Algebra Strings

Look for patterns.

$$\frac{12-6}{10-5}$$

$$\frac{11-5}{9-4}$$

$$\frac{10-4}{8-3}$$

$$\frac{4-10}{3-8}$$

Look for patterns. Teacher Notes

Analyzing fractions that include subtraction in the numerator and denominator supports students' slope calculations. Use this Math Talk at the beginning of the lesson. Students may notice that each fraction reduces to 6/5. As students share their thoughts, ask:

- What pattern do you see in the fractions?
- If you graphed the points (10, 12) and (5, 6), what relationship would they have? What about the points (7, 10) and (2, 4)?
- What do you know about the value of the variable a in the last fraction?

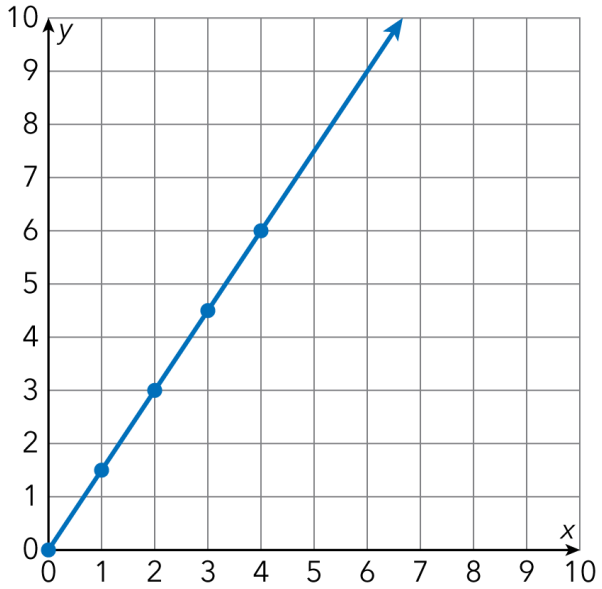
Encourage students to think about the reduced form of the fractions and the points each fraction might represent. Record students' observations. Students may say that a could be any number. This is a valid point, but if the fraction fits the pattern in the string, $a = 3$.

If time allows, invite students to generate other strings of slope fractions.

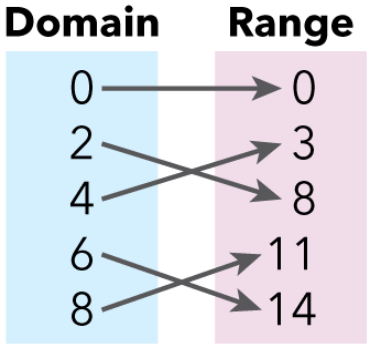
Which One Doesn't Belong?

Choose one. Tell how it is different.

A



B



C

(0, 0), (2, 3), (2, 5), (4, 6), (6, 10), (8, 11)

D

Input	0	2	4	6	8
Output	4	3	2	1	0

Which One Doesn't Belong?

Choose one. Tell how it is different. Teacher Notes

These representations of relations review concepts related to proportional and linear relationships, and support students' understanding of relations and functions. Use this Math Talk at the beginning of the lesson.

Students are likely to notice right away that A is a graph, B is an arrow diagram, C is a list of ordered pairs, and D is a table. Encourage them to examine the representations carefully to see how they can find a common way to group three together with one outstanding.

They may notice the following:

- the output values of A, C, and D are all increasing or decreasing, while the output values for B are both increasing and decreasing;
- A, B, and D are functions, but C is not;
- A, B, and C include the origin, but D does not.

Strategize First Steps

Decide on a first step.

Marcus went for a hike in the woods. He made a couple of notes along the way. What was his average walking rate?

Time (hours)	$\frac{1}{4}$	$1\frac{1}{2}$
Distance (miles)	0.8	4.8

Decide on a first step. Teacher Notes.

Students strategize about properties of linear functions as they consider possible first steps for this problem.

Tell students that the focus of the discussion should be on the first step, and not on solving the problem.

As students share, support them in making connections among the strategies. Ask:

- When would you find it helpful to graph the points?
- When do you need to find the slope? the y-intercept? Which would you find first?
- How does graphing the points help you find the slope? the y-intercept?

At this point in their learning, students are likely to present several possible first steps.

Equation Detective

Analyze this solution. Look for any mistakes.

