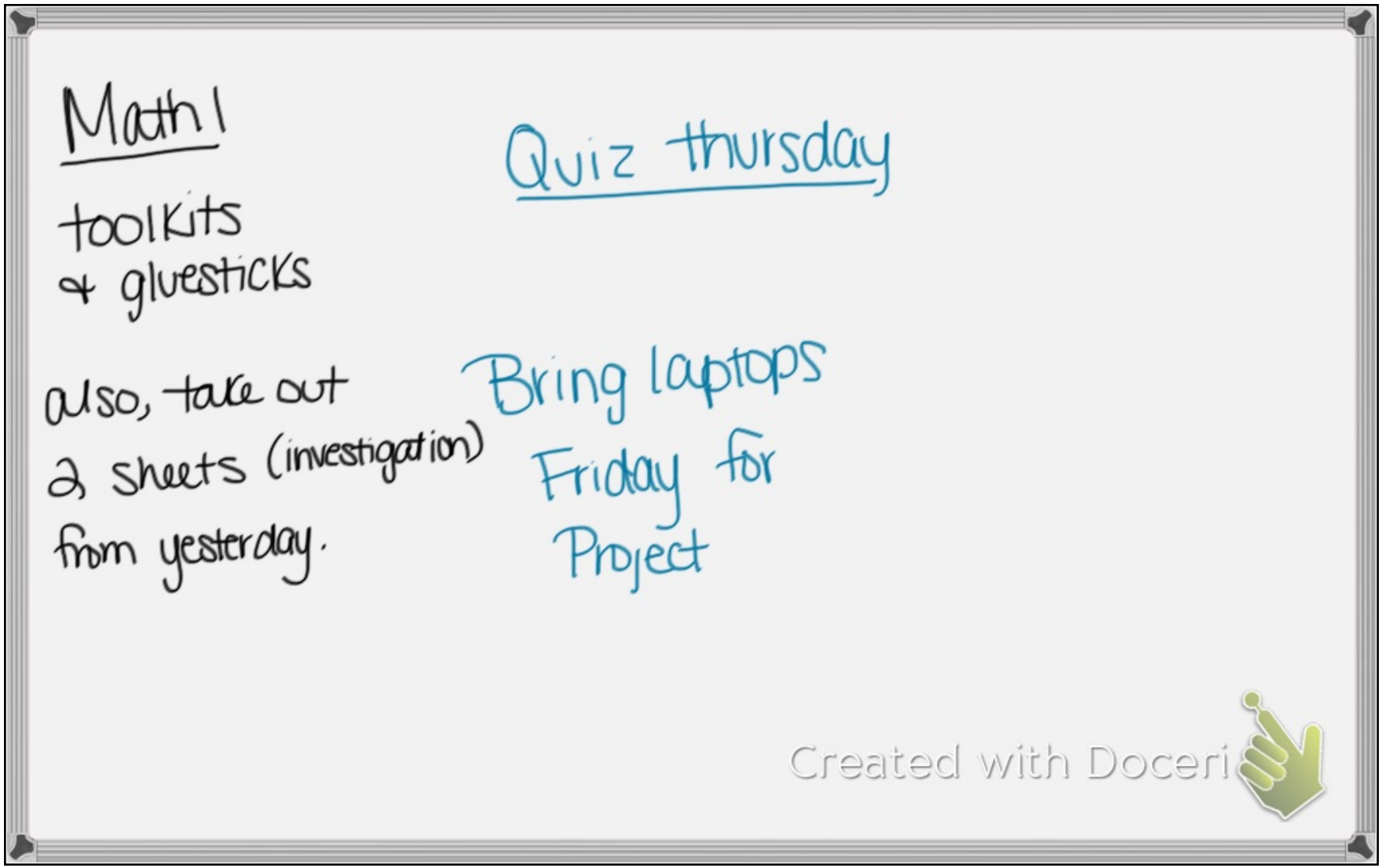
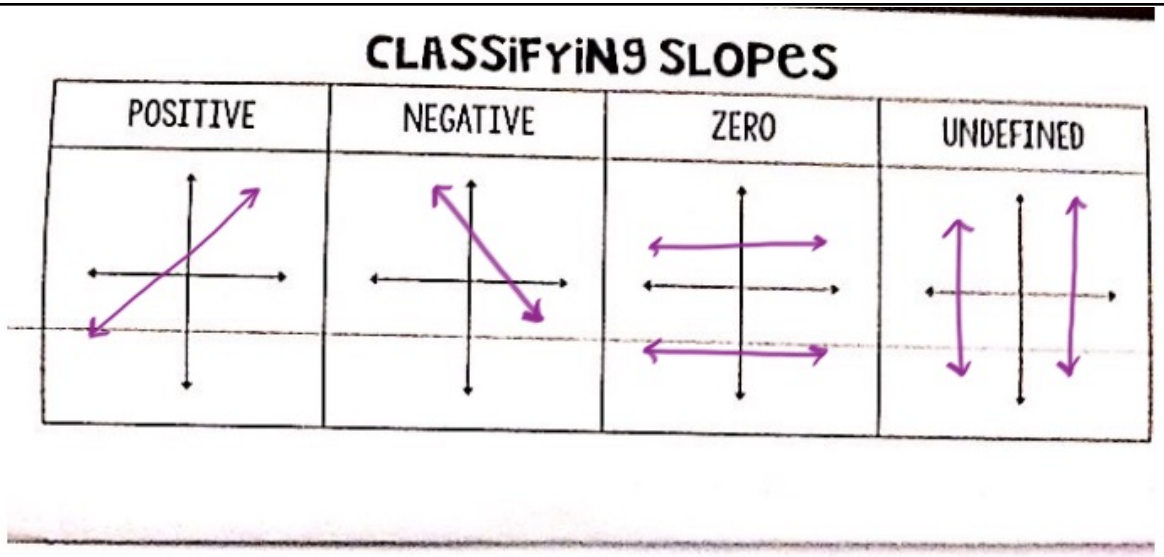

