



DETECTIVE NOTEBOOK

Proportional Relationships

Tables, Graphs, Equations & Verbal Descriptions

Case 1	Case 2	Case 3	Case 4
Testing for Proportional Relationships	Constant of Proportionality	Equations $y = kx$	Points on a Graph
7.RP.A.2a	7.RP.A.2b	7.RP.A.2c	7.RP.A.2d

4 Cases | 16 Problems | 4 Real-World Scenarios

Detective Name: _____ Date: _____

Grade 7 | CCSS 7.RP.A.2a-d

CCSS ANCHOR CHART

7.RP.A.2 Standard Alignment Map

This anchor chart maps each sub-standard of 7.RP.A.2 to its corresponding case in this resource, showing the key skill, the real-world scenario used, and the mathematical representations students will engage with. Teachers can print this page as a reference poster or include it in students' detective notebooks as a roadmap for the investigation.

Sub-Stan dard	Key Skill	Case	Scenario	Representations
7.RP.A.2a	Decide whether two quantities are in a proportional relationship by testing equivalent ratios in a table or by graphing on a coordinate plane	Case 1	Lemonade Stand	Tables, Coordinate Graphs
7.RP.A.2b	Identify the constant of proportionality (unit rate) from tables, graphs, equations, diagrams, and verbal descriptions	Case 2	Road Trip	Tables, Graphs, Equations, Diagrams, Verbal
7.RP.A.2c	Represent proportional relationships by equations of the form $y = kx$	Case 3	Recipe Scaling	Equations, Tables, Verbal
7.RP.A.2d	Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to $(0, 0)$ and $(1, r)$ where r is the unit rate	Case 4	Savings Account	Coordinate Points, Graphs, Verbal

What Is a Proportional Relationship?

A proportional relationship exists between two quantities when they change at a constant rate. This means the ratio between the two quantities is always the same, no matter which values you compare. If you divide the second quantity by the first, you always get the same number, called the **constant of proportionality** (k). On a graph, proportional relationships always pass through the origin $(0, 0)$ and form a straight line. The equation $y = kx$ captures this relationship algebraically, where k is the constant of proportionality. Understanding proportional relationships is essential because they appear everywhere in real life, from shopping prices to recipe measurements to speed calculations.

CASE

1

Testing for Proportional Relationships

The Lemonade Stand Investigation | 7.RP.A.2a



Skill Focus: Deciding Whether Two Quantities Are Proportional

To determine if two quantities are in a proportional relationship, you use two powerful methods. **Method 1: Test for Equivalent Ratios in a Table.** For each pair of values, compute the ratio y/x . If every pair gives the same value, the relationship is proportional. If even one ratio differs, the relationship is NOT proportional. **Method 2: Graph on a Coordinate Plane.** Plot the data points. If they fall on a straight line that passes through the origin (0, 0), the relationship is proportional. If the line curves, has a break, or does not pass through the origin, the relationship is NOT proportional. These two methods always agree, so you can use either one, or both for extra confidence!

You have been called to investigate the local lemonade stand. The owner claims the price is perfectly proportional to the number of cups sold. Your job is to examine the evidence and determine whether each set of data supports a proportional relationship. Use tables and graphs to build your case!

Problem 1.1: The Classic Recipe

A lemonade stand sells cups of lemonade. The table below shows the number of cups sold and the total cost in dollars. Is the relationship between cups sold and total cost proportional? Justify your answer by testing for equivalent ratios AND by graphing the data on a coordinate plane.

