



UM PRINTABLES

PREMIUM EDUCATIONAL RESOURCES

GRADE 6 | CCSS 6.EE.C.9 | DISCOVERY LAB

Dependent & Independent Variables Discovery Lab

Tables, Graphs & Equations — Real-World Lab

Lemonade Stand

Distance Traveled

Phone Plan Cost

Plant Growth

A 4-scenario, discovery-based mega unit helping students derive the relationship between variables through tables, graphs, and equations.

UM PRINTABLES · PREMIUM EDUCATIONAL RESOURCES

Teacher-tested · Classrooms-ready · Aligned to Common Core State Standards

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SECTION 4

Anchor Chart — Variables Identification

Print on 11×17 cardstock and laminate. Hang year-round as a reference.

INDEPENDENT VARIABLE

The variable **you choose** or **you control**. It is the input.

Ask: "What am I changing?" or "What do I pick?"

Goes on the **x-axis** (horizontal).

Goes in the **left column** of a table.

DEPENDENT VARIABLE

The variable **you measure** or **compute**. It is the output.

Ask: "What depends on my choice?" or "What do I find out?"

Goes on the **y-axis** (vertical).

Goes in the **right column** of a table.

The "I-Change / I-Measure" Test

When you read a real-world scenario, run this two-question test on each quantity. The quantity you can **set** or **choose** is the independent variable. The quantity that **results from** your choice is the dependent variable. If you cannot decide, ask yourself: "If I changed this number, would the other number also have to change?" The one you change first is independent.

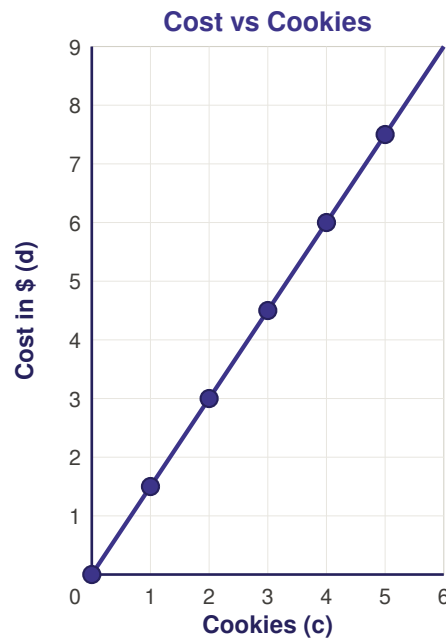
Decision Flowchart

Read the scenario. Underline the two quantities.
Q1: Can I choose or set the value of this quantity?
YES → This is the INDEPENDENT variable (x-axis)
NO → This is the DEPENDENT variable (y-axis)
Check: Does the second quantity change when the first one changes? If yes, you are correct.

Four Worked Examples

Scenario	Independent (x)	Dependent (y)
Lemonade Stand: \$2.50 per cup sold.	Cups sold (t) — I choose how many cups to track.	Dollars earned (d) — depends on cups sold.
Driving at 45 mph for several hours.	Time in hours (t) — I choose the times I check.	Distance in miles (d) — depends on time.
Phone plan: \$20 monthly + \$0.05 per minute.	Minutes used (m) — depends on how I talk.	Total cost in dollars (c) — depends on minutes.

Cookies (c)	Cost in \$ (d)
0	0.00
1	1.50
2	3.00
3	4.50
4	6.00
5	7.50

**Step 4 → Equation:**

Looking at the table, each time c goes up by 1, d goes up by 1.50. The slope is **1.50**. The line crosses the y -axis at 0, so the y -intercept is **0**.

$$d = 1.50c$$

Verify: $c = 3 \rightarrow d = 1.50 \times 3 = 4.50$

✓ (matches table row 4)

Proportional vs Non-Proportional — A Quick Visual Check

Proportional relationships have a graph that goes through the origin $(0, 0)$ and an equation of the form $y = mx$ (no constant added). All four scenarios in this unit involve continuous data, so points should be connected with a line. **Non-proportional** relationships have a graph that does NOT go through the origin and an equation of the form $y = mx + b$ where $b \neq 0$. The y -intercept (b) tells you the value of the dependent variable when the independent variable is 0.

