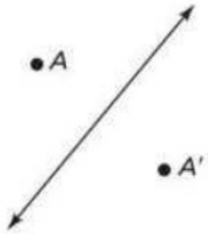
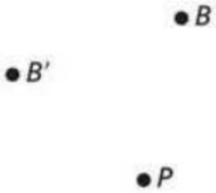
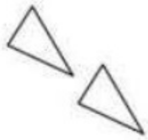
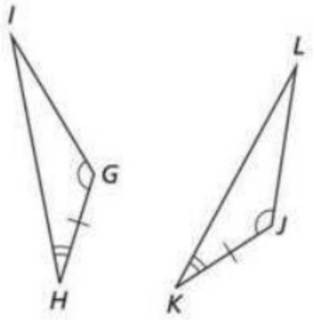
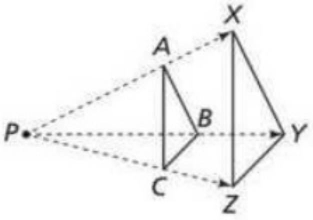
Butterflies, Pinwheels, and Wallpaper

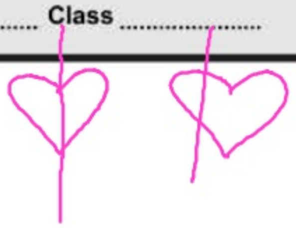
Day	Topic	Homework	IXL	√	Grade
1	Explore symmetry	Complete google classroom assignment			
2	Inv 1.1	Inv 1/ACE # 1-6			
3	Inv 1.2	Inv 1/ACE # 19-20			
4	Inv 1.3	Inv 1/ACE # 8-12 (all part a only!)			
5	Inv 1.4	Inv 1/ACE # 14-17, 30-34, 36a, 37a			
6	Practice	Study for Quiz	P.1		
7	Quiz	Worksheet 1	P.2		
8	Inv 2.1	Worksheet 2	P.3		
9	Inv 2.2	Worksheet 3	P.4		
10	Inv 2.3	Worksheet 4	P.5		
11	Inv 3.1	Worksheet 5	P.6		
12	Inv 3.2	Worksheet 6	P.7		
13	Inv 3.3	Study for Quiz	P.8		
14	Quiz	Worksheet 7	P.9		
15	Inv 3.4	Worksheet 8	P.10		
16	Inv 3.5	Worksheet 9	P.11		
17	Practice	Worksheet 10	Q.1		
18	Inv 4.1	Worksheet 11	Q.2		
19	Inv 4.2	Worksheet 12	Q.3		
20	Inv 4.3	Worksheet 13	Q.4		
21	Inv 4.4	Worksheet 14	Q.5		
22	Practice	Review Packet			
23	Review	Study for Test			
24	Unit Test	None			

Name: ____

Important Concepts	Examples
Symmetry Transformations You can use symmetry transformations—reflections, rotations, and translations—to create symmetric designs and to compare the size and shape of figures. You can specify a **reflection** by giving the line of reflection. You can specify a **rotation** by giving the center of rotation and the angle of the turn. You can specify a **translation** by giving the length and direction of the slide. Usually, an arrow with the appropriate length and direction is drawn.	Point *A* and its reflection image point *A′* lie on a line that is perpendicular to the line of symmetry and are equidistant from that line.  Point *B* and its image point *B′* are equidistant from the center of rotation *P*. A point under a rotation "travels" on the arc of a circle whose radius is the constant distance between point *B* and center *P*.  The set of circles on which the points of a figure "travel" are concentric circles with center *P*. The angles formed by the vertex points of the figure and their rotation images all have measures equal to the angle of the turn. If you draw the segments connecting a number of points to their images, the segments will be parallel and the same length. The length is equal to the distance of the translation. 
Congruent Figures Figures of the same size and shape are congruent.	You can "move" one triangle exactly onto the other by a sequence of symmetry transformations. 
Similarity A two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations. A **dilation** enlarges or reduces a figure by scale factor about a center point so that the original figure and its image are similar. You can specify a dilation by giving the center of dilation and the scale factor.	Dilations conserve the shape of a figure, but not the size. A scale factor that is greater than 1 stretches the figure. A scale factor that is less than 1 shrinks the figure. 

Name .... **Date** .... **Class** ....