EVIDENCE: Data Table

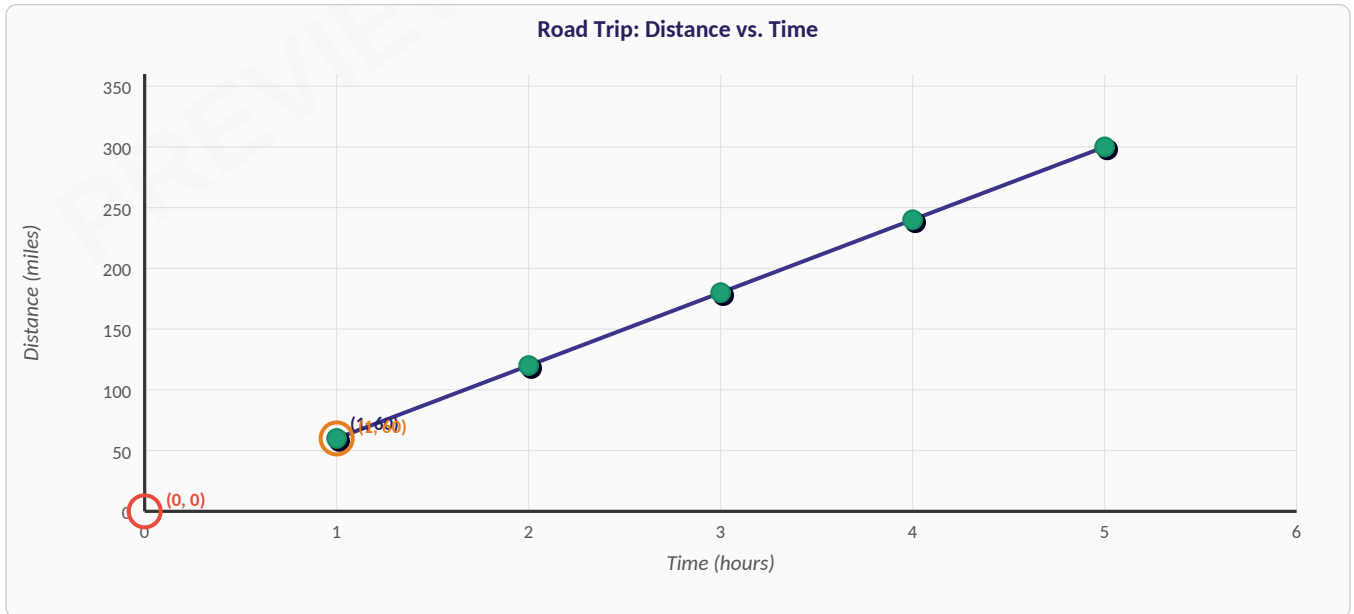
Cups (x)	Total Cost in \$ (y)	Ratio y/x
2	3.00	
4	6.00	
6	9.00	
8	12.00	
10	15.00	

Detective Tip: To test for equivalent ratios, divide each y-value by its matching x-value. If ALL the ratios simplify to the same number, you have found a constant of proportionality, and the relationship IS proportional. Write each ratio in the third column of the table above!

Graph the data:

Problem 2.2: The Speed Graph

A different road trip produced the graph below. Identify the constant of proportionality from the graph by finding the slope of the line.



What is the constant of proportionality from the graph? $k =$ _____

How can you find k using the coordinates of any two points on the line?

CASE
3

Representing Proportional Relationships by Equations

The Recipe Scaling Investigation | 7.RP.A.2c

Skill Focus: Writing Equations for Proportional Relationships ($y = kx$)

When two quantities are in a proportional relationship, you can represent that relationship with an equation in the form $y = kx$, where k is the constant of proportionality. The variable x represents the input (independent variable), y represents the output (dependent variable), and k is the constant that tells you how y changes for each unit change in x . To write the equation, you first need to find k by dividing any pair of y and x values ($k = y/x$). Then substitute k into the form $y = kx$. For example, if a recipe calls for 2 cups of flour for every 3 cups of milk, then $k = 2/3$, and the equation is $y = (2/3)x$. This equation lets you predict the amount of flour needed for ANY amount of milk, which is incredibly powerful for scaling recipes up or down.