Vocabulary Cards — Cut Out & Fold

Cut along the solid borders. Fold along the dashed centerline (term outside, definition inside).

Independent Variable

Definition: The variable whose value you choose or control. It is the input of the relationship.

Example: In Scenario 1, the **number of cups sold** is independent.

Non-example: The dollars earned is NOT independent — it depends on cups sold.

Dependent Variable

Definition: The variable whose value is determined by the independent variable. It is the output.

Example: In Scenario 1, the **dollars earned** is dependent.

Non-example: The number of cups sold is NOT dependent — you choose it first.

Discrete Data

Definition: Data that can only take specific values (usually counted). Points are not connected on a graph.

Example: Number of students in a class: 1, 2, 3 — you cannot have 2.5 students.

Non-example: A person's height in cm is NOT discrete — it can be any value within a range.

Continuous Data

Definition: Data that can take any value within a range (usually measured). Points are connected with a line on a graph.

Example: Distance a car travels: 0, 1.5, 7.3, 12.8 miles — any value is possible.

Non-example: The number of cars in a parking lot is NOT continuous — it must be a whole number.

Proportional Relationship

Definition: A relationship where $y = mx$. The graph is a straight line through the origin (0, 0).

Example: $d = 2.50t$ (Scenario 1) — 0 cups sold = \$0 earned.

Non-example: $c = 20 + 0.05m$ (Scenario 3) is NOT proportional — it has a \$20 starting fee.

Linear Relationship

Definition: A relationship where $y = mx + b$. The graph is a straight line (may or may not pass through the origin).

Example: All four scenarios in this lab are linear relationships.

Non-example: A relationship like $y = x^2$ is NOT linear — its graph is a curve.

Key: The top shaded box is the term (visible when folded). The bottom box contains the definition, example, and non-example (hidden inside the fold).

SECTION 1

Scenario 1 — Lemonade Stand

A proportional relationship: $d = 2.50t$ (dollars earned per cup sold).



$$d = 2.50t$$

Learning Target

I can identify the independent and dependent variables in a real-world scenario, build a table of values, graph the relationship, and derive the equation $y = mx$ for a proportional relationship.

Scenario Introduction (read aloud)

Maya is running a lemonade stand at her neighborhood block party. She charges **\$2.50 for each cup of lemonade**. As the afternoon goes on, she keeps a tally of how many cups she sells. At the end of the day, she wants to know how much money she made. The number of cups sold determines the dollars earned — each cup adds \$2.50 to her total. Your job is to discover the relationship between cups sold and dollars earned, and to write an equation that lets Maya predict her earnings for any number of cups.

Warm-up (5 min)

Show students a real cup (or a picture of one). Ask: "If I sell 1 cup for \$2.50, how much do I earn? What about 2 cups? 10 cups?" Let students compute mentally and share answers. Then ask: "How could we predict the earnings for ANY number of cups without doing each multiplication separately?" Collect predictions on the board. This primes them for the equation.

Math Talk Moves

Wait time: After asking "what pattern do you notice?", wait at least 7 seconds before taking responses. **Revoice:** "So you are saying that every time t goes up by 1, d goes up by 2.50?" **Press for reasoning:** "How do you know the line goes through the origin?" **Add on:** "Who can add to what Jamal just said about the multiplier?" **Turn and talk:** "With your shoulder partner, decide whether this relationship is proportional or not — be ready to defend your answer."

Differentiation

- Below-level scaffold:** Pre-fill the first 2 rows of the data table. Provide a partially completed graph with the x-axis and y-axis labeled and the first point (0, 0) plotted. Use a calculator. Work with a partner. Sentence stem: "Each time t goes up by ____, d goes up by ____."
- Above-level extension:** Ask: "What would the equation be if Maya raised her price to \$3.00 per cup? To \$4.00?" Have students graph all three lines on the same coordinate plane and observe how the slope changes. Ask: "What does a steeper line mean in this context?"