Investigation 1



VOCABULARY

Reflection Symmetry: (flip or line symmetry) If a design is cut in half, one half is the mirror of the other half.

Rotation Symmetry: (turn or spin symmetry) If a design is turned less than a full circle around a center point, it will look the same as it did in its original position.

Translational Symmetry: (slide symmetry) If you can slide a design to a position in which it looks exactly the same as it did in its original position.

Basic Design Element: the smallest piece of a design which can be used to create the remainder of the design.

Transformation: any change to a basic element

Center of rotation: the point about which a design can be turned to create the new image

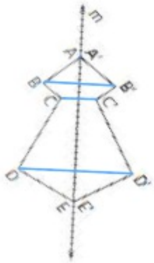
Angle of rotation: the smallest angle that a basic design element can be turned to create the new image

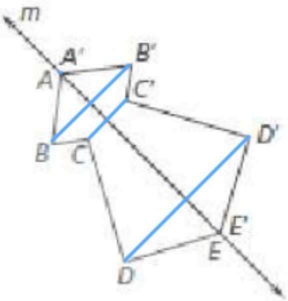
360° is a full turn

Line of Symmetry: (axis of symmetry) the line that divides an image in half to create mirror images

Investigation 1.1

A) Do part A #1





Observations:

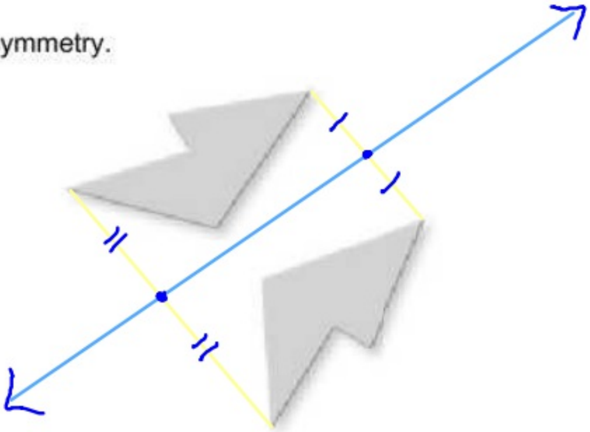
All of the line segments are parallel.

The point and its image are the same distance from line of reflection.

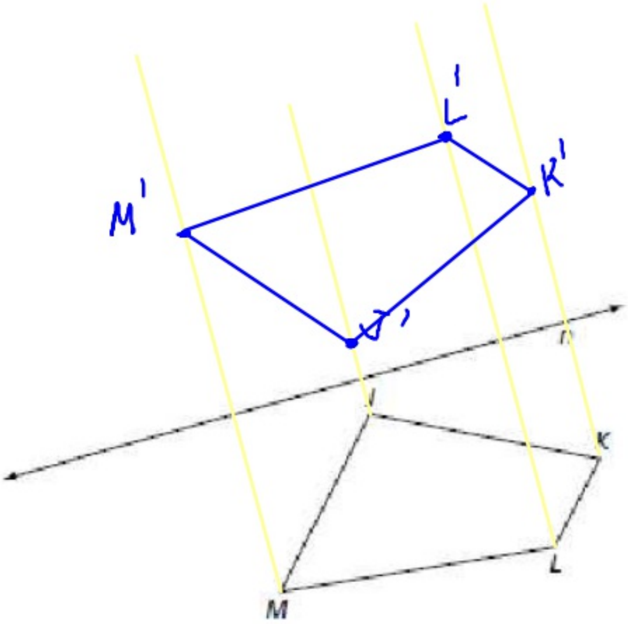
All of the line segments are perpendicular to line m.

The points that do not move are the points that are on the line of reflection.

B) Locate and draw the line of symmetry.



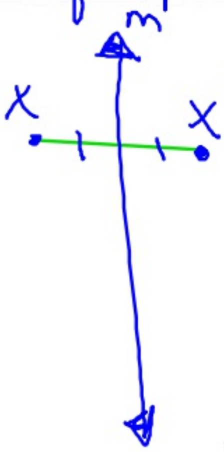
C) Try to draw the reflection of JKLM using the information you gathered from part A.



Will the image be congruent to JKLM? Yes

Will the image points be on the same side of line n? No they will be on the other side.

