On your whiteboard...

Without a calculator

A] $\dfrac{3-5}{-6+12} = \dfrac{-2}{6} = -\dfrac{1}{3}$

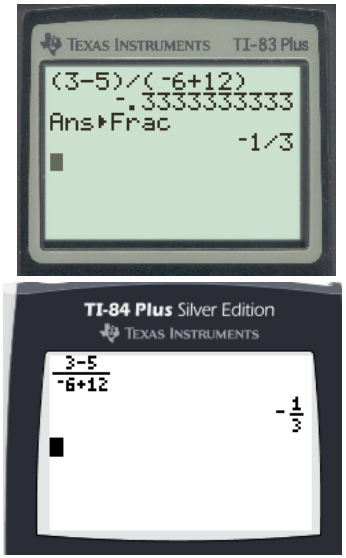
B] $\dfrac{-3-5}{-6+12} = \dfrac{-8}{6} = -\dfrac{4}{3}$

C] $\dfrac{3-(-5)}{6+(-12)} = \dfrac{3+5}{6-12} = \dfrac{8}{-6} = -\dfrac{4}{3}$

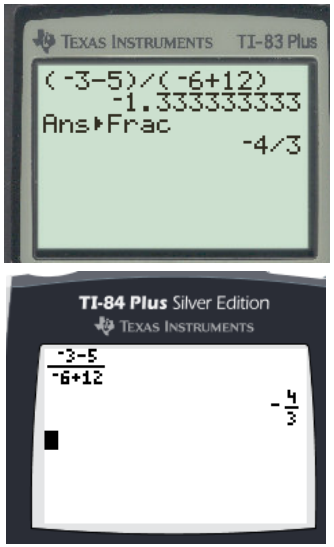
On your whiteboard...

