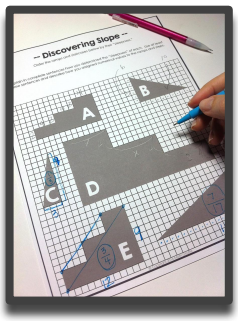
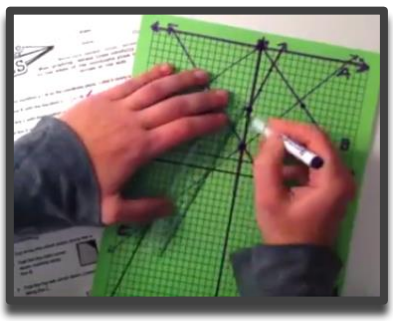
- your complete, FREE -

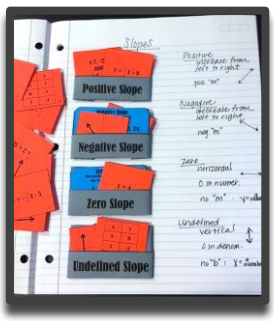
Guide to Teaching

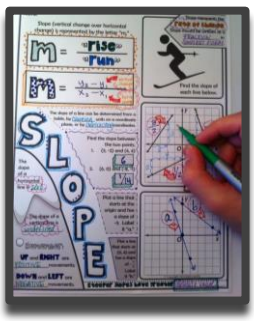
SLOPE

- with creative & effective methods -









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This teaching guide contains ideas and printable resources for teaching slope, along with advertisements for additional teaching materials that are available for purchase.

Thanks so much for downloading this file!

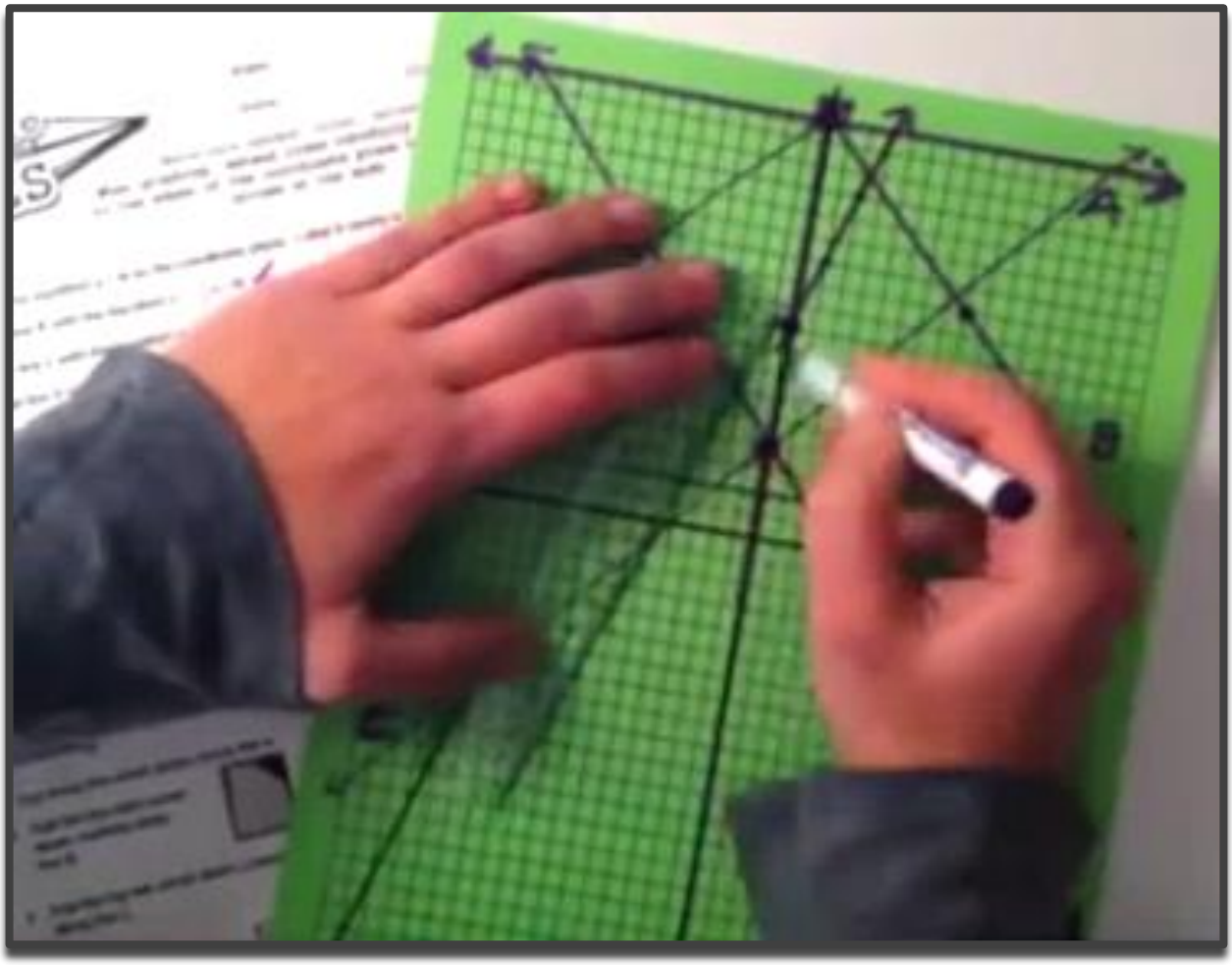
I hope that you and your students enjoy these strategies!

Guide to Teaching Slope

CONTENTS

PART I

Activating Prior Knowledge



Review Old Skills

Before jumping into a new math concept, it's always helpful to review the old skills that are about to pop up again.

I like to do this through daily warm-ups. Warm-ups are a great way to get students started working quietly each class period while you take attendance, touch base with students who have been absent, and handle other little tasks.

For a lesson introducing slope, here are some prior skills that you'll want to refresh in student minds:

- Simplifying fractions (This should be simple for them by now, but be sure to throw in situations with negative numbers now – What happens when the numerator and denominator are both negative? What about when only one is negative? Also include situations with zero for special cases – What happens when the numerator is zero? What about when the denominator is zero?)
- Plotting points on the coordinate plane
- Finding patterns in tables (x-y relationships)

Reviewing these and hitting all the special cases ahead of time in the simpler problems that cover prior knowledge will help the lesson to go more smoothly.

To Review in Warm-Ups:

- **Simplifying fractions containing negative numbers and zero**
- **Plotting points in the coordinate plane**
- **Relationships in x-y tables**

You can print the next page for a sample student warm-up that is perfect for leading into your introductory lesson on slope.

Warm-Up

Name:

Simplify.