Math 1
toolkits
& gluesticks
also, take out
2 sheets (investigation)
from yesterday.
Quiz thursday
Bring laptops
Friday for
Project
Created with Doceri

CLASSIFYING SLOPES



SLOPE FORMULA $M = \frac{Y_2 - Y_1}{X_2 - X_1} = \frac{\Delta y}{\Delta x} = \frac{\text{rise}}{\text{run}}$

DETERMINE THE SLOPE OF THE LINE THAT CONTAINS THE GIVEN POINTS

EX 1 A (3, 1) & B (-2, 1)

x	y
3	1
-2	1

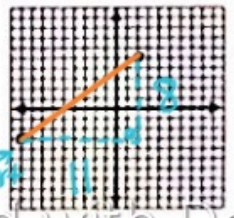
$\frac{\Delta y}{\Delta x} = \frac{0}{-5} = 0$

EX 2 C (-4, 3) & D (-4, 7)

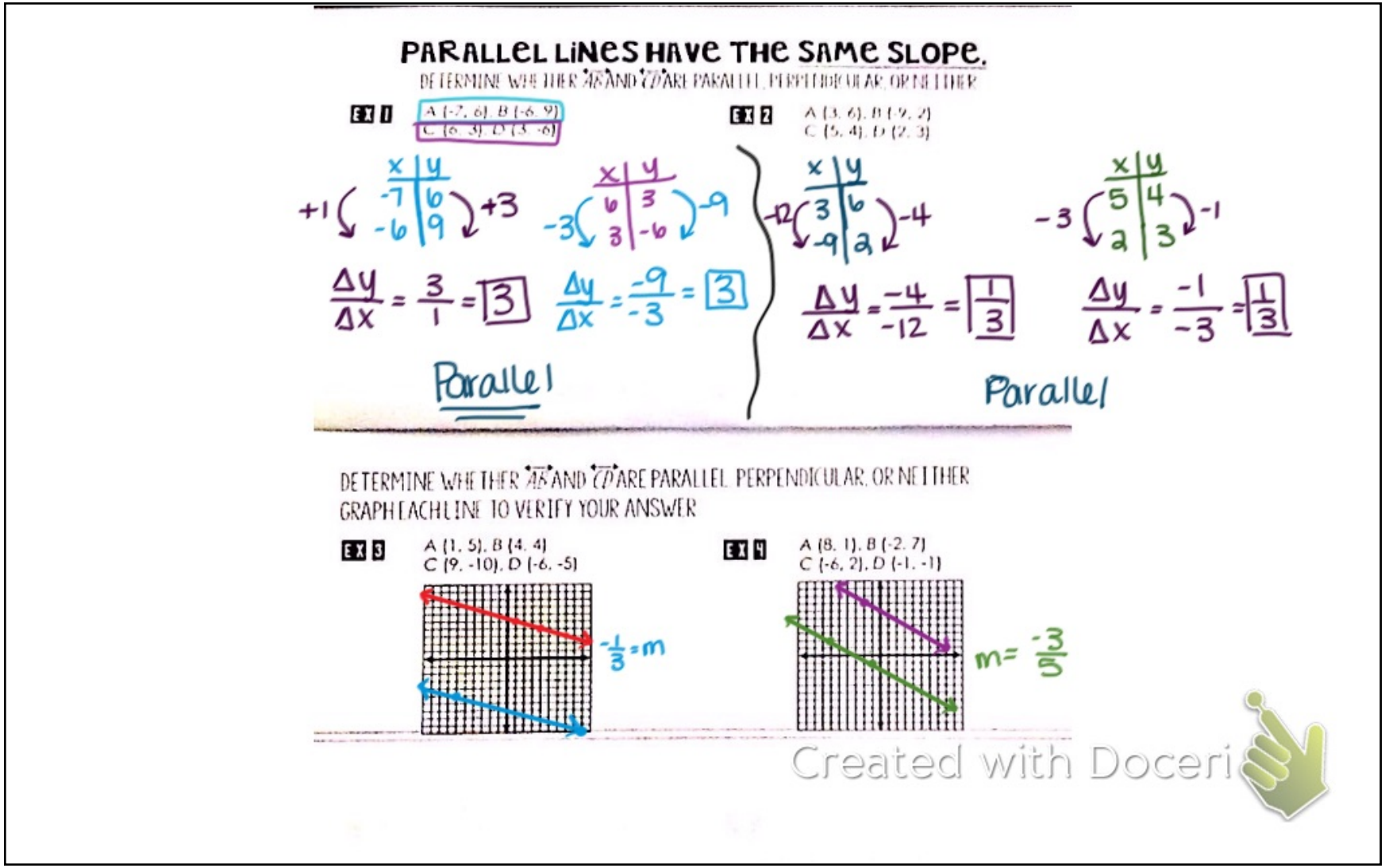
x	y
-4	3
-4	7

$\frac{\Delta y}{\Delta x} = \frac{4}{0} =$ undefined

EX 3



$\frac{\text{rise}}{\text{run}} = \frac{8}{11}$


PARALLEL LINES HAVE THE SAME SLOPE.
DETERMINE WHETHER AB AND CD ARE PARALLEL, PERPENDICULAR, OR NEITHER
EX 1
A (-7, 6), B (-6, 9)
C (6, 3), D (3, -6)
x | y
-7 | 6
-6 | 9
+1 +3
x | y
6 | 3
3 | -6
-3 -9
Δy/Δx = 3/1 = 3
Δy/Δx = -9/-3 = 3
Parallel
EX 2
A (3, 6), B (9, 2)
C (5, 4), D (2, 3)
x | y
3 | 6
9 | 2
-12 -4
x | y
5 | 4
2 | 3
-3 -1
Δy/Δx = -4/-12 = 1/3
Δy/Δx = -1/-3 = 1/3
Parallel
DETERMINE WHETHER AB AND CD ARE PARALLEL, PERPENDICULAR, OR NEITHER
GRAPH EACH LINE TO VERIFY YOUR ANSWER
EX 3
A (1, 5), B (4, 4)
C (9, -10), D (-6, -5)
-1/3 = m
EX 4
A (8, 1), B (-2, 7)
C (-6, 2), D (-1, -1)
m = -3/5
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PERPENDICULAR LINES HAVE OPPOSITE RECIPROCAL SLOPES. $\frac{a}{b} \perp -\frac{b}{a}$