With a calculator

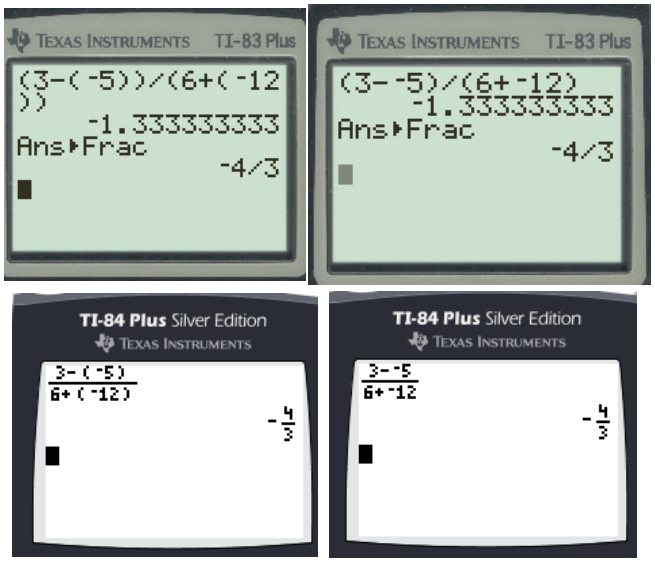
A] $\dfrac{3-5}{-6+12} =$

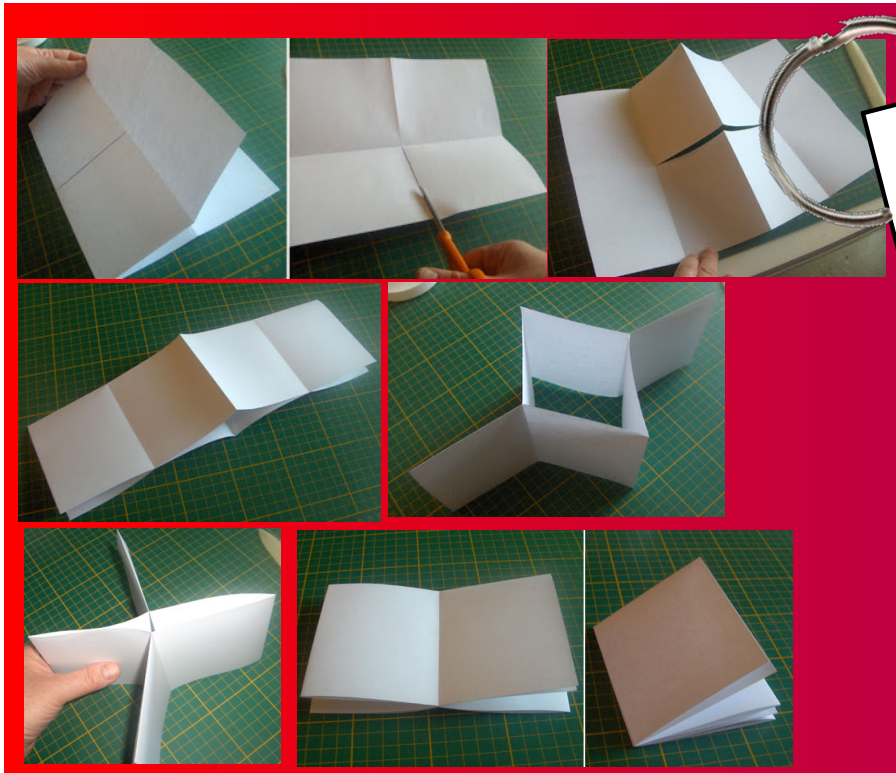


B] $\dfrac{-3-5}{-6+12} =$



C] $\dfrac{3-(-5)}{6+(-12)} =$





Slope

slope

y-int

$$y = mx + b$$

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

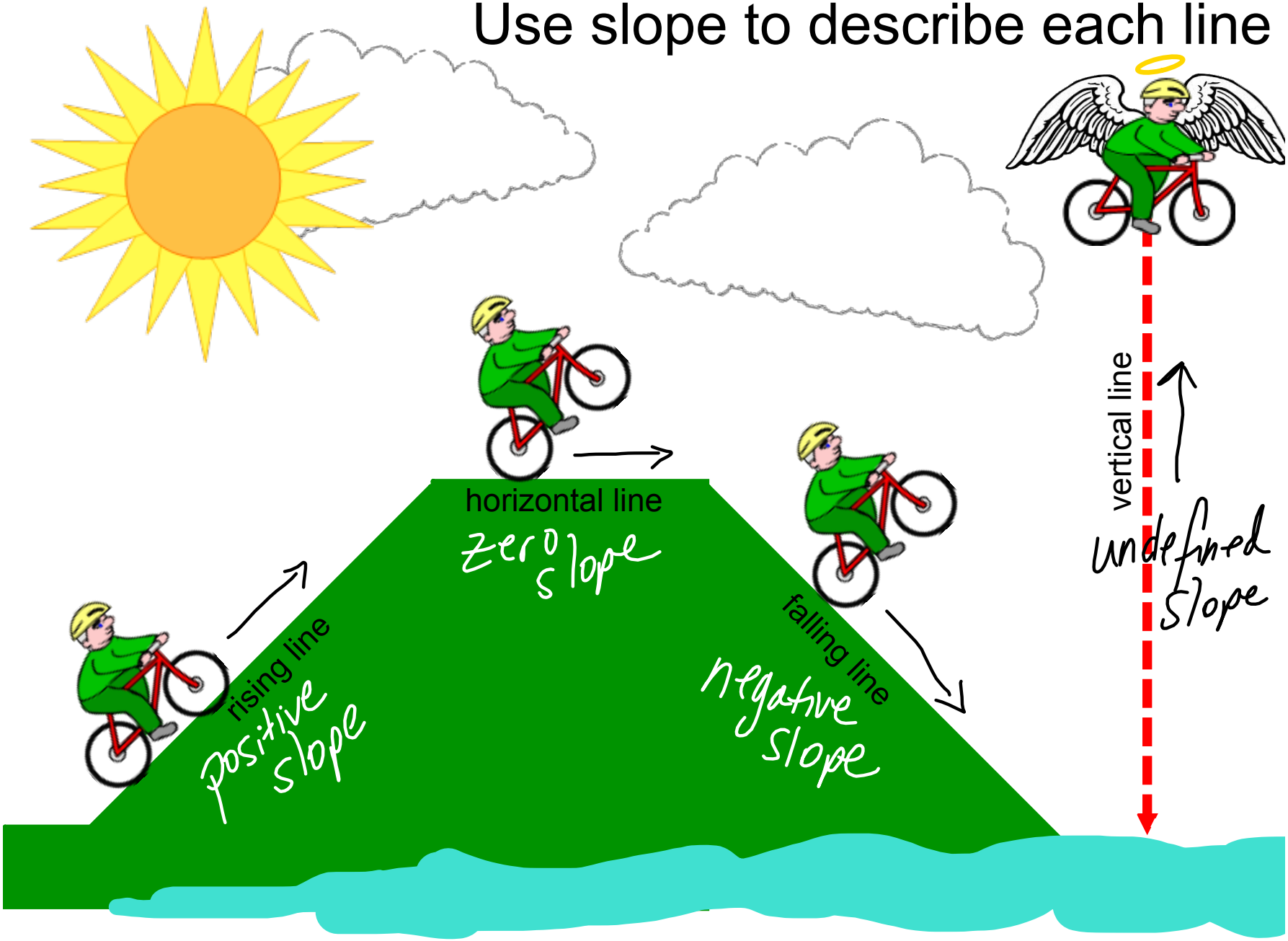
Where's the slope?
Where's the slope?
Rise over run.
Rise over run.
Difference of the y's
Over difference of the x's
Simplify.
That's the slope.