Write an equation for the line that passes through $\left(2\frac{1}{2}, 5\frac{3}{4}\right)$ and $\left(6\frac{1}{2}, 1\frac{3}{4}\right)$.

Find the slope: $\dfrac{5\frac{3}{4} - 1\frac{3}{4}}{6\frac{1}{2} - 2\frac{1}{2}} = \frac{4}{4}$, or 1

Find the y-intercept: $y = 1x + b$

$$5\frac{3}{4} = 1\left(2\frac{1}{2}\right) + b$$

$$b = 5\frac{3}{4} - 2\frac{1}{2}, \text{ or } 3\frac{1}{4}$$

An equation for the line is $y = x + 3\frac{1}{4}$.

Equation Detective

Analyze this solution. Look for any mistakes.

Teacher Notes.

Operating flexibly with fractions and decimals prepares students for working with rates of change in this lesson. Use this Math Talk at the to support students' understanding of how to find slope.

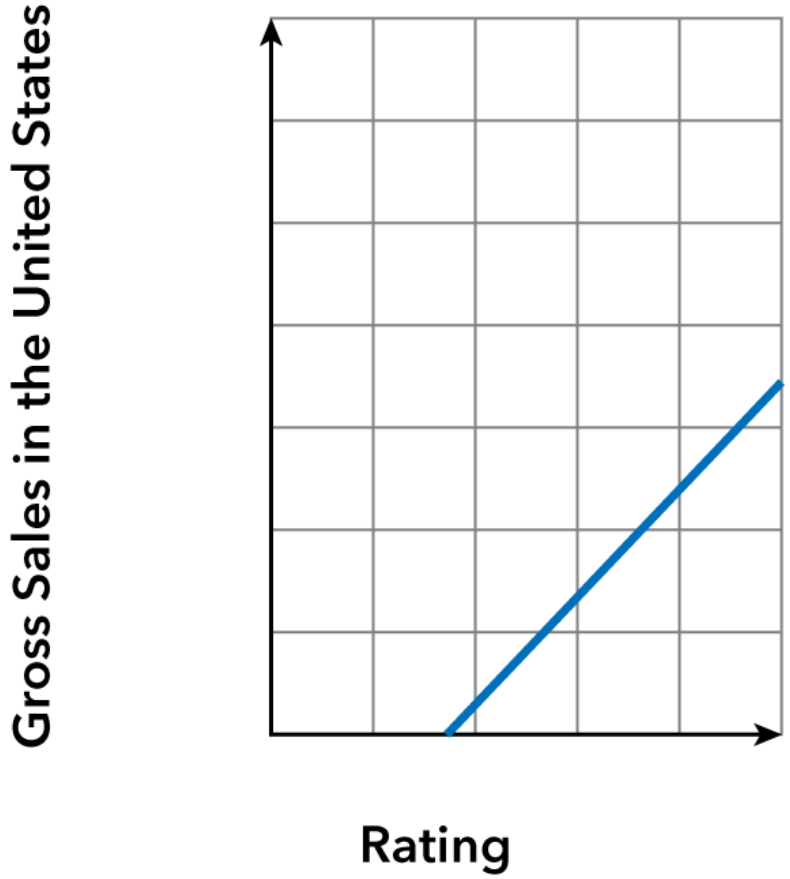
If students are still learning about slope, they may not notice the error in the slope formula (the student wrote $\frac{y_1 - y_2}{x_2 - x_1}$).
Note that the calculations are, in fact, correct, even though the original substitution was not.

As students talk about the work, ask:

- What steps did this student take to write an equation from two points?
- Did the student perform the order of operations correctly?
- Are the student's calculations correct? How do you know?
- Why might you want to graph the two points? What might you see?