DETERMINE WHETHER $\overline{AB}$ AND $\overline{CD}$ ARE PARALLEL, PERPENDICULAR OR NEITHER

EX 1 A (2, 4), B (4, 5)
C (4, 1), D (8, -7)

$\overline{AB}$

x	y
2	4
4	5

(+2, +1)

$\frac{\Delta y}{\Delta x} = \frac{1}{2}$

$\overline{CD}$

x	y
4	1
8	-7

(+4, -8)

$\frac{\Delta y}{\Delta x} = \frac{-8}{4} = \frac{-2}{1}$ ✓

$\frac{1}{2} \rightarrow \frac{2}{1} \rightarrow \frac{-2}{1} \rightarrow \frac{1}{2}$ ✓

flip opp.

Perpendicular

EX 2 A (1, -3), B (0, 2)
C (-2, 0), D (8, 2)

$\overline{AB}$

x	y
1	-3
0	2

(-1, +5)

$\frac{\Delta y}{\Delta x} = \frac{5}{-1} = -\frac{5}{1}$

$\overline{CD}$

x	y
-2	0
8	2

(+10, +2)

$\frac{\Delta y}{\Delta x} = \frac{2}{10} = \frac{1}{5}$ ✓

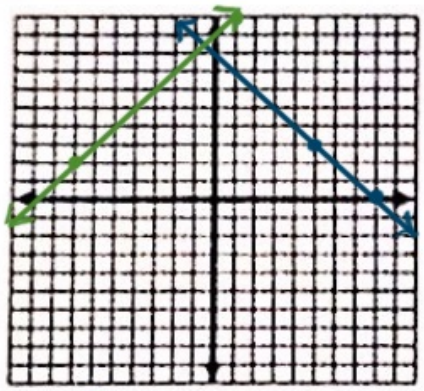
$-\frac{5}{1} \rightarrow \frac{1}{-5} \rightarrow \frac{1}{5} \rightarrow \frac{1}{5}$ ✓

flip opp

Perpendicular

DETERMINE WHETHER $\overleftrightarrow{AB}$ AND $\overleftrightarrow{CD}$ ARE PARALLEL, PERPENDICULAR, OR NEITHER. GRAPH EACH LINE TO VERIFY YOUR ANSWER.

EX 3 A (5, 3), B (8, 0)
C (-7, 2), D (1, 10)

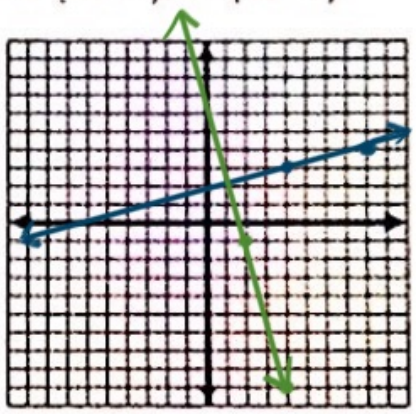


$m = \frac{8}{8} = \frac{1}{1}$

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

Perpendicular

EX 4 A (8, 4), B (4, 3)
C (4, -9), D (2, -1)



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

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

Perpendicular

	Slope of Line 1	Slope of Line 2	Answer
1)	$\frac{7}{1} \rightarrow \frac{1}{7}$ flip $\rightarrow \frac{-1}{7}$ opp	$-\frac{1}{7}$	Perpendicular
2)	$\frac{7}{11}$	$\frac{7}{11}$	Parallel
3)	3	3	Parallel
4)	$\frac{9}{1} \perp \frac{-1}{9}$	-9	Neither
5)	3	3	Parallel
6)	$\frac{7}{1}$	$-\frac{1}{7}$	Perpendicular
7)	11	$\frac{1}{11}$	neither
8)	$\frac{2}{5}$	$\frac{5}{2}$	neither
9)	$\frac{5}{9}$	$-\frac{5}{9}$	nether
10)	$\frac{2}{7} \rightarrow \frac{7}{2} \rightarrow \frac{-7}{2}$	$-\frac{7}{2}$	Perpendicular

Investigation: Exploring Properties of Plane Shapes

Coordinate methods can be used to reason about plane shapes. Given two points (x_1, y_1) and (x_2, y_2), the distance between them can be calculated and the midpoint can be located. These methods are useful to explore plane shapes and their properties. As you work on the following problems, look for an answer to this question:

How can coordinates be used to reason about plane shapes?

1. Triangle ABC is an acute triangle with coordinates A(2,4), B(8,8) and C(17,1).
   a. Graph ΔABC and calculate the perimeter of the triangle.
   b. In order to calculate the area of the triangle, the height is needed. Graph point D(7,3) on side AC and draw the line segment BD. The segment BD represents the height from vertex B to the base side AC. Calculate the area of ΔABC and compare your result with others. Resolve any differences.

2. In activity 1, the coordinates for point D were given so that BD represented the height of the triangle. BD is also called the **altitude** of the triangle. Consider how the altitude might be determined if the point were not given.
   a. What is the relationship between the altitude and the base side? must be prependicular.
   b. Which of the following figures illustrates an altitude of the triangle?

