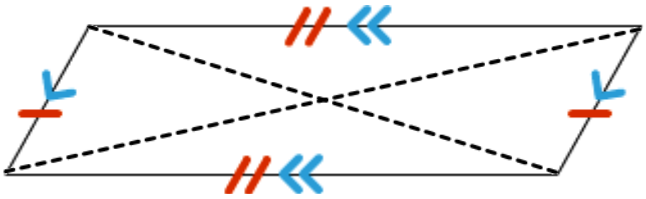
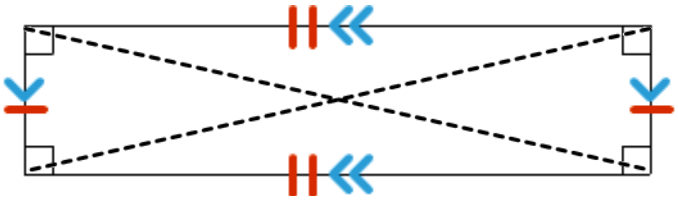
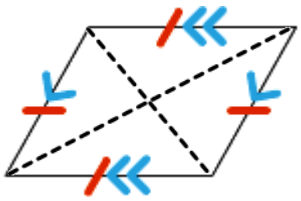
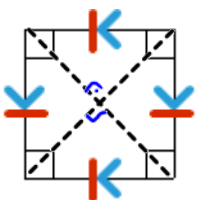
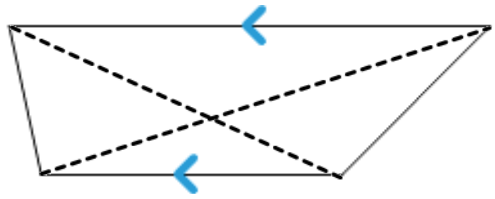
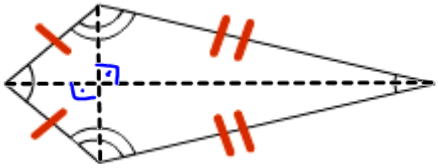
Meet the Quadrilateral Family

Go to http://bit.ly/classifyingquadrilaterals

- Complete the activity online. Once it is finished, it loops back to the beginning again - so you can stop once it repeats.
- Fill in the blanks as you complete the activity.

	This is a PARALLELOGRAM Opposite sides are parallel and equal
	This is a rectangle It is also a parallelogram with 2 different pairs of equal sides 4 right angles
	This is a rhombus It is also a parallelogram with 4 equal sides 2 pairs of parallel sides
	This is a square It is also a parallelogram and a rhombus with 4 equal sides 4 right angles and 2 pairs of parallel sides

	This is a trapezoid It has one pair of parallel sides
	This is a kite It has two pairs of equal sides and 2 pairs of equal adjacent sides

Examine the relationship in the diagonals of the quadrilaterals.

1. Which ones are equal in length? square rectangle
2. Which ones are perpendicular? kite square, rhombus
3. Which ones bisect each other? square rhombus kite parallelogram
   equally

What am I?

My opposite sides are parallel and equal in length: parallelogram

My opposite sides are parallel and equal in length, and my sides are perpendicular: rectangle