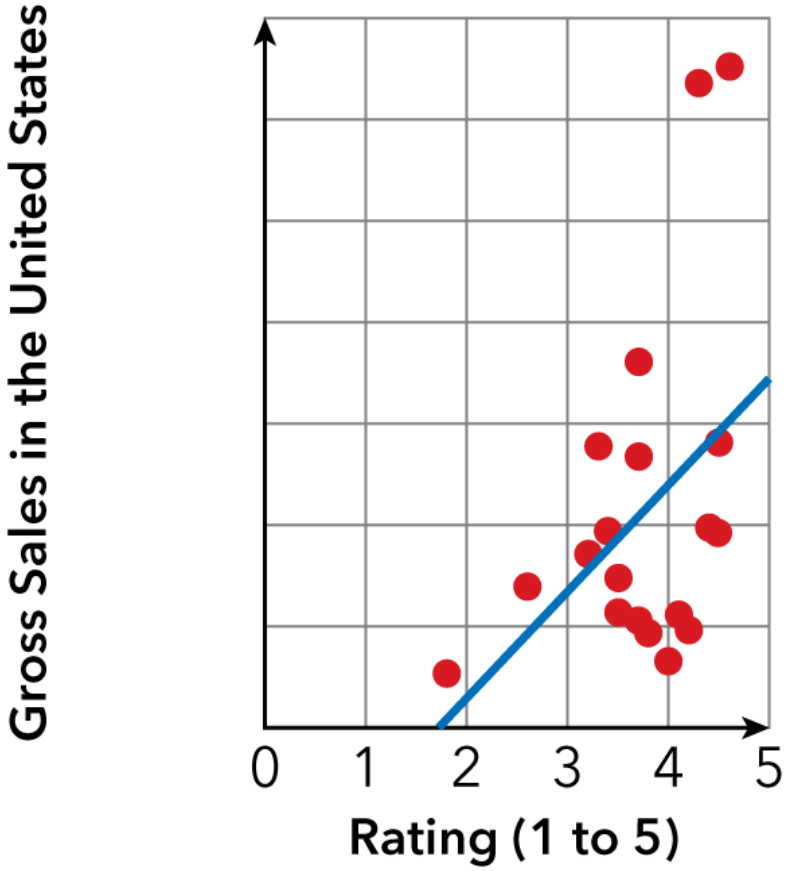
Slow Reveal Graph (1 of 4)

What do you think this graph is about?



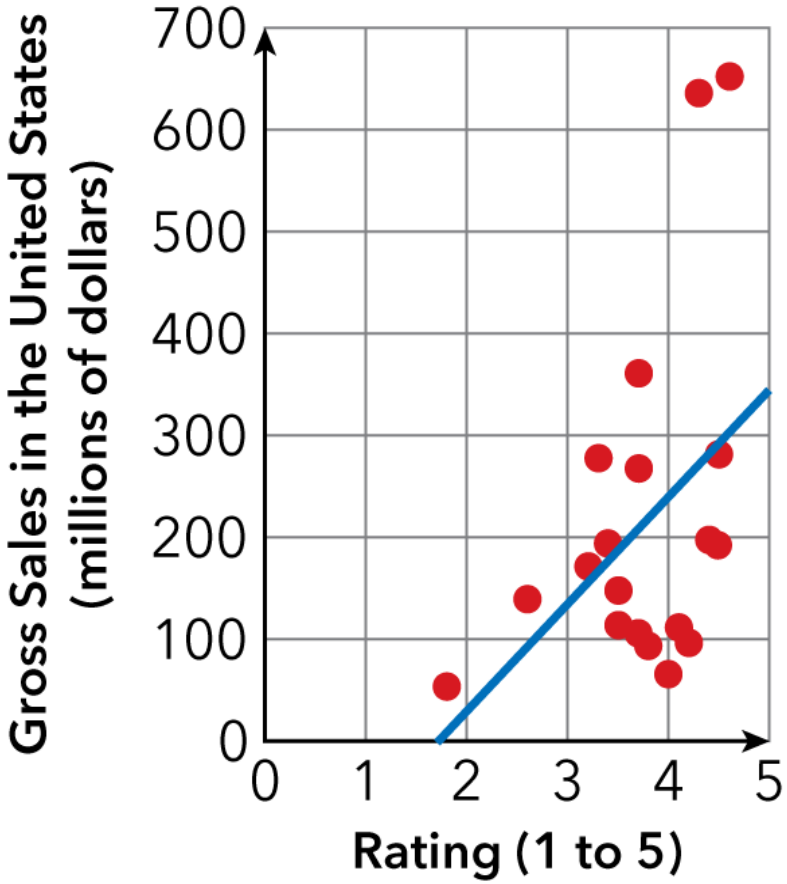
Slow Reveal Graph (2 of 4)

What do you think this graph is about?



