

Find Slope ...

$$(-1, 0) \text{ \& } (7, 3)$$

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

$$M = \frac{3 - 0}{7 - (-1)}$$

$$M = \frac{3}{8} = \frac{-3}{-8}$$

$$-1 - (-4)$$

$$(b) (-4, -7) \text{ \& } (-1, 10)$$

$$M = \frac{-7 - 10}{-4 - (-1)}$$

$$M = \frac{-17}{-3} = \frac{17}{3}$$

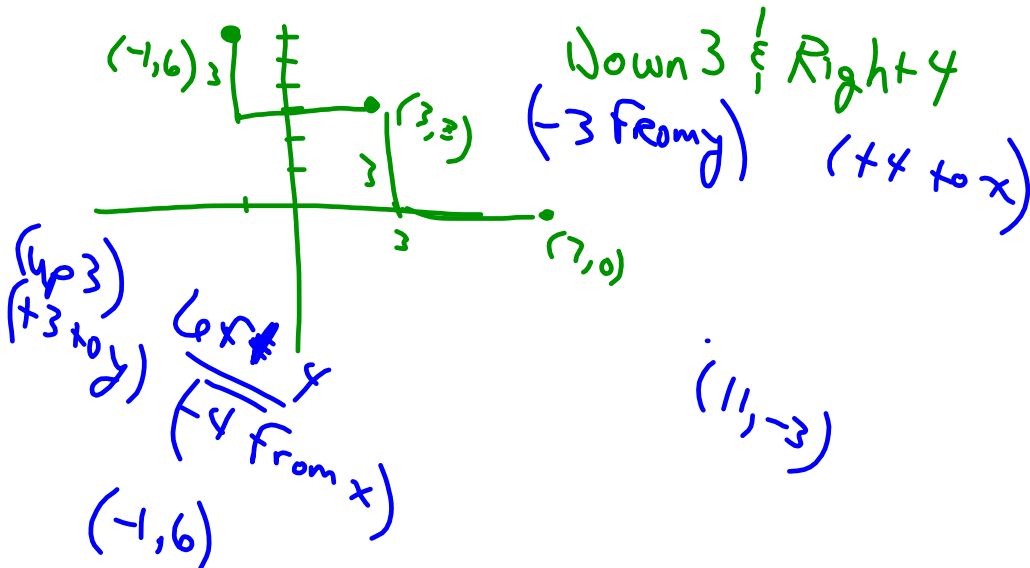
ex.

$$(-5, 9)$$

$$(3, 3)$$

$M = -\frac{3}{4}$  ← Rise  
 Passes through  $(-1, 6)$   
 ← Run

Identify 2 other points on this line.



$$(-1, 6)$$

$$(-5, 9)$$

$$(-9, 12)$$

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

$$-\frac{3}{4} = \frac{6 - y}{-4 - x}$$

## 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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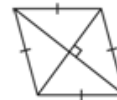
6.2 Slopes of Parallel and Perpendicular Lines

## Activate Prior Learning: Properties of Quadrilaterals

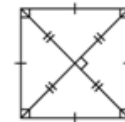
A **rectangle** is a parallelogram with 4 right angles. It has all the properties of a parallelogram and its diagonals are equal.



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.



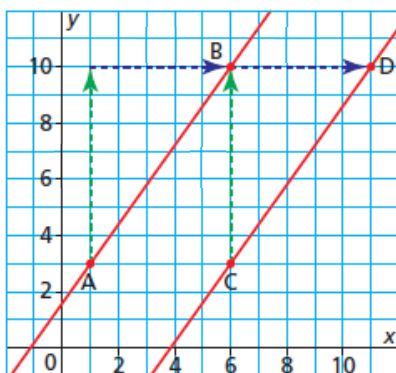
## 6.2 Slopes of Parallel and Perpendicular Lines

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

Lines that have the same slope are parallel.

$$\text{Slope of AB} = \frac{7}{5}$$

$$\text{Slope of CD} = \frac{7}{5}$$



Since the slope of AB is equal to the slope of CD, line AB is parallel to line CD.

## Parallel Lines have EQUAL slopes

### Example 1 Identifying Parallel Lines

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.

$$m_{GH} = \frac{3}{-6} \\ = -\frac{1}{2}$$

$$m_{JK} = \frac{7-3}{-1-7} \\ = \frac{4}{-8} \\ = -\frac{1}{2}$$

$$m_{MN} = \frac{5-1}{-4-5} = \frac{4}{-9}$$

$\therefore JK \parallel GH$

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;

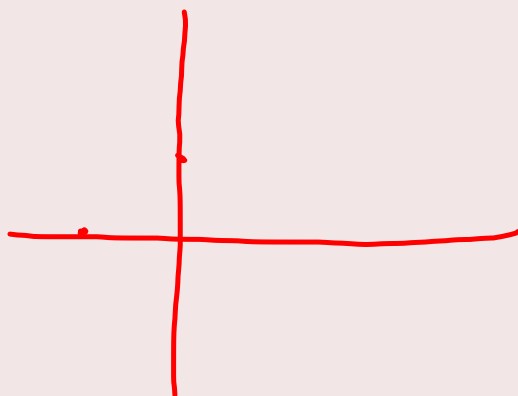
that is, a line with slope  $a$ ,  $a \neq 0$ , is perpendicular to a line with slope  $-\frac{1}{a}$ .