My opposite sides are parallel and all sides are equal in length: rhombus

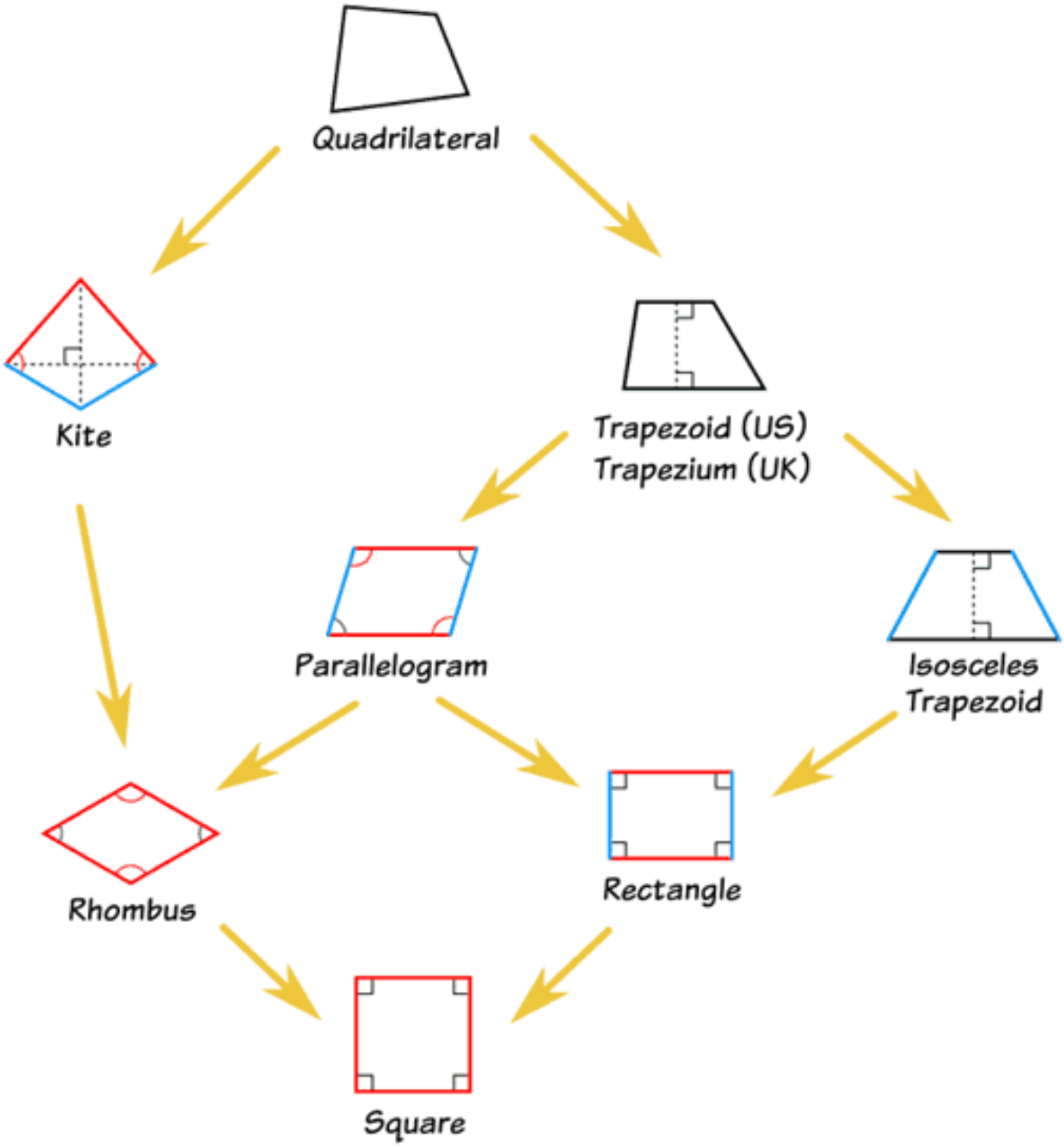
My opposite sides are parallel, all sides are equal in length, and my sides are perpendicular: square

Two of my sides are parallel, but not equal in length. The other two sides are equal in length but not parallel: isosceles trapezoid