1. $\frac{-3}{-6}$

2. $\frac{-8}{2}$

3. $-\frac{12}{9}$

4. $\frac{0}{-7}$

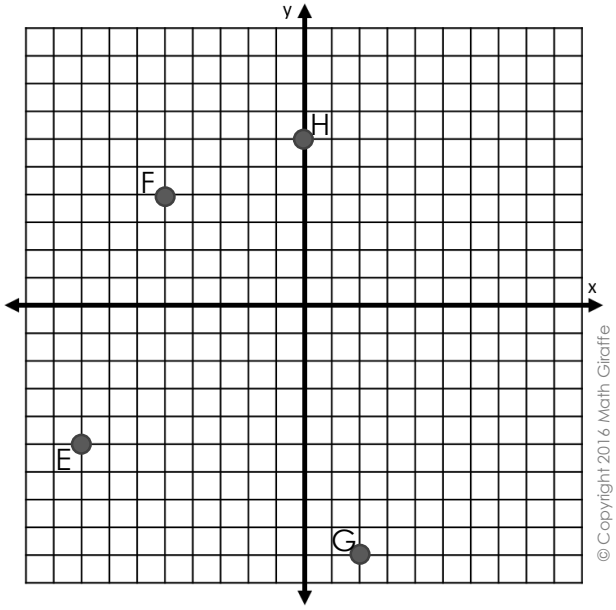
Explain each relationship using a complete sentence.

5.

x	y
-1	-3
1	3
3	9

6.

X	0	4	8	12
y	0	3	6	9



Plot each point on the coordinate plane:
A: (-2, 5) B: (9, 0) C: (-3, -7) D: (0, -1)

Write the coordinates for each point:
E: F: G: H:

Warm-Up

Name:

Simplify.

1. $\frac{-3}{-6}$

2. $\frac{-8}{2}$

3. $-\frac{12}{9}$

4. $\frac{0}{-7}$

Explain each relationship using a complete sentence.

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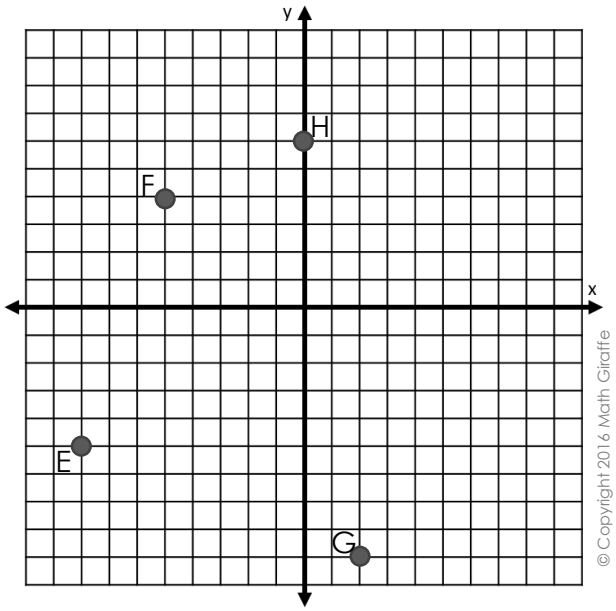

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Plot each point on the coordinate plane:
A: (-2, 5) B: (9, 0) C: (-3, -7) D: (0, -1)

Write the coordinates for each point:
E: F: G: H:

Warm-Up

Name: Answer Key

Simplify.

1. $\frac{-3}{-6}$ $\frac{1}{2}$

2. $\frac{-8}{2}$ -4

3. $-\frac{12}{9}$ $-\frac{4}{3}$

4. $\frac{0}{-7}$ 0

Explain each relationship using a complete sentence.

5.

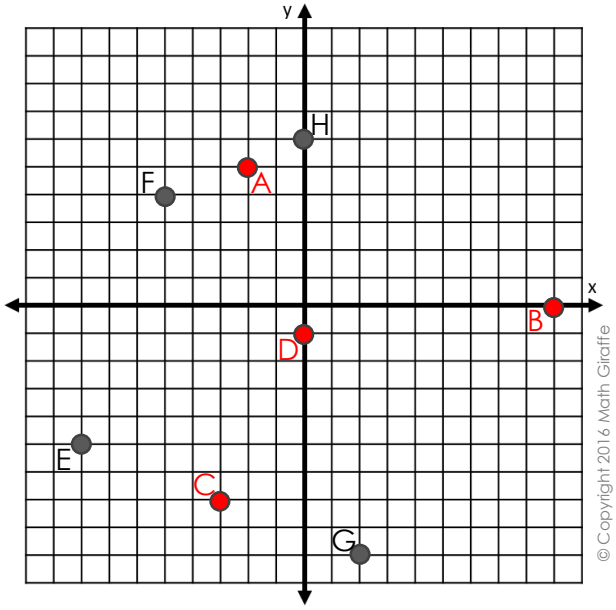
x	y
-1	-3
1	3
3	9

Each y-value is 3 times the corresponding x-value.

6.

X	0	4	8	12
y	0	3	6	9

Multiplying each x- value by ¾ gives the corresponding y-value.



Plot each point on the coordinate plane:
A: (-2, 5) B: (9, 0) C: (-3, -7) D: (0, -1)

Write the coordinates for each point:
E: (-8, -5) F: (-5, 4) G: (2, -9) H: (0, 6)

Warm-Up

Name: Answer Key

Simplify.

1. $\frac{-3}{-6}$ $\frac{1}{2}$

2. $\frac{-8}{2}$ 4

3. $-\frac{12}{9}$ $-\frac{4}{3}$

4. $\frac{0}{-7}$ 0

Explain each relationship using a complete sentence.

5.

x	y
-1	-3
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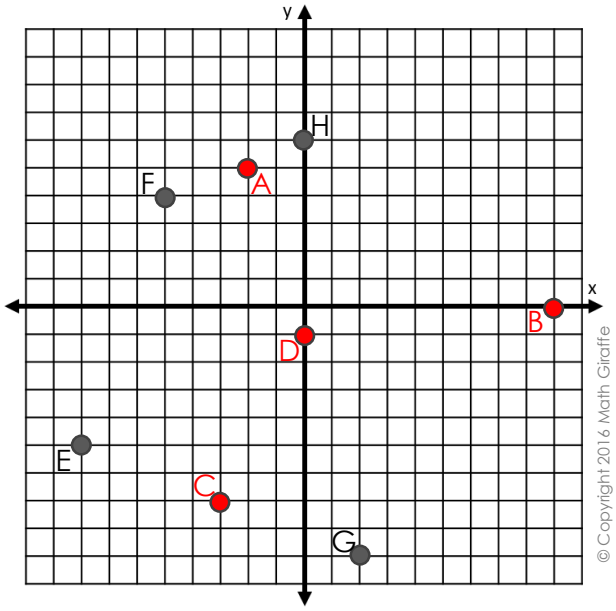

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Plot each point on the coordinate plane:
A: (-2, 5) B: (9, 0) C: (-3, -7) D: (0, -1)

Write the coordinates for each point:
E: (-8, -5) F: (-5, 4) G: (2, -9) H: (0, 6)

Things to Point Out & Consider After the Warm-Up

If your class had trouble with #s 1 through 4, most likely they were tripped up by the double negatives. If not, be sure to review simplifying fractions in warm-ups for the next week or so. Reinforce the fact that a single negative (in either the numerator or the denominator) will result in a negative simplest form, but if both the numerator and denominator are negative, then it will end up positive overall.

