

Substitute Guide: Ratios, Rates, and Percents

Grade: 6 **Subject:** Mathematics **Time:** ~45 min core + ~15 min extension Math

Learning goal (plain language)

Students practice **ratios** (comparing two amounts, in simplest form), **equivalent ratios and ratio tables**, **unit rates and unit prices** (an amount "per one," used to find the better buy), and **percents** (a ratio out of 100, used for tax and for a percent of a quantity). **You do not need a math background to run this.** Every formula and a worked example are printed in the student packet. Students **show their work**; you do not need to teach the method — the packet does the teaching. Your job is to hand it out, read the start script, keep the room on task, and collect the packets.

Standards alignment

Framework: 19 TAC §111.26 (Grade 6 Mathematics). Knowledge & skills **6.4** and **6.5** — ratios, rates, and percents.

- **Primary — 6.4B (provisional):** apply qualitative and quantitative reasoning to solve prediction and comparison problems involving ratios and rates.
- **Primary — 6.5B (provisional):** solve real-world problems to find the whole given a part and a percent, to find the part given the whole and a percent, and to find the percent given the part and the whole.
- **Supporting — 6.4C (provisional):** give examples of ratios as multiplicative comparisons of two quantities describing the same situation.

Provisional — pending educator verification against the current official TAC source.

(Standards are paraphrased here, not quoted. Please confirm codes and wording against your official source.)

Setup Before class (5 min)

- Count and hand out one **student packet** per student.
- Confirm each student has a **pencil**. A **basic calculator is allowed but not required**; students who have one may use it.
- Write the date on the board and remind students to fill in the name line.
- Keep the **answer key** with you — it is a separate file and is **not** in the student packet.

Materials What's needed

- Printed student packet (4–6 pages) per student.
- Pencil per student; a basic four-function calculator is optional.
- This guide and the separate answer key (teacher only).
- No technology, no internet, no special supplies.

Timing Suggested pacing (~45–60 min)

Segment	Time	What students do
Start — Retrieval warm-up	5 min	Q1–Q2 (ratio, unit rate)
Build — Study the math	5–10 min	Read reference box, worked example, ratio-table figure; Q3
Apply — Use what you know	20–25 min	Q4–Q7 (match forms, best buy, error analysis, percent of a quantity)
Explain — Justify (CER)	5–10 min	Q8 claim/evidence/reasoning
Close — ACE	5 min	Articulate / Connect / Extend
Continue — early finishers	optional ~15 min	Write-your-own best-buy challenge

Script Read aloud to start

"Today's assignment is a paper math packet called *Ratios, Rates, and Percents*. You will work by yourself with a pencil. A basic calculator is allowed if you have one, but you do not need one. The most important rule: **show your work** — write down the numbers you use, not just a final answer. Everything you need is printed in the packet, including a worked example and all the formulas. Start with the warm-up, then read the Build section before the Apply questions. If a question is tricky, skip it and come back. Put your name, class period, and date at the top now. You have about 45 minutes; raise your hand if you need help reading a question."

Support When students ask for help

- **Students show their work; you do not need to teach the method.** Point them back to the printed **reference box** and the **worked example** — the method is right there.
- **You may read any part aloud** to a student or the class.
- If a student is stuck, prompt with "What does the worked example do?" or "What's the unit rate — the amount for one?" rather than giving the answer.
- For percents, remind them the packet says a percent means "per 100," so a percent becomes a decimal by putting it over 100 ($6\% = 6/100 = 0.06$).
- For a best buy, remind them the **lower price for one** (unit price) is the better deal.
- It is fine if a student cannot finish the optional early-finisher challenge.

Access Accommodations & language support

- **Read-aloud** of any question is allowed for all students.
- Point students to the **worked example**, the **formulas** in the reference box, and the **sentence stems** for Q8 and ACE.
- A **calculator is allowed** for any student who wants one — this removes the arithmetic barrier so students can focus on the reasoning.
- Extended time is fine; the core can stop after Q8 if time runs short.
- Students may show work with numbers and short phrases if writing full sentences is a barrier, as long as the reasoning is clear.
- The packet is grayscale-safe — it prints and reads clearly in black and white (the ratio-table figure uses a pattern, not color).

Tools Allowed & not allowed

Allowed: pencil, the printed packet, a basic (four-function) calculator, quiet self-read-aloud. **Not needed / not allowed:** phones, internet, graphing/AI calculators, or getting answers from another student.

