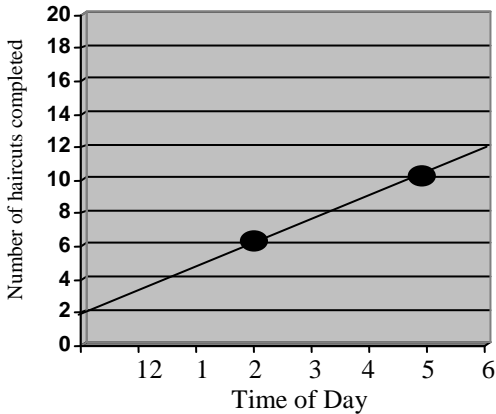
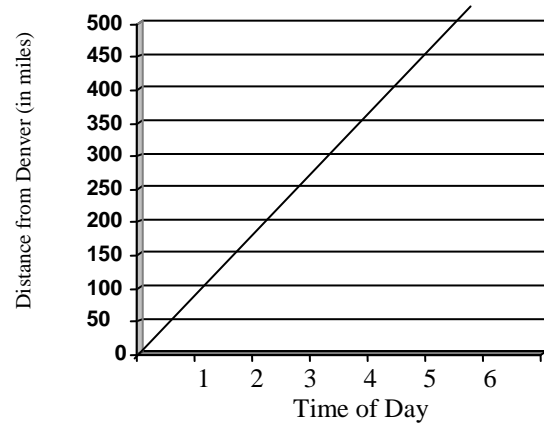


3.5 Rate of Change and the Slope of a Line

Hairdresser. Eve's Custom Cuts has a graph displaying data from a recent day of work. At what rate does Eve work?



Train travel. The following graph shows data from a recent train ride from Denver to Kansas City. At what rate did the train travel?



For situations such as this it is often useful to calculate a *rate of change*. The rate of change indicates how two quantities change with respect to each other.

$$\text{Rate of change} = \frac{\text{y change}}{\text{x change}}$$

The *slope* of a line is a number that measures the line's steepness. We can calculate it by picking two points on the line and writing the ratio of the vertical change (called the *rise*) to the horizontal change (called the *run*) as we move from one point to another.

$$m = \frac{\text{change in y-values}}{\text{change in x-values}} = \frac{\text{rise}}{\text{run}}$$

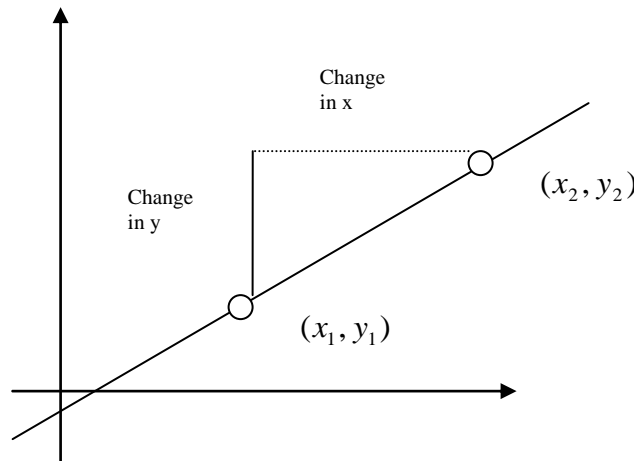
To find the change in y (the rise), subtract the y-values
 To find the change in x (the run), subtract the x-values

slope is a *ratio*

The *slope formula*

The slope of the line containing points (x_1, y_1) and (x_2, y_2) is given by

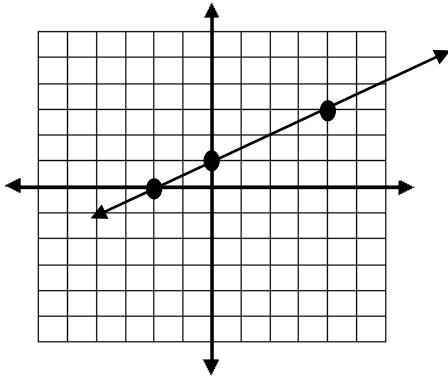
$$m = \frac{\text{vertical change}}{\text{horizontal change}} = \frac{\text{change in y}}{\text{change in x}} = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$$