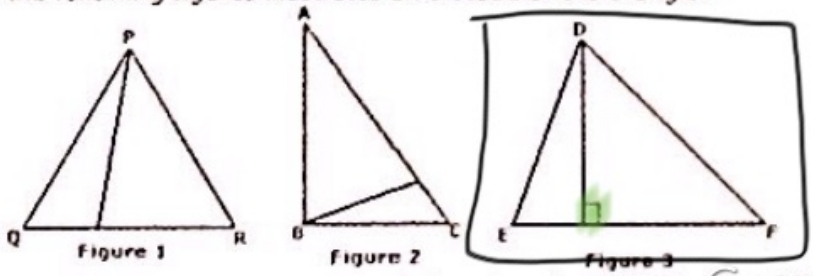
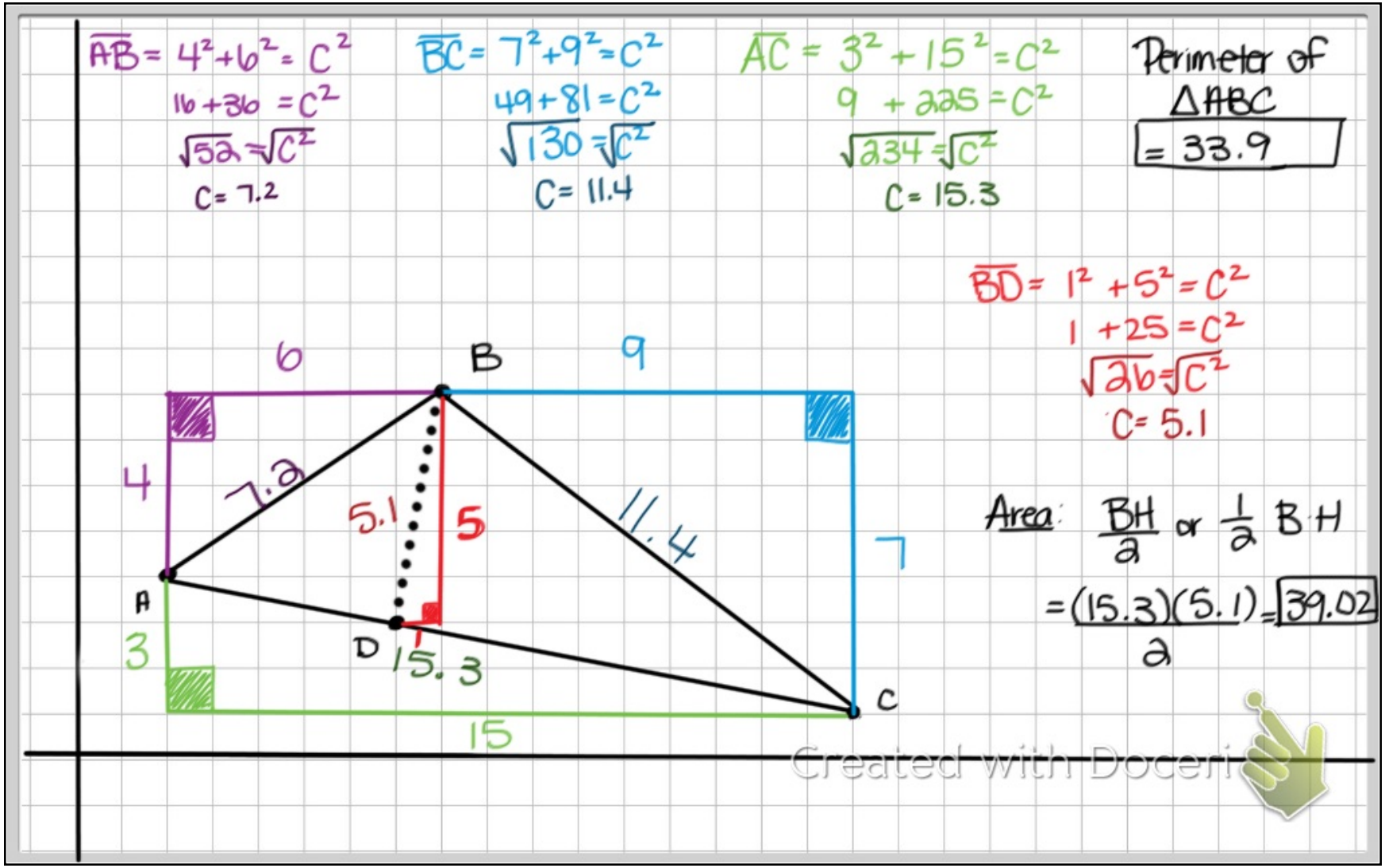


Figure 1 Figure 2 Figure 3

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

   c. Refer back to the triangle in activity 1. Calculate the slope of side AC and the slope of altitude BD. Record the slopes in reduced fraction form. Describe any relationship between the two slopes. $m\overline{AC} = \frac{-3}{15} = \frac{-1}{5}$ $m\overline{BD} = \frac{5}{1}$ Slopes are ⊥


$\overline{AB} = 4^2 + 6^2 = c^2$
$16 + 36 = c^2$
$\sqrt{52} = \sqrt{c^2}$
$c = 7.2$
$\overline{BC} = 7^2 + 9^2 = c^2$
$49 + 81 = c^2$
$\sqrt{130} = \sqrt{c^2}$
$c = 11.4$
$\overline{AC} = 3^2 + 15^2 = c^2$
$9 + 225 = c^2$
$\sqrt{234} = \sqrt{c^2}$
$c = 15.3$
Perimeter of $\triangle ABC$
$= 33.9$
$\overline{BD} = 1^2 + 5^2 = c^2$
$1 + 25 = c^2$
$\sqrt{26} = \sqrt{c^2}$
$c = 5.1$
Area: $\frac{BH}{2}$ or $\frac{1}{2} B \cdot H$
$= \frac{(15.3)(5.1)}{2} = 39.02$
6
B
9
4
7.2
5.1
5
11.4
7
A
3
D
15.3
C
15
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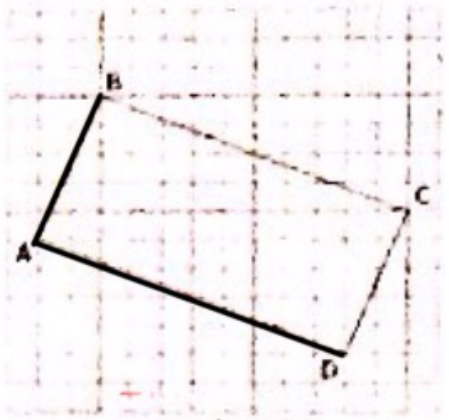
3. Right angles (angles measuring 90°) can be found in plane shapes such as right triangles, rectangles, and squares. Two lines are considered perpendicular when they intersect at a right angle. For each plane shape, identify a pair of perpendicular sides and compare their slopes. Describe the relationship between the slopes of perpendicular lines.



