Then divide:

$$550 \div 0.55 = 1000$$

1000 students were surveyed.

Practice On Your Own

Find the Part, Whole, or Percent

1. What is 60% of 95?
2. Eight is what percent of 64?
3. One is what percent of 6?
4. What percent of 40 is 25?
5. Fifteen is what percent of 40?
6. What number is 85% of 40?
7. 85% of a number is 510. What is the number?
8. 20% of a number is 150. What is the number?

Real-Life Scenarios

9. A driver's test has 30 questions. To pass, you must score at least 24 points. What percent do you need to pass?
10. A student scores 27 out of 30 on one test and 42 out of 50 on another. What percent of the total points did they earn?
11. A backpack is 25% off. The original price was \$80. What is the discount? What's the new price?
12. A restaurant offers 30% off drinks during happy hour. A soda usually costs \$3.50. What is the discount? What is the happy hour price?
13. A survey shows 68% of people prefer cats to dogs. If 250 people were asked, how many chose dogs?
14. A company sells fidget spinners. In a quality control test, they found that 3% of the fidget spinners tested were defective. If 60 spinners were defective, how many fidget spinners did they test?

Challenge Problems

15. A class has 24 students. 1/3 are in choir, 25% are in band. The rest of the students are in art.
    What percent of students are in art class?
16. A shirt is marked down by 40%. It now costs \$27. What was the original price?
17. You have 88% of 325 points in Algebra. The last exam has 50 questions and is worth 100 points. If it takes 90% to get an A, is it possible to get an A in the class? If so, how many points do you need to score on the exam?

Warm-Up

1. Smaller
2. That is a 60%. Most people would say no.
3. It means that the item will cost 25% less than it usually would.

Find the Part, Whole, or Percent

1. 57
2. 12.5%
3. $16.\overline{6}\%$
4. 62.5%
5. 37.5%
6. 34
7. 600
8. 750

Real-Life Scenarios

9. 80%
10. 86.25%
11. Discount: $20, Price: $60
12. Discount: $1.05, Price: $2.45
13. 80 chose dogs
14. 2000 fidget spinners

Challenge Problems

15. $41.\overline{6}\%$
16. $45
17. Yes. You need at least 97/100 on the exam (total needed: 0.90x425 = 382.5 383; you have 286 now, so 383-286 = 97). If each question is worth 2 points, that means 49 out of 50.

1.7 – 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 specific rules for what to do first. These rules are called the order of operations, and they help make sure everyone simplifies expressions the same way.

In this lesson, you'll learn how to follow those rules correctly—even when negatives, fractions, and grouping symbols are involved.

- ☐ I follow the correct order of operations (PEMDAS).
- ☐ I simplify expressions with fractions and negatives.
- ☐ I avoid common mistakes when simplifying expressions.

expression, order of operations, parentheses, exponent, multiplication, division, addition, subtraction

---

Warm-Up

1. You and your friend are asked to simplify $10 - 4 \times 2$. You got 2. They got 12. Who is right?
2. This question went viral. Can you get it right? Apparently 9 out of 10 can't!

$$6 \div 2(1 + 2)$$

Learn Together

1.7.1 – The Order Matters

In math, the order you do things **really matters** — doing steps out of order can completely change the answer.

Take this simple-looking problem:

$$10 + 3 \times 5$$

Let's try solving it from **left to right**:

$$10 + 3 \times 5 = 13 \times 5 = 65$$

Now let's try doing the **multiplication first**:

$$10 + 3 \times 5 = 10 + 15 = 25$$

So which one is correct — **65 or 25**?

The correct answer is **25**, because we follow a specific order of operations. Without these rules, people could get different answers to the same problem!

Let's look at the rules:

We often remember the order using **PEMDAS**:

- **P** – Parentheses (...)
- **E** – Exponents (like 3^2)
- **M/D** – Multiplication ($\times$) and Division ($\div$)
- **A/S** – Addition ($+$) and Subtraction ($-$)

Note:

- Multiplication and division are on the **same level**. Do them **left to right**.
- The same goes for addition and subtraction.

