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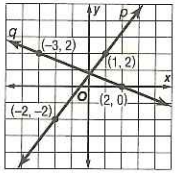
3-3 Study Guide and Intervention

Slopes of Lines

Slope of a Line The slope m of a line containing two points with coordinates (x_1, y_1) and (x_2, y_2) is given by the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$, where $x_1 \neq x_2$.

Example **Find the slope of each line.**



For line p, let (x_1, y_1) be (1, 2) and (x_2, y_2) be (−2, −2).

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-2 - 2}{-2 - 1} \text{ or } \frac{4}{3}$$

For line q, let (x_1, y_1) be (2, 0) and (x_2, y_2) be (−3, 2).

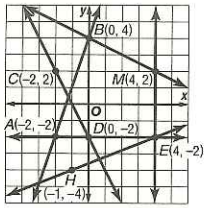
$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - 0}{-3 - 2} \text{ or } -\frac{2}{5}$$

Exercises

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

1. $J(0, 0), K(-2, 8)$ -4
2. $R(-2, -3), S(3, -5)$ $-\frac{2}{5}$
3. $L(1, -2), N(-6, 3)$ $-\frac{5}{7}$
4. $P(-1, 2), Q(-9, 6)$ $-\frac{1}{2}$
5. $T(1, -2), U(6, -2)$ 0
6. $V(-2, 10), W(-4, -3)$ $\frac{13}{2}$

Find the slope of each line.



7. $\overline{AB}$ 3
8. $\overline{CD}$ -2
9. $\overline{EM}$ undefined
10. $\overline{AE}$ 0
11. $\overline{EH}$ $\frac{2}{5}$
12. $\overline{BM}$ $-\frac{1}{2}$

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3-3 Study Guide and Intervention *(continued)*

Slopes of Lines

Parallel and Perpendicular Lines If you examine the slopes of pairs of parallel lines and the slopes of pairs of perpendicular lines, where neither line in each pair is vertical, you will discover the following properties.

Two lines have the same slope if and only if they are parallel.

Two lines are perpendicular if and only if the product of their slopes is −1.

Example 1 **Find the slope of a line parallel to the line containing $A(-3, 4)$ and $B(2, 5)$.**

Find the slope of $\overline{AB}$. Use (−3, 4) for (x_1, y_1) and use (2, 5) for (x_2, y_2).

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{5 - 4}{2 - (-3)} \text{ or } \frac{1}{5}$$

The slope of any line parallel to $\overline{AB}$ must be $\frac{1}{5}$.

Example 2 **Find the slope of a line perpendicular to $\overline{PQ}$ for $P(-2, -4)$ and $Q(4, 3)$.**

Find the slope of $\overline{PQ}$. Use (−2, −4) for (x_1, y_1) and use (4, 3) for (x_2, y_2).

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - (-4)}{4 - (-2)} \text{ or } \frac{7}{6}$$

Since $\frac{7}{6} \cdot \left(-\frac{6}{7}\right) = -1$, the slope of any line perpendicular to $\overline{PQ}$ must be $-\frac{6}{7}$.

Exercises

Determine whether $\overleftrightarrow{MN}$ and $\overleftrightarrow{RS}$ are *parallel*, *perpendicular*, or *neither*.

1. $M(0, 3), N(2, 4), R(2, 1), S(8, 4)$ parallel
2. $M(-1, 3), N(0, 5), R(2, 1), S(6, -1)$ perpendicular
3. $M(-1, 3), N(4, 4), R(3, 1), S(-2, 2)$ neither
4. $M(0, -3), N(-2, -7), R(2, 1), S(0, -3)$ parallel
5. $M(-2, 2), N(1, -3), R(-2, 1), S(3, 4)$ perpendicular
6. $M(0, 0), N(2, 4), R(2, 1), S(8, 4)$ neither

Find the slope of $\overleftrightarrow{MN}$ and the slope of any line perpendicular to $\overleftrightarrow{MN}$.

7. $M(2, -4), N(-2, -1)$ $-\frac{3}{4}; \frac{4}{3}$
8. $M(1, 3), N(-1, 5)$ $-1; 1$
9. $M(4, -2), N(5, 3)$ $5; -\frac{1}{5}$
10. $M(2, -3), N(-4, 1)$ $-\frac{2}{3}; \frac{3}{2}$