rectangle ABCD

$m\overline{AB} = \frac{5}{2}$

$m\overline{AD} = \frac{-4}{10} = -\frac{2}{5}$

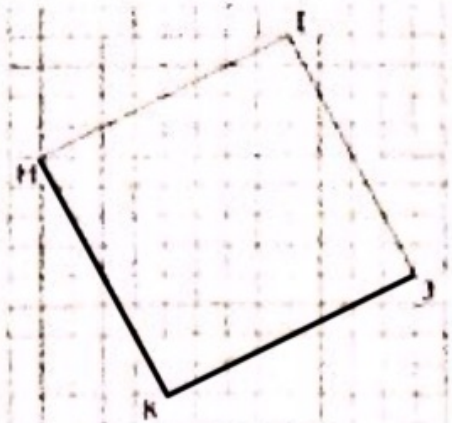
$\overline{AB} \perp \overline{AD}$

right triangle EFG

$m\overline{EG} = \frac{-8}{6} = \frac{-4}{3}$

$m\overline{GF} = \frac{3}{4}$

$\overline{EG} \perp \overline{GF}$



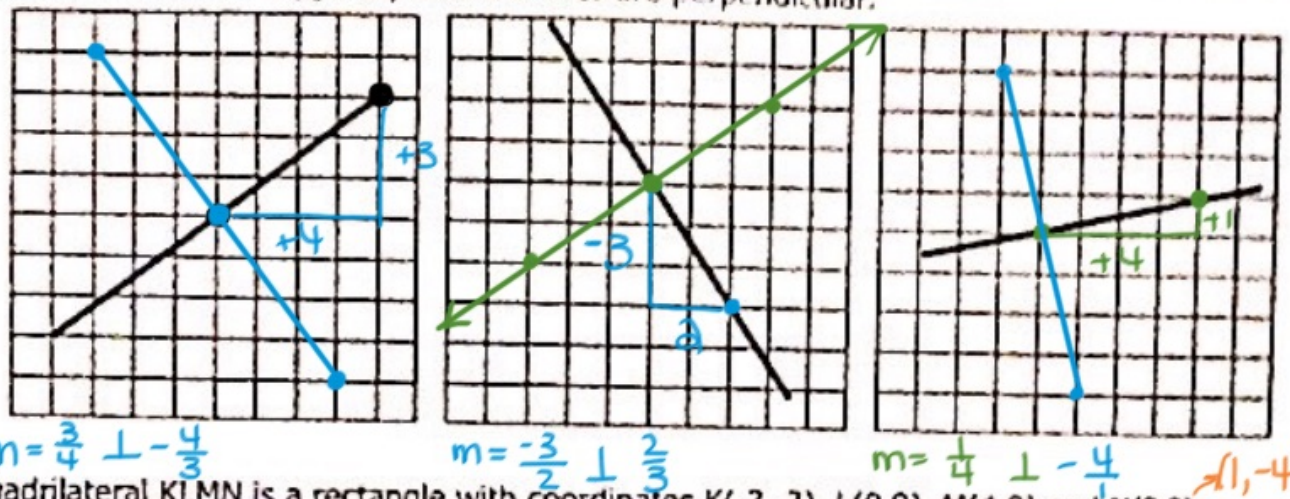
square HIJK

$m\overline{HK} = \frac{-8}{4} = \frac{-2}{1}$

$m\overline{KJ} = \frac{4}{8} = \frac{1}{2}$

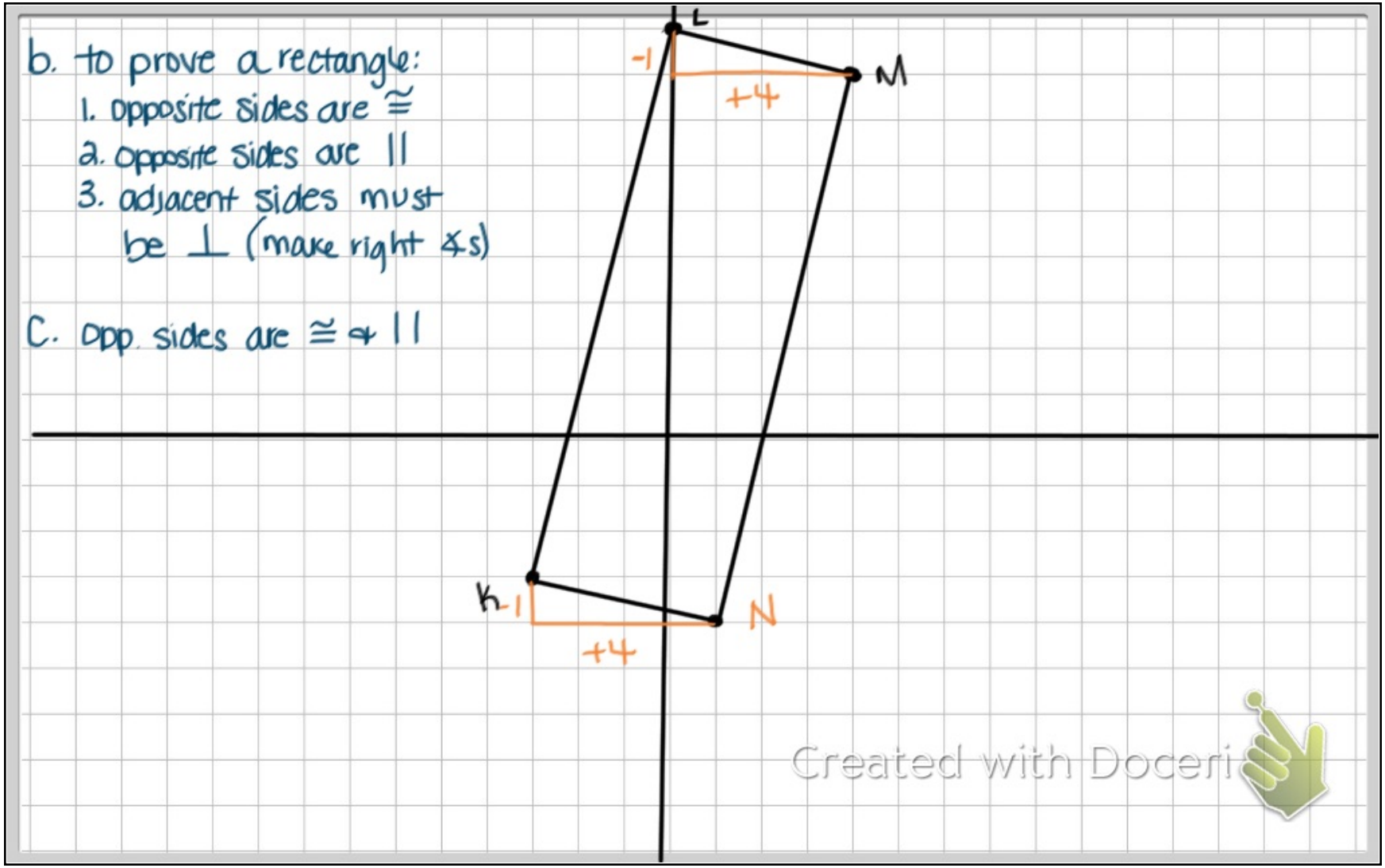
$\overline{HK} \perp \overline{KJ}$

4. In activities 2 & 3, you discovered that two intersecting lines are perpendicular if and only if their slopes are opposite reciprocals. Below are three line segments. Use the fact that the slopes of perpendicular lines are opposite reciprocals to draw a line segment perpendicular to the given line segment. In each case, justify that the lines are perpendicular.



$m = \frac{3}{4} \perp -\frac{4}{3}$ $m = \frac{-3}{2} \perp \frac{2}{3}$ $m = \frac{1}{4} \perp -\frac{4}{1}$

5. Quadrilateral KLMN is a rectangle with coordinates K(-3,-3), L(0,9), M(4,8) and N(?,?).
   a. Find the coordinates for point N. Explain how you determined the coordinates. (1,-4) opp. sides are parallel (same slope)
   b. Verify that quadrilateral KLMN is a rectangle by giving evidence related to its sides and angles.
