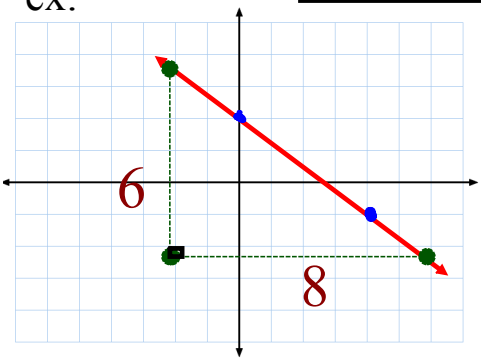
REVIEW: Calculating Slope

#1. Graph

Slope = $\frac{\text{Rise}}{\text{Run}}$

ex:



$m = \frac{rise}{run}$

$= \frac{-3}{4}$

#2. Two Points

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

ex: (-3, 5) & (1, -7)

$m = \frac{y_2 - y_1}{x_2 - x_1}$ $\quad m = \frac{\Delta y}{\Delta x}$

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

$= \frac{12}{-4}$

$= -3$

Problems with the homework?

Page 339 - 343: #4, 6, 8, 11, 13, 15, 17, 22, 26

22. $m = \frac{1}{12}$

rise 70cm

$m = \frac{rise}{run}$

$\frac{1}{12} = \frac{70}{x}$

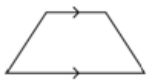
$x = 70(12)$

$= 840cm$

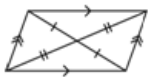
Activate Prior Learning:
Properties of Quadrilaterals

A **quadrilateral** is a polygon with 4 sides.

A **trapezoid** is a quadrilateral that has exactly one pair of parallel sides.



A **parallelogram** is a quadrilateral with both pairs of opposite sides parallel.
All parallelograms have:
- opposite sides equal
- opposite angles equal
- diagonals that bisect each other



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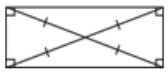
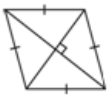
Activate Prior Learning:
Properties of Quadrilaterals

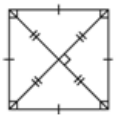
A **rectangle** is a parallelogram with 4 right angles.
It has all the properties of a parallelogram and its diagonals are equal.



A **rhombus** is a parallelogram with 4 equal sides.
It has all the properties of a parallelogram and its diagonals are perpendicular.



A **square** is a parallelogram with 4 equal sides and 4 right angles.
A square has all the properties of a parallelogram, a rectangle, and a rhombus.



6.2 Slopes of Parallel and Perpendicular Lines

6.2 Slopes of Parallel and Perpendicular Lines

When two lines have the same slope, congruent triangles can be drawn to show the rise and the run.

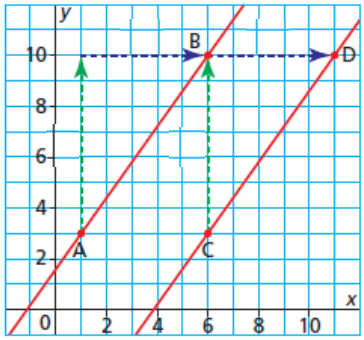
Lines that have the some slope are parallel.

Slope of AB = ?

Slope of CD = ?

$\frac{7}{5}$

$\frac{7}{5}$



?

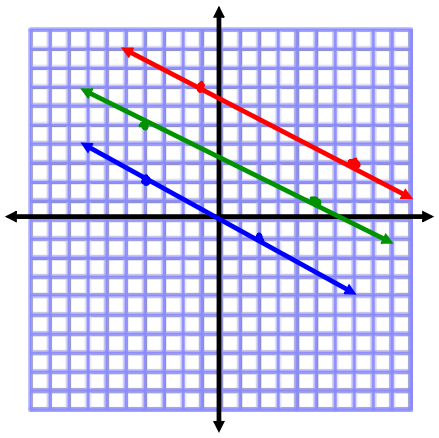
6.2 Slopes of Parallel and Perpendicular Lines

Parallel Lines have EQUAL slopes

Example 1 Identifying Parallel Lines

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

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



$m(GH) = \frac{2-(-1)}{-4-2}$

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

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

$m(JK) = \frac{7-3}{-1-7}$

$= \frac{4}{-8}$

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

$m(MN) = \frac{5-1}{-4-5}$

$= \frac{4}{-9}$

$= -\frac{4}{9}$

not parallel

The relationship between the slopes of AB and CD is true for any two oblique perpendicular lines. Horizontal and vertical lines are an exception.

