

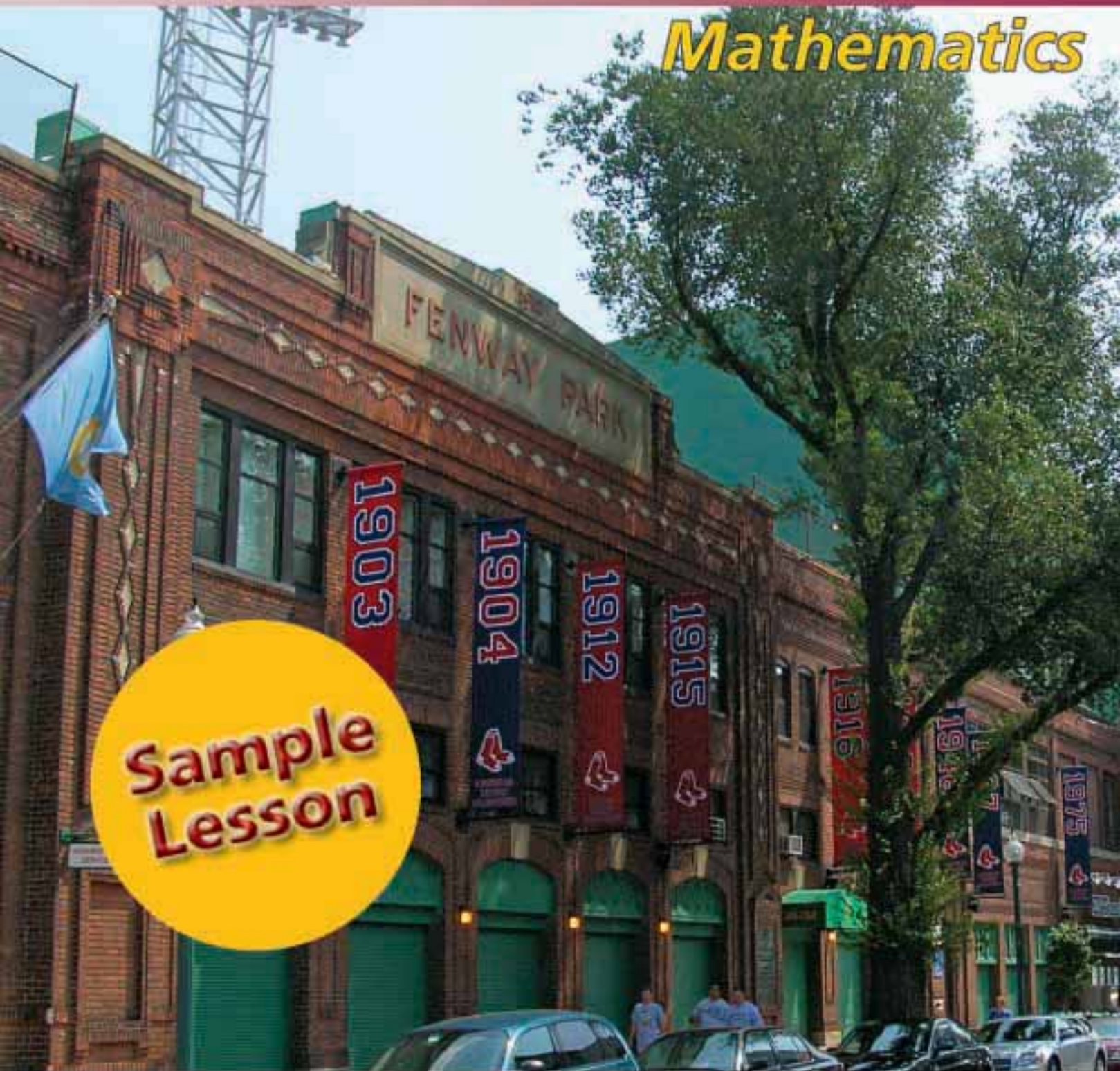


GRADE

10

# MCAS Finish Line

*Mathematics*



**Sample  
Lesson**

Continental Press

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# Slope and Intercepts of a Line

Standard 10.P.2

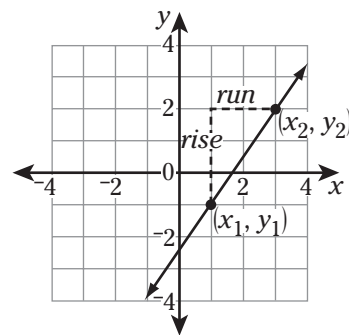
## Slope

**Slope** is a measure of the steepness of a line. It describes a rate of change. The slope of a line can be found using either of these methods:

1. On the graph of a line, determine the vertical change (the “rise”) over the horizontal change (the “run”) from one point to another.