You can think of it like a ladder. You start at the top and climb your way down!

Because they are **two sides of the same operation**. Any division problem can be rewritten as multiplication by using the **reciprocal**.

Example: $12 \div \frac{3}{2}$ becomes $12 \times \frac{2}{3} = 8$

The same is true for addition and subtraction. Subtraction is really just adding the opposite.

Example: $5 - 2$ becomes $5 + (-2) = 3$

1.7.2 – Examples with Integers

Let's look at some expressions that follow the order of operations. These use only whole numbers — no fractions or negatives yet.

Example 1: $5 + 3 \times 2$

First, do the multiplication:

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

Then do the addition:

$$5 + 6 = 11$$

Example 2: $(5 + 3) \times 2$

First, simplify the parentheses:

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

Then multiply:

$$8 \times 2 = 16$$

Example 3: $8 - 12 \div 3$

First, divide:

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

Then subtract:

$$8 - 4 = 4$$

Start with parentheses:

$$5(8 - 1) + 2 \times 3 = 5 \times 7 + 2 \times 3$$

Next, do the multiplication:

$$5 \times 7 + 2 \times 3 = 35 + 6$$

Finally, add:

$$35 + 6 = 41$$

1.7.3 – With Negatives and Fractions

Once you're comfortable with the basics, we can add in **negative numbers** and **fractions**. The order of operations still works the same way — you just have to be more careful.

Example 1: $-3 \times (4 - 7)$

First, simplify the parentheses:

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

Then multiply. Remember: a **negative times a negative is positive**.

$$-3 \times -3 = 9$$

What does multiplying by a negative number do?
It **reverses the sign** of the number it's multiplied by.

Example:
$3 \times -1 = -3 \to$ the positive 3 becomes negative

Now try it with a negative number:

Example:
$-3 \times -1 = 3 \to$ the negative 3 becomes positive

So multiplying by -1 always gives the **opposite sign**.
That's why $-3 \times -1 = 3$ — the opposite of negative 3 is positive 3.

Example 2: $\frac{1}{2} \times (6+2)$

First, simplify the parentheses:

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

Then multiply:

$$\frac{1}{2} \times 8 = \frac{1}{2} \times \frac{8}{1} = \frac{8}{2} = 4$$

Example 3: $\frac{3+5}{2}$

This fraction means to divide **after** you do the work on top.

Even though there are no parentheses, the **fraction bar acts like grouping symbols** — just like parentheses.

So:

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

First do the parentheses:

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

Then multiply:

$$-3 \times -3 = 9$$

1.7.4 – More Complex Expressions

Let's try putting all the steps together. When expressions involve grouping, exponents, fractions, and multiple operations, PEMDAS really helps keep things organized.

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

Step 1: Parentheses

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

Step 2: Exponents

$$4 + \frac{1}{2} \times 4^2 = 4 + \frac{1}{2} \times 16$$

Step 3: Multiplication

$$4 + \frac{1}{2} \times 16 = 4 + 8$$

Step 4: Addition

$$4 + 8 = 12$$

Without parentheses, you might square the wrong number. Always follow PEMDAS and work **inside parentheses first** — especially when there are **multiple layers**.

-3^2 means $-(3^2)$, which is:

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

But $(-3)^2$ means the negative is part of the base:

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

Nested Parentheses

Sometimes, expressions use **more than one layer of grouping**. When that happens:

- Always work **from the inside out**
- Brackets [ ] or braces { } might be used to help keep things clear

---

Example:

$$[3 + (2^2 + 1)] \times 2$$

Step 1: Inner parentheses

$$[3 + (2^2 + 1)] \times 2 = [3 + 5] \times 2$$

Step 2: Brackets

$$[3 + 5] \times 2 = 8 \times 2$$

Step 3: Multiply

$$8 \times 2 = 16$$

PEMDAS starts with **grouping**, and that means more than just parentheses!