SCENARIO 1 — STUDENT LAB (Part 2 of 2)

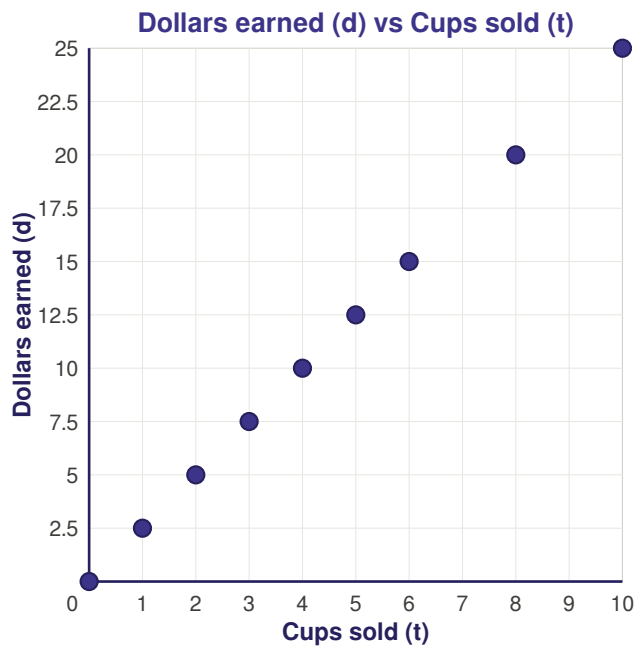
Lemonade Stand — Graph & Equation

Stop & Think

Before you graph: look at your completed table. As the independent variable increases by 1, how much does the dependent variable increase?
Write your observation here:

Step 3 — Graph the Data

Use the printable coordinate plane (Section 11) or the grid below. Plot each ordered pair from your table. Connect the points with a line if the data is continuous. Label both axes with units.



SCENARIO 1 — EQUATION & ANALYSIS

Lemonade Stand — Derive the Equation

Step 4 — Derive the Equation

Look at your table. **Each time t goes up by 1, d goes up by 2.50.** This means the multiplier (slope) is **2.50**. **When $t = 0$, $d = 0$** — the line passes through the origin, so there is no constant added. The equation takes the form **$d = mt$** where m is the slope. Substituting, we get **$d = 2.50t$** . This is a proportional relationship because it has the form $y = mx$ (no y -intercept).

Write Your Equation Here

Equation: _____

Verify Your Equation

Pick one row from your table. Plug the independent value into your equation. Check that you get the dependent value from the table.

Test value (x)	Substitute into equation	Compute	Matches table? (Y/N)

Analysis Questions

1. What is the slope of the line? What does it mean in the context of the lemonade stand?

2. Does the line pass through the origin (0, 0)? Why or why not?

3. Is this a proportional or non-proportional relationship? Explain how you know.

4. If Maya sold 20 cups of lemonade, how much money would she earn? Show your work.

5. Maya wants to earn \$50. How many cups does she need to sell? Show your work.

Reflection

SECTION 12

Exit Tickets

Four spiraled exit tickets — one per day of instruction. Print and cut in half.

EXIT TICKET #1

Name: _____ Date: _____ Class: _____

Scenario: Sarah sells handmade bracelets for \$4 each.

1. Identify the independent and dependent variables. Write each with its symbol and units.

2. Build a table for 0, 1, 2, 3, 4, 5 bracelets. Then write the equation that gives total sales s as a function of bracelets sold b .