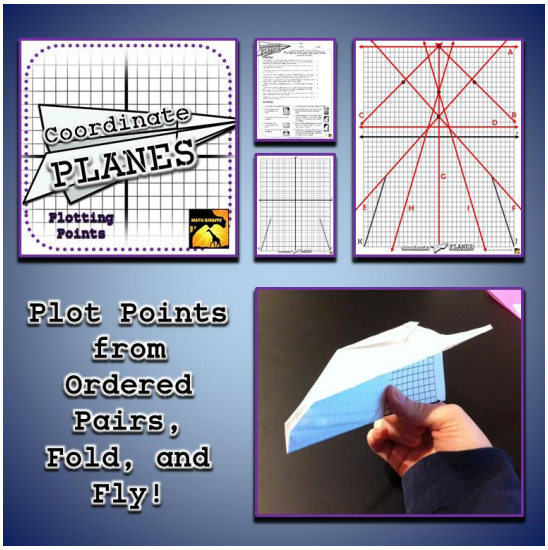
Work through the tables together and have students share their answers. If needed, practice with additional relationships in tables.

When you lead into working with lines on the coordinate plane instead of just points, be sure to also mention that a line has an infinite number of points on it. The most convenient points for us to find and use are the ones at a clear grid intersection on the coordinate plane, because they have integer coordinates.

If your students do need a review of plotting points, this activity is a fun way to practice or review.

They need to be really confident with the positive and negative directions on the coordinate plane before moving on.

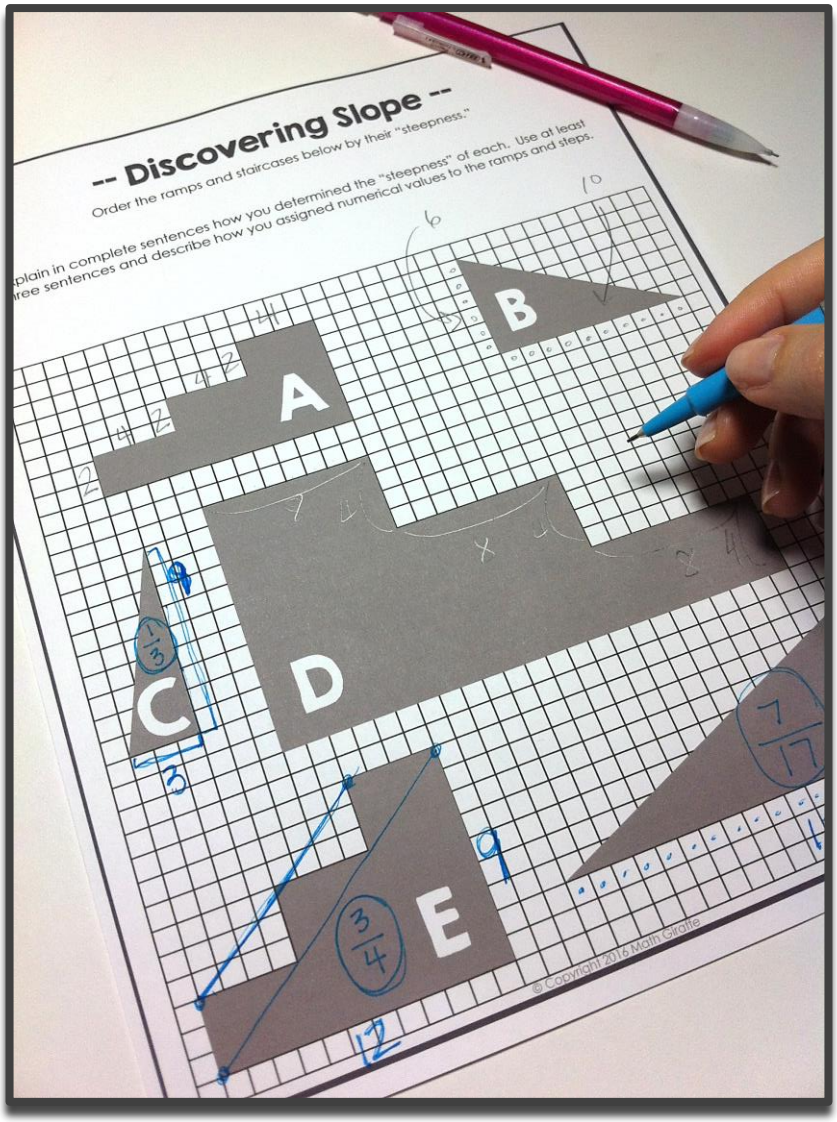
With this fun activity, if they plot and connect all the points correctly and then follow the folding directions, the entire page becomes a paper airplane! There is also a version for graphing lines, if you want to hold off and use it at the end of this unit instead!



Click here to purchase these "Coordinate PLANES!"

PART 2

Introduction



Concept Building through Inquiry

Introducing Through Inquiry

One of the best ways to lead into a new math concept is through an inquiry-based discovery activity. If you can set up a solid, structured inquiry process, your students will benefit in many ways.

Benefits of Discovery / Inquiry:

- **Build problem solving skills**
- **Gain deeper understanding of the concept**
- **Confidence boost & self-motivation**
- **Retention (Concept mastery replaces memorization)**

Inquiry lessons are best when done in pairs, so students can talk through the discoveries with a partner and make progress together. This way, the discussion helps solidify the concepts, but it also helps them to get un-stuck. They can start sharing ideas about how to get started and resist the temptation to give up and wait for the teacher to give a hint.

When you use this strategy, you have to sit back and let your students struggle. This takes a lot of practice. We tend to want to jump in and help. Try to avoid giving hints. Your students will need practice with this too. They need to build up their persistence. Don't let them give up. They will end up making great observations once they jump in and embrace the uncertainty.

The new material will be so much more memorable for them when they uncover it this way for themselves. They will also have a much deeper understanding of the math principles that are going on.

How to Use the Discovery Sheet

1. Group students into pairs so each has a partner.
2. Distribute one "Discovering Slope" sheet to each pair.
3. Tell them to read the directions and do the page. Sit back and resist giving help.
4. Walk around and listen to the conversations each pair is having. Take note of any interesting methods/approaches that you may want to ask them to share with the class in the discussion period afterward.
5. Give encouragement to groups that are truly stuck and frustrated. But avoid giving a hint about how to begin. Train your class to try something that they think makes sense, and see where they get. That is the purpose of the discovery process. Each time you stick to letting them struggle through on their own, you'll build those skills and they will do better next time.