Where's the slope?
Where's the slope?
Rise over run.
Rise over run.
Difference of the y's
Over difference of the x's
Simplify.
That's the slope.

(2,1), (6,9)

$$\frac{9-1}{6-2} = \frac{8}{4} = 2$$

Use slope to describe each line



Example 1 Use slope to describe a line

The line **RISES** from left to right when the slope is positive.
The line **FALLS** from left to right when the slope is negative.
The line is **HORIZONTAL** when the slope is zero.
The line is **VERTICAL** when the slope is undefined.

A] (1, 1), (3, -5)

$\frac{-5-1}{3-1} = \frac{-6}{2} = -3$ FALLS

B] (2,4), (2,9)

$\frac{9-4}{2-2} = \frac{5}{0} =$ undef Vertical

C] (-5,2), (5,2)

$\frac{2-2}{5-(-5)} = \frac{0}{10} = 0$ Horizontal

D] $2(3-y) = 4-12x$

$6-2y = 4-12x$

$-6 \quad -6$

$-2y = -12x \quad -2$

$-2 \quad -2 \quad -2$

$y = 6x+1$

$m = 6$ Rises

E] $2x-3y = -15$

$-2x \quad -2x$

$-3y = -2x-15$

$-3 \quad -3 \quad -3$

$y = \frac{2}{3}x+5$

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

F] $5-3y = 2y-15$

$-5 \quad -5$

$-3y = 2y-20$

$-2y \quad -2y$

$-5y = -20$

$-5 \quad -5$

$y = 4$

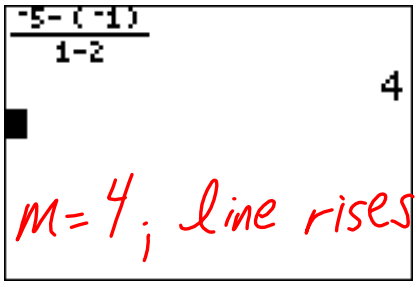
$y = 0x+4$

$m = 0$ Horizontal

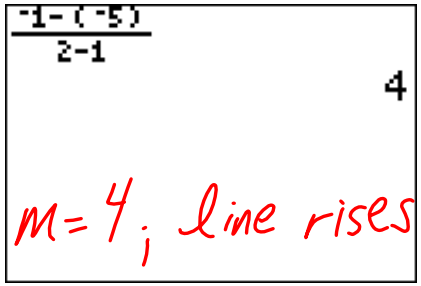
On your whiteboard...

Find the slope and describe the line.

Windows
(2,-1), (1,-5)



Wall
(1,-5), (2,-1)



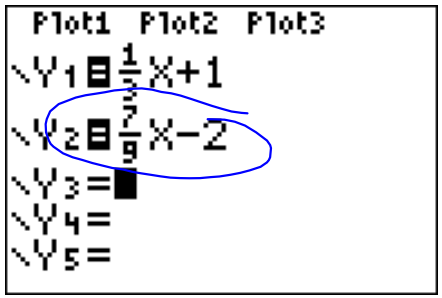
Discuss with your partner...