   c. What do you notice about the sides that are opposite of one another? What can be said about the sides if the slopes are the same?


b. to prove a rectangle:
1. opposite sides are ≅
2. opposite sides are ||
3. adjacent sides must be ⊥ (make right ∠s)
C. opp. sides are ≅ & ||
L
M
N
K
-1
+4
-1
+4
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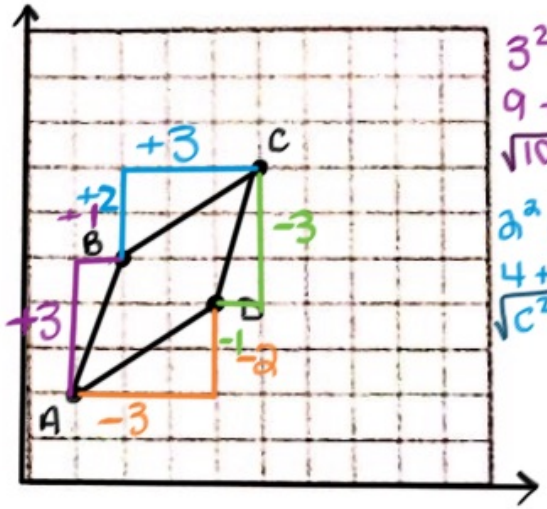
6. Lengths and slopes of the sides of plane shapes can assist in identifying the specific type of shape. Coordinates of different triangles and quadrilaterals are given below. In each case, carefully draw the figure on a coordinate grid and determine as precisely as possible the type of shape. You may want to refer to *Shapes and Their Properties* handout for specific properties of different shapes.
   a. A(1,2) B(2,5) C(5,7) D(4,4)
   b. E(4, -1) F(5,6) G(1,3)
   c. H(-3,2) I(-2, 6) J(2,7) K(1,3)
   d. L(2,2) M(5,-2) N(9,1) P(6,5)

6. a.



$3^2 + 1^2$
$9 + 1 = 10$
$\sqrt{10} = \sqrt{c^2}$

$2^2 + 3^2$
$4 + 9 = 13$
$\sqrt{c^2} = \sqrt{13}$

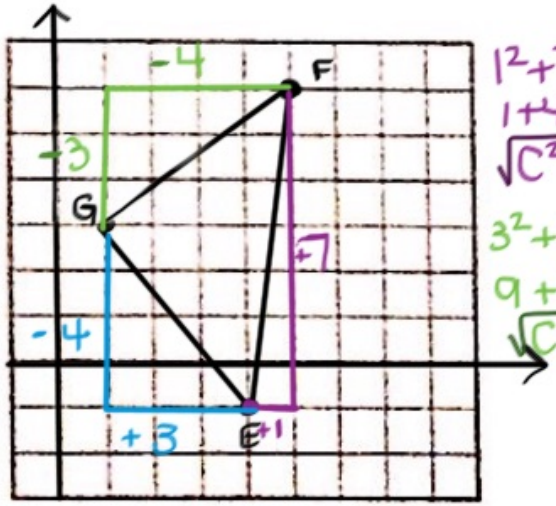
	length	slope
AB	$\sqrt{10} = 3.2$	$\frac{3}{1}$
BC	$\sqrt{13} = 3.6$	$\frac{2}{3}$
CD	$\sqrt{10} = 3.2$	$\frac{-3}{-1} = \frac{3}{1}$
DA	$\sqrt{13} = 3.6$	$\frac{-2}{-3} = \frac{2}{3}$

Opp. sides ≅

Opp sides ||

parallelogram

b.