Follow-Up Discussion:

After most pairs are done, come back together as a whole class to compare observations. Clear up any misconceptions and allow students/pairs to share some of their approaches. See if you can lead the conversation toward noticing that once simplified, two of the slopes were the same. Or did any of your students disagree that two were equivalent because of the directions of the slopes? Some face the other way. Accept all observations here. Later, this will lead you into the differences between positive and negative slopes, writing a slope in simplest form, and noting that any two points on the same line will give the same slope.

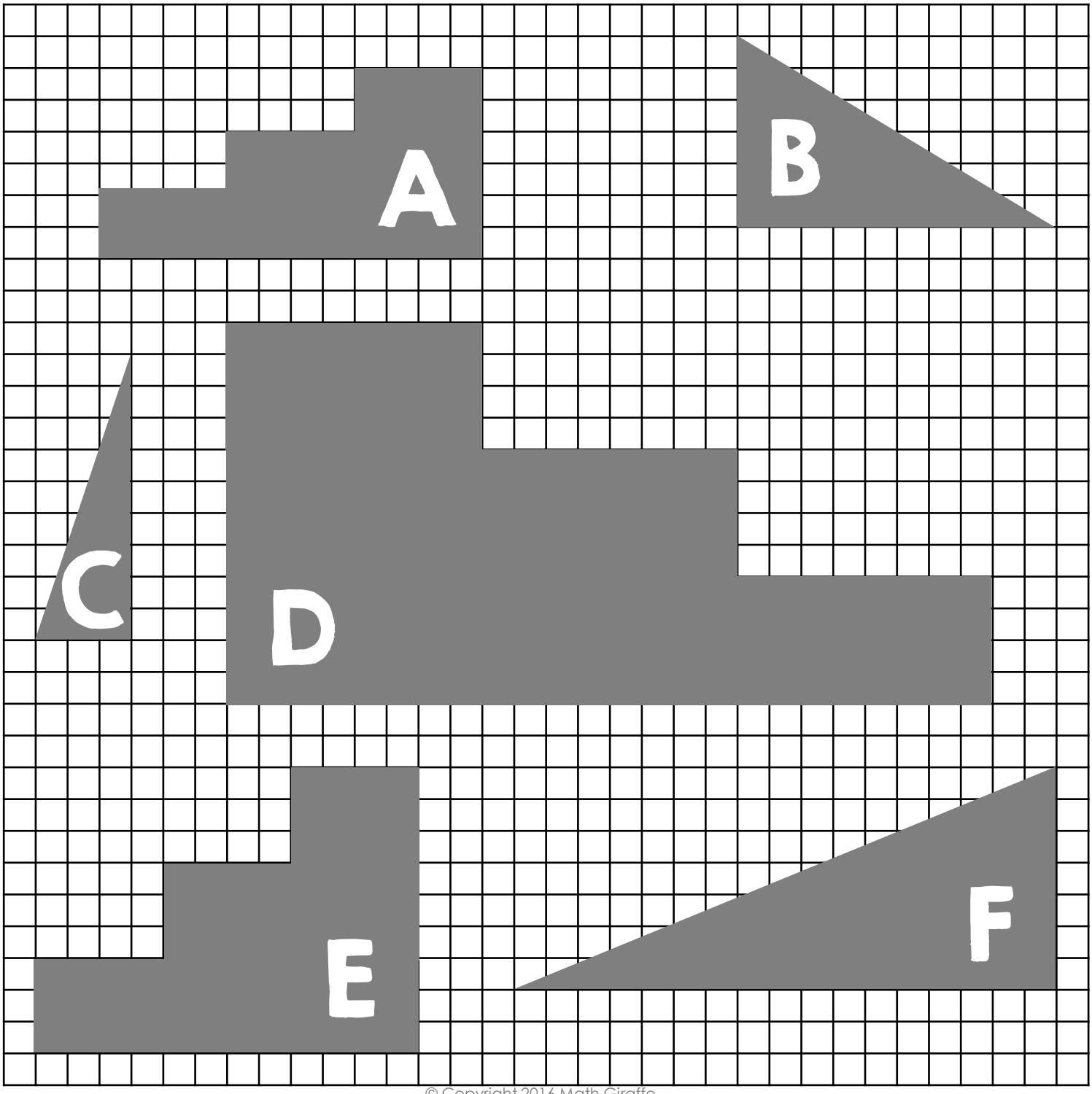
Once this activity is done, you'll be ready to lead your class into a lecture with guided notes on the Algebra notation, definition of slope, and practice problems.

Name(s):

-- Discovering Slope --

Order the ramps and staircases below by their "steepness."

Explain in complete sentences how you determined the "steepness" of each. Use at least three sentences and describe how you assigned numerical values to the ramps and steps.



Name(s): Answer Key

-- Discovering Slope --

Order the ramps and staircases below by their "steepness."

