**Lesson 9**

**RF3** Demonstrate an understanding of slope with respect to rise and run, line segments and lines, rate of change, parallel lines, perpendicular lines.

**Parallel Lines**

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If two lines are parallel (symbol ǁ ) they have the same slope.

To prove ( or disprove) that two lines are parallel, find the slopes of the lines. If the slopes are equal then the lines are parallel.

Example 1:

Is AB parallel to BC?



Find the slopes

mAB = $\frac{rise}{run}$ mCD = $\frac{rise}{run}$

 = $\frac{6}{4}$ = $\frac{6}{4}$

 = $\frac{3}{2}$ = $\frac{3}{2}$

The slopes are equal so AB ǁ CD

Example 2:

Line GH passes through G( -4,2) and H(2,-1). Like JK passes through J(-1,7) and K(7,3). Line MN passes through M(-4,5) and N(5,1). Are the lines parallel? Justify the answer.

If the lines are parallel then the slopes of the lines are equal. Find the slopes.

Slope Formula: **Slope =** $\frac{y2-y1}{x2-x1}$

mGH = $\frac{-1-2}{2-(-4)}$ mJK= $\frac{3-7}{7-(-1)}$ mMN= $\frac{1-5}{5-(-4)}$

 = $\frac{-3}{6}$ = $\frac{-4}{8}$ = $\frac{-4}{9}$

 = $\frac{-1}{2}$ = $\frac{-1}{2}$

The slope of GH and JK are equal so GH ǁ JK.

**Perpendicular Lines**



**The slopes of two oblique perpendicular lines are negative reciprocals; that is a line with a slope of a, a ≠ 0, is perpendicular to a line with a slope of** $\frac{-1}{a}$**.**

Example: Is AB perpendicular (ꓕ) to CD?



mAB = $\frac{-2}{4}$ mCD = $\frac{4}{2}$

 = $\frac{-1}{2}$ = $\frac{2}{1}$

For the fraction $\frac{-1}{2}$ the reciprocal would be $\frac{2}{-1}$. To take the negative of the fraction - ($\frac{2}{-1}$) = ($\frac{2}{1}$). His is the slope of CD

Therefore AB ꓕ CD.

Example 3:

Line PQ passes through P(-7,2) and Q(-2,10). Line RS passes through R(-3,-4) and S(5,1). Are the lines parallel, perpendicular or neither? Justify your answer.

Answer:

mPQ = $\frac{y2-y1}{x2-x1}$mRS = $\frac{y2-y1}{x2-x1}$

= $\frac{10-2}{-2-(-7)}$ = $\frac{1-(-4)}{5-(-3)}$

 = $\frac{8}{5}$ = $\frac{5}{8}$

These lines are neither parallel or perpendicular.

TRY THIS

Line ST passes through S(-2,7) and T(2,-5). Line UV passes through U(-2,3) and V(7,6). Are the two lines parallel, perpendicular or neither? Justify your answer.

(Answer: The lines are perpendicular)

Example 4:

Determine the slope of the line that is perpendicular to the line through E(2,3) and F(-4,-1)

Answer:

mEF = $\frac{-1-3}{-4-2}$

 = $\frac{-4}{-6}$

 = $\frac{2}{3}$

The negative reciprocal of $\frac{2}{3}$ is $\frac{-3}{2}$.

The slope of the line perpendicular to EF is $\frac{-3}{2}$.

Example 5:

Is quadrilateral ABCD a rectangle? Justify your answer.



A quadrilateral is a rectangle if the opposite sides are parallel and the adjacent sides are perpendicular, To prove or disprove ABCD being a rectangle the slopes of the sides must be found.

mAB= $\frac{-4}{1}$ mCD = $\frac{-4}{1}$

mAD = $\frac{2}{8}$ mBC = $\frac{2}{8}$

 = $\frac{1}{4}$ = $\frac{1}{4}$

The opposite sides of ABCD have equal slopes and the adjacent sides have slopes that are negative reciprocals so ABCD is a rectangle.

Practice Questions from the textbook p.349-350 #3 to 6, 8 to 17