These all group parts of an expression:

- (...) — parentheses

- [ ] or { } — brackets/braces (used for nesting)
- Fraction bars $\frac{a}{b}$
- Square roots $\sqrt{a+b}$

Always simplify **grouped expressions** before applying exponents or multiplying.

Step 1: Inner parentheses

$$[5 + (3^2 - 1)] \times 2 = [5 + 8] \times 2$$

Step 2: Brackets

$$[5 + 8] \times 2 = 13 \times 2$$

Step 3: Multiply

$$13 \times 2 = 26$$

Final Answer: **26**

1.7.5 – Why This Matters

This might feel like just number-crunching, but it lays the foundation for Algebra. You'll need these skills to simplify expressions, solve equations, and understand formulas.

Later in Algebra, you'll see variables, combining like terms, and the distributive property. If you can't simplify numbers correctly, the rest will fall apart.

You get a 25% off coupon and a $10 gift card. The item costs $40.

Which should be applied first?

- 25% off first → $40 × 0.75 = $30 → $30 - $10 = **$20**
- Gift card first → $40 - $10 = $30 → 25% off = $22.50

Same ingredients, different result. Order matters!

Practice On Your Own

Basic Order of Operations

1. Simplify:

- a. $4 + 6 \times 2$
- b. $(4 + 6) \times 2$
- c. $12 \div 4 \times 3$
- d. $12 \div (4 \times 3)$

With Negatives & Fractions

2. Simplify:

- a. $-2 \times (3 - 5)$
- b. $\frac{1}{2} \times (8 + 4)$
- c. $(6 - 2)^2 \div 2$
- d. $(3 + 5) \div 2$

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 Problems

4. Two students simplified this expression differently:

   $8 - 3 + 2$

   - Student A: $(8 - 3) + 2 = 7$
   - Student B: $8 - (3 + 2) = 3$

   Who is correct? What mistake did the other student make?

5. Simplify the expression:

   $6 + \frac{4 \times (2+1)}{3^2}$

   Be careful with grouping and exponents.

6. A student simplified this:

   $2 + 3^2 \times (4 - 1)$
   and got **27**.

   - What mistake did they make?
   - What is the correct answer?

7. Create your own expression using **at least three operations**, **one fraction**, and **a set of parentheses**.
   Swap with a partner — can they simplify it correctly?

Warm-Up

1. You are correct! Multiply first and then add.
2. The answer is 9 (not 1).

Basic Order of Operations

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

With Negatives & Fractions

2. a. **4**

b. **6**
c. **8**
d. **4**

Expression Breakdown

3. a. **15**
   b. **16**
   c. **1**
   d. **6**

Challenge Problems

4. **7**
5. $\frac{22}{3}$ or $7\frac{1}{3}$
6. **29**
7. *Answers will vary*

Part II

Unit 2: Algebraic Expressions

Introduction

Welcome to Unit 2! This unit is all about using **variables** and **expressions** to represent patterns, describe relationships, and build the foundation for equations.

You'll learn how to write algebraic expressions, simplify them, evaluate them using substitution, and understand when two expressions are really saying the same thing — even if they look different.

This unit also introduces the key idea behind **functions**: that one input leads to one output. No graphing yet — just solid building blocks to prepare for what's ahead.

What You'll Learn

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

- Identify parts of an expression and describe their meaning
- Write and evaluate expressions using variables and the order of operations
- Combine like terms and use the distributive property to simplify expressions
- Understand how inputs and rules connect to outputs — and what makes something a function
- Tell whether two expressions are equivalent using simplification and substitution

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Topics in This Unit

Expressions & Their Parts
Learn what algebraic expressions are made of — variables, terms, constants, and coefficients — and how to describe real-world situations with math.

Evaluating Expressions
Plug in values for variables and simplify expressions using the correct order of operations (PEMDAS). Learn why parentheses matter!

Combining Like Terms
Identify and combine terms that have the same variable part. Simplify expressions and see why combining like terms works.

The Distributive Property
Use multiplication to "distribute" across parentheses. Learn how this helps simplify expressions and spot equivalent forms.