$1^2 + 7^2 = c^2$
$1 + 49 = 50$
$\sqrt{c^2} = \sqrt{50}$

$3^2 + 4^2 = c^2$
$9 + 16 = 25$
$\sqrt{c^2} = \sqrt{25}$

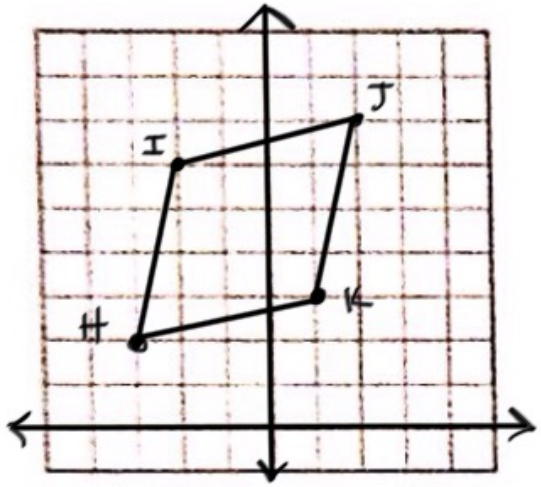
	length	slope
EF	$\sqrt{50} = 7.1$	$\frac{7}{1}$
FG	$\sqrt{25} = 5$	$\frac{-3}{-4} = \frac{3}{4}$
GE	$\sqrt{25} = 5$	$\frac{-4}{3}$

2 sides are ≅
↓
isosceles

perpendicular
(right ∠)

isosceles
right Δ

c.

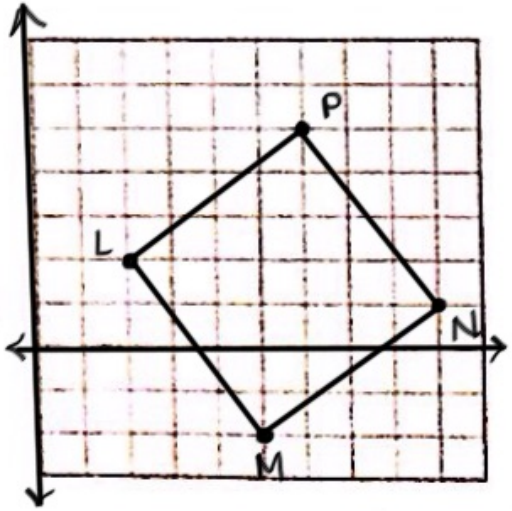


	length	slope
HI	4.1	$\frac{4}{1}$
IJ	4.1	$\frac{1}{4}$
JK	4.1	$\frac{4}{1}$
KH	4.1	$\frac{1}{4}$

All sides $\cong$
Opp. sides $\parallel$

Rhombus

d.



	length	slope
LM	5	$\frac{-4}{3}$
MN	5	$\frac{3}{4}$
NP	5	$\frac{-4}{3}$
PL	5	$\frac{3}{4}$

All sides $\cong$

adjacent sides are $\perp$

opp. sides $\parallel$

Square

7. Coordinate points are often used to define the endpoints for a line segment. Linear equations can be used to define lines that extend in both directions without end. Examine the following linear equations.

A. $y = 8 + 3x$ B. $y = 2x + 5$ C. $y = \frac{-1x}{3} + 7$ D. $y = \frac{6 - 4x}{-2}$ E. $y = -3 + 5x$

$y = -\frac{1}{3}x + 7$ $y = -3 + 2x$

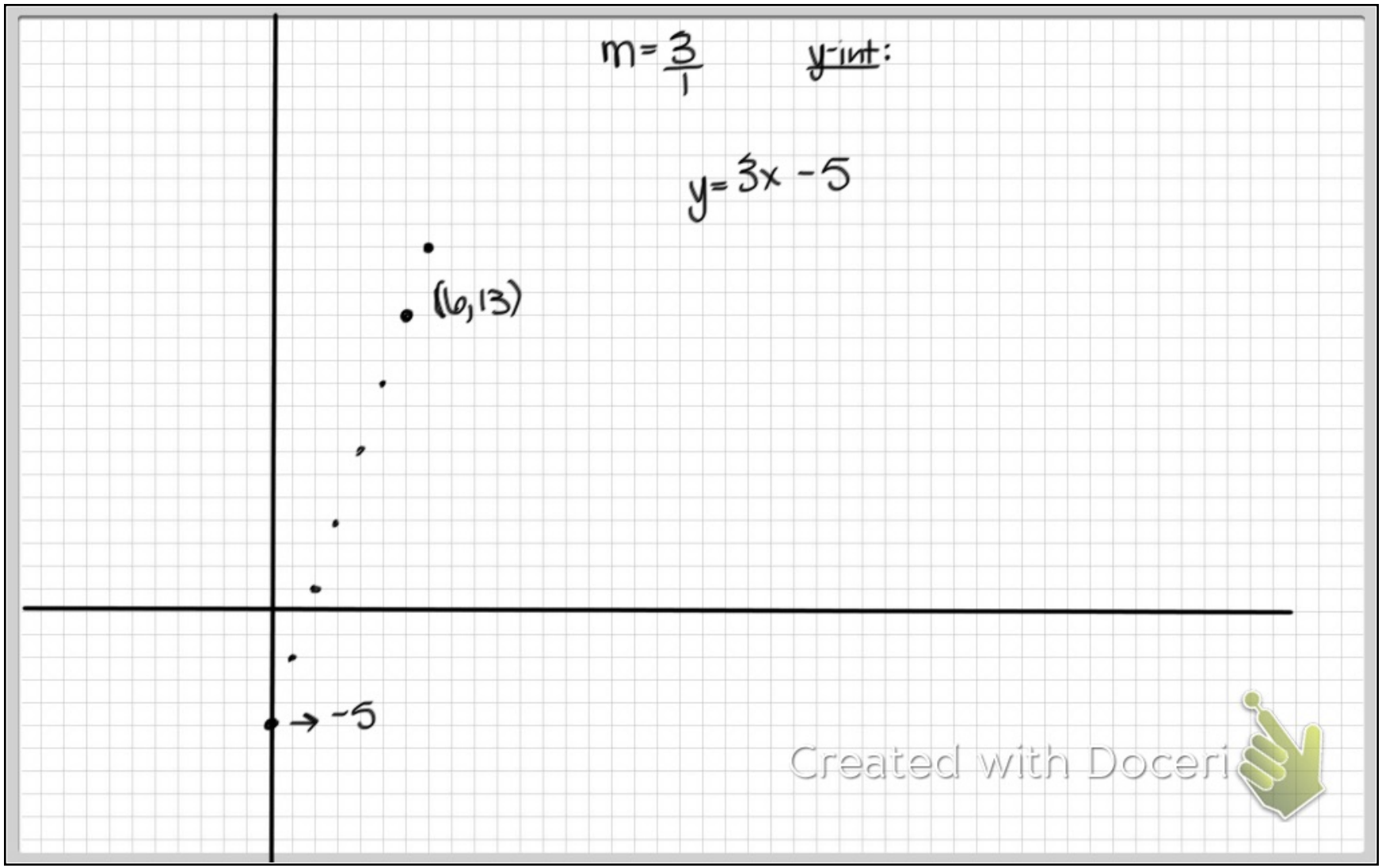
a. Identify a pair of parallel lines and explain how you know they are parallel by examining the equations. B & D → same slope