My diagonals are perpendicular and equal: square

My diagonals are equal but not perpendicular: parallelogram

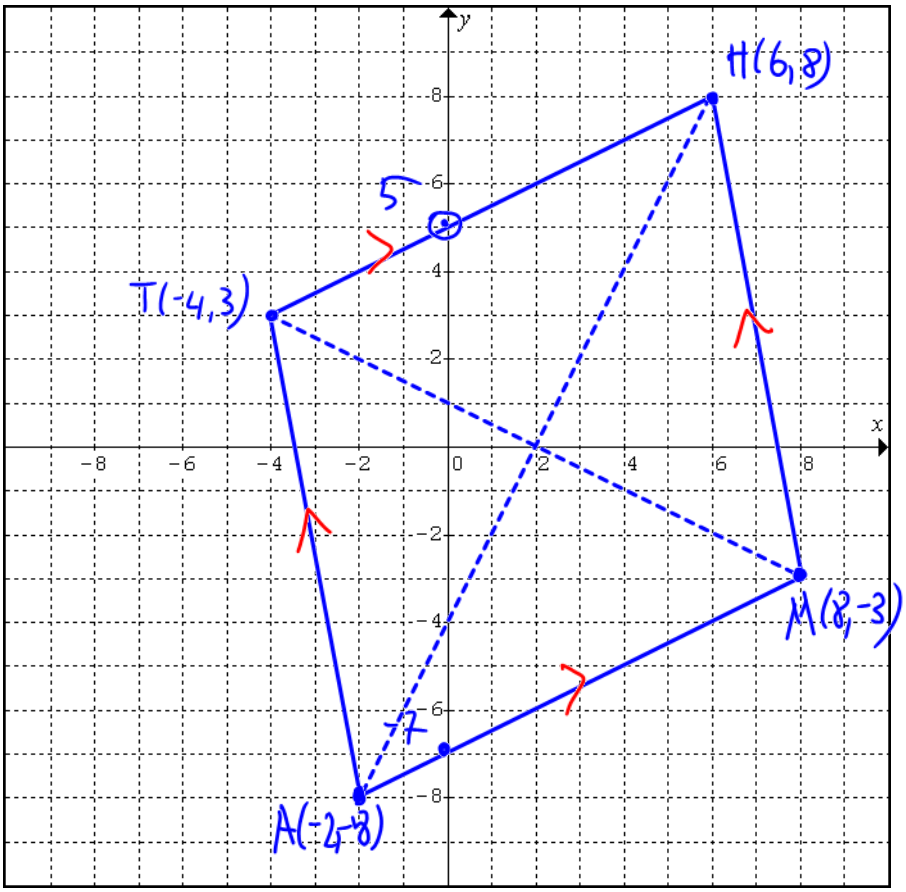
The Quadrilateral Family



Classifying Quadrilaterals

Problem A:

A quadrilateral has these coordinates: M(8, -3), A(-2, -8), T(-4, 3), and H(6, 8).
Graph this quadrilateral and complete the following questions.



1. Determine the length of each side.

MA	AT	TH	HM
$d=\sqrt{(-2-8)^2+(-8+3)^2}$ $=\sqrt{100+25}$ $=\sqrt{125}$ $=$	$d=\sqrt{(-4+2)^2+(3+8)^2}$ $=\sqrt{4+121}$ $=\sqrt{125}$	$d=\sqrt{(-4-6)^2+(3-8)^2}$ $=\sqrt{100+25}$ $=\sqrt{125}$	$d=\sqrt{(6-8)^2+(8+3)^2}$ $=\sqrt{4+121}$ $=\sqrt{125}$

2. Determine the slope of each side.

MA	AT	TH	HM
$m=\frac{y_2-y_1}{x_2-x_1}=\frac{-3+8}{8+2}$ $m=\frac{5}{10}=\frac{1}{2}$ $m=0.5$	$m=\frac{y_2-y_1}{x_2-x_1}=\frac{3+8}{-4+2}$ $m=\frac{11}{-2}$ $m=-5.5$	$m=\frac{y_2-y_1}{x_2-x_1}=\frac{8-3}{6+4}$ $m=\frac{5}{10}=\frac{1}{2}$ $m=0.5$	$m=\frac{y_2-y_1}{x_2-x_1}=\frac{8+3}{6-8}$ $m=\frac{11}{-2}$ $m=-5.5$

3. Is MATH a parallelogram? Justify your answer with proper calculations (IE: how do you know).

It's because opposite sides are parallel because they have the same slope and different y-int.

4. Is MATH a rectangle? Justify your answer with proper calculations (IE: how do you know).

No because $m_{MA} \times m_{AT} \neq -1$

$0.5 \times -5.5 = -2.75$

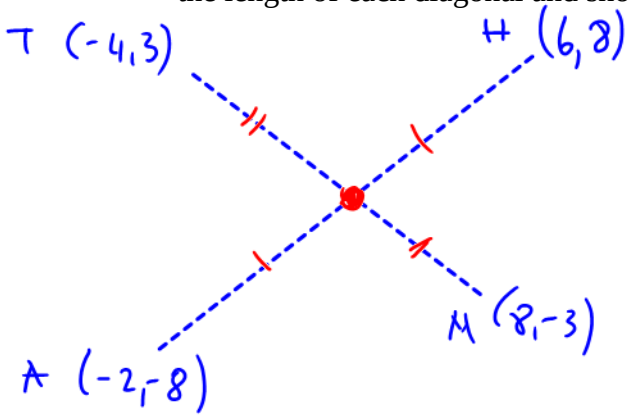
5. Is MATH a rhombus? Justify your answer with proper calculations (IE: how do you know).