You are consulting for a bakery that needs to scale its famous cookie recipe for different batch sizes. Your job is to write equations that represent the proportional relationships between ingredients, so the bakery can scale up or down with precision.

Problem 3.1: The Flour Formula

The original recipe calls for 2 cups of flour for every 1 batch of cookies. Write an equation that relates the number of cups of flour (y) to the number of batches (x).

EVIDENCE: Relationship Data

Batches (x)	Cups of Flour (y)	y/x
1	2	$2/1 = 2$
2	4	$4/2 = 2$
3	6	$6/3 = 2$
5	10	$10/5 = 2$
8	16	$16/8 = 2$

What is the constant of proportionality? $k =$ _____

Write the equation: $y =$ _____

Use your equation to find how many cups of flour are needed for 12 batches. Show your work.

CASE

4

Explaining Points on the Graph of a Proportional Relationship

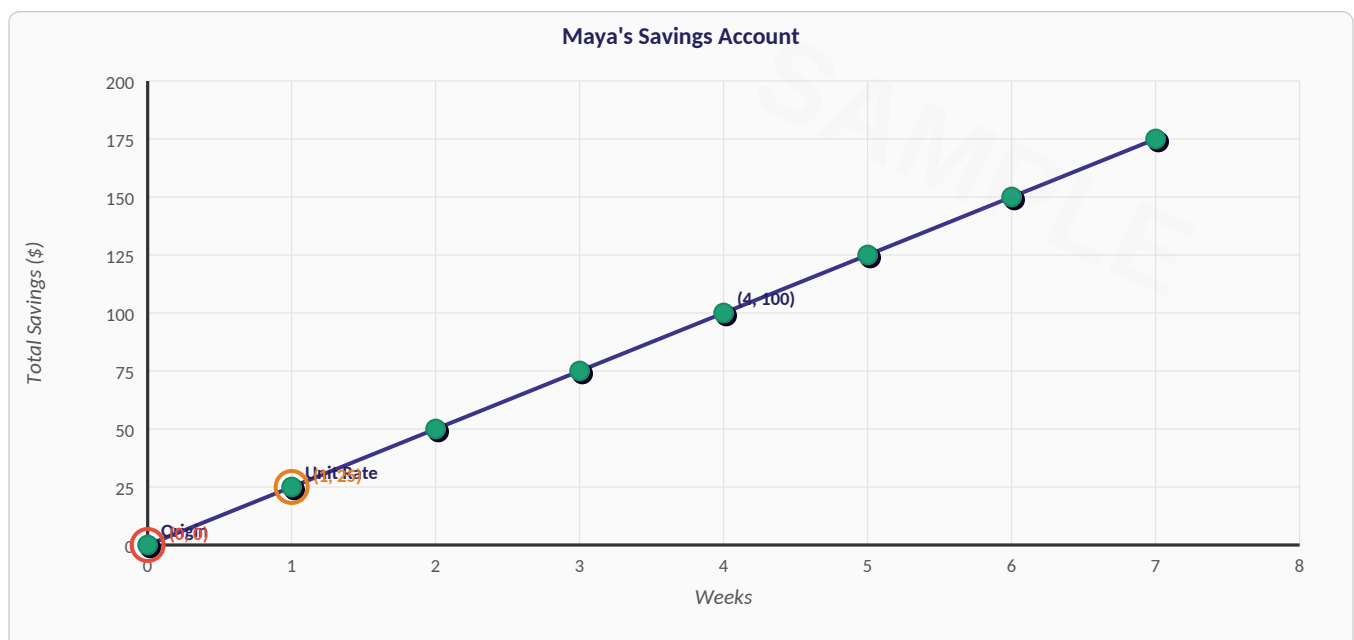
*The Savings Account Investigation | 7.RP.A.2d***Skill Focus: Interpreting Points (x, y) on the Graph, Especially (0, 0) and (1, r)**