b. Identify a pair of perpendicular lines and explain how you know they are perpendicular by examining the equations. A & C → opp. reciprocals

c. Write the equation of the line parallel to $y = 3x + 12$ and passing through (6,13). $m = 3$

d. Write the equation of the line perpendicular to $y = \frac{2}{3}x - 5$ and passing through (4,9).

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


m = 3/1
y-int:
y = 3x - 5
(6, 13)
-5
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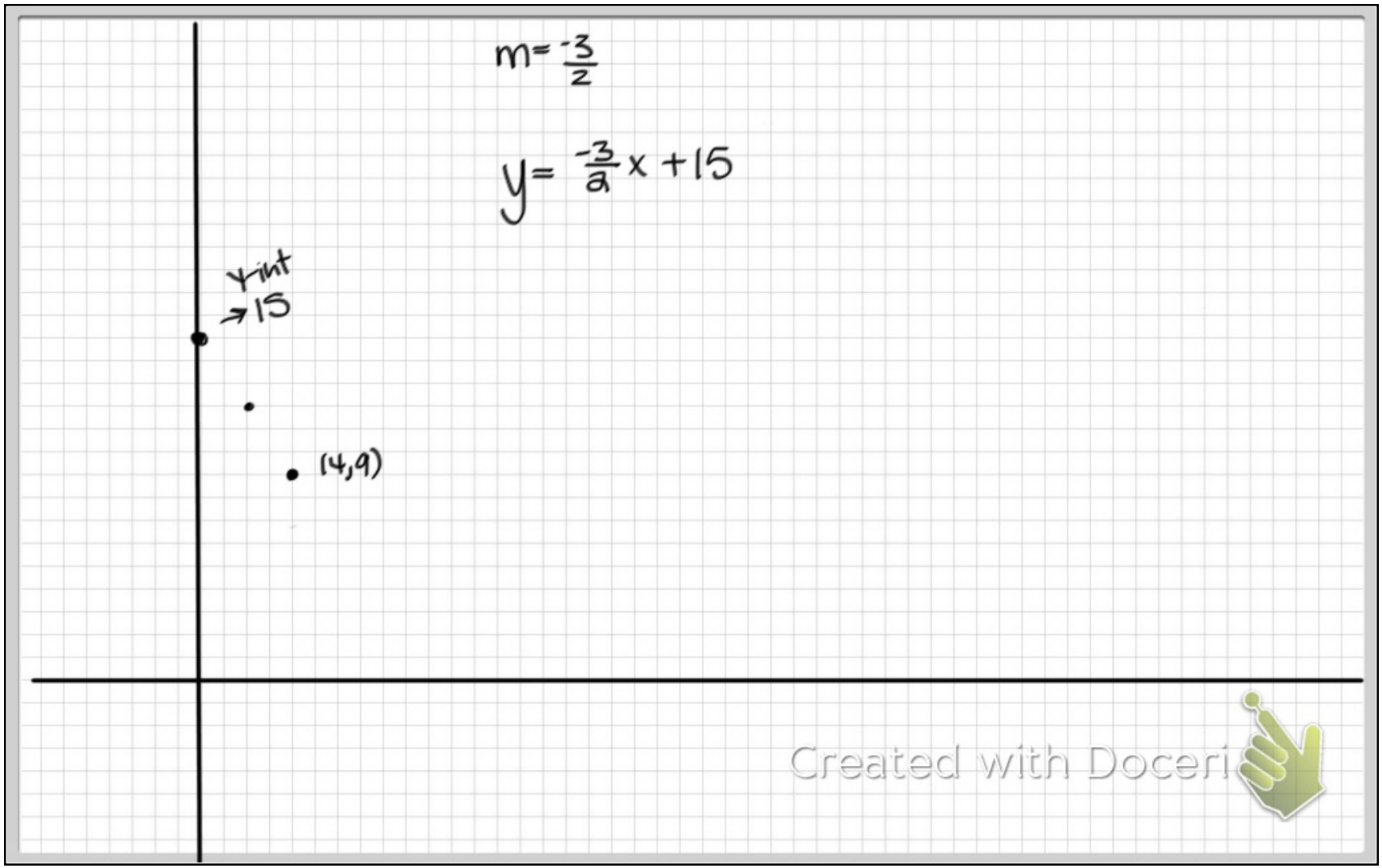
m= -3/2
y= -3/2 x +15
y-int
→15
(4,9)
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