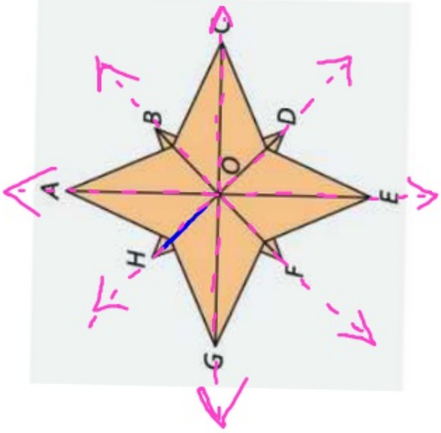
D) Complete this sentence: A reflection in line m matches each point X on a figure to an image point X' so that they are equidistant from line m, line segment XX' is perpendicular to line m, and line m bisects or cuts into two equal pieces line segment XX'.

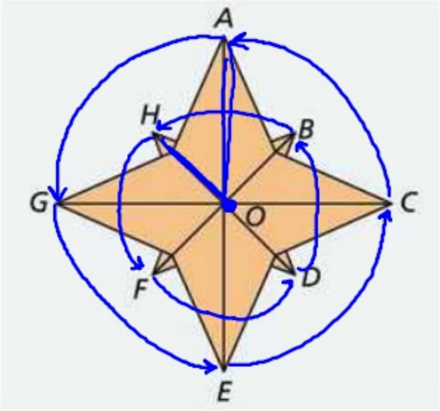


$\frac{360^\circ}{4} = 90^\circ$

Investigation 1.2

A)





1) 90°

2) The point → image matches are: A→ G, G→ E, E→ C, C→ A, H→ F, F→ D, D→ B, and B→ H.