Every point on the graph of a proportional relationship tells a story about the two quantities. The point (x, y) means that when the input is x units, the output is y units. Two special points deserve extra attention: **The origin $(0, 0)$** always appears on the graph of a proportional relationship. It means that when the input is zero, the output is also zero. For example, if you save zero weeks, you accumulate zero dollars. If a graph does NOT pass through $(0, 0)$, the relationship is NOT proportional. **The point $(1, r)$** where r is the unit rate (constant of proportionality). This point tells you the output for exactly one unit of input. For instance, $(1, 25)$ means that in 1 week, you save \$25. The value r directly reveals how fast the output changes per unit of input, making it one of the most informative points on the entire graph. When reading any graph of a proportional relationship, always locate these two key points first, as they encode the most essential information about the situation.

A student named Maya opens a savings account. She deposits the same amount every week, and the total balance grows proportionally. Your mission is to interpret the key points on the graph of her savings and explain what each point means in the context of her financial journey.

Problem 4.1: Maya's Savings Graph

Maya saves \$25 per week. The graph below shows her total savings over time. Answer the questions about the labeled points.



ANSWER KEY | WORKED EXEMPLARS

Complete Answer Key with Multiple Representations

Each solution below shows the answer using multiple representations: tables, graphs, equations, and verbal descriptions. This models the interconnected nature of proportional relationships and gives students a complete picture of how each representation connects to the others.

CASE 1

Testing for Proportional Relationships

Problem 1.1: The Classic Recipe

Table Representation:

Cups (x)	Cost (y)	Ratio y/x	Equivalent?
2	\$3.00	$3.00/2 = 1.50$	Yes
4	\$6.00	$6.00/4 = 1.50$	Yes
6	\$9.00	$9.00/6 = 1.50$	Yes
8	\$12.00	$12.00/8 = 1.50$	Yes
10	\$15.00	$15.00/10 = 1.50$	Yes

Graph Representation: The graph shows all five points falling exactly on a straight line that passes through the origin (0, 0). This confirms the relationship is proportional.

Equation Representation: $y = 1.50x$, where $k = 1.50$ (cost per cup).

Verbal Description: The cost is \$1.50 per cup of lemonade. Every cup adds exactly \$1.50 to the total, so the relationship between cups and cost is proportional.

Conclusion: YES, the relationship IS proportional because all ratios y/x equal 1.50, and the graph is a straight line through the origin.

Problem 1.2: The Discount Day

Table Representation:

Cups (x)	Cost (y)	Ratio y/x	Equivalent?
1	\$2.00	$2.00/1 = 2.00$	--
2	\$3.50	$3.50/2 = 1.75$	No

TEACHER PACING GUIDE

Teacher Pacing Guide

This pacing guide provides a recommended instructional sequence for using this resource across multiple class periods. The guide is designed for a typical 45-50 minute class period and can be adapted based on student needs, prior knowledge, and available instructional time. Each case builds on the previous one, so the sequential order is strongly recommended for initial instruction. However, teachers may choose to revisit specific cases for targeted review or remediation as needed.

Day	Focus	Activities	Time	Materials
1	Introduction & Case 1	Introduce detective theme. Review proportional relationship concepts. Complete Case 1 Problems 1.1-1.2 (testing ratios and graphing). Students set up Detective Notebooks.	45-50 min	Notebook, graph paper, ruler
2	Case 1 (cont.) & Case 2 Intro	Complete Case 1 Problems 1.3-1.4. Discuss findings. Introduce Case 2 and complete Problem 2.1 (finding k from tables).	45-50 min	Completed Case 1 work
3	Case 2 (cont.)	Complete Case 2 Problems 2.2-2.4 (k from graphs, equations, and verbal descriptions). Emphasize that k appears in every representation.	45-50 min	Ruler, graph paper
4	Case 3: Equations	Complete all four Case 3 problems. Focus on writing $y = kx$ from various data sources. Practice substitution to find unknowns.	45-50 min	Calculator (optional)
5	Case 4: Graph Points	Complete Case 4 Problems 4.1-4.2. Deep discussion of $(0,0)$ and $(1, r)$. Compare proportional vs. non-proportional graphs.	45-50 min	Ruler, colored pencils
6	Case 4 (cont.) & Review	Complete Case 4 Problems 4.3-4.4. Whole-class review connecting all four cases. Students present their detective conclusions.	45-50 min	All completed cases
7	Assessment & Extension	Formative assessment or quiz using answer key exemplars as models. Optional: students create their own proportional relationship case file.	45-50 min	Assessment handout