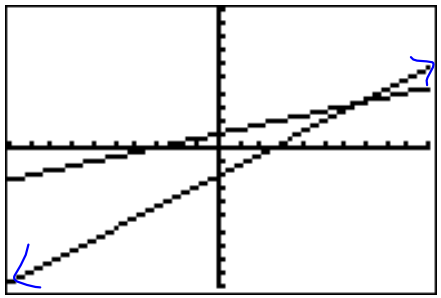
Does it matter which point you use as (x_1,y_1)? No

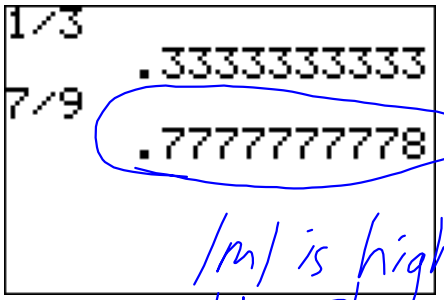
Discuss with your partner.

Which line is steeper?

A]

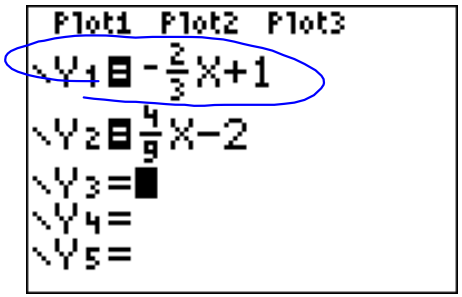


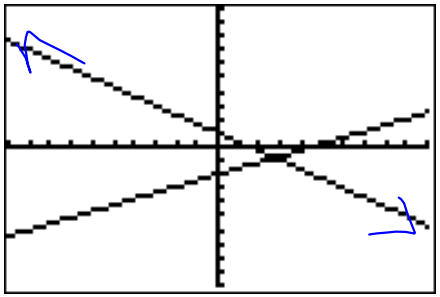


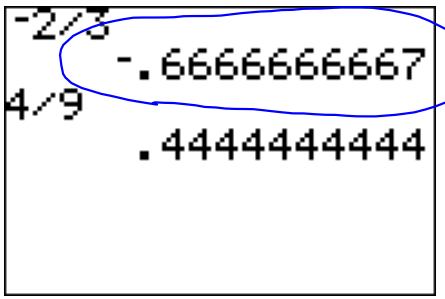


|m| is highest in the steeper line

B]







Example 2 Comparing steepness of lines

Compare the absolute value of each slope. The greater the slope, the steeper the line.

A] Line 1

(1, -12), (-4, 8)

$\frac{8-(-12)}{-4-1}$

$|-4| = 4$

Line 2

(-1, 5), (2, -4)

$\frac{-4-5}{2-(-1)}$

$|-3| = 3$

B] Line 1

$y = -\frac{4}{7}x + 10$

-4/7

-.5714285714

0.57

Line 2

$y = \frac{5}{9}x - 12$

5/9

.5555555556

0.56

C] Line 1

$x + 4y = -28$

$-x \qquad -x$

$\frac{4y}{4} = \frac{-x}{4} - \frac{28}{4}$

$|-\frac{1}{4}| = 0.25$

$y = -\frac{1}{4}x - 7$

Line 2

$x - 2y = -16$

$-x \qquad -x$

$\frac{-2y}{-2} = \frac{-x}{-2} - \frac{16}{-2}$

$|\frac{1}{2}| = 0.5$

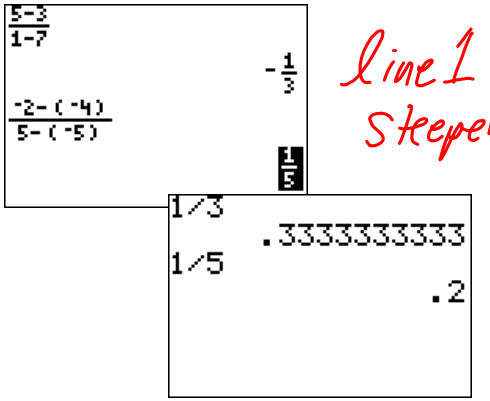
$y = \frac{1}{2}x + 8$

On your whiteboard...

Determine which line is steeper.