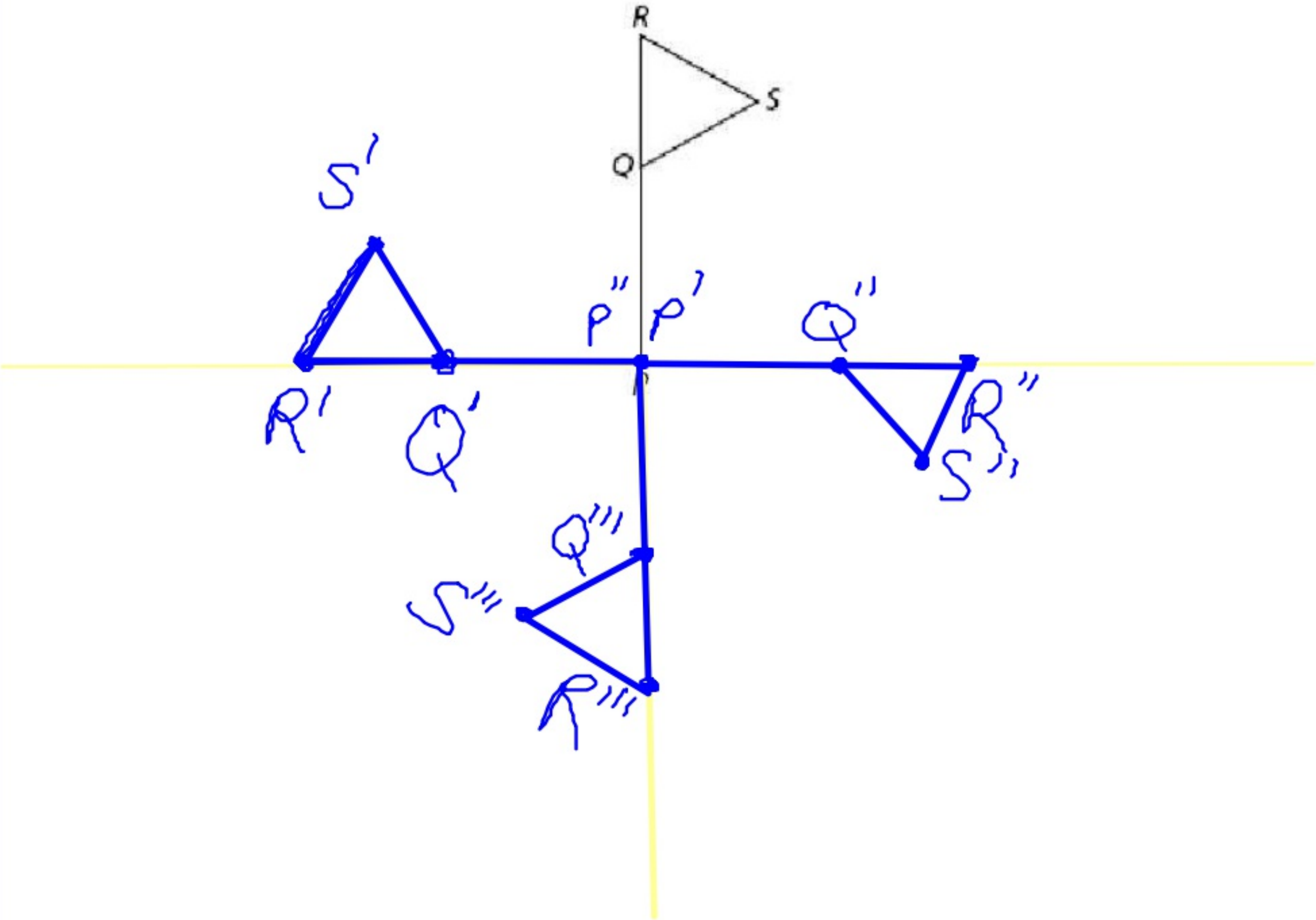
AO→ GO; HO→ FO

3) Each point moves along an arc of a circle with center at O. The radius of the circle is the same distance between point O and points A, G, E, and C. Likewise, points H, F, D, and B move along the arc of a circle with the same center but a different distance

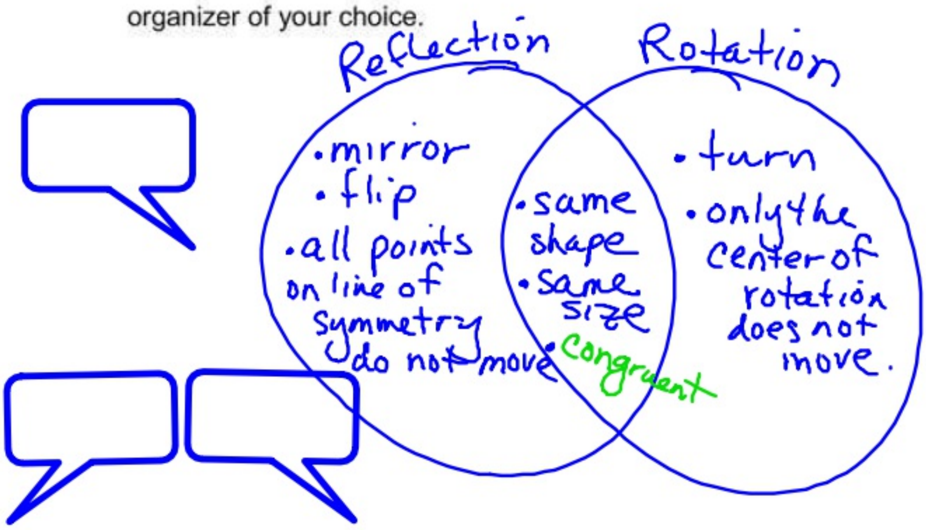
4) Points X, X′, and the center of the compass star O determine a fixed angle ∠XPX′ and line segments XP and X′P have the same length.

5) Yes, this compass star also reflection symmetry about any of the line segments drawn through the center point O.

B) Try to draw a pattern that has 90° rotation symmetry.



C) Compare and contrast reflection symmetry and rotation symmetry. Feel free to use a graphic organizer of your choice.



D) Complete this sentence: A rotation of ***d*** degrees about point O matches each point X on a figure to an image point X' so that OX is congruent to OX' and angle XOX' has a measure of d °.