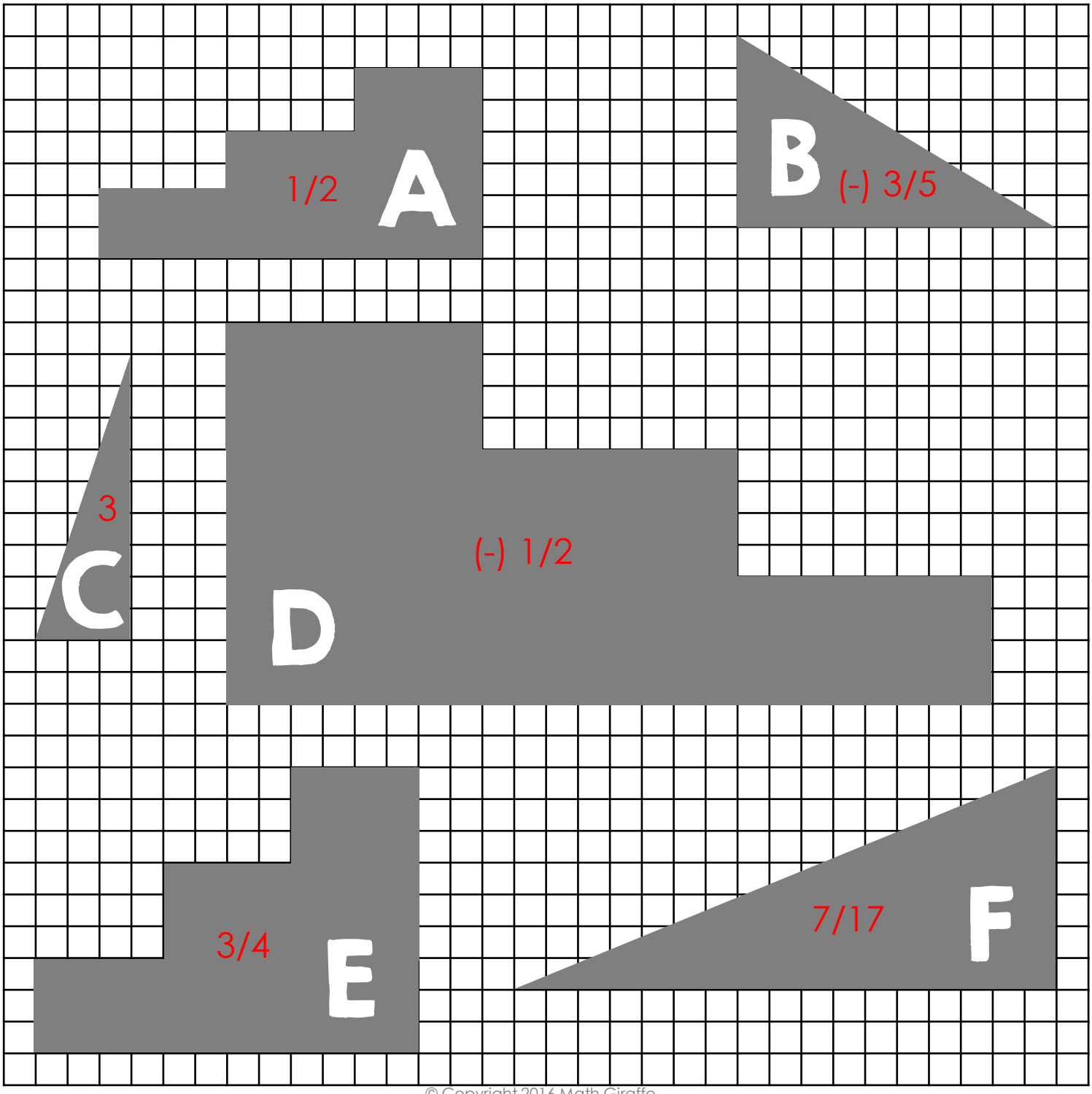
F, A & D (same), B, E, C

OR: B, D, F, A, E, C (if students used negatives for the ones slanting down to the right)

Explain in complete sentences how you determined the "steepness" of each. Use at least three sentences and describe how you assigned numerical values to the ramps and steps.

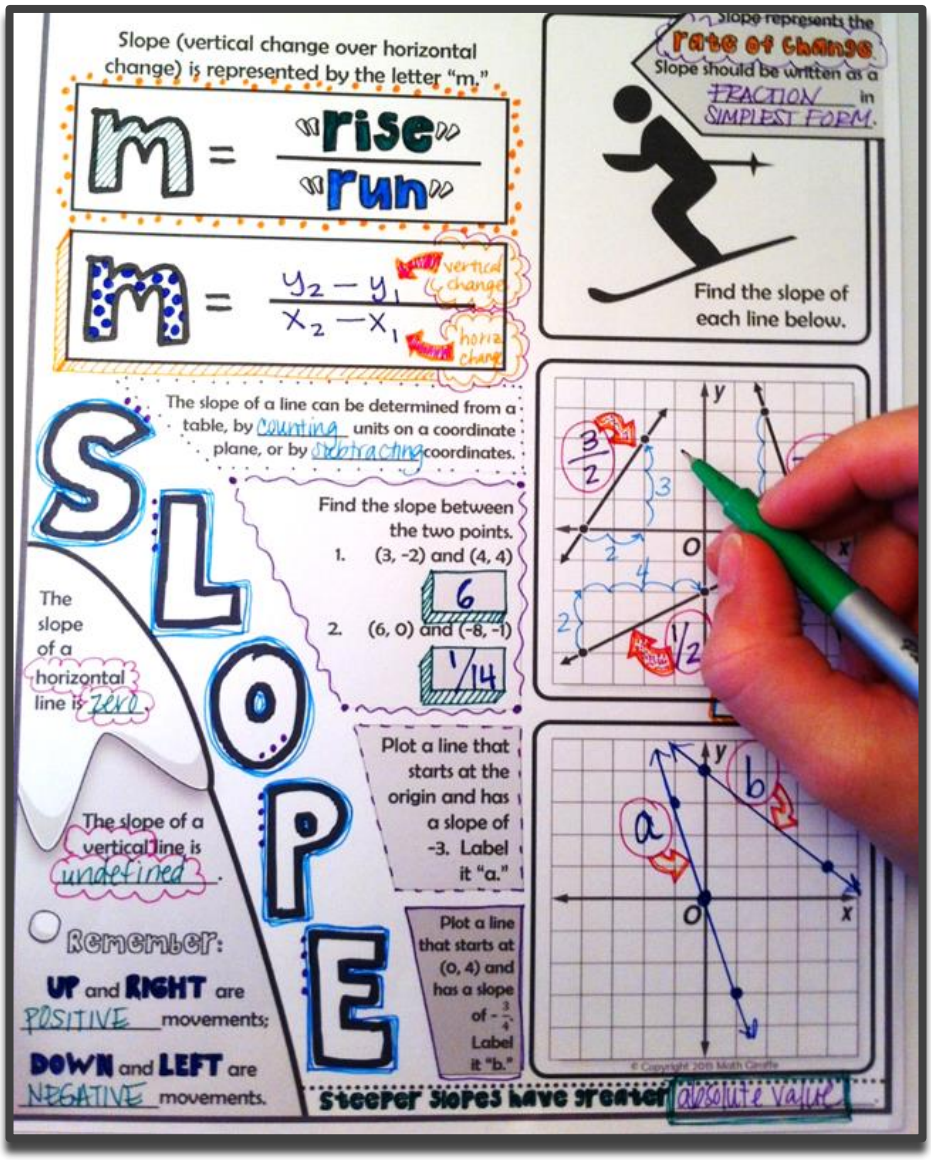
(Student answers will vary- Have them share observations.)

Sample: We counted the upward increase and the horizontal distance for each first. Then we made a fraction for each to assign it a number for steepness. To compare the fractions, we converted them into decimals to order from least to greatest.



PART 3

Lesson



Notes & Lecture

It's time to start the lecture portion of the lesson! Be sure that your students take good notes.

Include the key concept of slope as rate of change. Also be sure to include the slope formula and define it as vertical change over horizontal change as well. Then, include all the different types of examples of finding slope and graphing a line with a particular slope. Don't forget special cases! Here are the key types of examples to be sure to include. Hit 1 or 2 of each of these as a follow up to the notes, then throw a mix of each type into your practice problems.

Finding Slope from a Graph

Students have to select their own two points on a line on a coordinate plane. Show them how to select any two points that have integer coordinates, then count out the rise and run.

Reinforce that this will be a fraction, and should be simplified for the final answer when they write out the slope. Be sure to talk about positive and negative movements, and cases where the numerator and denominator are both negative (if the student counted left and down) and the slope is then positive.

Finding Slope from Two Points

Give two ordered pairs, and have students use the slope formula, $m = \frac{y_2 - y_1}{x_2 - x_1}$ to calculate the slope. Show that subtracting in either order gives the same answer, as long as you are consistent with the x and y values. Compare this horizontal and vertical "difference" to what is happening on the coordinate plane when we count out the rise and run. Make this connection clear, so they understand this formula well.