WHAT'S INSIDE THE FULL RESOURCE

Proportional Relationships Detective | Grade 7 | CCSS 7.RP.A.2a-d

1

Case 1: Testing for Proportional Relationships

The Lemonade Stand Investigation | 7.RP.A.2a

- ✓ 4 problems testing equivalent ratios in tables
- ✓ 4 coordinate plane graphs to analyze
- ✓ Proportional AND non-proportional examples
- ✓ Evidence-collection worksheet format

2

Case 2: Identifying the Constant of Proportionality

The Road Trip Investigation | 7.RP.A.2b

- ✓ 4 problems finding k from multiple representations
- ✓ Tables, graphs, equations, diagrams & verbal descriptions
- ✓ Unit rate (k) highlighted in every format
- ✓ Slope calculation from coordinate graphs

3

Case 3: Representing Proportional Relationships by Equations

The Recipe Scaling Investigation | 7.RP.A.2c

- ✓ 4 problems writing $y = kx$ equations
- ✓ Substitution practice to find unknowns
- ✓ Recipe scaling with flour, sugar, chocolate chips, butter
- ✓ Correct vs. incorrect equation comparison

4

Case 4: Explaining Points on the Graph

The Savings Account Investigation | 7.RP.A.2d

- ✓ 4 problems interpreting (x, y) points in context
- ✓ Special focus on $(0, 0)$ and $(1, r)$ where r = unit rate
- ✓ Proportional vs. non-proportional graph comparison
- ✓ Real-world savings scenarios with and without initial balance

34

PAGES

WHAT'S INSIDE THE FULL RESOURCE

Proportional Relationships Detective | Grade 7 | CCSS 7.RP.A.2a-d

A 34-page Grade 7 investigation organized into four cases. Students work with tables, graphs, equations, and verbal descriptions to explore proportional relationships across four real-world scenarios.

CASE 1

Testing for Proportional Relationships

The Lemonade Stand Investigation | 7.RP.A.2a

- 4 problems using equivalent ratios and coordinate graphs
- Proportional and non-proportional data sets
- Evidence-collection worksheet format

CASE 2

Identifying the Constant of Proportionality

The Road Trip Investigation | 7.RP.A.2b

- 4 problems finding k from multiple representations
- Tables, graphs, equations, diagrams, and verbal descriptions
- Includes slope from coordinate graphs

CASE 3

Representing Proportional Relationships by Equations

The Recipe Scaling Investigation | 7.RP.A.2c

- 4 problems writing equations in the form $y = kx$
- Substitution practice for unknown values
- Recipe examples and equation comparisons

CASE 4

Explaining Points on the Graph

The Savings Account Investigation | 7.RP.A.2d

- 4 problems interpreting (x, y) points in context
- Focus on $(0, 0)$ and $(1, r)$, where r is the unit rate
- Proportional and non-proportional graph comparisons

BONUS RESOURCES & TEACHER TOOLS

- Detective Notebook cover (printable)
- 4 color-coded tab dividers (cut-ready)
- Case-file folder template with evidence checklist
- CCSS alignment anchor chart for 7.RP.A.2a-d
- Complete answer key with worked exemplars
- Teacher pacing guide with a 7-day recommended sequence
- Review request page

34

Total Pages

16

Problems

4

Cases

4

Real-World Scenarios