Inputs, Outputs & Functions
Explore how rules turn inputs into outputs. Learn what makes something a function and how to represent it with tables and expressions.

Equivalent Expressions
Discover how different-looking expressions can mean the same thing. Use simplification and substitution to test for equivalence.

Curious how much of this you already know? Try the Unit 2 pre-test!

2.1 – Expressions & Their Parts

Algebra is a language made of **expressions** — math phrases that use numbers, symbols, and variables to describe patterns or situations. Before we learn to simplify or solve anything, we need to understand what expressions are and how to describe their parts.

In this lesson, you'll learn what a variable is, what makes up an expression, and how to recognize important parts like terms, coefficients, and constants.

- ☐ I can identify the parts of an algebraic expression
- ☐ I can describe what a variable, constant, coefficient, and term are
- ☐ I can write a simple expression to describe a real-world situation

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coefficient, constant, expression, term, variable

Warm-Up

1. If a shirt costs \$10, how do you find the total cost of many shirts?
2. You have some cookies. You eat 3. How can you show how many cookies are left?
3. A car drives 50 miles every hour. How can you find the total distance for many hours?

Learn Together

2.1.1 – What Is a Variable?

Sometimes we need to talk about a number we don't know yet—or one that can change. For that, we use a variable.

A variable is a letter or symbol that stands for an unknown or changing number. You can use many letters, but in algebra we most often use **x**.

Think of an **x** as the label on a mystery box. You know the box holds a number inside, but you don't know which number it is yet!

Example:

You work at a grocery store. Your boss hands you a stack of labels and points to some apple boxes: "Write how many apples are in each box."

You pick up a sealed box. You can't see inside, so you write x on the label — x stands for "the number of apples in this box (unknown)."

Your boss isn't satisfied and says, "Check inside." You open the box and peek: there are 3 apples.

Now that you know the number, you change the label to 3.

Before you opened it, x was a variable—a placeholder for an unknown number. After you looked, you found $x = 3$, so you replaced the variable with the number.

2.1.2 – What Is an Expression?

An **expression** is a math phrase made of numbers, variables, and operations — **but no equal sign**.

Examples (expressions):

- $3x + 5$
- $x - 7$

- $\frac{1}{2}(y+4)$
- $4(a-3)$

Not expressions (these make a claim):

- $3x+5=20$ *(has an equals sign → an equation)*
- $x>7$ *(comparison)*

In algebra we often multiply by just **putting things next to each other**. We call this **multiplication by proximity**.

- $3x$ means $3 \times x$
- $4(a-3)$ means $4 \times (a-3)$

Price × quantity: If stickers cost \$0.50 each and you buy s stickers, the cost is $0.50s$. That's multiplication by proximity in the wild.

Visual idea: Two columns "Expression / Not an Expression." On the right, highlight the equals sign in color. On the left, show $3x$ with a tiny label "proximity = multiply."

2.1.3 – Terms, Coefficients, and Constants

Consider:

$$4x+2y-7$$

- **Terms** are the chunks separated by $+$ or $-$: $4x$, $2y$, -7.
- A **coefficient** tells "how many copies of the variable": 4 is the coefficient of x; 2 is the coefficient of y.
- A **constant** is a number that doesn't change: -7.

- The **sign in front** belongs to the term → the last term here is -7.
- A lone variable has an **implied coefficient of 1**. Examples: coefficient of x is 1; coefficient of $-y$ is -1.

Visual idea: Show $4x+2y-7$. Circle each term, box the coefficients, underline the constant. Add a mini-example $-y+9$ to spotlight the **coefficient** -1 idea.

Answer: terms: 9, $-3x$, y; coefficients: $x \to -3$, $y \to 1$; constant: 9.

2.1.4 – Reading Expressions in Words

Expressions are short stories.

- $10h$: "\$10 **per hour** for h hours."
- $s + 15$: "start at speed s, then increase by 15."
- $5x$: "5 in each group, x groups."
- $2(x + 3)$: "double the amount **after** adding 3."

