Finding Slope of a Line From Graphs, Tables, Ordered Pa

Summary

Define slope as the ratio of the vertical change to the horizontal change. Recognize slope from tables, ordered pairs, or graphs. Show that slope is constant using similarity of right triangles

Materials

- Little Graph Treasure Map
  Transparencies: Slope/Skiing, graph paper transparency
- Slope Foldable
  for each student (teacher and student version attached)
- 10 cards each with a different ordered pair, transparency for tables
  (cut separately)
  Centimeter Cubes
  Worksheets: Slopes from Graphs, Slopes and Right Triangles

Background for Teachers

Understanding (Big Ideas):
slope of a line
Essential Questions:

How can a ratio be used to describe the steepness of a line?
Why does the slope of a line remain constant?
How can right triangles be used to show that slope is constant?

Skill Focus:
Write a ratio for slope of a line. Use similar triangles to show slope as constant.
Vocabulary Focus:
slope, change in y, change in x, rise, run, similar triangles, constant
Ways to Gain/Maintain Attention (Primacy):
treasure map, connection to skiing, predicting, note taking, cooperative activity, music and movement, game

Instructional Procedures

Starter:
Have your materials manager pick up the Little Graph Treasure Map paper, a ruler and your graphing calculator. Follow the directions on the map to arrive at the point where the treasure is. If you end up at the right point, you will get the treasure.
Lesson Segment 1: How would you describe the graph of the ordered pairs for a relationship where the ratio of change is constant?
Have a student come to the overhead to place a point where each of the points on in the starter should be. If a student correctly places the points, the team gets a little treat.
Q. Think-Team-share Q. How would you describe a line that contains each of these points?
Have the students sketch a line using their rulers through the points on their treasure map and plot several other points that lie on that line. Have them write the directions for finding the next point as a ratio comparing the number of spaces they moved up to the number they moved across. Explain that the change or distance from one point to another moving up and moving across can be written as a ratio, ½.
Q: Think-Team-Share. What make the line straight rather than being curvy? Remind students that moving vertically is moving parallel to the y-axis, and moving horizontally is moving parallel to the x-

axis. So, rather than simply using the words, "change" or "move", we could use the words, "change in y over change in x". Refer to the vocabulary on the board.
Ask students to sketch a prediction on the back of the Little Treasure Map for what the line would look like if change Y and the change in X were to be different from point to point. Then, have them start at the original point and use the slope 1/1 to plot another point, then 2/5 to plot a third point, then -3/2 to plot a fourth point.
Lesson Segment 2: How can a ratio be used to describe the "steepness" of a line? Why does slope remain constant?
Explain that the change in y compared to the change is x is called the slope. The slope refers to the steepness of the line. When the slope is a small number, the line is less steep. When the slope is a larger number, the line is more steep. Show students the Skiing graphic (attached). Have them predict whether the slope of each line will be a smaller or a larger number, or a number close to 0. Overlay each line of the skiing transparency on a graph paper transparency and demonstrate identifying two points then counting the slope from one point to another emphasizing how Y changes and how X changes from one point to the other.
Slopes from graphs:
We write the steepness of a line as a ratio telling how the rise of the line compares to the run of the line. Hand out the "Slopes From Graphs" worksheet. Help students identify four points where the line intersects two gridlines and have them count the change in Y and the change in x and write the change as a ratio for each. Have students compare the ratio for change in y/change in x with each point asking whether or not the ratios are equivalent. Remind students that they decided if the ratios were not equivalent, the line would not be a straight line.
Discuss lines with a positive, negative, 0, or not slope at all. A mnemonic for this is the skiing scenario