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

2. Use the **slope formula**. For any two points on a line,  $(x_1, y_1)$  and  $(x_2, y_2)$  and  $x_1 \neq x_2$ , slope =  $\frac{y_2 - y_1}{x_2 - x_1}$ .

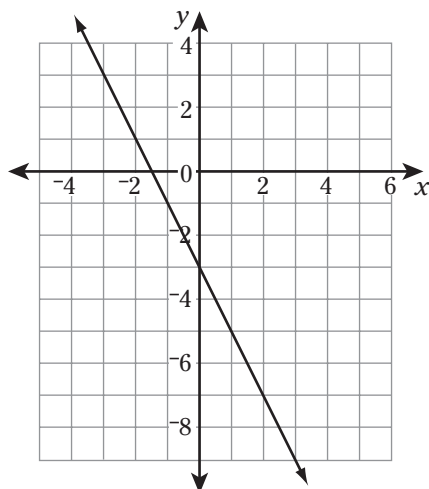


A line that slants upward from left to right always has a positive slope. A line that slants downward from left to right always has a negative slope.

It is a good idea to check the slope of a line found when looking at a graph using rise over run by also using the slope formula.

The sample problem below shows how both methods for finding the slope can be used.

**S-1** What is the slope of the line graphed below?



- A**  $-3$       **B**  $-2$       **C**  $-\frac{1}{2}$       **D**  $-\frac{1}{3}$

Horizontal lines have a slope of 0.

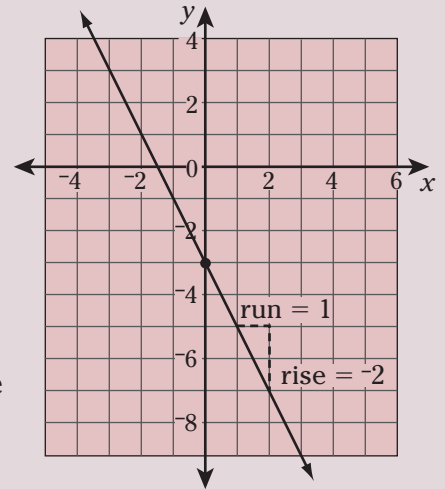
Vertical lines have an undefined slope.



Find the slope using the rise over the run, or  $\frac{\text{rise}}{\text{run}}$ . By looking at the graph, you can see that the line has a rise of  $-2$  and a run of  $1$ , so the slope is  $\frac{-2}{1}$  or  $-2$ . Verify this slope by using the slope formula with any two points on the graph.

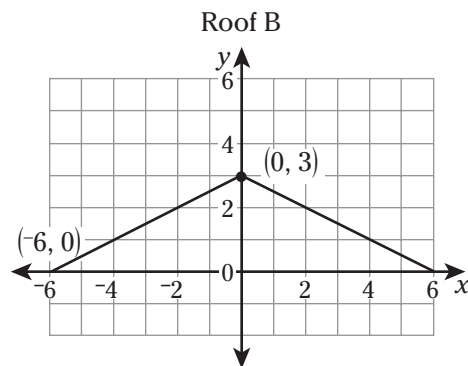
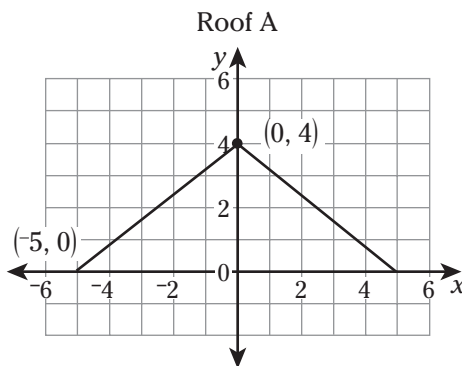
$$\text{Slope} = \frac{-5 - (-3)}{1 - 0} = \frac{-5 + 3}{1} = \frac{-2}{1} \text{ or } -2.$$

Both methods result in the same slope. Choice B is correct.



## Applications of Slope

Slope can be used to find different rates of change, such as the grade of a road or the pitch of a roof. The greater the slope, the steeper the road or the roof pitch. For example, suppose an architect draws the two roofs shown on the coordinate planes below.



The coordinates of the left sides of each roof drawing are shown. Use these coordinates and the slope formula to find the slope of each roof.

The slope of roof A is  $\frac{4 - 0}{0 - (-5)} = \frac{4}{5}$ . The slope of roof B is  $\frac{3 - 0}{0 - (-6)} = \frac{3}{6} = \frac{1}{2}$ . The slope of roof A is greater than the slope of roof B since  $\frac{4}{5} > \frac{1}{2}$ . So, roof A is steeper than roof B.

For any two points on a line  $(x_1, y_1)$  and  $(x_2, y_2)$  and  $x_1 \neq x_2$ , the slope of the line is  $\frac{y_2 - y_1}{x_2 - x_1}$ .

Now try this example.

**S-2** Rosemary grows a plant from seed. In 2 weeks, the plant is 5 centimeters tall. In 6 weeks, the plant is 17 centimeters tall. What is the average growth rate each week of this plant between weeks 2 and 6?

- A** 3 cm                      **B** 4 cm                      **C** 8 cm                      **D** 12 cm

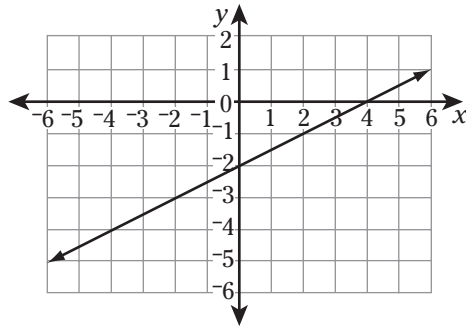


To find the average growth rate each week, find the slope of the line between the points (2, 5) and (6, 17). Slope  $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{17 - 5}{6 - 2} = \frac{12}{4} = 3$ . Choice A is correct.

### Finding Intercepts from Graphs

On the graph of a line, the point where the line touches the  $x$ -axis is the  **$x$ -intercept** of the line. The point where the line touches the  $y$ -axis is the  **$y$ -intercept** of the line.

For example, on the graph below, the line touches the  $x$ -axis at  $x = 4$  and the  $y$ -axis at  $y = -2$ . The  $x$ -intercept of this line is the point (4, 0). The  $y$ -intercept is the point (0, -2).

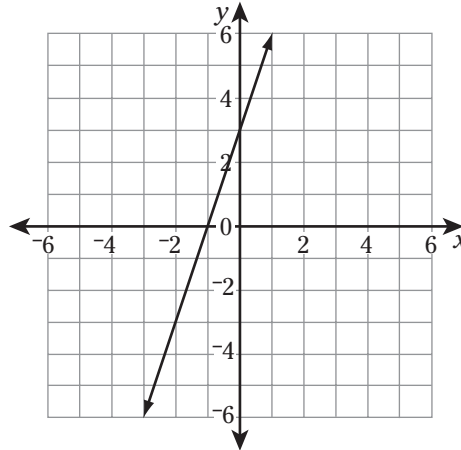


If a line touches the  $x$ -axis at  $x = a$ , the  $x$ -intercept is the point  $(a, 0)$ .

If a line touches the  $y$ -axis at  $y = b$ , the  $y$ -intercept is the point  $(0, b)$ .

Try this sample question.

**S-3** Which statement best describes the graph of the line shown below?



- A The slope is positive and the  $x$ -intercept is  $-1$ .
- B The slope is negative and the  $x$ -intercept is 3.
- C The slope is positive and the  $y$ -intercept is  $-1$ .
- D The slope is negative and the  $y$ -intercept is 3.

The line on the graph slants upward from left to right, so the slope is positive. The line touches the  $x$ -axis at  $-1$  and it touches the  $y$ -axis at 3. So, the  $x$ -intercept is  $-1$  and the  $y$ -intercept is 3. Choice A is correct.



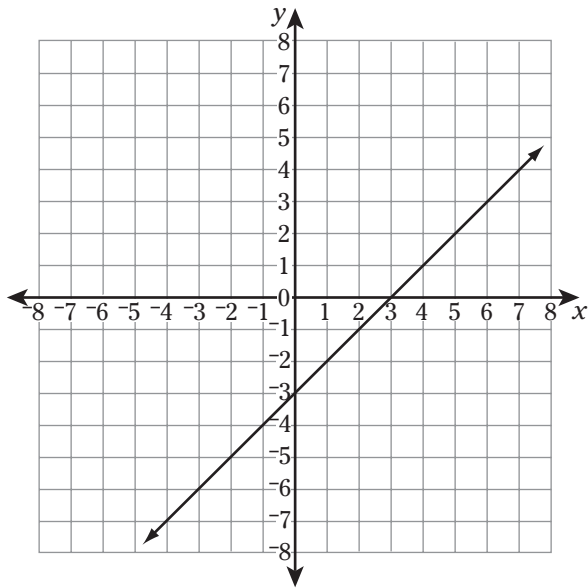
# IT'S YOUR TURN

Read each problem. Circle the letter of the best answer.

1. Line  $p$  passes through the points  $(3, -2)$  and  $(5, 3)$ . What is the slope of line  $p$ ?

- A  $\frac{2}{5}$
- B  $\frac{1}{2}$
- C  $\frac{2}{1}$
- D  $\frac{5}{2}$

2. What is the  $y$ -intercept of the line graphed below?

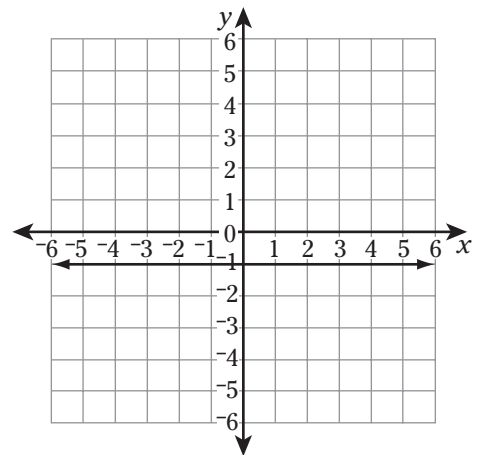


- A  $-3$
- B  $-1$
- C  $1$
- D  $3$

3. Which intercepts *must* be on a line with a negative slope?

- A  $x$ -intercept = 0,  $y$ -intercept = 0
- B  $x$ -intercept = 1,  $y$ -intercept = 6
- C  $x$ -intercept =  $-4$ ,  $y$ -intercept = 3
- D  $x$ -intercept = 5,  $y$ -intercept =  $-2$

4. What is the slope of the line shown below?



- A  $-1$
- B  $0$
- C  $1$
- D undefined

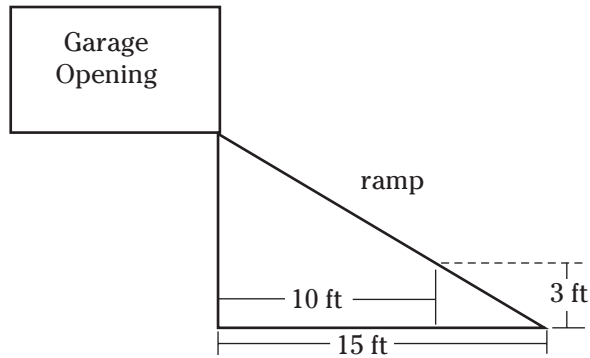
5. A pole is placed against a house 6 feet from its base. The top of the pole reaches a height 10 feet off the ground. Which number best represents the slope of the pole?

- A  $\frac{1}{4}$
- B  $\frac{3}{5}$
- C  $\frac{5}{3}$
- D  $\frac{4}{1}$



Read the problem. Write your answer.

6. The bottom of a ramp is placed 15 feet from a garage opening at a warehouse. The ramp is 3 feet off the ground when it is 10 feet from the garage opening.



How many feet off the ground is the top of the ramp?

*Answer:* \_\_\_\_\_