Collect at the end: Collect every packet, whether finished or not, with names on them. Stack them for the teacher. Note on a sticky how far most students got and any questions that caused confusion. Answer key: The **answer key is a separate file** (answerkey.html) and is for the teacher only. Please do not hand it to students.

Teacher follow-up (for the returning teacher)

The highest-value items to review next class are the **error analysis (Q6)** and the **justification (Q8)**, which reveal whether students understand "percent means per 100" and why unit price is the fair comparison for a best buy. Watch for **additive instead of multiplicative reasoning** on the ratio-scaling items (Q3, Q4b), and **part-part vs. part-whole** confusion on Q4c. The percent-of-a-quantity item (Q7) shows who can find a part from a whole and a percent. The separate answer key lists worked steps, alternate strategies, misconceptions, and a 3-point rubric for Q8.

G06_MATH_Ratios_01 — Ratios, Rates, and Percents Substitute Guide

Ratios, Rates, and Percents

Grade: 6 **Subject:** Mathematics **Time:** ~45 min core + ~15 min extension **Work mode:** Independent · pencil + packet Math

Start Here

This is a **paper math packet** about ratios, rates, 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, an example) 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 ratios and rates.

1Ratio. A fruit bowl has **6 apples** and **9 oranges**. Write the ratio of **apples to oranges**, then write it again in **simplest form**. Show what you divided by.

2Unit rate. A car travels **120 miles** on **4 gallons** of gas. What is the unit rate in **miles per gallon**? Show the division you used.

Build Study the Math 5–10 min

What you need to know (with formulas)

A **ratio** compares two amounts. The ratio "6 apples to 9 oranges" can be written **6 to 9**, **6 : 9**, or **6/9**. To write a ratio in **simplest form**, divide both numbers by the same number (their greatest common factor): $6/9 \rightarrow$ divide both by 3 $\rightarrow$ **2 : 3**.

Equivalent ratios name the same comparison. You make one by multiplying (or dividing) **both** numbers by the same number. A **ratio table** lines up equivalent ratios in columns:

$$2 : 3 = 4 : 6 = 6 : 9 = 8 : 12 \text{ (each } \times 2, \times 3, \times 4 \dots)$$

A **rate** compares two amounts with **different units** (miles and gallons, dollars and pounds). A **unit rate** is a rate "per 1." To find it, **divide**:

$$\text{unit rate} = (\text{first amount}) \div (\text{second amount})$$

Example: $120 \text{ miles} \div 4 \text{ gallons} =$ **30 miles per gallon**. A **unit price** is a unit rate in dollars: $\text{dollars} \div \text{items} =$ **price for one**. The lower unit price is the "better buy."

Percent means "**per 100**," so a percent is a ratio out of 100 ($25\% = 25 \text{ out of } 100 = 25/100 = 0.25$). To turn a ratio into a percent, make an **equivalent ratio with 100 on the bottom** — this is a ratio-table method:

$$18/20 \rightarrow (\times 5 \text{ top and bottom}) \rightarrow 90/100 = 90\%$$

- **Percent of a number:** multiply. *percent (as a decimal) × whole*. Example: 15% of 40 = $0.15 \times 40 = 6$.
- You can also use a ratio table: 15 out of 100 is the same as ? out of 40.

Tip: keep the order the same in every ratio. If you write "apples : oranges," keep apples first every time.

Worked Example — a ratio table and a unit rate

A smoothie recipe mixes **2 cups of yogurt** for every **3 cups of fruit**. That is the ratio **2 : 3** (yogurt : fruit). To find other amounts that taste the same, multiply **both** numbers by the same factor. This makes a **ratio table**:

Ratio table for yogurt :
fruit = 2 : 3 (multiply
both by the same
number).

Yogurt (cups) 2 4 6 8
Fruit (cups) 3 6 9 12

Every column is **2 : 3** (4:6 divides to 2:3; 6:9 divides to 2:3; and so on). The **unit rate** of fruit per 1 cup of yogurt is $3 \div 2 = 1.5$ **cups of fruit per cup of yogurt**.

		both $\times 2$	$\div$ back to 2:3	both grow together
Yogurt (cups)	2	4	6	8
Fruit (cups)	3	6	9	12

Every column equals the ratio 2 : 3

Header cells are shaded with a pattern so the table reads clearly in black and white.

