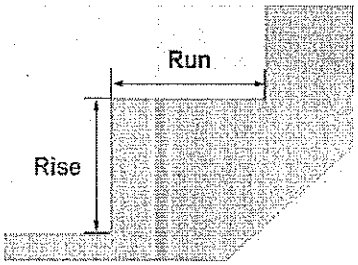
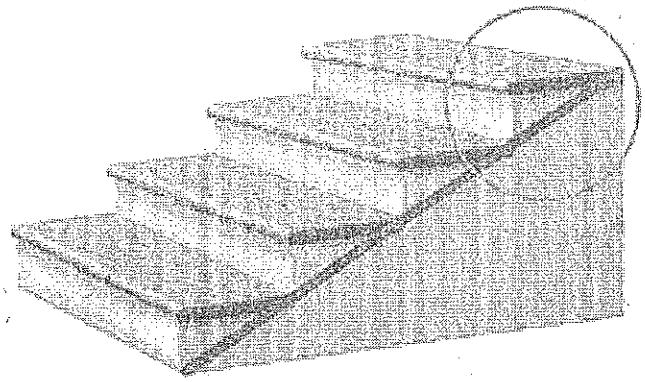
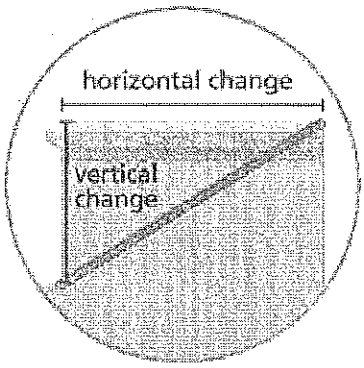
Name: Key Date: Class:

finding the slope of a line 4.2

Climbing stairs is good exercise, so some athletes run up and down stairs as part of their training. The steepness of stairs determines how difficult they are to climb. By investigating the steepness of stairs, you can find another important way to describe the steepness of a line. Carpenters have developed the following guideline to ensure that the stairs they build are relatively easy for a person to climb: the ratio of rise to run for each step should be between 0.45 and 0.60. Steps are measured in inches.

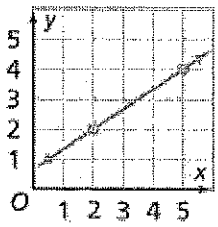






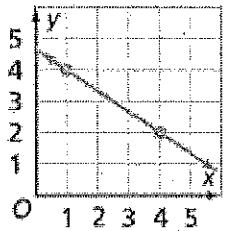
This method for finding the steepness of stairs suggests a way to find the steepness of a line. A line drawn from the bottom step of a set of stairs to the top step touches each step at one point. The rise and run of a step are the vertical and the horizontal changes, respectively, between two points on the line.

The steepness of the line is the ratio of rise to run, or vertical change to horizontal change, for this step. We call this ratio the **slope** of the line. Unlike the steepness of stairs, the slope of a line can be negative. To determine the slope of a line, you need to consider the direction, or sign, of the vertical and horizontal changes from one point to another. Lines that slant *upward* from left to right have *positive slope*. Lines that slant *downward* from left to right have *negative slope*.



*Line with **positive** slope*

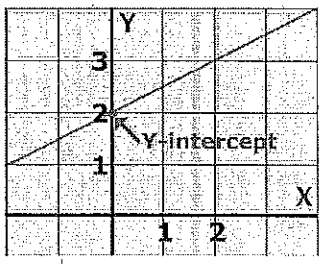
$$slope = \frac{vertical\ change}{horizontal\ change} = \frac{rise}{run}$$



*Line with **negative** slope*

Remember!

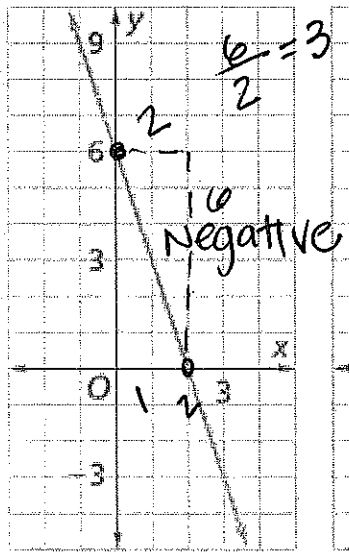
The point at which a line crosses the y-axis is called the **y-intercept**. It is also the y-value associated with an x-value of zero. We have seen this is previous examples as the *starting value* associated with a given context. The y-intercept of the graph shown to the right is 2.



Information about a linear relationship can be given in several different representations, such as a table, a graph, or an equation. These representations are useful in answering questions about linear situations.

The graphs, tables, and equations shown below all represent linear relationships.

Graph 1



Graph 2

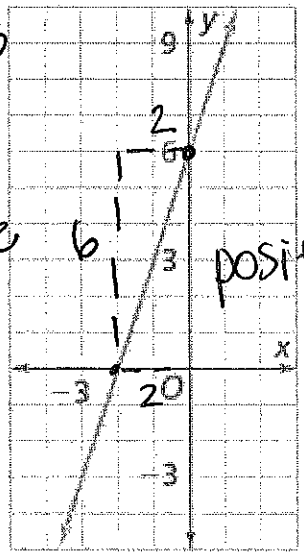


Table 1

x	−6	−4	−2	0	2	4
y	−10	−7	−4	−1	2	5

+2, +2, +3, +3

Table 2

x	1	2	3	4	5	6
y	4.5	4.0	3.5	3.0	2.5	2.0

0, +1, 5, −.5

Equation 1

$y = 2.5x + 5$

Equation 2

$y = 20 - 3x$

1. Find the slope & y-intercept of the line associated with each of the above representations.

Graph 1: Slope = −3 y-intercept = 6

Graph 2: Slope = 6/2 = +3 y-intercept = 6

Table 1: Slope = 3/2 y-intercept = −1

Table 2: Slope = −.5 (−1/2) y-intercept = 5

Equation 1: Slope = 2.5 y-intercept = 5

Equation 2: Slope = −3 y-intercept = 20

2. Write an equation for each of the graphs and tables.

Graph 1 Equation: $y = -3x + 6$

Graph 2 Equation: $y = 3x + 6$

Table 1 Equation: $y = \frac{3}{2}x - 1$

Table 2 Equation: $y = -\frac{1}{2}x + 5$

Think about it:

Using the idea that the slope of a line is found by looking at it's "rise" and "run", what would be the slope of a horizontal line? What about a vertical line?

↕ vertical — undefined

↔ horizontal — zero