orientation

Investigation 1.3

Complete A #1

Diagram 1

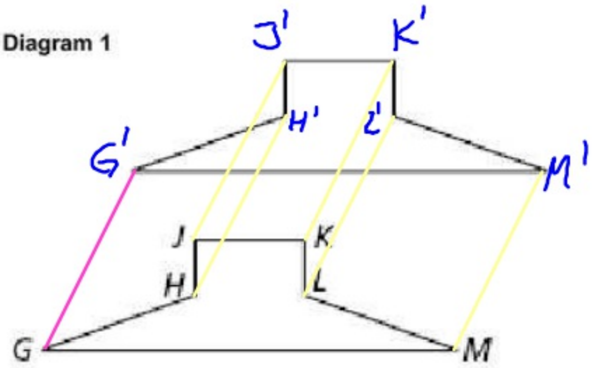
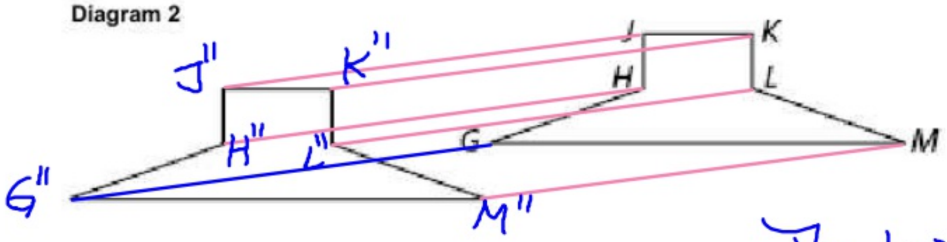


Diagram 2



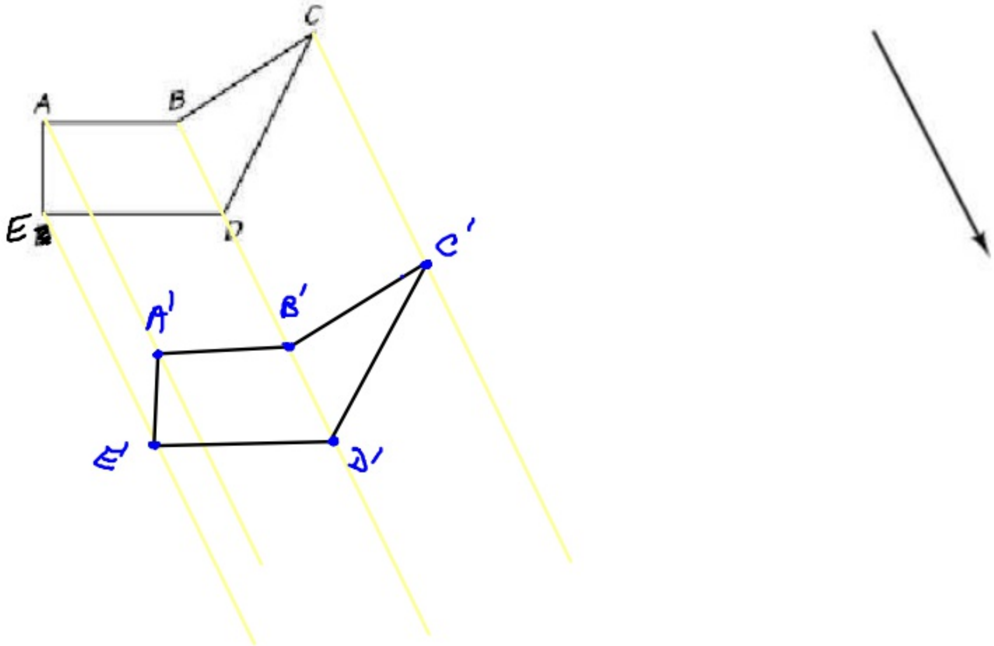
The line segments show the direction and distance of the slide.

Observations:

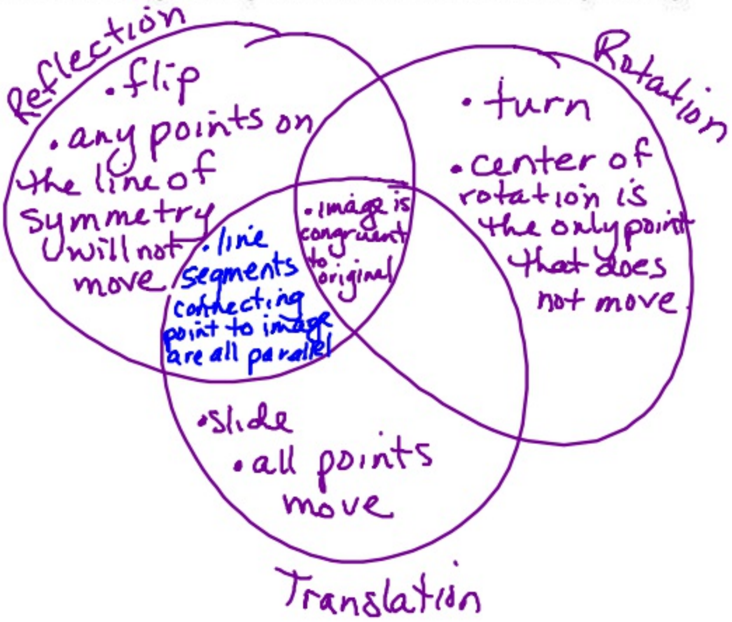
All the line segments drawn are Same length.