Figure 1. A ratio table for yogurt : fruit = 2 : 3. The top row is yogurt (2, 4, 6, 8) and the bottom row is fruit (3, 6, 9, 12). Moving right, both numbers are multiplied by the same growing amount, so every column simplifies back to 2 : 3. The header cells use a diagonal-line pattern (not color) so the figure reads clearly in grayscale.

3Using the worked example (yogurt : fruit = 2 : 3), how many cups of **fruit** go with **10 cups of yogurt**? Extend the ratio table or multiply both numbers by the same factor. Show your work.

Apply Use What You Know 20–25 min

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

4**Match the forms.** A paint mix uses **3 cups of blue** for every **5 cups of white**. The **same relationship** is shown three ways below: a ratio, a ratio table, and words. Study them, then answer 4a–4c.

Table B. Paint mix (blue :
white = 3 : 5).

Blue (cups) 3 6 9 ?

White (cups) 5 10 15 20

4a. Write the paint ratio blue : white in simplest form, and as a fraction.

4b. Fill in the missing "?" cup of blue that goes with 20 cups of white. Show how you scaled the ratio.

4c. In words: which is the "part-to-part" ratio, blue : white (3 : 5) or blue : total (3 : 8)? Explain in one sentence.

5Best buy (unit price). The same brand of juice comes two ways: a **3-quart bottle for \$4.50** and a **5-quart bottle for \$7.00**. Find each **unit price** (dollars per quart) and decide which is the better buy.

5a. Unit price of the 3-quart bottle. Show $\$4.50 \div 3$.

5b. Unit price of the 5-quart bottle. Show $\$7.00 \div 5$.

5c. Which bottle is the better buy? Circle it and write one sentence telling how you know.

6Error analysis. A student solved this problem: "A shirt costs \$25. The sales tax is 6%. How much is the tax?" Their work is shown in the box. **Find the mistake, explain it, and give the correct tax.**

Student's work:

6% means 6, so the tax is 6 out of 25.

So the tax is \$6.

What is wrong, and what is the correct tax?

7Multi-step percent of a quantity. A middle school has **300 students**. On a survey, **40%** chose pizza as their favorite lunch.

7a. How many students chose pizza? Show 0.40×300 (or use a ratio table: 40 out of 100 = ? out of 300).

7b. How many students did **not** choose pizza? Show your work.

Explain Justify Your Decision 5–10 min

Question 8. Two snack packs of the same crackers are on the shelf. Pack A holds **8 crackers for \$2.00**. Pack B holds **12 crackers for \$2.40**. **Which pack is the better buy, and why?** Write a **Claim** (your decision), **Evidence** (the unit prices you calculated), and **Reasoning** (why the unit-price method makes this a fair comparison).

Sentence stems you may use: "The better buy is Pack ____ because..." · "I found Pack A's price per cracker by... and Pack B's by..." · "Pack A costs ____ per cracker and Pack B costs ____ per cracker." · "Comparing unit prices is fair because..."

Claim (your decision)

Evidence (the numbers you used)

Reasoning (why the method is fair)

Close ACE Wrap-Up 5 min

Articulate

In your own words, explain how to make an **equivalent ratio** from a ratio you already have.

Connect

Point to one item in this packet where you found a **unit rate** or **unit price**. Give its number.

Extend

Give a **new** real-life example of a ratio or rate (a "per one" amount) that was *not* in this packet.

Continue Early Finisher optional · ~15 min

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

Write and solve your own best-buy problem. On the back of this page: (1) invent two package sizes of the same item with different prices (use whole numbers that divide evenly); (2) find the **unit price** of each and name the better buy; and (3) explain why a shopper might still choose the pricier package anyway (think about how much they actually need). 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.

G06_MATH_Ratios_01 — Ratios, Rates, and Percents Student Packet



TEACHER ANSWER KEY FOLLOWS

Do not copy the pages after this divider for students.

Answer Key: Ratios, Rates, and Percents

Grade: 6 **Subject:** Mathematics **For teacher use only** Math

How to use this key

Answers are grouped by section and question number, with full worked steps. Accept any correct method that reaches the right value — alternate strategies (ratio tables, scale factors, or unit rates) are noted where they apply. Watch-for notes flag common misconceptions. A basic calculator is allowed, so grade the **reasoning and steps**, not just the arithmetic. Estimated grading time: ~5–7 min per packet.