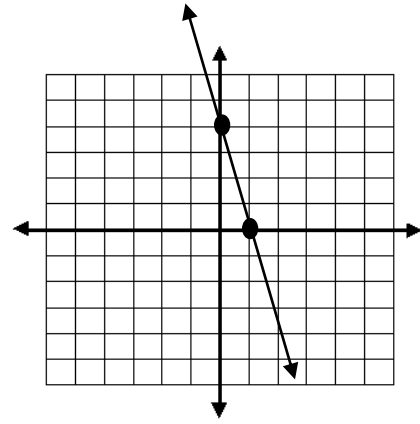
- A line with a positive slope goes up from left to right. /
- A line with a negative slope goes down from left to right. \

For problems below, use the graph to determine slope.

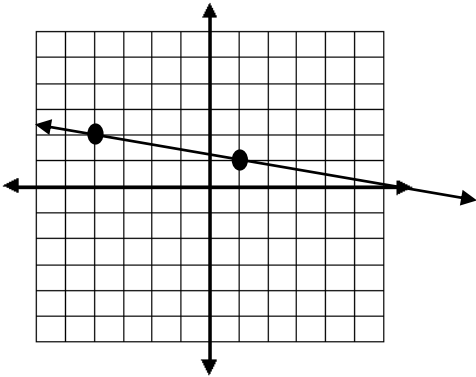
1.



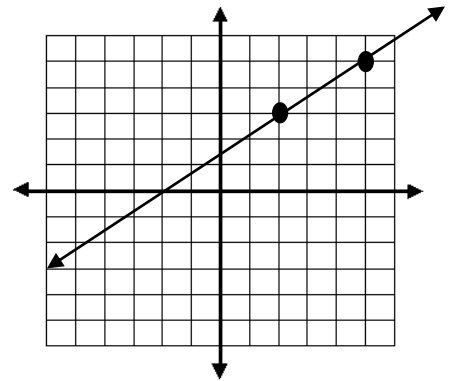
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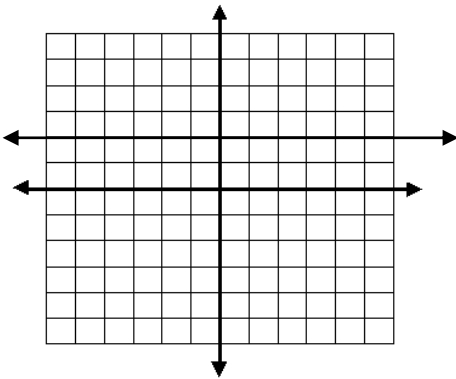
3.



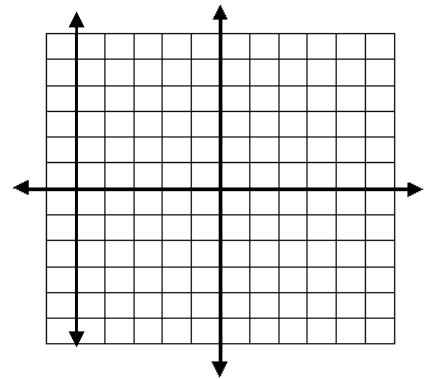
4.



5.



6.



The slope of a horizontal line is _____.

The slope of a vertical line is _____.

Find the slope of the line from the equation.

7. $y = -3$

8. $x = 4$

9. $x = -9$

10. $y = 8$

11. Find the slope of the line containing each given pair of points.

(a) $(1, -2)$ and $(5, 4)$

(b) $(5, -3)$ and $(2, -7)$

(c) $(-4, 8)$ and $(-4, 3)$