Yes, because each side are equal & parallel.

6. Is MATH a square? Justify your answer with proper calculations (IE: how do you know).

It's not a square because the angle between line segments are not right. For example $m_{MA} \times m_{AT} = -2.75$

7. Draw in the diagonals. Obviously, they are unequal in length. Verify this algebraically (IE: calculate the length of each diagonal and show they are unequal).



$|HH| = \sqrt{(-2-6)^2 + (-8-8)^2}$

$= \sqrt{64 + 256}$

$= \sqrt{320}$

$|MT| = \sqrt{(8+4)^2 + (-3-3)^2}$

$= \sqrt{144 + 36} = \sqrt{180}$

8. Determine the midpoint of each diagonal. What do you notice? What does this mean?

$M_{AT} = \left(\frac{8-4}{2}, \frac{-3+3}{2}\right)$ $M_{AH} = \left(\frac{6-2}{2}, \frac{8-8}{2}\right)$

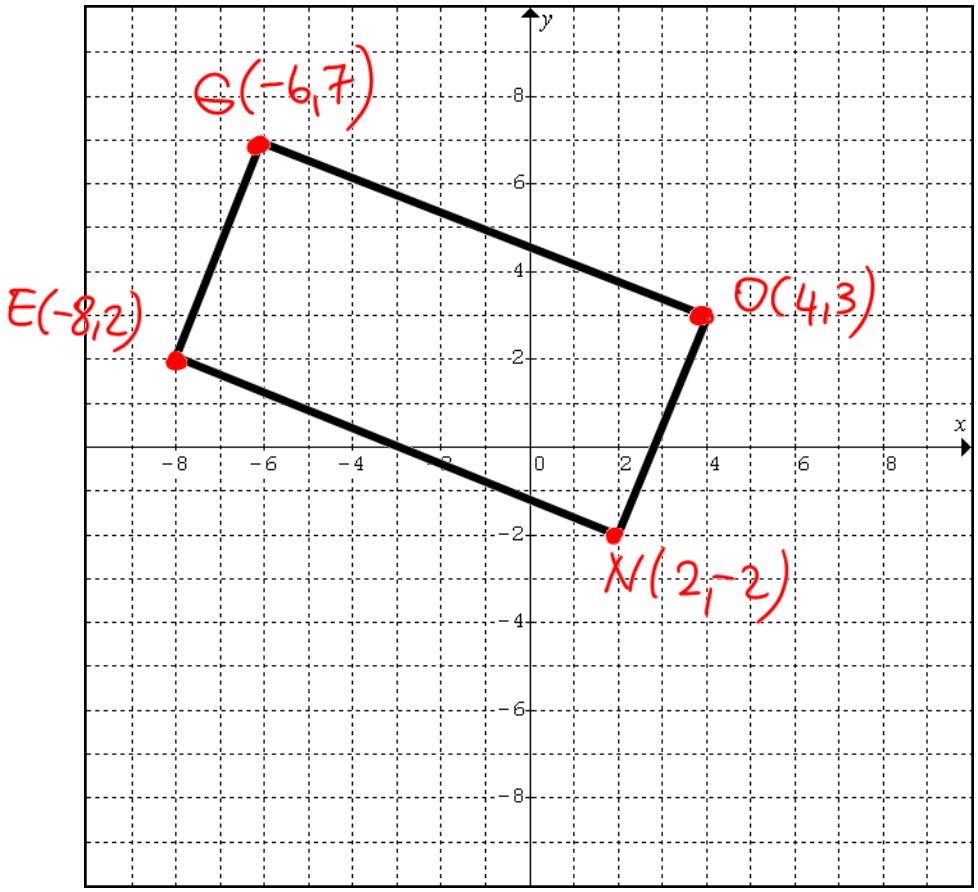
$M_{AT} = (2,0)$ $M_{AH} = (2,0)$

Midpoints of each diagonal are also POI

Diagonals bisect each other equally

Problem B:

Points G(-6, 7), O(4, 3), N(2, -2), and E(-8, 2) form a quadrilateral.



