

The GED Math Foundations Roadmap

Installment 4 — Percentages, Ratios & Proportions

Lessons 11-13: Percentages · Ratios · Proportions

Start anywhere

Each lesson stands completely on its own — you don't need the one before it. Pick the topic you want to work on today and dive in. Every lesson tells you the idea first, shows you a worked example, gives you practice, and then explains every answer.

Every lesson speaks in the same five colors — after one lesson, you can find your place by color alone:

blue = the idea	green = worked examples	amber = your turn	violet = answers, explained	teal = more practice
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Lesson 11: Percentages

Per Hundred, in Real Life

LESSON 11 OF 19	PHASE 4 · RELATIONSHIPS	ABOUT 20-25 MINUTES
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Warm-Up — start with a win

Two questions you can already do. Answer them in your head — then you've officially started.

1. What is 100% of 12?
2. What is 50% of 20?

Answers: 12 — all of it · 10 — half of it

The Concept — the idea behind the math

“Percent” means “per hundred.” 25% is just 25 out of every 100 — which is why it equals $25/100$, or 0.25 as a decimal. Almost every

percent problem on the test comes down to one move:

To find a percent OF a number, turn the percent into a decimal and multiply. (Remember from Lesson 10: drop the % and slide the dot two places left.) And in math, the word “of” always means multiply.

$$25\% \text{ of } 80 \rightarrow 0.25 \times 80 = 20$$

That single move handles the three situations you meet in real life:

- **Discounts:** a 20%-off item — find 20% of the price and subtract it (or notice you simply pay the other 80%).
- **Tips:** a 15% tip — find 15% of the bill and add it on.
- **Sales tax:** 8% tax — find 8% of the price and add it on.

Worked Examples — watch the moves

15% tip on a \$40 meal:

$$0.15 \times 40 = \$6.00 \quad (\text{so the total bill is } \$46)$$

20% off a \$50 jacket:

$$\text{discount: } 0.20 \times 50 = \$10 \rightarrow \text{you pay } \$40$$

8% sales tax on a \$25 purchase:

$$0.08 \times 25 = \$2.00 \rightarrow \text{total } \$27$$

Check for Understanding — your turn (5 questions)

1. What is 10% of 70?
2. What is 50% of 18?
3. A \$30 shirt is 20% off. How much is taken off the price?
4. A meal costs \$40 and you leave a 15% tip. How much is the tip?
5. **Critical Thinking:** A \$200 TV is 25% off. What is the sale price — the amount you actually pay?

PAUSE HERE — try all five on your own first. Getting them wrong costs nothing; that's what they're for.

Answer Key — every answer, explained

- 1. 7** ($0.10 \times 70 = 7$. Shortcut: 10% of anything is just that number with the dot moved one place left.)
- 2. 9** (50% is half, and half of 18 is 9.)
- 3. \$6** ($0.20 \times 30 = 6$.)
- 4. \$6** ($0.15 \times 40 = 6$.)
- 5. \$150** (Discount: $0.25 \times 200 = 50$, so $200 - 50 = 150$. Quicker: you pay 75%, and $0.75 \times 200 = 150$.)

More Practice — reps make it stick

Find each amount:

- 1.** 10% of 90
- 2.** 25% of 40
- 3.** 50% of 64
- 4.** 20% of 150

Real-life problems:

- 5.** A \$60 jacket is 10% off. How much is taken off?
- 6.** How much is 8% sales tax on a \$50 purchase?
- 7.** How much is a 20% tip on a \$25 meal?
- 8.** An \$80 item is 25% off. What is the sale price?

More Practice — Answer Key

1. **9** (0.10×90 .)
2. **10** (0.25×40 ; 25% is one quarter.)
3. **32** (Half of 64.)
4. **30** (0.20×150 ; 20% is one fifth.)
5. **\$6** (0.10×60 .)
6. **\$4** (0.08×50 .)
7. **\$5** (0.20×25 .)
8. **\$60** (Discount $0.25 \times 80 = 20$, so $80 - 20 = 60$. Or pay 75%:
 $0.75 \times 80 = 60$.)

Update your tracker:

Topic	New to this	Practicing	Got this!
Percent of a Number	☐	☐	☐
Discounts, Tips & Tax	☐	☐	☐

Lesson 12: Ratios

Comparing Two Quantities

LESSON 12 OF 19

PHASE 4 •
RELATIONSHIPS

ABOUT 20-25 MINUTES

Warm-Up — start with a win

Two questions you can already do. Answer them in your head — then you've officially started.