All of the line segments drawn are parallel.

B. Just try to draw the translation of ABCDB using the arrow as the direction and distance that you slide.



C) Compare translation symmetry to reflection and rotation symmetry.



- flip
- any points on the line of symmetry will not move

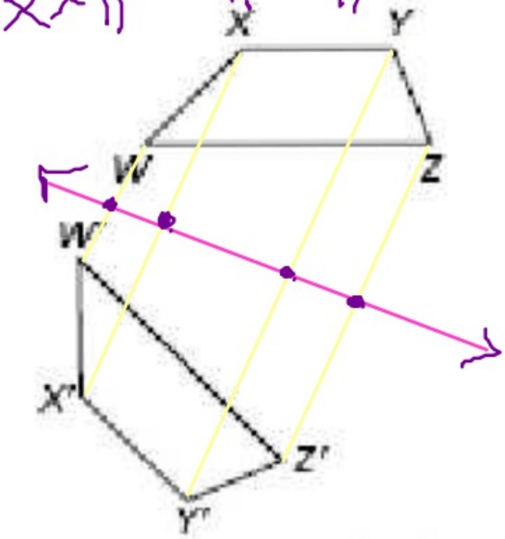
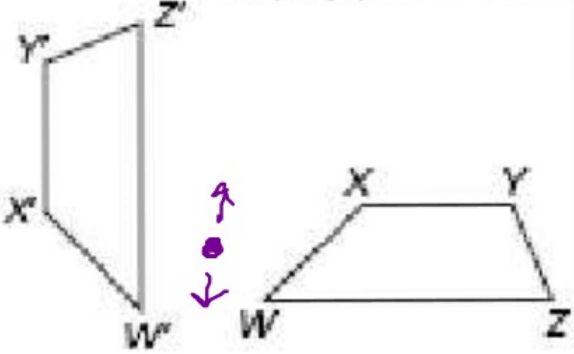
- turn
- center of rotation is the only point that does not move

- slide
- all points move

- line segments connecting point to image are all parallel

- image is congruent to original

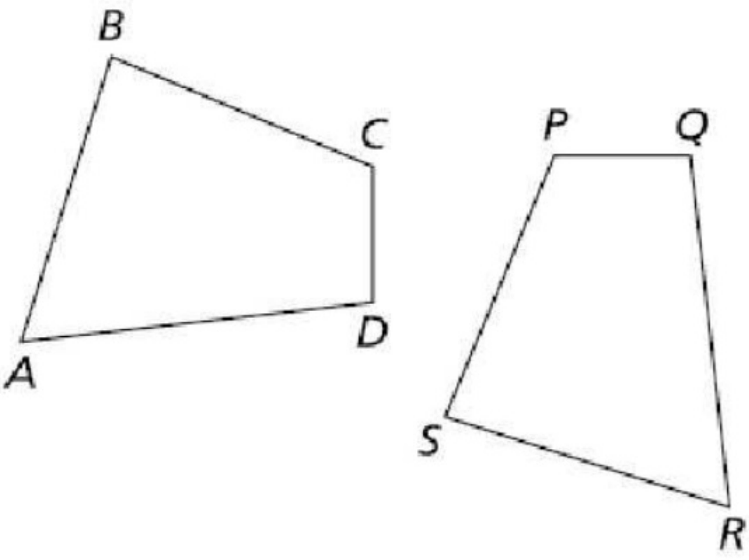
D) Complete this sentence: A translation matches any two points X and Y on a figure to points X' and Y' so that XX' and YY' are parallel and congruent.

ion	**Reflection: Find the reflection line.** $XX' \parallel WW' \parallel YY' \parallel ZZ'$ 	**Rotation: Find the center of rotation.** 90° counter clockwise 	**Find t** **of the** 
	$WX \cong W'X'$ $XY \cong X'Y'$ $YZ \cong Y'Z'$ $WZ \cong W'Z'$ corresponding sides are congruent.	→	→
	$\angle W \cong \angle W'$ $\angle X \cong \angle X'$ corresponding angles are congruent.	→	→
	$XY \parallel WZ$ and $X'Y' \parallel W'Z'$ (PARALLELISM)	→	→
	any points on the line of symmetry don't move	center of rotation is the only point that does not move	a l
ed?	PARALLELISM CONGRUENCY	→ →	→ →

Name .... **Date** .... **Class** ....