- "Twice a number **increased by 3**" $\rightarrow 2x + 3$
- "Twice **the number increased by 3**" $\rightarrow 2(x + 3)$ Those are **not** the same.

Step then scale: A club charges a \$5 sign-up fee and then doubles your donation. If you donate d, the club adds \$5 first, then doubles: $2(d + 5)$.

Answer: "Take y, subtract 2, **then** triple the result." First subtract, then multiply.

2.1.5 – Writing Expressions for Situations

From situation $\rightarrow$ expression:

- You have **3 more apples** than your friend, who has x. $\rightarrow x + 3$
- A shirt costs \$12. You buy n shirts. $\rightarrow 12n$ *(multiplication by proximity)*
- A plant is **8 inches** tall and grows g inches each day. $\rightarrow 8 + g$
- You spend \$20 and then buy **2 items** that cost x each. $\rightarrow 20 + 2x$

Travel: A bus goes 45 miles per hour. After t hours, the distance is $45t$. That's proximity multiplication again (speed $\times$ time).

Answer: $3 + 2m$.

Answer: width $= L - 3$; perimeter $= 2L + 2(L - 3) = 4L - 6$.

2.1.6 – Concept Lab: Build an Expression

We'll *build* expressions from pieces to feel what each part means. (Tiles, paper strips, or quick sketches work great.)

1. "Three x's and two more." Arrange $x, x, x, 1, 1$. Write: $3x + 2$.
2. "Double the amount after adding 4." Build $x, 1, 1, 1, 1$; then duplicate the group. Write: $2(x + 4)$.
3. "Start at 10, then lose 2 each game for g games." Write: $10 - 2g$.

Visual idea: A photo/diagram of (a) $3x + 2$ arranged with tiles, (b) two identical groups for $2(x + 4)$. Minimal labels so students do the talking.

2.1.7 – Common Misconceptions

- **Don't add a '$\times$'**: $3x$ already means multiply (multiplication by proximity).
- **Sign goes with the term**: in $9 - 2x$, the second term is $-2x$.
- **"Less than" flips order**: "6 fewer than a number" $\rightarrow$ $x - 6$, not $6 - x$.
- **Coefficient exponent**: in $4x^2$, 4 is the coefficient; the 2 is an exponent ("square").

Practice On Your Own

Identify the Parts

For each, list **terms**, give the **coefficient** for each variable, and the **constant(s)**.

1. $7x - 5$
2. $3a + 4b - 9$
3. $5x + 2y - 6$
4. $-y + 12$
5. $\frac{1}{2}m + 4 - 3n$

Say It in Words

Write a short sentence (in your own words) for each expression.

6. $9 + t$
7. $0.5x$
8. $4(n - 1)$
9. $3p + 7$
10. $2(x + 3)$

From Situation to Expression

11. You have x stickers. Your friend gives you 6 more.
12. A gym costs $20 to join plus $8 per month for m months.
13. A tank starts with 50 liters and drains 3 liters each minute for t minutes.
14. A rectangle's width is w; its length is 5 more than its width. (Write length and perimeter.)
15. A phone plan includes 2 GB free, then charges $5 per extra GB g.

Match the Story to the Expression

Stories a) "Double the amount after adding 2." b) "Start at 10, then subtract 3 each day d." c) "$4 per ticket for t tickets, plus a $6 fee." d) "Three groups of x, then add 1." e) "Half of m, then add 5."

Expressions A) $2(x + 2)$ B) $10 - 3d$ C) $4t + 6$ D) $3x + 1$ E) $\frac{1}{2}m + 5$

Which One Doesn't Belong?

16. $2x + 6$ $\quad 2(x + 3)$ $\quad x + x + 6$ $\quad x + 3 + x + 3$
17. $5n - 2$ $\quad 5(n - 2)$ $\quad n + n + n + n + n - 2$ $\quad 5(n + 2)$

Error Analysis

18. A student says the coefficient of y in $-y + 9$ is 0 because there's no number in front. What would you say?
19. A student writes "6 fewer than a number" as $6 - x$. Explain and correct it.
20. A student says $2x + 3$ and $2(x + 3)$ mean the same thing. Give a counterexample by choosing a value of x.

