

Mine Shaft Grade 8 Slope Clarification

CCSSM: Grade 8

DOMAIN: Expressions and Equations

Cluster: Understand the connections between proportional relationships, lines, and linear equations.

Standard: 8.EE.5: Graph proportional relationships, interpreting the **unit rate** as the **slope** of the graph. Compare two different proportional relationships represented in different ways.

CCSSM: Grade 8

DOMAIN: Functions

Cluster: Define, evaluate, and compare functions.

Standard: 8.F.1: Understand that a **function** is a rule that assigns to each input exactly one output. The **graph of a function** is the set of ordered pairs consisting of an input and the corresponding output.

Standard: 8.F.2: Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

Standard: 8.F.3: Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.

Standard: 8.F.4: Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.

Clarification of Math Discussion Terms

A **POLYGON** is a geometric figure with sides that are segments. Specific polygons are named according to the number of sides they have:

Number of Sides	Name of Polygon
3	TRIANGLE
4	QUADRILATERAL
5	PENTAGON
6	HEXAGON
7	SEPTAGON (HEPTAGON)
8	OCTAGON

Classroom Example 1

What is the name for a polygon with 6 sides?

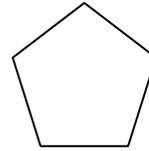
A polygon with 6 sides is called a hexagon.

How many sides does an octagon have?

An octagon has 8 sides.

What is the name of the geometric figure shown at the right?

Since the figure is a polygon with five sides, it is a pentagon.



Sometimes a **RULE** is written to generate a set of multiples. For example:

Rule for multiples of 6: $6n$ where n represents any whole number.

A rule may also be written as an equation used to represent a relationship between two variables. For example, the equation $y = 6x$, where x is any whole number and y is the multiple, may be called the rule for generating the set of multiples of 6. The values for x and y are frequently arranged in a **TABLE OF VALUES** as shown below. Note that for this rule, there is a constant difference of 6 units between the values of y and a constant difference of 1 unit between the values of x .

x	0	1	2	3	4	5
y	0	6	12	18	24	30

Classroom Example 2

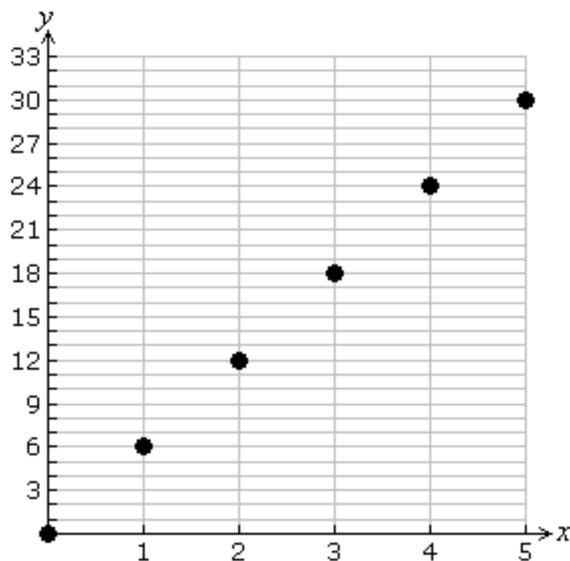
Complete the table of values for the equation $y = 3x + 2$.

x	0	1	2	3	4	5
y	2	5				

The completed table of values is:

x	0	1	2	3	4	5
y	2	5	8	11	14	17

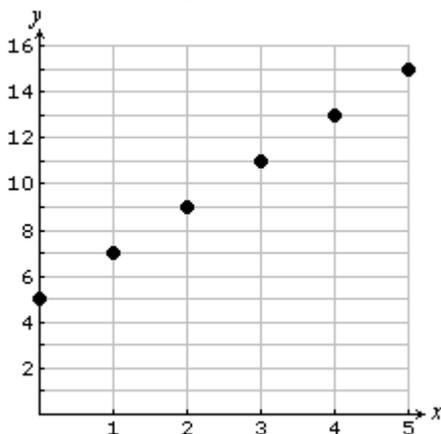
Another way the values for x and y may be displayed is in a coordinate **GRAPH**. The values for x are represented on the horizontal axis (the x -axis) and the corresponding values for y are represented on the vertical axis (the y -axis.) For the equation $y = 6x$, (where x represents a whole number,) the graph is shown below:



When there is a constant difference between the y -values as the x -values increase by one unit, the points on the graph will lie on a line. The equation is called a **LINEAR EQUATION**. The increase (or decrease) in the values of y as the x -values increase by 1 unit is called the **RATE OF CHANGE**. This number is used to describe the **SLOPE** of the line. In the line above, the y -values increase (rise) 6 units for each unit that the x -values increase. The **SLOPE** of this line is $\frac{6}{1}$ or 6. The point at which the line crosses the y -axis is called the **Y-INTERCEPT**. In the example, the **Y-INTERCEPT** is 0.

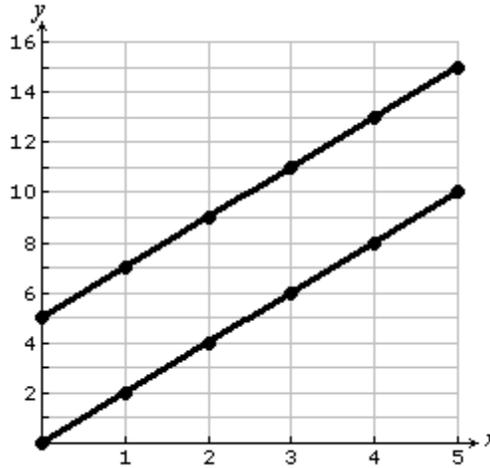
Classroom Example 3

What is the slope of the line shown below?



The slope is 2 because the y -values increase by 2 units for each increase of 1 unit in the x -values.

A **SEGMENT** is a subset or part of a line. A line segment contains two endpoints and all the points between them. When two lines or **SEGMENTS** are **PARALLEL**, they have the same **SLOPE**. For example, the lines representing the equations $y = 2x$ and $y = 2x + 5$ have the same **SLOPE**. The **SEGMENTS** in the graph below are **PARALLEL**.



The Math in the Puzzle

In the Mine Shaft puzzles, players must place the bots so that they will not land on any flowers as they hop from the beginning to the end of the row. The number of sides of the bot corresponds to the multiples on which the bots will land.

In the screen shot below, any bot except the quadrilateral are possible choices for the top row. The quadrilateral cannot be used since there is a flower on the number 4. The player must eliminate choices for each row by considering the requirements of the other rows. For example, the quadrilateral can only be placed on the third row, since it would land on a multiple of 4 in each of the other rows.

on row 1, since the pink octagon will travel up from row 2 to row 1 when it reaches the pink tube at the number 16.

Placing the pentagon on row 2 will destroy the wall on row 2, because it will first move up to row 1 on the lift at the number 10, continuing to hop to the numbers 11 and 16, and then travel down the blue tube, hopping to 21 and through the wall. The lift always changes the sequence by having the bot land on the next number. The constant difference between the terms of the sequence (the slope) remains the same.