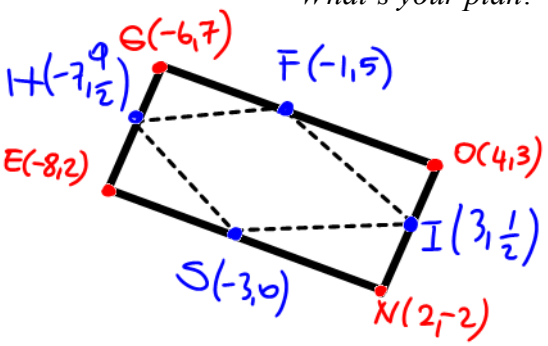
1. Classify the quadrilateral.

What's your plan? IE: What do you need to calculate?

slope of each line, length of each side

LENGTH			
GO $d=\sqrt{(-6-4)^2+(7-3)^2}$ $=\sqrt{100+16}$ $=\sqrt{116}$	ON $d=\sqrt{(4-2)^2+(3+2)^2}$ $=\sqrt{4+25}$ $=\sqrt{29}$	EN $d=\sqrt{(-8-2)^2+(2+2)^2}$ $=\sqrt{100+16}$ $=\sqrt{116}$	GE $d=\sqrt{(-6+8)^2+(7-2)}$ $=\sqrt{4+25}$ $=\sqrt{29}$
slope GO $m=\frac{7-3}{-6-4}=\frac{4}{-10}$ $m=-\frac{2}{5}$	slope ON $m=\frac{3+2}{4-2}=\frac{5}{2}$ $m=\frac{5}{2}$	slope EN $m=\frac{2+2}{-8-2}=\frac{-4}{10}$ $m=-\frac{2}{5}$	slope GE $m=\frac{7-2}{-6+8}=\frac{5}{2}$ $m=\frac{5}{2}$

2. Join the midpoints of each side to form another quadrilateral.
   What's your plan? IE: What do you need to calculate?



$F(x,y) = \left(\frac{-6+4}{2}, \frac{7+3}{2}\right)$

$F = (-1,5)$

$I(x,y) = \left(\frac{4+2}{2}, \frac{3-2}{2}\right)$

$I = \left(3, \frac{1}{2}\right)$

$S(x,y) = \left(\frac{-8+2}{2}, \frac{2-2}{2}\right)$

$S = (-3,0)$

$H(x,y) = \left(\frac{-6-8}{2}, \frac{7+2}{2}\right)$

$H = \left(-7, \frac{9}{2}\right)$

3. Verify that this 'midpoint' quadrilateral is a parallelogram.
   What's your plan? IE: What do you need to calculate?

length HF	length FI	length IS	length SH
$\lvert HF\rvert = \sqrt{(-7-(-1))^2+(5-4.5)^2}$	$\lvert FI\rvert = \sqrt{(-1-3)^2+(5-0.5)^2}$	$\lvert IS\rvert = \sqrt{(3-(-3))^2+(0.5-0)^2}$	$\lvert SH\rvert = \sqrt{(-3-(-7))^2+(-\frac{9}{2})^2}$
$= \sqrt{(-7+1)^2+(0.5)^2}$	$= \sqrt{16+20.25}$	$= \sqrt{36+0.25}$	$= \sqrt{16+20.25}$
$= \sqrt{36+0.25}$	$= \sqrt{36.25}$	$= \sqrt{36.25}$	$= \sqrt{36.25}$
$= \sqrt{36.25}$			
$m_{FH} = \frac{5-\frac{9}{2}}{-1-(-7)}$	$m_{FI} = \frac{5-\frac{1}{2}}{-1-3}$	$m_{IS} = \frac{\frac{1}{2}-0}{3-(-3)}$	$m_{SH} = \frac{\frac{9}{2}-0}{-7-(-3)}$
$= \frac{\frac{1}{2}}{6}$	$= \frac{\frac{9}{2}}{-4}$	$= \frac{\frac{1}{2}}{6}$	$m_{SH} = \frac{\frac{9}{2}}{-4}$
$m_{FH} = \frac{1}{12}$	$m_{FI} = -\frac{9}{8}$	$m_{IS} = \frac{1}{12}$	$m_{SH} = -\frac{9}{8}$

$m_{FH} = m_{IS}$ $\quad m_{FI} = m_{SH}$

$\lvert FH\rvert = \lvert IS\rvert$ $\quad \lvert FI\rvert = \lvert SH\rvert$

$\therefore$ It's a parallelogram.