Real-World Mix

21. **Shopping:** Each notebook costs \$5 and you also buy one binder for \$2. Write two different expressions for the total with n notebooks.
22. **Reading goal:** You start with 7 points and earn 0.25 points per hour h. Write an expression.
23. **Road trip:** A car travels 60 miles per hour. How far in t hours? What if the car already started 30 miles ahead?

Challenge Problems

24. Two different stories lead to the **same expression**. Create **two** real-world stories that both match $2x + 6$. Explain why they both fit.
25. Find a value of x that makes $2x + 3 = 2(x + 3)$ **false** and explain what this shows about order and grouping.

A. Identify the Parts

1. terms: $7x$, -5; coeff: $x \to 7$; constant: -5
2. terms: $3a$, $4b$, -9; coeffs: $a \to 3$, $b \to 4$; constant: -9
3. terms: $5x$, $2y$, -6; coeffs: $x \to 5$, $y \to 2$; constant: -6
4. terms: $-y$, 12; coeff: $y \to -1$; constant: 12
5. terms: $\frac{1}{2}m$, 4, $-3n$; coeffs: $m \to \frac{1}{2}$, $n \to -3$; constant: 4

B. Words *(sample)* 6) add 9 to t 7) half of x 8) four times one less than n 9) three times p, then add 7 10) double the amount after adding 3

C. Situations 11) $x+6$ 12) $20+8m$ 13) $50-3t$ 14) length $= w+5$; perimeter $= 2w+2(w+5) = 4w + 10$ 15) $2 + 5g$

D. Match a→A, b→B, c→C, d→D, e→E

E. WODB *(many answers okay—justify!)* 16) All four are equivalent to $2x + 6 \to$ you could say "none doesn't belong," or pick one and justify. 17) $5(n - 2) = 5n - 10$ differs from the others (which equal $5n - 2$ or $5n + 10$).

F. Error Analysis 18) The coefficient is -1 in $-y$; a lone variable has an implied 1, and the sign belongs to the term. 19) "6 fewer than a number" means *take 6 away from the number* $\to x - 6$, not $6 - x$. 20) Try $x = 1$: $2x + 3 = 5$ but $2(x + 3) = 8$. Not the same.

G. Real-World Mix 21) $5n + 2$ and $2 + 5n$ 22) $7 + 0.25h$ 23) distance $= 60t$; with a 30-mile head start: $30 + 60t$

Challenge 24) sample stories:

- "Buy x movie tickets at \$2 each and a \$6 service fee" $\rightarrow 2x + 6$
- "Two packs of snacks at \$x each, plus \$6 delivery" $\rightarrow 2x + 6$ Both describe "two times something, then add six," so both fit.

25. e.g., $x = 1$: $2x + 3 = 5$ but $2(x + 3) = 8 \rightarrow$ not equal. This shows **grouping** changes the meaning: $2x + 3$ is "double x, then add 3," while $2(x + 3)$ is "add 3, then double."

2.2 – Evaluating Expressions

Once we know how to write algebraic expressions, the next step is to **evaluate** them. That means plugging in a number for each variable and simplifying the result. This is like testing what an expression equals when we know the value of the variable.

In this lesson, you'll practice **substituting** values into expressions and using **order of operations** (PEMDAS) to simplify. You'll also start seeing how some expressions are always equal — even if they look different at first.

- I can substitute values into expressions and simplify them
- I can use the correct order of operations with variables and parentheses
- I can recognize when two expressions are equivalent

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evaluate, substitute, equivalent expressions, order of operations, parentheses

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1. What do you get if you simplify this expression?
   [3 + 2 4]
   Why do we multiply before adding?
2. A student says (2x + 5) and (5 + 2x) are different. Do you agree? Why or why not?
3. What happens when you square a negative number, like ((-3)^2)? What if you forget the parentheses?

   These questions build on Unit 1 thinking and help students prepare to handle substitution and order of operations correctly — especially with negatives and parentheses.