Finding Slope from a Table

This is just another format, so students connect the different views of the coordinates (graph, table, ordered pairs, equation). Students will still select two points and use the slope formula. Encourage them to check their work with another two points. Remind them that if the table represents a linear relationship, the slope should be consistent throughout.

Special Cases

Show students a slope of zero (horizontal line) and an undefined slope (vertical line). Clarify which comes from a zero in the numerator versus in the denominator. Show each in terms of "rise" and "run."

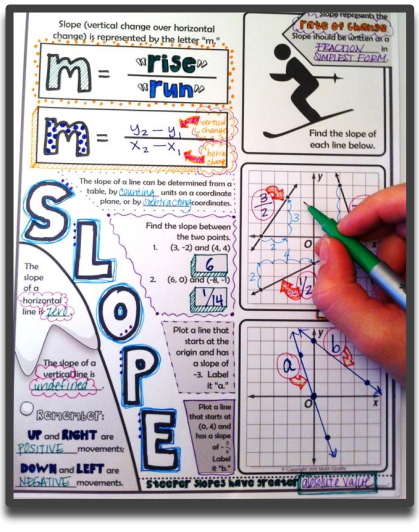
Graphing a Line with a Particular Slope

Try problems like:

- Graph a line with a slope of ½ that passes through the point (3, 5).
- Graph a line with a slope of -3 that passes through the origin.
- Graph a line with undefined slope that passes through (3, -1).

Creative Notes & Reference Sheets

For a brain-based visual guided note sheet, try this Slope "Doodle Note" page. The right-brain / left-brain integration increases focus and retention of the concepts! Click here to purchase Slope Doodle Notes.



Another option is a pre-made infographic. This can be used as a binder bookmark. ($1)

Or, print the following page as a quick guide.

Slope represents the **rate of change.**

- Steepness
- How fast / slow is the increase / decrease?

SLOPE

Quick Tips & Key Ideas

Count out a slope between two points using RISE OVER RUN (vertical change over horizontal change).

Up is a positive movement.
Down is a negative movement.
Right is a positive movement.
Left is a negative movement.

0 in numerator = **ZERO** slope (horizontal line)

0 in denominator = **UNDEFINED** slope (vertical line)

Write a slope as a fraction in **simplest form.**

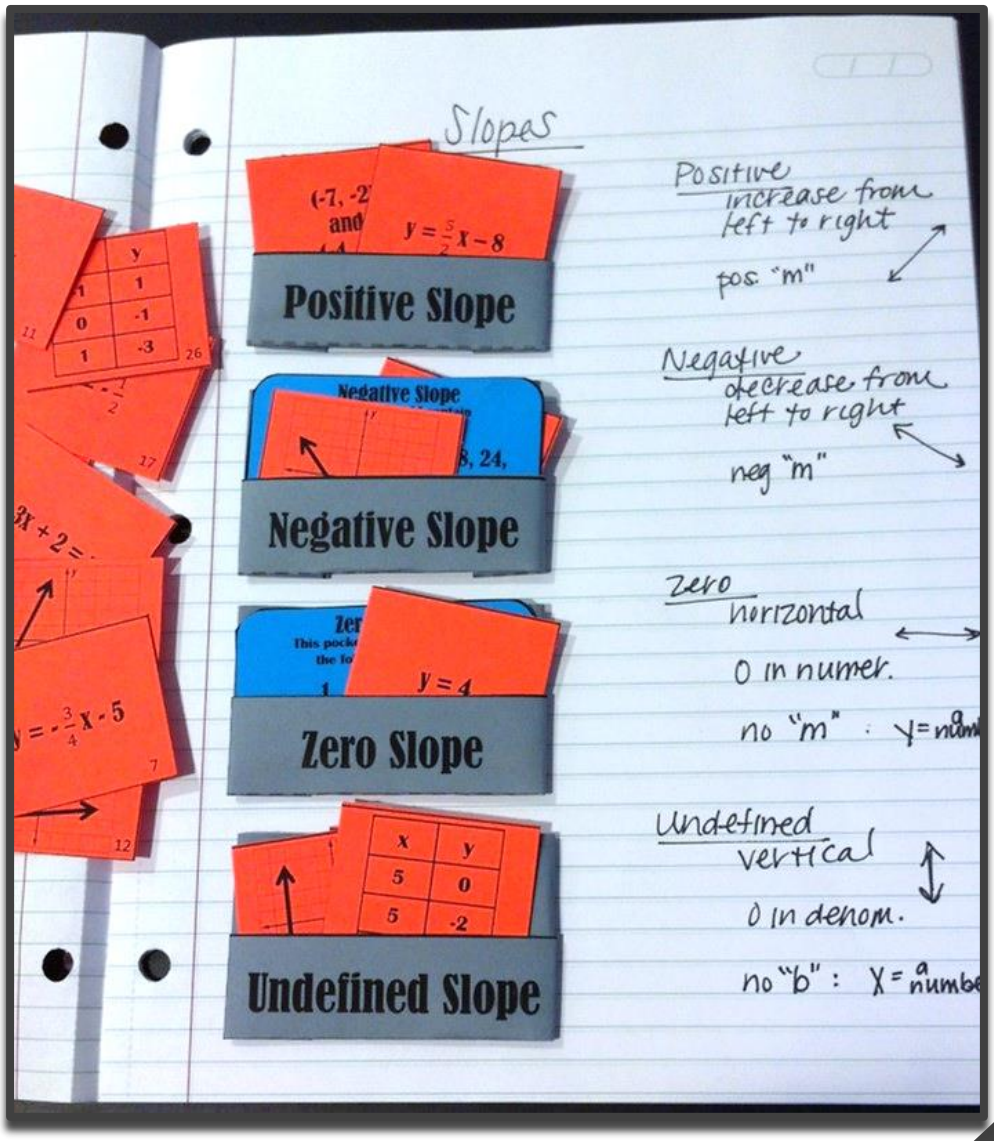
A line has the same slope EVERYWHERE. You can choose **any two points** to calculate the slope (and then use another two to check your work!)

When using two points (as coordinates or from a table), use the slope formula to calculate the slope:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

PART 4

Practice



Resources & Ideas

When students practice with slope, it's important to mix up a good blend of input types (points, graphs, tables, and equations).

Be sure that your class is building the connections between each format. They should be able to fluidly translate between each form of input. When given a table, they should be able to check work by plotting those points and counting out the slope. When given two points, they should be able to use slope formula, but also know how to place them on a graph or even put them back into a table.

The key concepts here lead into a solid understanding of lines in different forms, so be sure to build that foundation now by including all these forms of given information.

