


Look at $\frac{\text{rise}}{\text{run}}$ as $\frac{\text{the change in the } y\text{'s}}{\text{the change in the } x\text{'s}}$

$$= \frac{3 - (-1)}{4 - (-2)} = \frac{4}{6} = \frac{2}{3}$$

Unit 5: Linear Equations



5.3 Slope Formula

Warm-Up #2 Investigating the Slope Formula

a) Calculate the slope of line segment AB using slope = $\frac{\text{rise}}{\text{run}}$. $\frac{3}{6} = \frac{1}{2}$

b) List the coordinates of the endpoints of line segment AB. A(1, 8) B(7, 11)

c) How can the rise of line segment AB be determined using y_2 and y_1 ? $11 - 8 = 3$

d) How can the run of line segment AB be determined using x_2 and x_1 ? $7 - 1 = 6$

e) Use your results from c) and d) to write a formula which describes how the slope of line segment AB can be calculated using its endpoints.

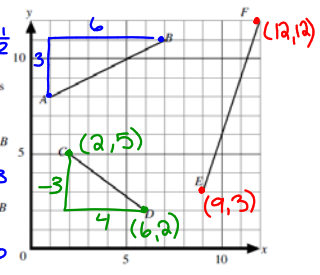
$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

f) Calculate the slope of line segment AB using the formula in e).

$$m = \frac{11 - 8}{7 - 1} = \frac{3}{6} = \frac{1}{2}$$

g) Calculate the slope of the line segments CD and EF using the method in a) and verify using the formula from e).

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - 5}{6 - 2} = \frac{-3}{4}$$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{12 - 3}{12 - 9} = \frac{9}{3} = 3$$


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The Slope Formula

In mathematics the letter "m" is used to represent slope. If the graph of a linear relation passes through the points $P(x_1, y_1)$ and $Q(x_2, y_2)$, then the slope of this line can be calculated using

$$m = \frac{y_2 - y_1}{x_2 - x_1} \quad \text{or} \quad m_{PQ} = \frac{y_Q - y_P}{x_Q - x_P}$$

come from the same ordered pair

Class Ex. #1 Find the slope of a line which passes through the points G(-3, 8) and H(7, -2).

$$m_{GH} = \frac{y_H - y_G}{x_H - x_G} = \frac{-2 - 8}{7 - (-3)} = \frac{-10}{10} = -1$$


Class Ex. #2 Eleanor, Bonnie, and Carl are calculating the slope of a line segment with endpoints E(15, 8) and F(-10, 6). Their work is shown below.

	Eleanor	Bonnie	Carl
Step 1:	$m_{EF} = \frac{8 - 6}{6 - 8}$	$m_{EF} = \frac{6 - 8}{-10 - (-10)}$	$m_{EF} = \frac{8 - 6}{15 - 10}$
Step 2:	$= \frac{-2}{-2}$	$= \frac{-2}{0}$	$= \frac{2}{5}$
Step 3:	$m_{EF} = 1$	$m_{EF} = \frac{-2}{0}$	$m_{EF} = \frac{2}{5}$

Since their answers are all different, at least two of the students have made errors in their calculations. Describe all the errors which have been made and determine the correct slope

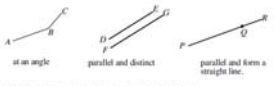
$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{6 - 8}{-10 - 15} = \frac{-2}{-25} = \frac{2}{25}$$

Look at $\frac{\text{rise}}{\text{run}}$ as
 the change in the y's
 the change in the x's

$$= \frac{3 - (-1)}{4 - (-2)} = \frac{4}{6} = \frac{2}{3}$$


Collinear Points

Two lines in a plane can either be



at an angle parallel and distinct parallel and form a straight line.

Points that lie on the same straight line are said to be collinear.
 i.e. P, Q, and R are collinear.

If three points P, Q, and R are collinear then $m_{PQ} = m_{QR} = m_{PR}$.
 Proving that any two of these three slopes are equal is sufficient for the third to be equal and for the points to be collinear.

Consider the points A(5, -3), B(2, 6) and C(-7, 33).

a) Prove points A, B, and C are collinear.

$$m_{AB} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{6 - (-3)}{2 - 5} = \frac{9}{-3} = -3$$

$$m_{BC} = \frac{6 - 33}{2 - (-7)} = \frac{-27}{9} = -3$$

$$m_{AC} = \frac{33 - (-3)}{-7 - 5} = \frac{36}{-12} = -3$$

b) Find the value of y if the point D(-4, y) lies on line segment AC.

B(2, 6)
 D(-4, y)

$$\frac{-3}{1} = \frac{y - 6}{-4 - 2}$$

$$\frac{-3}{1} = \frac{y - 6}{-6}$$

$$18 = 1(y - 6)$$

$$18 = y - 6$$

$$+6 \quad +6$$

$$\boxed{24 = y}$$