EXIT TICKET #2

Name: _____ Date: _____ Class: _____

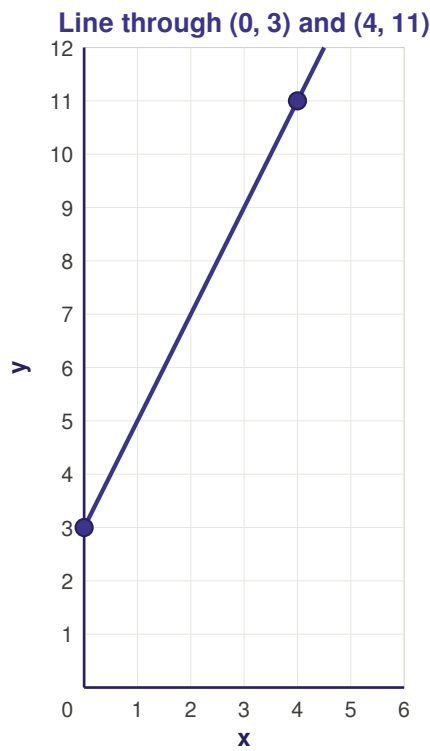
Scenario: A train travels at a constant speed of 60 miles per hour.

1. Identify the independent and dependent variables. Which one goes on the x-axis and which on the y-axis?

2. Make a table for 0, 1, 2, 3, 4 hours. Write the equation for distance d as a function of time t . Is this proportional? How do you know?

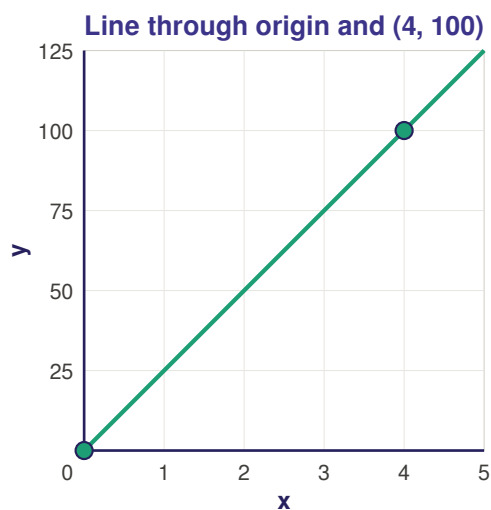
Part 4 — Graph Interpretation (2 questions, 5 points each)

9. (5 pts) A line on a coordinate plane passes through the points $(0, 3)$ and $(4, 11)$. Find the slope and y-intercept. Then write the equation of the line.



Slope, y-intercept, and equation:

10. (5 pts) A line on a coordinate plane is shown below. The line passes through the origin and the point $(4, 100)$. What is the equation of the line? Is this a proportional relationship? Explain.



Equation and explanation:

SECTION 14

Student Self-Assessment Rubric

Reflect on your understanding of 6.EE.C.9 and set a goal for your next steps.

Name: _____ Date: _____

After completing this lab, rate yourself on each skill using the rubric below. Be honest — this helps you (and your teacher) know what to focus on next. Check the box that best matches your current understanding.

Rubric

Skill	Novice (1)	Apprentice (2)	Proficient (3)	Expert (4)	Your Level
9a. Identify variables Pick independent vs dependent in a real-world context.	I am not sure which variable is which.	I can identify variables with help.	I can identify variables on my own.	I can explain why each is independent or dependent.	☐ ☐ ☐ ☐
9b. Build a table Generate ordered pairs from an equation or rule.	I cannot fill in a table.	I can fill in some rows with help.	I can complete a table on my own.	I can choose good x-values (including 0) and verify.	☐ ☐ ☐ ☐
9c. Graph the data Plot ordered pairs on a coordinate plane.	I cannot plot points.	I can plot points with help.	I can plot and label points independently.	I can plot, label, and connect points appropriately.	☐ ☐ ☐ ☐
9d. Write an equation Derive $y = mx$ or $y = mx + b$ from a table or graph.	I cannot write an equation.	I can write $y = mx$ but not $y = mx + b$.	I can write both forms correctly.	I can derive and verify the equation for any new scenario.	☐ ☐ ☐ ☐
9e. Analyze & relate Identify proportional vs non-proportional; connect graph to equation.	I do not know the difference.	I can identify proportional but not explain why.	I can identify and explain using a graph or table.	I can teach this to a peer.	☐ ☐ ☐ ☐

Reflection Prompts

1. Which skill are you strongest in? Why?

2. Which skill do you most need to practice? What will you do to improve?

SECTION 15

Teacher Answer Key — Scenarios 1–4

Complete worked solutions for every scenario. Show these to students only after they have attempted the lab themselves.