1. A recipe uses 2 cups of water for every 1 cup of rice. For 2 cups of rice, how much water?
2. 3 dogs and 2 cats: which are there more of?

Answers: 4 cups · Dogs — and 3:2 is how math says it

The Concept — the idea behind the math

A **ratio** compares two amounts. If a recipe calls for 2 cups of water for every 1 cup of rice, the ratio of water to rice is **2 to 1**. You can write that same ratio three ways, and they all mean the same thing:

2 to 1 2:1 2/1

Ratios simplify exactly like fractions. Divide both numbers by the same value: 6:8 becomes 3:4. The relationship doesn't change — just the way you write it.

Watch one thing carefully: part-to-part versus part-to-whole.

Say a bag holds 3 red and 5 blue marbles.

- Red **to blue** is 3:5 — a **part-to-part** ratio.
- Red **to the total** is 3:8, because there are 8 marbles in all — a **part-to-whole** ratio.

Read the question slowly and notice which one it asks for. That single distinction trips up more people than the arithmetic ever does.

Worked Examples — watch the moves

Simplify the ratio 6:8. Divide both by 2:

$$6:8 \rightarrow 3:4$$

A bag has 3 red and 5 blue marbles. Red to blue is 3:5. Red to total is 3:8 ($3 + 5 = 8$ marbles in all).

A recipe uses 2 cups flour to 1 cup sugar. If you scale up to 6 cups of flour, the relationship 2:1 scales the same way — multiply both by 3:

$$2:1 \rightarrow 6:3 \quad (\text{so 3 cups of sugar})$$

Check for Understanding — your turn (5 questions)

1. Write the ratio “5 dogs to 3 cats” using a colon.
2. Simplify the ratio 10:15.
3. A team has 7 wins and 3 losses. What is the ratio of wins to losses?
4. In a class of 4 boys and 6 girls, what is the ratio of boys to the total number of students? (Simplify.)
5. **Critical Thinking:** A smoothie uses 2 bananas for every 3 cups of milk. If you use 4 bananas, how many cups of milk keep the same taste?

PAUSE HERE — try all five on your own first. Getting them wrong costs nothing; that's what they're for.

Answer Key — every answer, explained

1. **5:3** (Dogs first, cats second — the order the question gives.)
2. **2:3** (Divide both by 5.)
3. **7:3** (Wins to losses, in that order.)

4. **2:5** (Total students = $4 + 6 = 10$, so boys to total is 4:10, which simplifies to 2:5.)
5. **6 cups** (2:3 scaled by 2 gives 4:6 — double the bananas, double the milk.)

More Practice — reps make it stick

Write or simplify each ratio:

1. Write “8 apples to 5 oranges” as a ratio with a colon.
2. Simplify 12:8.
3. Simplify 9:6.
4. Simplify 20:25.

Marbles and mixtures:

5. A bag has 4 red and 8 green marbles. Ratio of red to green (simplest)?
6. Same bag — ratio of red to the total (simplest)?
7. A recipe is 3 cups oats to 1 cup honey. For 9 cups of oats, how much honey?
8. A paint mix is 2 parts blue to 5 parts white. For 4 parts blue, how much white?

More Practice — Answer Key

1. **8:5** (Apples first, oranges second.)
2. **3:2** (Divide both by 4.)
3. **3:2** (Divide both by 3.)
4. **4:5** (Divide both by 5.)
5. **1:2** (4:8 divides by 4 — a part-to-part ratio.)
6. **1:3** (Total = 12, so red to total is 4:12, which simplifies to 1:3 —

part-to-whole.)

7. 3 cups (3:1 scaled by 3 gives 9:3.)

8. 10 parts (2:5 scaled by 2 gives 4:10.)

Update your tracker:

Topic	New to this	Practicing	Got this!
Writing & Simplifying Ratios	☐	☐	☐
Part-to-Part vs Part-to-Whole	☐	☐	☐

Lesson 13: Proportions

Two Ratios That Agree — Solving for the Unknown

LESSON 13 OF 19

PHASE 4 •
RELATIONSHIPS

ABOUT 25-30 MINUTES

Warm-Up — start with a win

Two questions you can already do. Answer them in your head — then you've officially started.

