

5.1 Rate of Change and Slope Notes

A. Rate of Change = Slope = $\frac{\text{Change in DEPENDENT}}{\text{Change in INDEPENDENT}}$

B. Find Rate of Change

1.

FUNDRAISING The table shows the amount of money a Booster Club made washing cars for a fundraiser. Use the information to find the rate of change in dollars per car.

Cars Washed	
Number	Money (\$)
5	40
+5	+40
10	80
+5	+40
15	120
+5	+40
20	160

Find the unit rate to determine the rate of change.

$$\frac{\text{change in money}}{\text{change in cars}} = \frac{40 \text{ dollars}}{5 \text{ cars}} \quad \text{The money earned increases by } \$40 \text{ for every 5 cars.}$$

$$= \frac{8 \text{ dollar}}{1 \text{ car}} \quad \text{Write as a unit rate.}$$

So, the number of dollars earned increases by \$8 for every car washed.

2.

PLANES The table shows the number of miles a plane traveled while in flight. Use the information to find the approximate rate of change in miles per minute.

Time (min)	30	60	90	120
Distance (mi)	290	580	870	1,160

3. Find the rate of change. Include units.

PHYSICAL SCIENCE The table below shows the relationship between the number of seconds y it takes to hear the thunder after a lightning strike and the distance x you are from the lightning.

Distance (x)	0	1	2	3	4	5
Seconds (y)	0	5	10	15	20	25

For Exercises 4 and 5, find the rate of change for each table.

4.

Time (s)	Distance (m)
0	6
1	12
2	18
3	24

5.

Time (h)	Wage (\$)
0	0
1	9
2	18
3	27

6. The number of minutes included in different cell phone plans and the costs are shown in the table. What is the approximate rate of change in cost per minute?

Cost (\$)	38	50	62	74	86
Minutes	1,000	1,500	2,000	2,500	3,000

7. WATER At 1:00, the water level in a pool is 13 inches. At 2:30, the water level is 28 inches. What is the rate of change?

8. MONEY Dwayne opens a savings account with \$75. He makes the same deposit every month and makes no withdrawals. After 3 months, he has \$150. After 6 months, he has \$300. After 9 months, he has \$450 dollars. What is the rate of change?

C. Linear? It is only if the rate of change is CONSTANT.

1.

x	y
0	1
3	3
6	5
9	7

2.

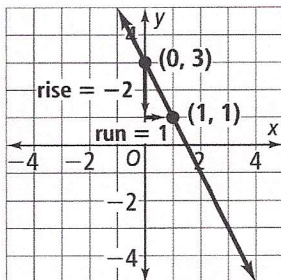
x	y
2	0
4	3
6	7
8	12

$$\text{slope} = \frac{\text{vertical change}}{\text{horizontal change}} = \frac{\text{rise}}{\text{run}} \quad \text{ALWAYS REDUCE FRACTIONS/LEAVE IMPROPER}$$

There are two special cases for slopes: A horizontal line has a slope of 0. A vertical line has an undefined slope

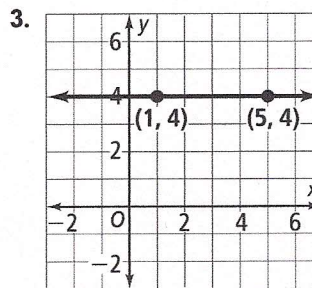
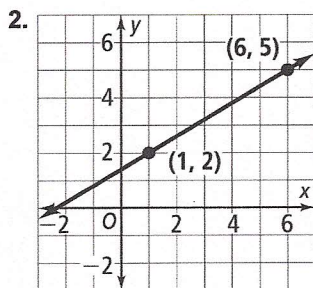
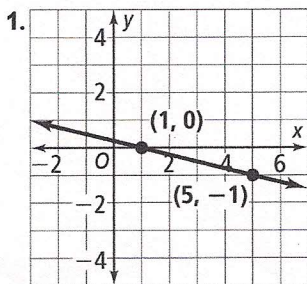
What is the slope of the line?

$$\begin{aligned} \text{slope} &= \frac{\text{vertical change}}{\text{horizontal change}} = \frac{\text{rise}}{\text{run}} \\ &= \frac{-2}{1} \\ &= -2 \end{aligned}$$



The slope of the line is -2 . (In general, a line that slants downward from left to right has a negative slope.)

Find the slope of each line.



Suppose one point on a line has the coordinates (x_1, y_1) and another point on the same line has the coordinates (x_2, y_2) . You can use the following formula to find the slope of the line.

What is the slope of the line through $R(2, 5)$ and $S(-1, 7)$?

$$\begin{aligned} \text{slope} &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{7 - 5}{-1 - 2} \quad \text{Let } y_2 = 7 \text{ and } y_1 = 5. \\ &= \frac{2}{-3} \quad \text{Let } x_2 = -1 \text{ and } x_1 = 2. \\ &= -\frac{2}{3} \end{aligned}$$

Exercises

Find the slope of the line that passes through each pair of points.

4. $(0, 0), (4, 5)$

5. $(2, 4), (7, 8)$

6. $(-2, 0), (-3, 2)$

7. $(-2, -3), (1, 1)$

8. $(1, 4), (2, -3)$

9. $(3, 2), (-5, 3)$