Start Warm-Up: Retrieval ~1 min

1 Ratio: 6 apples to 9 oranges.

Ratio apples : oranges = **6 : 9**. Divide both by their GCF, 3: $6 \div 3 = 2$ and $9 \div 3 = 3$, so simplest form is **2 : 3**. Full credit for the original ratio, the " $\div 3$," and 2 : 3. Accept the forms 2 to 3 or 2/3. *Watch:* order must be apples first (not 3 : 2).

2 Unit rate: 120 miles on 4 gallons.

$120 \div 4 =$ **30 miles per gallon**. Full credit for showing the division and the "per gallon" unit. *Alternate:* a ratio table halving $120 : 4 \rightarrow 60 : 2 \rightarrow 30 : 1$ also lands on 30 mpg.

Build Study the Math ~1 min

3 Fruit for 10 cups of yogurt (yogurt : fruit = 2 : 3).

From 2 cups of yogurt to 10 cups is $\times 5$, so multiply both by 5: $2 \times 5 = 10$ yogurt and $3 \times 5 =$ **15 cups of fruit**. *Alternate (unit rate):* fruit per cup of yogurt = $3 \div 2 = 1.5$, then $1.5 \times 10 = 15$ cups. Both correct.

Apply Use What You Know ~2–3 min

4 Match the forms (paint, blue : white, Table B).

4a. The ratio is already in simplest form: **3 : 5** (GCF of 3 and 5 is 1). As a fraction, **3/5**.

4b. White goes $5 \rightarrow 20$, which is $\times 4$, so blue = $3 \times 4 =$ **12 cups of blue** (the "?" is 12). Check: 12 : 20 divides by 4 back to 3 : 5.

4c. Blue : white (3 : 5) is the part-to-part ratio — it compares one part (blue) to another part (white). Blue : total (3 : 8) is part-to-whole, because $3 + 5 = 8$ is the whole mixture. Full credit for naming 3 : 5 as part-to-part with a reason.

5 Best buy: 3 qt for \$4.50 vs. 5 qt for \$7.00.

5a. $\$4.50 \div 3 =$ **\$1.50 per quart**.

5b. $\$7.00 \div 5 =$ **\$1.40 per quart**.

5c. The **5-quart bottle** is the better buy because its unit price (\$1.40/qt) is **lower** than the 3-quart bottle's

(\$1.50/qt). Full credit requires both unit prices and choosing the 5-quart bottle with a "lower price per quart" reason.

Alternate: comparing total cost for a common amount (e.g., 15 quarts: $5 \times \$4.50 = \22.50 vs. $3 \times \$7.00 = \21.00) also shows the 5-quart is cheaper.

6 Error analysis: 6% tax on a \$25 shirt.

The mistake: The student treated "**6%**" as a **plain 6** (6 dollars, or 6 out of 25) instead of "**6 per 100.**" Percent means out of 100, so $6\% = 6/100 = 0.06$, not 6.

Correct work: Tax = 6% of \$25 = $0.06 \times 25 = \$1.50$.

Alternate correct method (ratio table): 6 out of 100 = ? out of 25. Since 25 is $100 \div 4$, divide 6 by 4 $\rightarrow$ \$1.50.

Accept either as the "fix." Full credit requires (1) naming that 6% is 6 per 100 (= 0.06), not 6, and (2) the correct tax of \$1.50.

7 Percent of a quantity: 40% of 300 students chose pizza.

7a. 40% of 300 = $0.40 \times 300 = 120$ **students.** *Alternate (ratio table):* 40 out of 100 = ? out of 300; 300 is 100×3 , so $40 \times 3 = 120$.

7b. Did not choose pizza = $300 - 120 = 180$ **students.** *Alternate:* $100\% - 40\% = 60\%$, and $0.60 \times 300 = 180$. Both correct.

Explain Justify Your Decision (Q8) ~1–2 min

8 Pack A (8 crackers, \$2.00) vs. Pack B (12 crackers, \$2.40) — better buy?

Model answer. Claim: **Pack B** is the better buy. Evidence: Pack A: $\$2.00 \div 8 = \0.25 **per cracker.** Pack B: $\$2.40 \div 12 = \0.20 **per cracker.** Reasoning: Comparing the **price for one cracker** (the unit price) is fair because the packs hold different numbers of crackers, so their total prices cannot be compared directly. Pack B costs less per cracker ($\$0.20 < \0.25), so it is the better buy.