1. $1/2 = ?/4$
2. 2 pens cost \$4. What does 1 pen cost?

Answers: 2 · \$2 — you just solved a proportion

The Concept — the idea behind the math

A **proportion** is simply a statement that two ratios are equal, like $2/3 = 4/6$. It's the everyday tool behind “if this much costs that, how much does *this* much cost?” — recipe scaling, map distances, unit prices, gas mileage.

The power move is cross-multiplication. When two fractions are equal, multiplying across the diagonals gives equal products:

$$\text{if } a/b = c/d \text{ then } a \times d = b \times c$$

That lets you solve when one of the four numbers is missing. Here's the reliable recipe:

- **Set up two fractions** with the labels lined up the same way on both sides — miles over hours equals miles over hours.
- **Put a letter where the unknown is** (we'll use x).
- **Cross-multiply**, then divide to get x alone.

Lining up the labels is the whole game. Keep the same kind of thing on top on both sides, and the setup can't betray you.

Worked Examples — watch the moves

Solve $2/3 = x/12$. Cross-multiply:

$$2 \times 12 = 3 \times x \rightarrow 24 = 3x \rightarrow x = 8$$

Recipe — 2 eggs make 12 cookies. How many eggs for 30 cookies? Keep eggs on top, cookies on the bottom:

$$2/12 = x/30 \rightarrow 2 \times 30 = 12 \times x \rightarrow 60 = 12x \rightarrow x = 5 \text{ eggs}$$

Price — 4 pens cost \$6. What do 6 pens cost? Pens on top, dollars on the bottom:

$$4/6 = 6/x \rightarrow 4 \times x = 6 \times 6 \rightarrow 4x = 36 \rightarrow x = \$9$$

Check for Understanding — your turn (5 questions)

1. Solve for x: $1/2 = x/10$
2. Solve for x: $3/4 = 9/x$
3. Solve for x: $x/5 = 6/15$
4. A car travels 60 miles in 1 hour. At the same speed, how far does it go in 3 hours?
5. **Critical Thinking:** 2 cups of rice feed 6 people. How many cups are needed to feed 15 people?

PAUSE HERE — try all five on your own first. Getting them wrong costs nothing; that's what they're for.

Answer Key — every answer, explained

1. **x = 5** (Cross-multiply: $1 \times 10 = 2 \times x \rightarrow 10 = 2x \rightarrow x = 5$.)
2. **x = 12** ($3 \times x = 4 \times 9 \rightarrow 3x = 36 \rightarrow x = 12$.)
3. **x = 2** ($15 \times x = 5 \times 6 \rightarrow 15x = 30 \rightarrow x = 2$.)
4. **180 miles** ($60/1 = x/3 \rightarrow x = 180$.)

5. 5 cups ($2/6 = x/15 \rightarrow 2 \times 15 = 6 \times x \rightarrow 30 = 6x \rightarrow x = 5$.)

More Practice — reps make it stick

Solve for x:

1. $1/3 = x/9$
2. $2/5 = x/20$
3. $4/x = 2/3$
4. $x/8 = 3/4$
5. $7/2 = x/4$

Word problems (set up a proportion, then solve):

6. 3 tickets cost \$24. How much do 5 tickets cost?
7. On a map, 2 inches represents 50 miles. How many miles does 6 inches represent?
8. 5 pounds of apples cost \$10. What do 8 pounds cost?

More Practice — Answer Key

1. **x = 3** ($1 \times 9 = 3 \times x \rightarrow 9 = 3x$.)
2. **x = 8** ($2 \times 20 = 5 \times x \rightarrow 40 = 5x$.)
3. **x = 6** ($4 \times 3 = 2 \times x \rightarrow 12 = 2x$.)
4. **x = 6** ($4 \times x = 8 \times 3 \rightarrow 4x = 24$.)
5. **x = 14** ($7 \times 4 = 2 \times x \rightarrow 28 = 2x$.)
6. **\$40** ($3/24 = 5/x \rightarrow 3x = 120 \rightarrow x = 40$.)
7. **150 miles** ($2/50 = 6/x \rightarrow 2x = 300 \rightarrow x = 150$.)
8. **\$16** ($5/10 = 8/x \rightarrow 5x = 80 \rightarrow x = 16$.)

Update your tracker:

Topic	New to this	Practicing	Got this!
Setting Up Proportions	☐	☐	☐
Cross-Multiplying to Solve	☐	☐	☐