Variety of Input

A great way to get this blend is to collect (or create) 5-10 of each of the following given sets of information:

- Ordered pairs
- Tables
- Graphs
- Equations (students will have to graph or make a table at this point to find the slope, since they probably do not know slope-intercept form yet)

Critical Thinking

With the mix of these problems, have students pair up and work through finding slopes, or even just sorting into categories:

- Positive slope
- Zero slope
- Negative slope
- Undefined slope

(Be sure to include those special cases!)

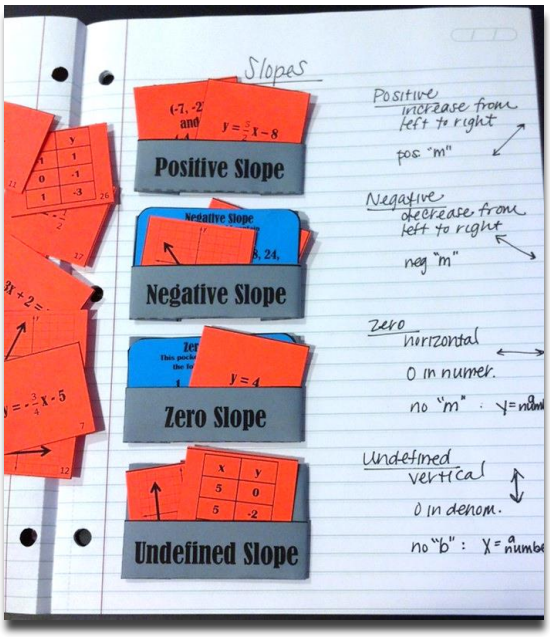
This will amp up your students' critical thinking, because they will naturally start trying to develop shortcuts for what makes it obviously

a positive or negative slope, etc. without having to actually calculate it. This may seem lazy, but it's perfectly ok! This motivates them to actually learn one step of deeper meaning in order to save themselves time and become more efficient.

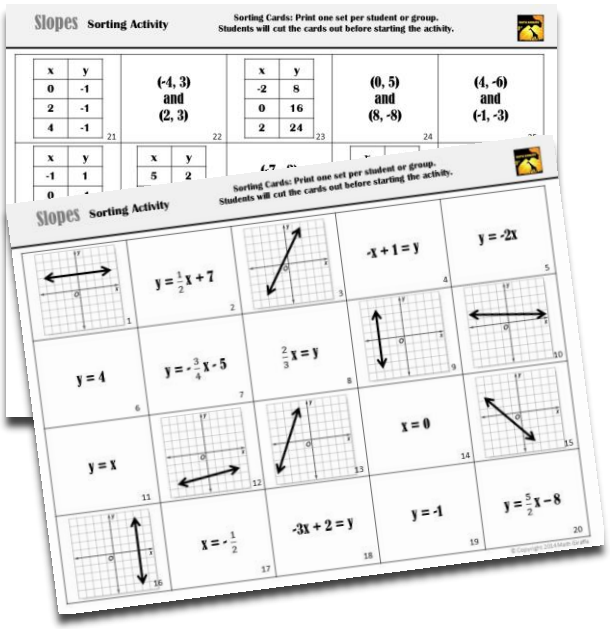
They'll start noticing what makes a slope follow certain rules and patterns, and these observations will lead to more success in future units for linear equations.

Card Sort

A great way to build these concepts, get practice, and get "math talk" going with partners is through a pocket-style card sort. You can just use scrap paper as pockets and cut up problems from a worksheet or textbook if you can find a nice blend.



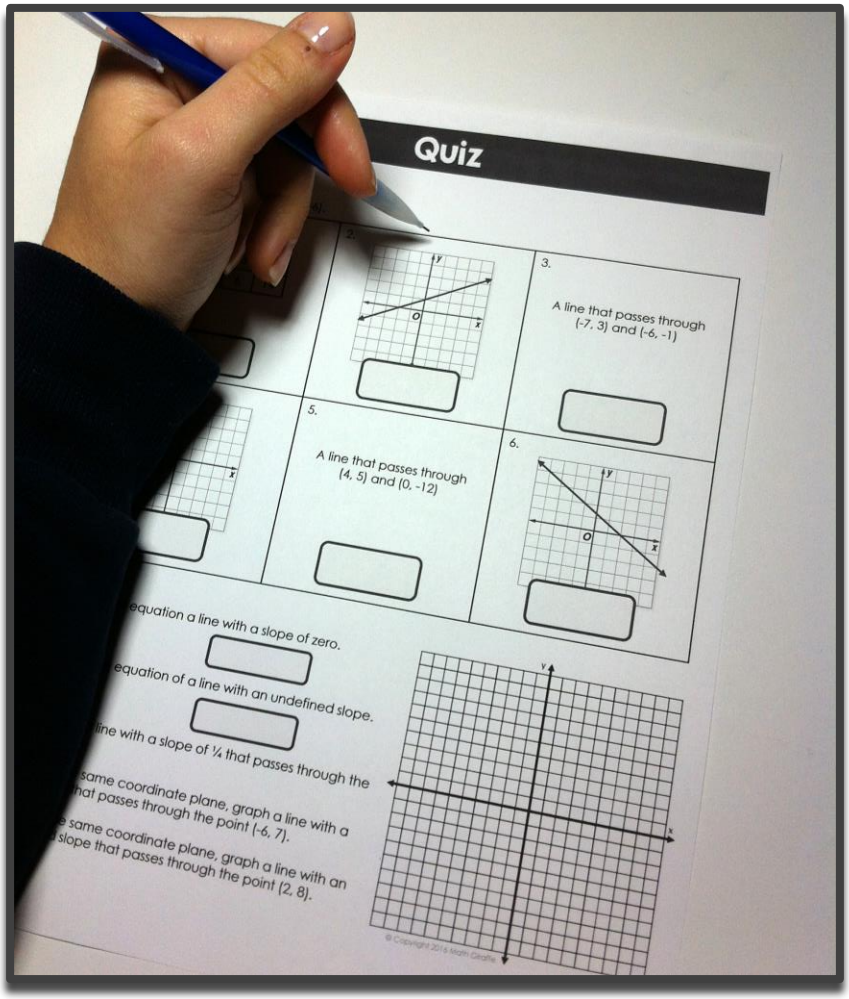
Or, you can use this pre-made set, which works really well for students because each pocket includes a little check/answer card, so they can keep these pockets and cards in their notebooks, and re-do the activity at any time as a review or study guide.



This set also includes an add-on set of 10 additional cards that have equations that are not in slope-intercept form (y =). Those can be added in for students who are ready for a challenge, or can be included later in the unit, once you introduce linear equations in slope-intercept form. You can purchase the sorting activity here.

PART 4

Assessment



Quiz

Quiz

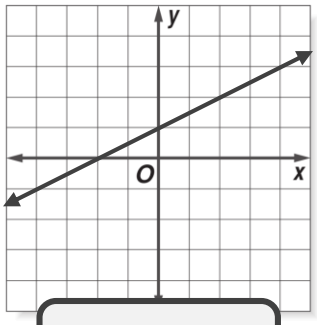
Name:

Find the slope for each (#1-6).