The slope of a horizontal line is 0. The slope of a vertical line is $\frac{1}{0}$, which is not defined. So, the slopes of horizontal and vertical lines are not negative reciprocals.

Slopes of Perpendicular Lines

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

6.2 Slopes of Parallel and Perpendicular Lines

$m = \frac{2}{3}$ $\perp m = -\frac{3}{2}$

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

$m = \frac{1}{5}$ $\perp m = -5$

$m = \frac{2}{5}$ $\perp m = -\frac{5}{2}$

$m = -\frac{1}{3}$ $\perp m = 3$

Perpendicular Lines have slopes that are **NEGATIVE RECIPROCALS**

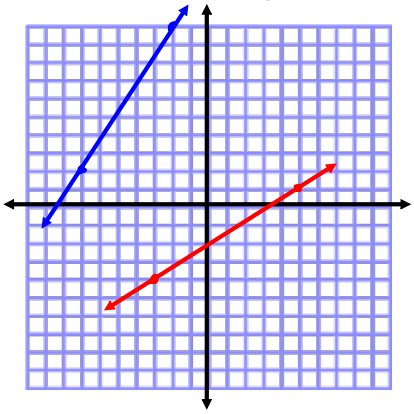
Example: 2 and $\frac{-1}{2}$

Example 2 Examining Slopes to Compare Lines

Line PQ passes through P(−7, 2) and Q(−2, 10).
Line RS passes through R(−3, −4) and S(5, 1).

a) Are these two lines parallel, perpendicular, or neither? Justify the answer.

b) Sketch the lines to verify the answer to part a.



$m(PQ) = \frac{y_2 - y_1}{x_2 - x_1} = \frac{10-2}{-2-(-7)} = \frac{8}{5}$

$m(RS) = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1-(-4)}{5-(-3)} = \frac{5}{8}$

Not parallel or perpendicular

Example 3 Identifying a Line Perpendicular to a Given Line

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

b) Determine the coordinates of G so that line EG is perpendicular to line EF.

a) $m(EF) = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3-(-1)}{2-(-4)} = \frac{4}{6} = \frac{2}{3}$

$\perp m = -\frac{3}{2}$

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

$-\frac{3}{2} = \frac{y-3}{x-2}$

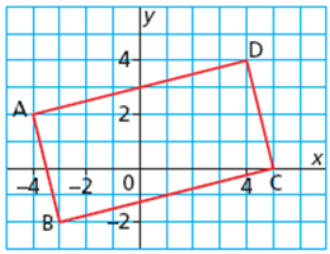
$y - 3 = -3$
$y = -3 + 3$
$= 0$

$x - 2 = 2$
$x = 2 + 2$
$= 4$

$G = (4, 0)$

Example 4 Using Slope to Identify a Polygon

ABCD is a parallelogram. Is it a rectangle? Justify the answer.



A (-4, 2)
B (-3, -2)
C (5, 0)
D (4, 4)

$m(AD) = \frac{4-2}{4-(-4)} = \frac{2}{8} = \frac{1}{4}$

$m(BC) = \frac{0-(-2)}{5-(-3)} = \frac{2}{8} = \frac{1}{4}$

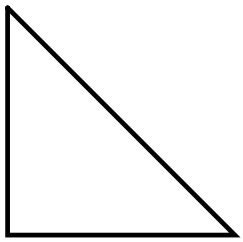
$m(AB) = \frac{2-(-2)}{-4-(-3)} = \frac{4}{-1} = -4$

$m(CD) = \frac{4-0}{4-5} = \frac{4}{-1} = -4$

EXAMPLE...

Show that the triangle whose vertices have the coordinates (3, 3), (8, 17) & (11, 5) is a **right triangle**.

A B C



$M(AB) = \frac{y_2-y_1}{x_2-x_1} = \frac{17-3}{8-3} = \frac{14}{5}$

$M(AC) = \frac{y_2-y_1}{x_2-x_1} = \frac{5-3}{11-3} = \frac{2}{8} = \frac{1}{4}$

$M(BC) = \frac{y_2-y_1}{x_2-x_1} = \frac{17-5}{8-11} = \frac{12}{-3} = -4$

$AC \perp BC$

TRY THIS ONE...

The slopes of two lines are given as $3k - 5$ and $2(k - 3)$.
Determine the value of k if the lines are parallel

$3k-5=2(k-3)$

$3k-5=2k-6$

$3k-2k=-6+5$

$k=-1$

PRACTICE PROBLEMS...

p. 340: #13, 18

p. 349: #5, 7, 9, 10, 13, 16, 17