

Proportional Reasoning and Percents

Grade: 7 **Subject:** Mathematics **Time:** ~45 min core + ~15 min extension **Work mode:** Independent · pencil + packet Math

Start Here

This is a **paper math packet** about unit rates, proportional relationships, and percents. Work by yourself with a pencil. **A calculator is not required, but a basic calculator is allowed** if you have one. **Show your work** — every answer should show the numbers you used, not just a final number. Everything you need (formulas, examples) is printed right here. If a question is hard, skip it, keep going, and come back. Circle or box your final answers.

Start Warm-Up: Retrieval 5 min

Bring back what you already know about rates and percents.

1Unit rate. A grocery store sells 3 pounds of apples for \$6.00. What is the price for **1 pound** (the unit rate in dollars per pound)? Show the division you used.

2Simple percent. A class has 25 students, and 20 of them ride the bus. What **percent** of the class rides the bus? Show your work.

Build Study the Math 5–10 min

What you need to know (with formulas)

Unit rate is a rate written as an amount "per 1." To find it, divide the two quantities. Example: \$6 for 3 lb → $\$6 \div 3 \text{ lb} = \2 per pound .

A **proportional relationship** connects two quantities x and y that always share the **same ratio**. The number you multiply x by to get y is the **constant of proportionality**, written k :

$$k = y \div x \rightarrow y = k \cdot x$$

The **same relationship** can be shown four ways, and they all give the same k :

- **Table:** every row's $y \div x$ equals k .
- **Graph:** a straight line through the point **(0, 0)** (the origin). The point $(1, k)$ is on the line.
- **Equation:** $y = k \cdot x$.
- **Situation:** a real story with a constant "per one" rate.

Percent means "out of 100," so a percent is a fraction over 100 ($25\% = 25/100 = 0.25$).

- **Percent of a number:** multiply. *percent (as a decimal) $\times$ whole*. Example: $15\% \text{ of } 40 = 0.15 \times 40 = 6$.
- **Percent increase:** $\text{new} = \text{whole} + (\text{percent} \times \text{whole})$. A 20% tip on \$10 = $\$10 + (0.20 \times \$10) = \$12$.
- **Percent decrease:** $\text{new} = \text{whole} - (\text{percent} \times \text{whole})$. A 20% discount on \$10 = $\$10 - (0.20 \times \$10) = \$8$.

Tip: "percent **of**" asks for the part; "percent **off**" (a discount) asks you to subtract the part from the original.

Worked Example — one relationship, four forms

A water dispenser fills cups at a steady rate. In **4 seconds** it pours **10 ounces**. Because it is steady, this is proportional.

Find k (ounces per second): $k = y \div x = 10 \text{ oz} \div 4 \text{ s} = 2.5 \text{ oz per second}$.

Equation: $y = 2.5x$, where x = seconds and y = ounces.

Table (each $y \div x = 2.5$) and **graph** below. The line goes through (0, 0), and the point (1, 2.5) shows the unit rate.

Water poured over time ($y = 2.5x$).