Scenario 1 — Lemonade Stand ($d = 2.50t$)

Variables: Independent: cups sold (t), units = cups. Dependent: dollars earned (d), units = dollars. **Equation:** $d = 2.50t$. **Proportional:** YES (y-intercept = 0, line passes through origin).

t (cups)	d (dollars)	Computation
0	0.00	$2.50 \times 0 = 0.00$
1	2.50	$2.50 \times 1 = 2.50$
2	5.00	$2.50 \times 2 = 5.00$
3	7.50	$2.50 \times 3 = 7.50$
4	10.00	$2.50 \times 4 = 10.00$
5	12.50	$2.50 \times 5 = 12.50$
10	25.00	$2.50 \times 10 = 25.00$
20	50.00	$2.50 \times 20 = 50.00$

Scenario 1 — Analysis Answers

- Slope = 2.50. It represents the price per cup (\$2.50/cup).
- YES, the line passes through (0, 0). At 0 cups sold, Maya earns \$0.
- Proportional. The graph passes through the origin and the equation is of the form $y = mx$ (no constant added). The ratio d/t is always 2.50.
- $d = 2.50 \times 20 = \$50.00$.
- $50 = 2.50t \rightarrow t = 50 \div 2.50 = 20$ cups.

Scenario 2 — Distance Traveled ($d = 45t$)

Variables: Independent: time in hours (t), units = hours. Dependent: distance in miles (d), units = miles. **Equation:** $d = 45t$.

Proportional: YES (y-intercept = 0).

t (hours)	d (miles)	Computation
0	0	$45 \times 0 = 0$
1	45	$45 \times 1 = 45$
2	90	$45 \times 2 = 90$
3	135	$45 \times 3 = 135$
4	180	$45 \times 4 = 180$



What's Inside the Full Resource

56 pages • Grade 6 • CCSS 6.EE.C.9 • Discovery Lab

UMPrintables.com

A complete classroom resource for connecting variables, tables, graphs, and equations.

Built around four real-world discovery scenarios and a sequence that moves students from identifying variables to modeling and analyzing relationships.

01 Teacher Overview & Pacing

Discovery approach, 5-day and 7-day pacing options, materials, lesson flow, assessment overview, and differentiation guidance.

02 CCSS Alignment Chart

6.EE.C.9 unpacked into observable sub-skills, plus a scenario-by-scenario map and Standards for Mathematical Practice.

03 2 Anchor Charts

Variables Identification and Table → Graph → Equation visual references for ongoing classroom use.

04 Vocabulary Foldable

Cut-and-fold cards for six terms: independent variable, dependent variable, discrete data, continuous data, proportional relationship, linear relationship.

05 Scenario 1 — Lemonade Stand

Proportional relationship: $d = 2.50t$. Includes teacher-facing launch/support and student work with table, graph, equation, and analysis.

06 Scenario 2 — Distance Traveled

Proportional constant-speed relationship: $d = 45t$. Students connect time, distance, tables, graphs, and equations.

07 Scenario 3 — Phone Plan Cost

Non-proportional relationship: $c = 20 + 0.05m$. Focuses on base fee, slope, y-intercept, and why the graph does not pass through the origin.

08 Scenario 4 — Plant Growth

Non-proportional relationship: $h = 2w + 5$. Students interpret starting height, growth rate, graph features, and equation structure.

09 Coordinate Plane Grids

Printable coordinate-plane grid paper in two scales, plus an axis-labeling guide matched to the four scenarios.

10 4 Exit Tickets

Four short formative checks, one built around each scenario, for quick evidence of student understanding.

11 12-Question Quiz

A 50-point summative quiz covering variable identification, table completion, graph interpretation, equations, and explanations.

12 Self-Assessment + Answer Keys

A four-level student rubric with reflection prompts, followed by complete worked keys for the four scenarios, exit tickets, and quiz.