When you are moving upward from right to left, this is a POSITIVE slope.
When you are moving downward from right to left, this is a NEGATIVE slope.
When you are skiing horizontally, this is cross country skiing with 0 slope.
When you are falling off a cliff (vertical line) this is NO SLOPE AT ALL
Dance: "Slope Dance"- Students stand and face the front of the room. You stand behind them. Put on music and have them use their arms to show a positive, negative, 0, or no slope line as you call each of these out.
Journal: Fold and cut the Finding the three Ways To Find Slope foldable. Fill in the example for finding slope from a graph of a line.
Lesson Segment 3: How can ordered pairs for a linear relation show that slope of a line is constant?
Slope from a table
Using The Table Ask Feature On the Graphing Calculator to Investigate Slope
To find patterns leading to the concept of slope, type an equation in the Y=. In Table Set, set the Independent and Dependent to "ask". Press the Table key and type values in the X list. Press the Enter key to put a few intermittent values in Y list. Leave some of the values out of the Y list. Have students determine what the missing values are. Ask, "How did you decide that?" Some students will remember this activity from the last lesson for writing an equation. Others will reply that they saw the pattern in the change in the Y values rather than in relating Y to X. Tell them for slope they will be using the change from Y2 to Y1 and from X2 to X1 Have them copy the tables on an assignment paper and write the change in Y to the change in X as a ratio. Do several equations in this manner. Some possible equations you may wish to try are: y = x, y = -x , y = 2x, y = -3x, y = ½ x, y = 1/3x, y = 5, y = x, y = -x
Connect the "change in Y over change in X" from the table to counting that change when they were looking at the graph. Discuss that just as the ratio of rise to run on the graph was always the same ratio, the ratios of change in Y to change in X in the table must be equivalent. On their assignment

paper ask them to begin with X being 0 and y being any number they choose and construct tables of values that having the following slope:

¾
1/3
-- ½
2/3
0

Game: Truth or Dare Give each team one of the tables from the Tables and Slope Transparencies. The team works together to determine if the tables show a linear relationship by checking for a constant ratio for change in y to change in x. A team member is then selected to bring the transparency to the overhead and ask the class members to determine if the table shows a linear relation or not and how they determined their answer. Class members are given 30 seconds to check with their team to reduce risk. The student at the overhead then selects a person from the class to either tell the truth or take a dare. If the selected student can tell the truth and explain their reasoning, they needn't take the dare. If not, the challenging team gives the dare such as, "Jump up and down while barking like a dog." All dares must be respectful and the teacher can veto a dare if is inappropriate. Students should copy all tables on an assignment paper and write the slope of the line IF the table indicates a linear relation.

Journal: Fill in the example for finding slope from a table on the foldable.

Slope from ordered pairs.

Have the students look again at their "Slopes From Graphs" paper. On the back of that paper, have them write the ordered pair for the points they identified in each graph. Help them identify how y has changed and how x has changed by looking at the difference in two of those ordered pairs. Help them write a math expression to compute the change (use slope formula and placing ordered pairs vertically as if in a table and subtracting). Then have them compare their computed slope value to the counted slope value from the front of the page.

Four-Corners practice: Use the ordered pairs on the 10 cards (attached). Ask person # 1 from a team to come draw out any two ordered pairs. Then, have person #2 from another team come do the same, and person # 3 from a team, and person # 4 from another team. Do Four Corners where all the #1's go to a corner, the # 2's to another corner, the # 3's to a third corner and the # 4's to the fourth corner of the room. In the corner they look at the 2 ordered pairs that were drawn. Together, they find the slope of the line that would contain those two points. Have the students return to their desks and teach their teams how to find the slopes. These four problems should also be recorded on the back of the Slopes from Graphs worksheet.

Journal: Fill in the example for finding slope using two ordered pairs.

Lesson Segment 4: How can right triangles be used to show that slope is constant?

Manipulative activity

Give each pair of students a few centimeter cubes. Each student should be given the Slope and Similar Triangles worksheet to record the work. Students will be building slope with Centimeter Cubes, Sketching a line along the lower vertices of the cubes and tracing the right triangles formed by the cubes. Students will then compare sides from several right triangles for a line from their sketches to determine if the triangles are similar or not. Remind students that similar triangles must have corresponding sides in proportion. If the ratios of rise to run are equivalent ratios, slope must be constant for the line.

Assessment Plan

performance, observation, questioning

Bibliography

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