$$m = \frac{3}{7} \quad \perp \quad M = -\frac{7}{3}$$

↑  
Perpendicular

6.2 Slopes of Parallel and Perpendicular Lines

$$M = -\frac{3}{1} \Rightarrow \perp m = +\frac{1}{3}$$

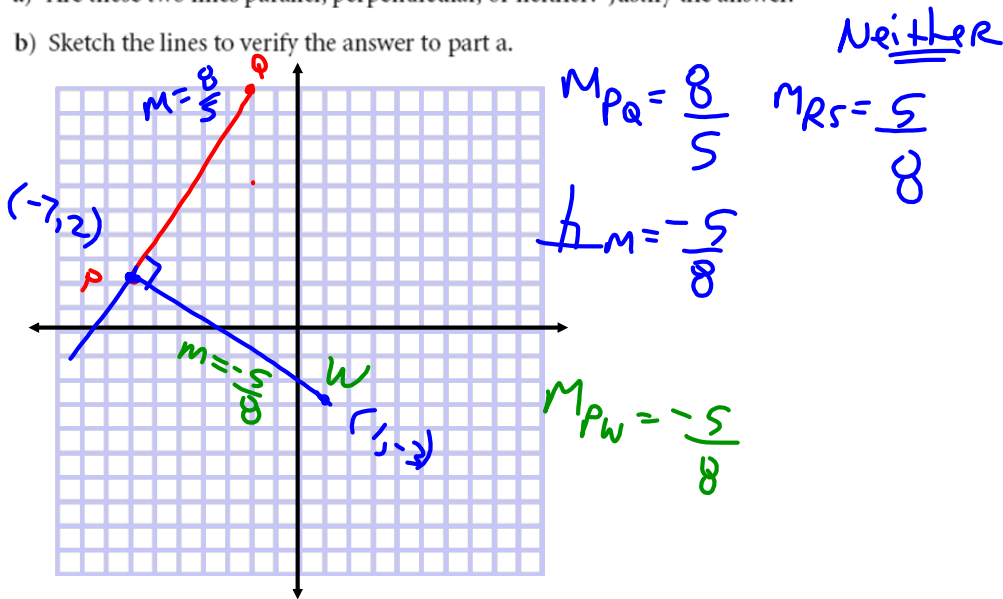


Perpendicular Lines have slopes  
that are **NEGATIVE RECIPROCALS**  
**(opposite) (flip)**

**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.



Property:

$$m = \frac{a}{b} \quad \perp m = -\frac{b}{a}$$

Product:  $\frac{a}{b} \times -\frac{b}{a} = -\frac{ab}{ab} = \textcircled{-1}$

$$\frac{4}{3} \left( -\frac{3}{4} \right) = \frac{-12}{12} = \textcircled{-1}$$

**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  $EF$ .

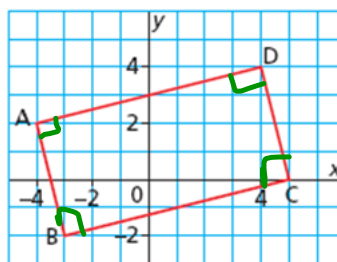
$$\begin{aligned}
 M_{EF} &= \frac{3 - (-1)}{2 - (-4)} \\
 &= \frac{4}{6} \\
 &= \frac{2}{3} \therefore \text{Perp } m = -\frac{3}{2}
 \end{aligned}$$

$\therefore$  ~~Perp~~  $m = \frac{2}{3}$   
 b) from  $E(2, 3)$  want  $m = -\frac{3}{2}$  to find  $G$   
 $G(4, 0)$



**Example 4** Using Slope to Identify a Polygon

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

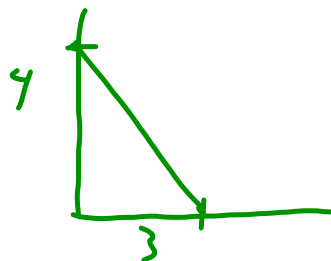
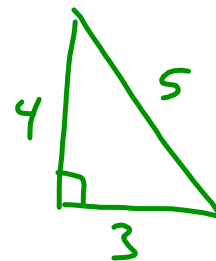


$$m_{AD} = \frac{2}{8} = \frac{1}{4}$$

$$m_{AB} = \frac{-4}{1} = -4$$

$AD \perp AB$

$\therefore$  Right Angle



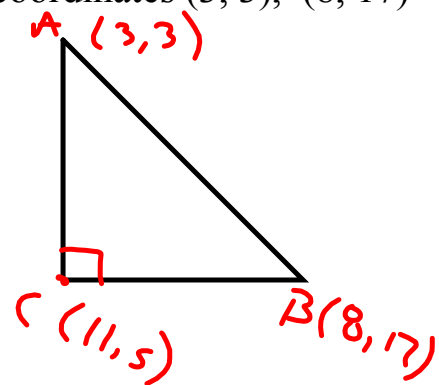
## EXAMPLE...

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

$$m_1 = \frac{17-3}{8-3} = \frac{14}{5}$$

$$m_2 = \frac{17-5}{8-11} = \frac{12}{-3} = -4$$

$$m_3 = \frac{5-3}{11-3} = \frac{2}{8} = \frac{1}{4}$$



Negative Reciprocals  $\therefore$  Must meet at 90°

**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

$$\begin{aligned}
 m_1 &= m_2 \\
 3k - 5 &= 2(k - 3) \\
 3k - 5 &= 2k - 6 \\
 3k - 2k &= -6 + 5 \\
 k &= -1
 \end{aligned}$$

$$\begin{array}{cc}
 m_1 & m_2 \\
 \rightarrow m_1 = m_2 & \\
 \begin{array}{l} 3(4) - 5 \\ -3 - 5 \\ m_1 = -8 \end{array} & \begin{array}{l} 2(-1 - 3) \\ 2(-4) \\ -8 \\ m_2 = -8 \end{array}
 \end{array}$$

Pg. 349-351  
# 6, 8, 9, 13, 14, 16, 17

Pg. 353  
# 1, 2, 5, 7, 8

## Attachments

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Bonus Soln - Fox Population.doc