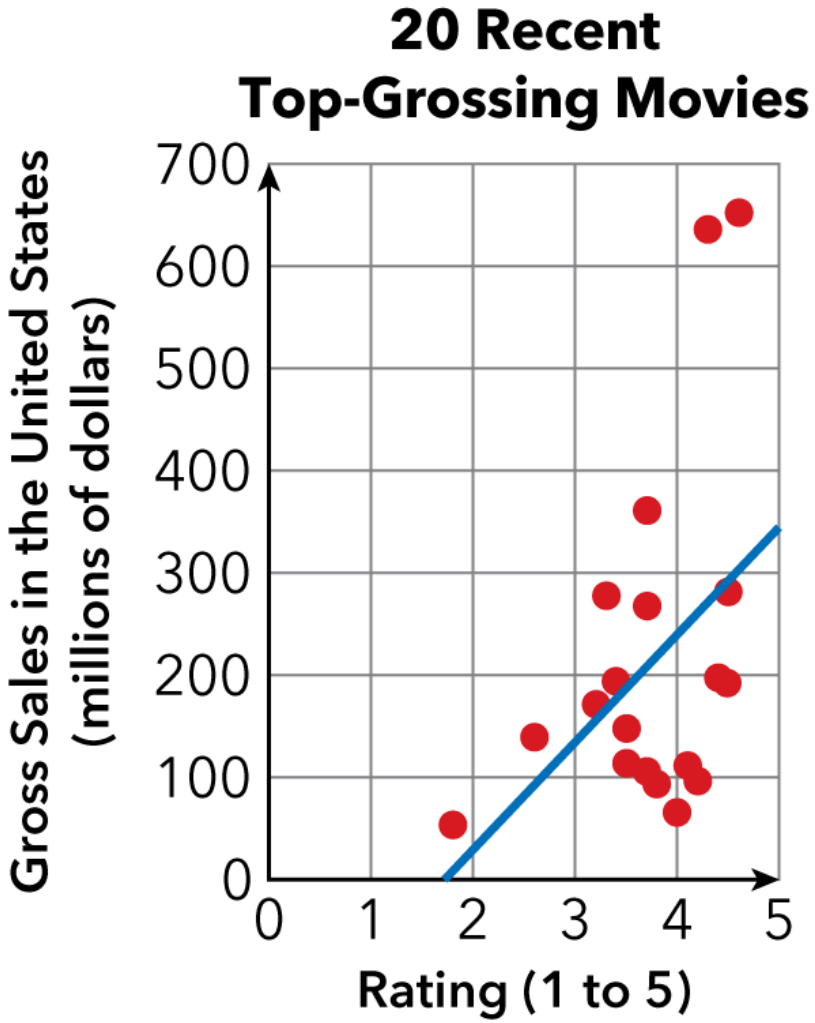
Slow Reveal Graph (3 of 4)

What do you think this graph is about?



Slow Reveal Graph (4 of 4)

What do you think this graph is about?



Slow Reveal Graph (4 of 4)

What do you think this graph is about? Teacher Notes.

The plot of real-world data prepares students for using trend lines and equations to make predictions. Use this Math Talk to prompt discussion about the fit of a trend line to data.

After the first slide, ask:

- What do you expect the axis scales to be? What might they represent?

After the second slide, ask:

- How well do you think the trend line fits the data?
- How would you describe this association?

After the third slide, ask:

- If a movie has a rating of 2.25, what would you expect the gross sales to be? How confident are you about your expectation? Explain.
- If a movie has a rating of 4.25, what would you expect the gross sales to be? How confident are you about your expectation? Explain.

Same But Different

Compare the tables.

Students Polled	Use Their School Website Daily		
	Yes	No	Total
Age 13–14	68	32	100
Age 15–16	90	10	100
Total	158	42	200

Students Polled	Use Their School Website Daily		
	Yes	No	Total
Age 13–14	34%	16%	50%
Age 15–16	45%	5%	50%
Total	79%	21%	100%

Same But Different

Compare the tables. Teacher Notes.

Comparing two tables prepares students for finding and interpreting relative frequencies in this lesson. Use this Math Talk to support analysis of a two-way frequency table and its connection to relative frequencies representing the same data.

Students may notice that the headings and categories for the two tables are the same. This may lead them to make the conjecture that the tables represent the same poll results. Ask:

- How do the values in the cells compare?
- Could the two tables represent the same poll results? How do you know?
- Could they represent different poll results? How?

Discuss the advantages of representing poll results using a two-way relative frequency table. Encourage students to look beyond the fact that the row and column heads are the same.