[A] Line 1: (7, 3), (1, 5)

Line 2: (-5, -4), (5, -2)



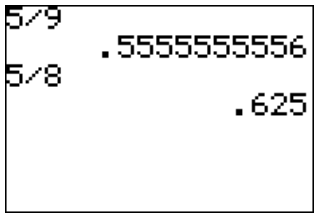
Line 1 is Steeper

[B] Line 1: $5x - 9y = 18$

Line 2: $5x - 8y = -8$

$-9y = -5x + 18$

$y = \frac{5}{9}x - 2$



$-8y = -5x - 8$

$y = \frac{5}{8}x + 1$

Line 2 is Steeper

Example 3 Parallel and perpendicular lines

Parallel lines have the same slope but different y-intercept.
Perpendicular lines have opposite reciprocal slopes.

A] Line 1

$6x - 2y = 10$

$-2y = -6x + 10$

$y = 3x - 5$

parallel

Line 2

$3x - y = -5$

$-y = -3x - 5$

$y = 3x + 5$

B] Line 1

$y = \frac{1}{2}x + 3$

perpendicular

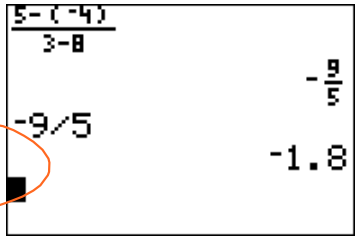
Line 2

$y = -2x + 3$

C] Line 1

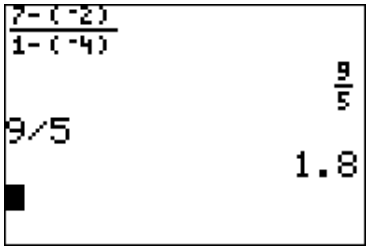
(8, -4), (3, 5)

neither



Line 2

(-4, -2), (1, 7)

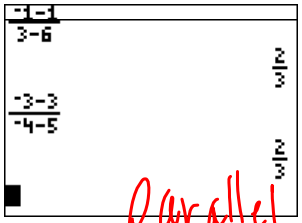


On your whiteboard...

Determine if the lines are parallel, perpendicular, or neither.

[A] Line 1
(6, 1), (3, -1)

Line 2
(5, 3), (-4, -3)



[B] Line 1 $y = \frac{7}{2}x - 3$

Line 2 $y = \frac{2}{7}x + 1$

Line 1 : $\frac{7}{2}$

Line 2 : $\frac{2}{7}$

neither

[C] Line 1 $8x + 5y = -10$

Line 2 $5x - 8y = -24$

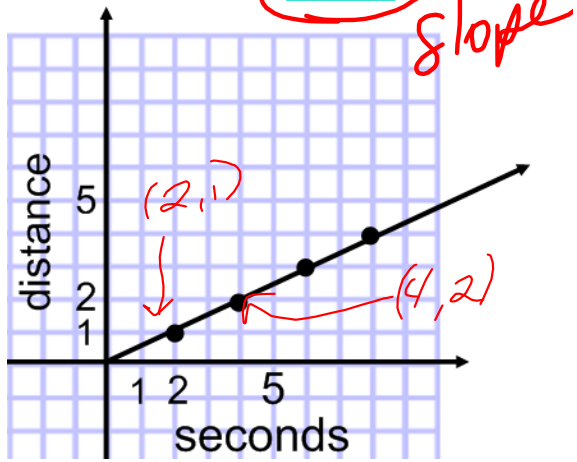
Line 1 : $y = -\frac{8}{5}x - 2$

Line 2 : $y = \frac{5}{8}x + 3$

perpendicular

Example 4

The distance that a toy boat traveled is graphed below. What is the rate at which the boat traveled?



Slope

$m = \frac{2-1}{4-2} = \frac{1}{2}$

a. 0.5 ft/sec b. 1 ft/sec c. 2 ft/sec d. 5 ft/sec

What does this problem have to do with SLOPE?

Rate means slope.

Name: Period:

Practice Worksheet: Slope

Find the slope of the line passing through the given points. Show all work.

1] Line 1: $(2,1), (6,9)$

2] Line 2: $(1,1), (2,-5)$

3] Line 3: $(-3,-2), (6,1)$

4] Line 4: $(3,-2), (-1,7)$

5] Line 5: $(0,5), (2,-1)$

6] Line 6: $(3,-4), (7,2)$

7] Place the lines from exercises 1-6 in order from least steep to most steep.

