

Name: _____

Date: _____

Slope as Rate of Change Algebra 1

We know that slope measures the steepness of a line by comparing how much the y -variable changes, its *rise*, to how much the x -variable changes, its *run*, by using a **ratio**. We use ratios to compare the rates at which two quantities change. These comparisons are called **rates of change**.

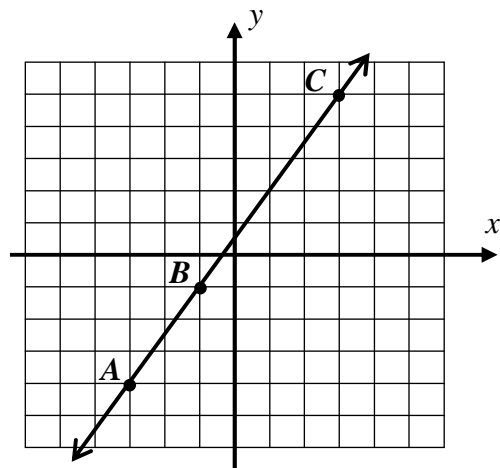
Exercise #1: Points A , B , and C are shown on the graph below.

- (a) Calculate the slope for each of the following line segments.
Write your answer in *reduced form*.

\overline{AB}

\overline{BC}

\overline{AC}

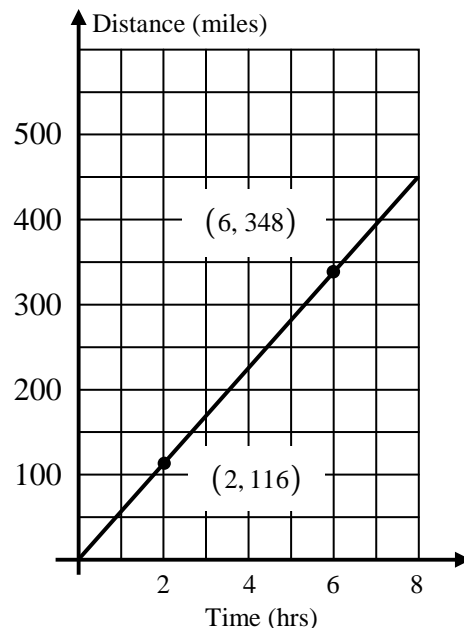


- (b) Place point D at any point on line \overline{AC} . Without calculation, what is the slope of \overline{AD} ? Explain.

We see from this exercise that any two points along the line can be used to calculate the slope (rate of change) of the line. This is true for all sets of two variables that are linearly related (form the graph of a line).

Exercise #2: The following graphs shows Raquel's distance from home as she drives to college.

- (a) Determine the slope of this linear relationship using the slope formula and the two points that are shown.
- (b) What are the units of the slope? Hint – Consider the units of the numerator and denominator.
- (c) What does this slope represent?



SLOPE AS RATE OF CHANGE

$$\text{slope} = \frac{\Delta \text{ dependent}}{\Delta \text{ independent}} = \text{rate of change}$$

Exercise #3: Hachi was driving a car at a constant speed on the New York State Thruway. He noticed that after driving for 1 hour he had 12 gallons of gas left. Then, after driving for a total of 3 hours, he had 8 gallons of gas left. Assume in this problem that there is a linear relationship between the amount of gasoline left and the time Hachi has been driving.

(a) Express the information given in this problem as two ordered pairs, where the independent variable is time and the dependent variable is the gallons of gasoline left.

(b) Calculate the slope of the line connecting these two points. Include units in your answer.

(c) How long, after he started driving, will Hachi run out of gasoline, assuming the rate you calculated in part (b) does not change (is constant)?

Exercise #4: Over the time interval given, calculate the rate of change for each variable. Include units in your answer:

(a) At 3 weeks old, a corn plant is 4 inches tall and at 15 weeks it is 46 inches tall.

(b) After driving for 4 hours, Tom is 82 miles from home and after driving for 7 hours, Tom is 244 miles from home.

Unit Conversions – One extremely important skill for both mathematics and science is the ability to change from one set of units to another. All of these changes are done by multiplying by the **rate** that one unit changes compared to another.

Exercise #5: The space shuttle can fly at a speed of 25,000 feet in one second. How many times faster does the space shuttle fly compared to a car going 55 miles per hour? Use the fact that one mile is 5280 feet long and round your final answer to the nearest *integer*.

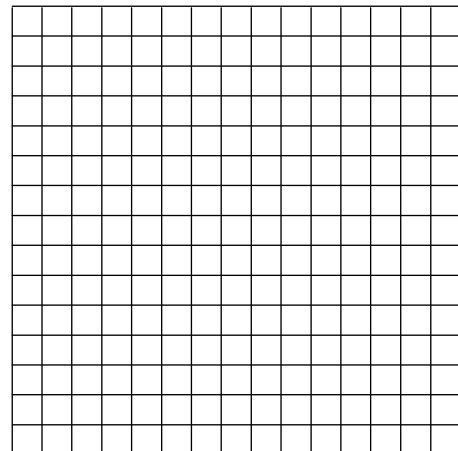
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Slope as Rate of Change Algebra 1 Homework

Applications

1. Over the time interval given, calculate the rate of change. Include appropriate units in each of your calculations.
- (a) A boy is 29 inches tall when he is 1 year old and 66 inches tall when he is 15 years old.
- (b) A car drives 80 miles in 2 hours and 200 miles in 5 hours.
- (c) Takeru “The Tsunami” Kobayashi eats 4 Nathan’s hot dogs in 2 minutes and 56 in 12 minutes.
- (d) LeBron James scored 6 points after 18 minutes and scored a total of 39 points by the end of the game (48 minutes).
2. Baden loans \$100 to Kailey who pays it back at a rate of \$10 per week. The amount of money that is owed to Baden by Kailey is a linear function of time. What is the slope? Include units.
3. Admiral Al needs a ramp to perform a stunt at the Arlington High School pep rally. For the first 20 feet along the ground, the ramp must rise off of the ground at a constant rate. After the construction crew has finished 5 feet of the horizontal distance, the track is 4 feet off the ground. After 20 feet of horizontal distance is constructed, Admiral Al needs to clear a 12 foot high barrier. Will he be able to do it? Use of the grid paper below is optional.



4. Elana is scaling up a 500-foot cliff. She starts at the bottom at $t = 0$ hours and carefully climbs at a constant rate of 120 feet per hour.

(a) After 3 hours, has Elana reached the top of the cliff? Justify.

(b) After how many minutes will Elana reach the top of the cliff? Show how you arrived at your answer.

(c) Express your answer to part (b) in terms of hours and minutes.

5. For homecoming, the student government bought balloons. Felix accidentally lets one of the balloons go that is attached to a 400 foot string. The balloon rises at a rate of 7 feet per second.

(a) Felix doesn't notice that he's let go of the balloon until 35 seconds have passed since it started to float upwards. Can he still catch the balloon? Justify.

(b) Determine the time, to the nearest *tenth* of a *second*, when the string will run out.

6. Gabe takes a bike ride starting from home. He travels 4 miles in 6 minutes. He then gets stopped in traffic for 3 minutes. Frustrated, Gabe decides to bike home, which takes 8 more minutes.

(a) Draw a graph of Gabe's distance from home as a function of the time since he left.

(b) Find the slope of each portion of this graph. Include units.