Time x (seconds)	Water y (ounces)	$y \div x$
0	0	—
2	5	2.5
4	10	2.5
6	15	2.5

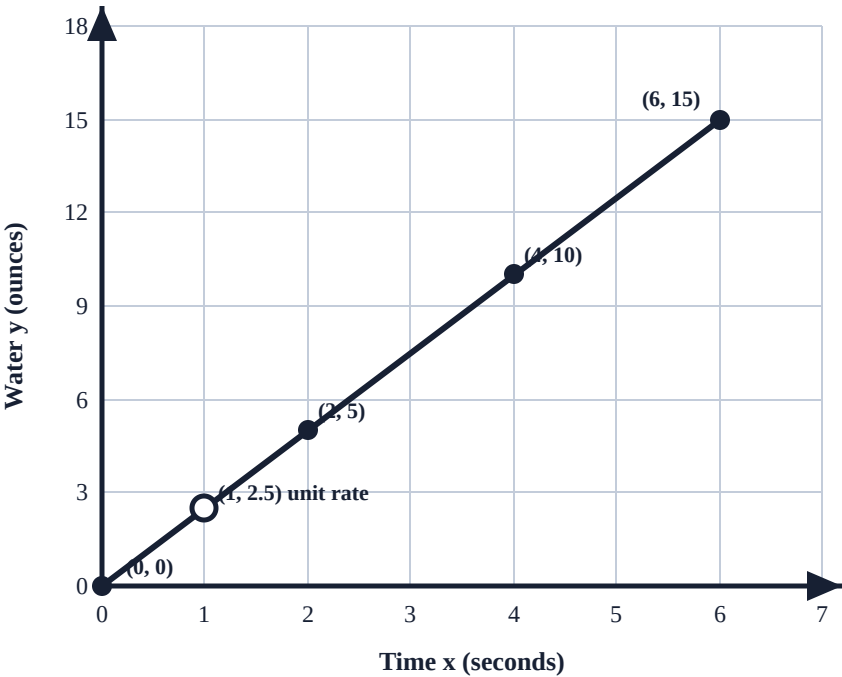


Figure 1. The graph of $y = 2.5x$. It is a straight line through the origin (0, 0). Each printed point (2, 5), (4, 10), (6, 15) matches a table row, and the hollow point (1, 2.5) shows the unit rate — the ounces poured in one second. The line and points are drawn in black so the figure reads clearly in grayscale.

3Using the worked example, how many ounces would the dispenser pour in **8 seconds**? Use $y = 2.5x$ and show your work.

Apply Use What You Know 20–25 min

Show the numbers you use in every item. A basic calculator is allowed.

4Match the four forms. A bakery sells muffins at a steady price. The relationship is described four ways below, but one form is missing a value and one situation must be matched. Study Table A, then answer 4a–4c.

Table A. Cost of muffins (a proportional relationship).

Muffins x Cost y (dollars)

2	3.00
4	6.00
6	9.00
10	?

4a. Find the constant of proportionality k (dollars per muffin). Show $y \div x$.

4b. Write the equation for cost y in terms of muffins x , then fill in the missing cost for 10 muffins.

4c. Which graph point would be on this line: (1, 1.50) or (1, 3.00)? Explain in one sentence why.

5Real-world percent (tax and tip). A family's restaurant bill is **\$40.00**. Sales tax is **8%**, and they want to leave a **15% tip** (the tip is figured on the \$40 food amount, before tax).

5a. How much is the 8% tax? Show 0.08×40 .

5b. How much is the 15% tip on the \$40 food? Show your work.

5c. What is the **total** the family pays (food + tax + tip)?

6Error analysis. A student solved this problem: "A \$50 jacket is marked **30% off**. What is the sale price?" Their work is shown in the box. **Find the mistake, explain it, and give the correct sale price.**

Student's work:

$$30\% \text{ of } \$50 = 0.30 \times 50 = \$15.$$

So the sale price is **\$15**.

What is wrong, and what is the correct sale price?

7Multi-step application (scaling a recipe). A muffin recipe makes **12 muffins** and uses **3 cups of flour** and **2 cups of sugar**. A baker wants to make **30 muffins**, keeping the same proportions.

7a. Find the flour needed per muffin (the unit rate), then the flour for 30 muffins.

7b. How many cups of sugar are needed for 30 muffins? Show your work.

Explain Justify Your Strategy 5–10 min

Question 8. A phone case costs \$20. Store A takes **25% off**. Store B takes **\$4 off**. **Which store gives the lower price, and why?** Write a **Claim** (your answer), **Evidence** (the numbers you calculated), and **Reasoning** (why your strategy works).

Sentence stems you may use: "The lower price is at Store ____ because..." · "I found Store A's price by... and Store B's price by..." · "25% of \$20 is... so Store A costs..." · "This strategy works because a percent means..."

Claim (your answer / strategy)

Evidence (the numbers you used)

Reasoning (why the strategy works)

Close ACE Wrap-Up 5 min

Articulate

In your own words, explain how to find the **constant of proportionality k** from a table.

Connect

Point to one item in this packet where you used $k = y \div x$ or a unit rate. Give its number.

Extend

Give a **new** real-life example of a proportional relationship (a steady "per one" rate) that was *not* in this packet.

Continue Early Finisher optional · ~15 min

If you finish early (a challenge — no new materials needed):

Two discounts in a row. A \$60 pair of shoes is first marked **20% off**. At the register, a coupon takes an **extra 10% off the already-reduced price**. On the back of this page: (1) find the final price step by step; (2) explain why the total discount is **not** 30% off the original \$60; and (3) find the single percent off the original \$60 that would give the same final price. Show all your work.

Turn in: Hand in this whole packet with your name, class period, and date filled in. Make sure questions 1–8 and the ACE box are answered **with your work shown**. The early-finisher challenge is optional but turn it in too if you did it.

G07_MATH_Proportions_01 — Proportional Reasoning and Percents Student Packet