Line ____	Line ____	Line ____	Line ____	Line ____	Line ____

Find the slope of each line and determine whether each line rises, falls, is horizontal, or is vertical.

8] $(-2,4), (2,5)$

9] $(3,1), (3,-2)$

10] $(8,15), (12,-1)$

11] $(5,-2), (2,-2)$

12] $2x + 3y = 3$

13] $3x + 3 = 5 - 2x$

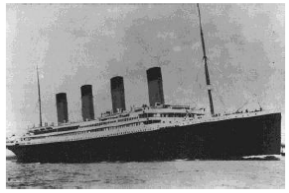
14] $4(2 - y) = 12$

15] $6x + 5 = \frac{1}{3}y$

16] $3(x - 2y) + y = 6 - 5y$

Math Journal: Rate of Change

The race to set transatlantic speed records has a long history. In July of 1845 the clipper ship *James Baines* set a record for sailing ships by sailing from Boston to Liverpool in 12 days and 6 hours. In 1998, a swimmer named Ben Lecomte set a much slower but equally amazing record. It took Lecomte 80 days to swim from Hyannis, MA to Quiberon on the French coast with the aid of a monofin attached to both feet. Ben was accompanied by a ship and swam inside a "protective ocean device" that used electric fields to repel sharks.



At 2:00 P.M. on April 11, 1912, the *Titanic* left Cobh, Ireland on her maiden voyage to New York City. At 11:40 P.M. on April 14, the *Titanic* struck an iceberg and sank, having covered only about 2100 miles of the approximately 3400 mile trip. Today, ocean liners still cross the Atlantic Ocean. The *Queen Elizabeth* 2, or *QE*2, is one of the fastest with a top speed of 32.5 knots (about 37 miles per hour).

Migrating birds have also set some impressive records. The current distance record holder appears to be a Common Tern. Banded as a chick on Finland on June 30, 1996, it was caught on January 24, 1997 on a beach in southeastern Australia. Scientists estimate that it flew about 26,000 kilometers in 208 days. (1km $\approx$ 0.621371 miles).

You may have noticed that the *QE*2's speed above was given in knots or nautical miles per hour. The nautical mile is about 1.151 land miles, which seems like a strange number. This "sea mile", which has been used by mariners since the seventeenth century, is based on the practice of measuring latitude and longitude in degrees. If you traveled all the way around the Earth at the equator, you would cover 360 degrees. Each degree is divided into 60 minutes. The nautical mile is denned so that one nautical mile equals one minute along any great circle. Aviators also navigate with degrees and minutes, so airplane speeds are also usually measured in knots.

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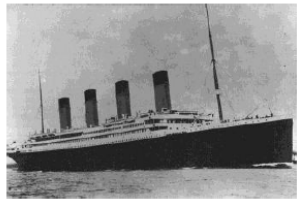

1. Find the average speed of the *Titanic* in miles per hour. Show your work.

2. If the *Titanic* had missed the iceberg and kept on going at the average speed, how many more hours would it have taken to reach New York? Show your work.

3. If the *Titanic* had missed the iceberg and kept on going at the average speed, when would it have reached New York? Give the date and time. Show your work or explain your reasoning.

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4. The fastest short distance flying speed of the Common Tern has been clocked at 40 miles per hour, which is faster than the average speed of the Titanic. Calculate the average speed in miles per hour of the Common Tern on its migration from Finland to Australia (show your work). Explain why the Common Tern's average speed crossing the Atlantic is so much slower than the Titanic's average speed.

The race to set transatlantic speed records has a long history. In July of 1845 the clipper ship *James Baines* set a record for sailing ships by sailing from Boston to Liverpool in 12 days and 6 hours. In 1998, a swimmer named Ben Lecomte set a much slower but equally amazing record. It took Lecomte 80 days to swim from Hyannis, MA to Quiberon on the French coast with the aid of a monofin attached to both feet. Ben was accompanied by a ship and swam inside a "protective ocean device" that used electric fields to repel sharks.

5. The distance from Boston to Liverpool is about 3150 miles. How many times faster was the *Titanic's* average speed than the average speed of the *James Baines* on its record-setting trip? Explain.

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6. Find Ben Lecomte's approximate speed in knots for his transatlantic swim, which covered 3376 nautical miles. Show your work.