1.

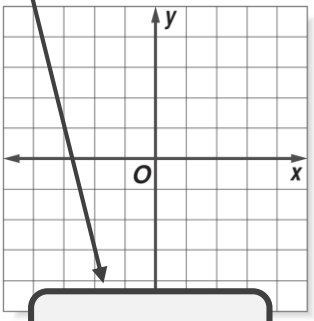
x	-5	-3	-1
y	-2	6	14

2.



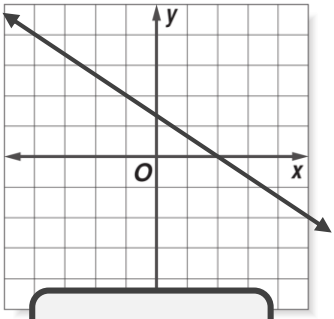
3. A line that passes through (-7, 3) and (-6, -1)

4.



5. A line that passes through (4, 5) and (0, -12)

6.



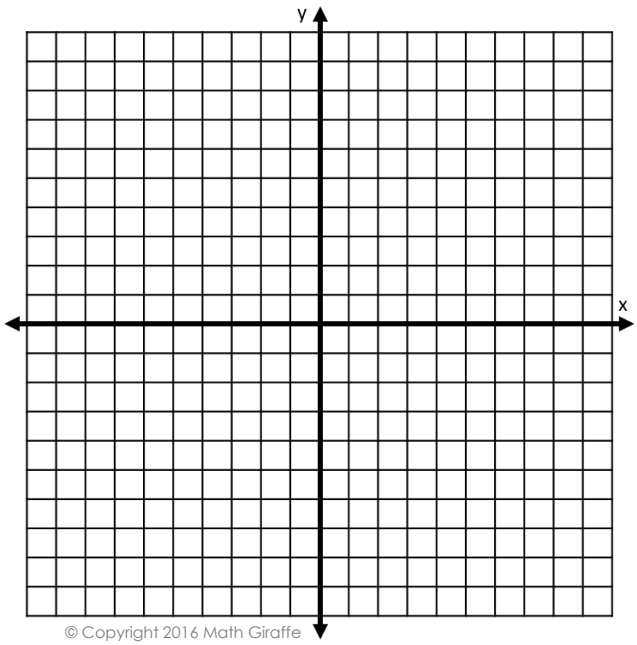
7. Write the equation a line with a slope of zero.

8. Write the equation of a line with an undefined slope.

9. Graph a line with a slope of ¼ that passes through the origin.

10. On the same coordinate plane, graph a line with a slope of -3 that passes through the point (-6, 7).

11. On the same coordinate plane, graph a line with an undefined slope that passes through the point (2, 8).



Quiz

Name:

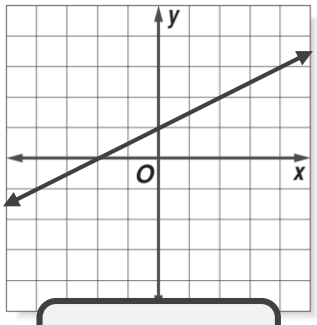
Find the slope for each (#1-6).

1.

x	-5	-3	-1
y	-2	6	14

1/4

2.



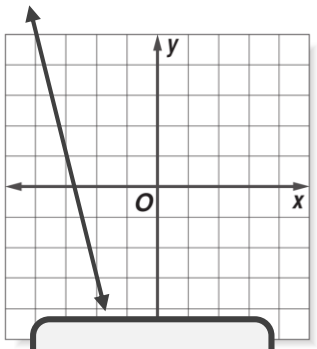
1/2

3.

A line that passes through (-7, 3) and (-6, -1)

-4

4.



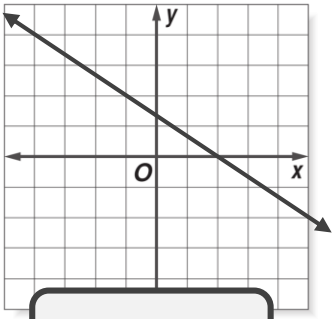
-4

5.

A line that passes through (4, 5) and (0, -12)

17/4

6.



-2/3

7. Write the equation a line with a slope of zero.

(ans. will vary) y = #

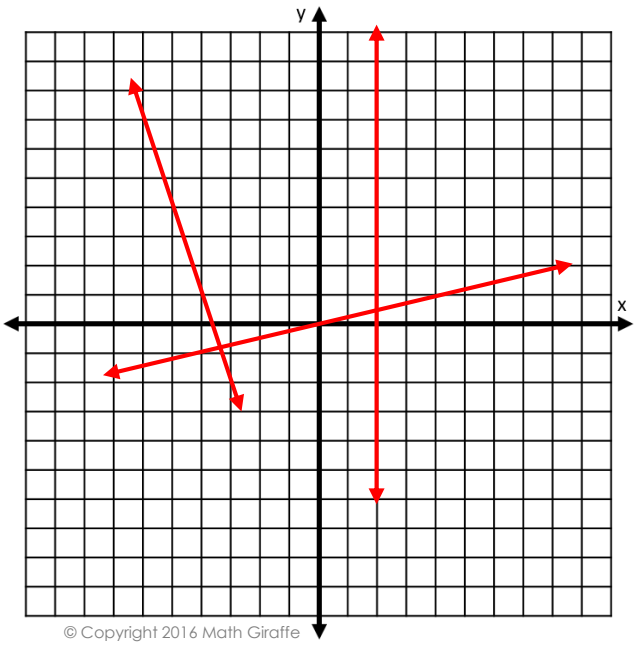
8. Write the equation of a line with an undefined slope.

(ans. will vary) x = #

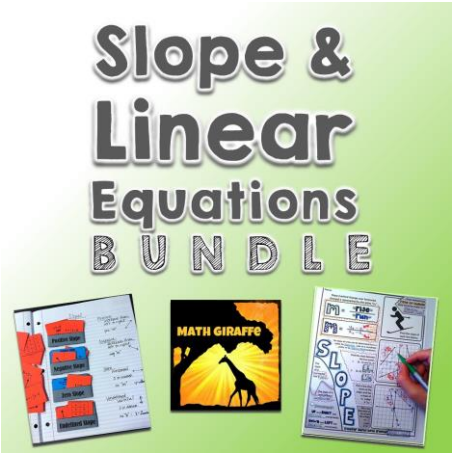
9. Graph a line with a slope of ¼ that passes through the origin.

10. On the same coordinate plane, graph a line with a slope of -3 that passes through the point (-6, 7).

11. On the same coordinate plane, graph a line with an undefined slope that passes through the point (2, 8).



Discounted Bundle



This set is a blend of all kinds of engaging and creative resources for teaching a unit that starts with slope and leads into graphing with Slope-Intercept and Point-Slope forms. [Check out the variety of fun and rigor here!]

What's Included: