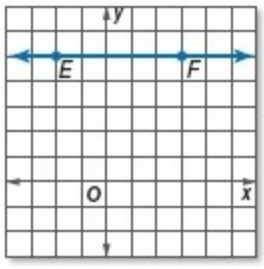
3-3 Slopes of Lines

Find the slope of each line.

14. 

SOLUTION:

Here, $\overline{EF}$ is a horizontal line. So, the slope is zero.

ANSWER:

0

Determine the slope of the line that contains the given points.

20. $G(-4, 3)$, $H(-4, 7)$

SOLUTION:

Substitute the coordinates of the points in the slope formula.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{7-3}{-4-(-4)}$$
$$= \frac{4}{0}$$

Division of any number by zero is undefined. Therefore, the slope of the line is undefined.

ANSWER:

undefined

24. $R(2, -6)$, $S(-6, 5)$

SOLUTION:

Substitute the coordinates of the points in the slope formula.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{5-(-6)}{-6-2}$$
$$= \frac{11}{-8}$$
$$= -\frac{11}{8}$$

Therefore, the slope of the line is $-\frac{11}{8}$.

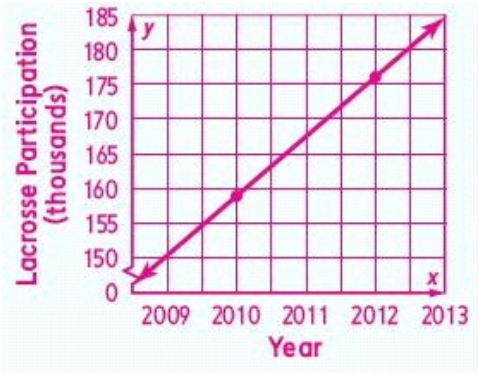
ANSWER:

$-\frac{11}{8}$

26. **APPLY MATH** In 2010, about 159,000 American high school students participated in lacrosse, and in 2012, about 176,000 participated.
a. Create a graph to show the number of participants in lacrosse based on the change in participation from 2010 to 2012.
b. Based on the data, what is the annual growth of the sport?
c. If participation continues at the same rate, what will be the participation in 2020 to the nearest 1000?

SOLUTION:

a. Plot the points (2010, 159) and (2012, 176), join them and extend the line.



b. Substitute the coordinates of any two points on the line in the slope formula. Consider the points (2010, 159) and (2012, 176) since neither has a decimal and will make the slope calculation easier.

Let (x_1, y_1)= (2010, 159) and (x_2, y_2) = (2012, 176). Find *m*.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{176 - 159}{2012 - 2010}$$
$$= \frac{17}{2}$$
$$= 8.5$$

The rate of growth is 8.5. That is, 8500 people per year.

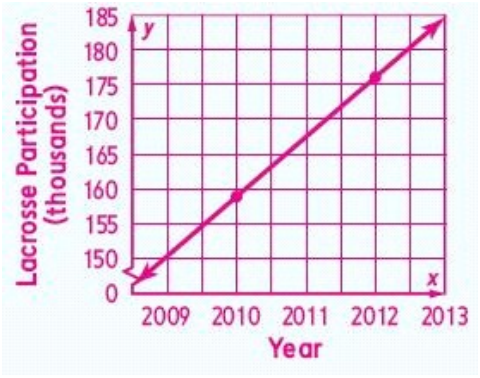
c. Substitute $m = 8.5$, x_1 = 2010, y_1 = 159, and x_2 = 2020 in the slope formula.

$$m = \frac{y_2 - y_1}{x_2 - x_1} \quad \text{Slope Formula}$$
$$8.5 = \frac{y_2 - 159}{2020 - 2010} \quad \text{Substitution.}$$
$$8.5 = \frac{y_2 - 159}{10} \quad \text{Subtraction.}$$
$$10(8.5) = 10\left(\frac{y_2 - 159}{10}\right) \quad \times \text{each side by 10.}$$
$$85 = y_2 - 159 \quad \text{Simplify.}$$
$$85 + 159 = y_2 - 159 + 159 \quad + 159 \text{ to each side.}$$
$$244 = y_2 \quad \text{Simplify.}$$

Therefore, if the trend continues the participation in 2020 will be about 244,000.

ANSWER:

a.



b. 8500

c. 244,000

Determine whether $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$ are *parallel*, *perpendicular*, or *neither*. Graph each line to verify your answer.

28. *A*(1, 5), *B*(4, 4), *C*(9, –10), *D*(–6, –5)

SOLUTION:

Substitute the coordinates of the points in slope formula to find the slopes of the lines.

Find slope of $\overleftrightarrow{AB}$ with (x_1, y_1) = (1, 5) and (x_2, y_2) = (4, 4).

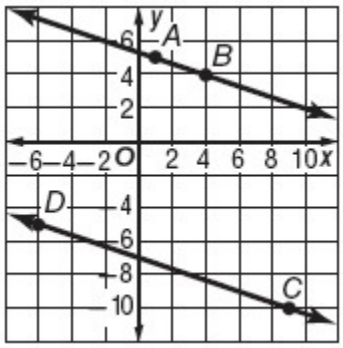
$$m_1 = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{4 - 5}{4 - 1}$$
$$= \frac{-1}{3}$$
$$= -\frac{1}{3}$$

Find slope of $\overleftrightarrow{CD}$ with (x_1, y_1) = (9, –10) and (x_2, y_2) = (–6, –5).

$$m_2 = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{-5 - (-10)}{-6 - 9}$$
$$= \frac{5}{-15}$$
$$= -\frac{1}{3}$$

The two lines have equal slopes, $-\frac{1}{3}$. Therefore, the lines are parallel.

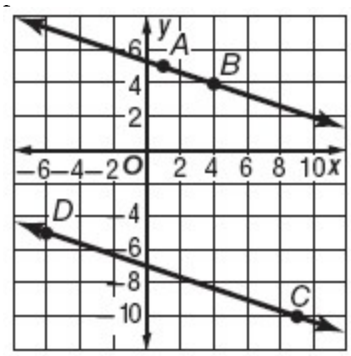
Graph the lines on a coordinate plane to verify the answer.



ANSWER:

parallel

3-3 Slopes of Lines



30. $A(4, 2)$, $B(-3, 1)$, $C(6, 0)$, $D(-10, 8)$

SOLUTION:

Substitute the coordinates of the points in slope formula to find the slopes of the lines.

Find slope of $\overleftrightarrow{AB}$ with $(x_1, y_1) = (4, 2)$ and $(x_2, y_2) = (-3, 1)$.

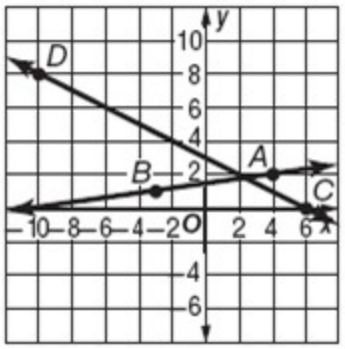
$$m_1 = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{1-2}{-3-4}$$
$$= \frac{-1}{-7}$$
$$= \frac{1}{7}$$

Find slope of $\overleftrightarrow{CD}$ with $(x_1, y_1) = (6, 0)$ and $(x_2, y_2) = (-10, 8)$.

$$m_2 = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{8-0}{-10-6}$$
$$= \frac{8}{-16}$$
$$= -\frac{1}{2}$$

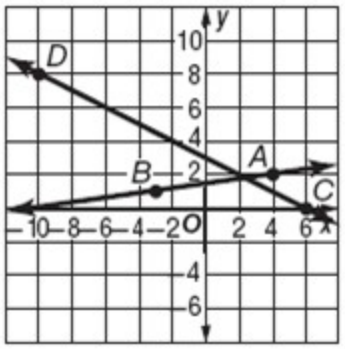
The two lines neither have equal slopes nor is their product –1. Therefore, the lines are neither parallel nor perpendicular.

Graph the lines on a coordinate plane to verify the answer.



ANSWER:

neither



32. $A(8, 4)$, $B(4, 3)$, $C(4, -9)$, $D(2, -1)$

SOLUTION:

Substitute the coordinates of the points in slope formula to find the slopes of the lines.

Find slope of $\overleftrightarrow{AB}$ with $(x_1, y_1) = (8, 4)$ and $(x_2, y_2) = (4, 3)$.

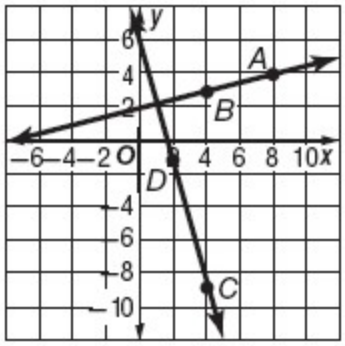
$$m_1 = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{3-4}{4-8}$$
$$= \frac{-1}{-4}$$
$$= \frac{1}{4}$$

Find slope of $\overleftrightarrow{CD}$ with $(x_1, y_1) = (4, -9)$ and $(x_2, y_2) = (2, -1)$.

$$m_2 = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{-1-(-9)}{2-4}$$
$$= \frac{8}{-2}$$
$$= -4$$

The product of the slopes of the lines is –1. Therefore, the lines are perpendicular.

Graph the lines on a coordinate plane to verify the answer.



ANSWER:

perpendicular