Note: Full credit requires both unit prices (\$0.25 and \$0.20) and a reason that explains why per-cracker price is the fair comparison. A student who only says "Pack B has more crackers" or "Pack B is cheaper total" without unit prices earns partial credit. (Comparing total cost for a common count — e.g., 24 crackers: $3 \times \$2.00 = \6.00 vs. $2 \times \$2.40 = \4.80 — is an acceptable alternate.)

Justification scoring rubric (3 points)

Score	Claim	Evidence	Reasoning
3	Correct pack named (Pack B).	Both unit prices computed correctly (\$0.25 and \$0.20) with the numbers shown.	Clearly explains why comparing price per cracker is a fair comparison when pack sizes differ.
2	Correct pack named.	One unit price computed, or both with a minor arithmetic slip.	Reasoning present but incomplete or missing the "different sizes $\rightarrow$ compare per one" link.
1	Pack named with weak or no support.	Evidence largely missing or incorrect.	Little or flawed reasoning.
0	No/incorrect claim.	No evidence.	No reasoning.

Close ACE ~1 min

ACE Articulate / Connect / Extend.

Articulate: Accept any correct plain-language method: "multiply (or divide) *both* numbers of the ratio by the same number; the result names the same comparison." Reject multiplying only one number.

Connect: Valid items where a unit rate or unit price was used include Q2, Q5a, Q5b, or Q8. Any of these earns credit if correctly named. (Q3 uses a ratio table / unit rate too.)

Extend: Any genuine ratio or "per one" rate not in the packet — e.g., heartbeats per minute, pages read per hour, cost per pound of bananas, students per teacher. More than one answer is defensible.

Challenge Early Finisher (optional)

EF Write and solve your own best-buy problem.

Answers vary. A complete response has: (1) two package sizes of one item with different prices; (2) a correct **unit price** for each (dollars $\div$ items) and the lower one named as the better buy; and (3) a sensible reason a shopper might still buy the pricier package — e.g., they only need a small amount and would waste the rest, the bigger package will not fit or will spoil, or they cannot afford the larger total even though it is cheaper per item. *Sample:* 6 pens for \$3.00 $\rightarrow$ \$0.50 each; 10 pens for \$4.00 $\rightarrow$ \$0.40 each; the 10-pack is the better buy, but a student who needs only 6 pens might still buy the 6-pack.

Watch Common misconceptions

- **Additive vs. multiplicative reasoning.** To make equivalent ratios, students may *add* the same number to both parts instead of *multiplying*. In Q3, going 2 $\rightarrow$ 10 cups of yogurt is $\times 5$, not "+8," so fruit becomes $3 \times 5 = 15$, not $3 + 8 = 11$. Reinforce scaling both parts by the same factor.
- **Part-part vs. part-whole ratios.** In Q4, blue : white (3 : 5) compares two parts, while blue : total (3 : 8) compares a part to the whole ($3 + 5 = 8$). Students often mix these up; always ask "is this part to part, or part to whole?"
- **The percent base ("percent of what?").** The Q6 error: treating 6% as a plain 6 instead of 6 **per 100** (0.06), and taking it "of 25." Percent is always out of 100 and always "of" a whole. In Q7, 40% is of the 300 students. Always identify the base before multiplying.
- **Reversing ratio order.** Writing apples : oranges as 3 : 2 instead of 2 : 3 (Q1), or blue : white as 5 : 3. Keep the stated order in every equivalent ratio.
- **Stopping too soon / picking the wrong "better."** In a best buy (Q5, Q8), the **lower** unit price wins; a bigger number of items or a bigger bottle is not automatically the better deal. Confirm students compared price per one.

Teacher follow-up based on likely errors

If many students miss Q6, do a quick 5-minute review that "percent means per 100," turning several percents into decimals and fractions over 100. If Q3 or Q4b shows additive reasoning (answers like $3 + 8 = 11$), model the scale-factor method and a ratio table side by side. If Q4c is missed, re-anchor part-to-part vs. part-to-whole with a quick color-mix example. The Q8 justifications reveal who can explain *why* unit price is the fair comparison — a good discussion starter next class.