Labsheet 2.1 Question D

Two figures are **congruent** if they have the same shape and size. They are also **congruent** if you can apply a transformation or series of transformations on one to get the other.



"maps to"

A) A-> R   B-> S   C-> P   D-> Q

B) $\overline{AB} \cong \overline{RS}$ $\overline{BC} \cong \overline{SP}$ $\overline{CD} \cong \overline{PQ}$ $\overline{DA} \cong \overline{QR}$

C) $\angle A \cong \angle R$ $\angle B \cong \angle S$ $\angle C \cong \angle P$ $\angle D \cong \angle Q$

D) 1) How can you transform ABCD to PQRS? Be sure to describe your transformation exactly. Is there more than one way?

Rotate 90° counterclockwise around point A

translate so that A → R

2) How could you rename quadrilateral *PQRS* so that its name shows how the vertices correspond to those of quadrilateral *ABCD*?

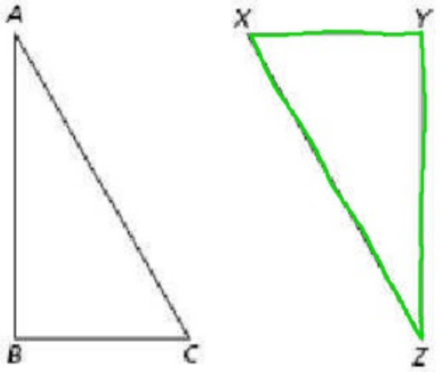
ABCD → RSPQ

Name .... Date .... Class ....

Labsheet 2.2 Questions A–F

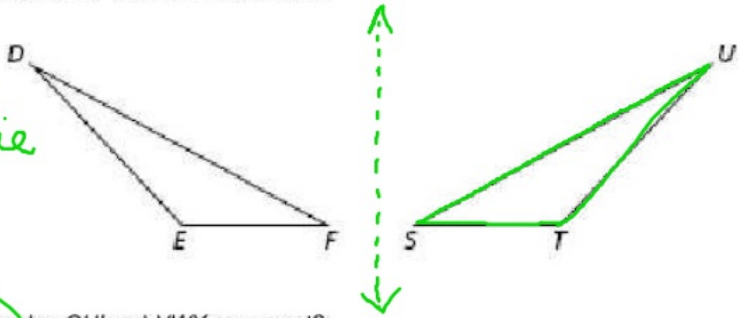
A. Are triangles *ABC* and *XYZ* congruent?

Congruent
A → Z
B → Y
C → X
- rotate 180° around point A
- translate so that A → Z



B. Are triangles *DEF* and *STU* congruent?

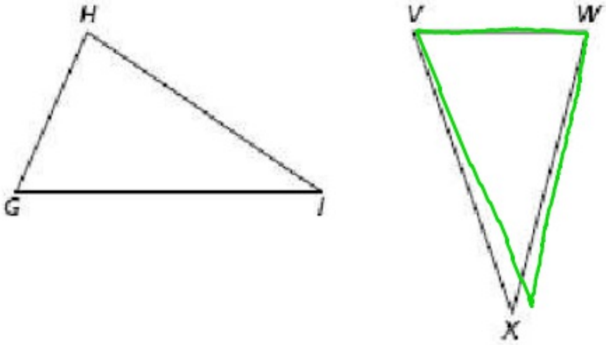
Reflect across the vertical line



congruent
U ← D
T ← E
S ← F

C. Are triangles *GHI* and *VWX* congruent?

not Congruent
~~G → V~~
~~H → W~~
~~I → X~~



Name .... Date .... Class ....

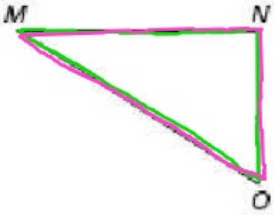
Labsheet 2.2

Questions A–F

D. Are triangles *JKL* and *MNO* congruent?

Congruent

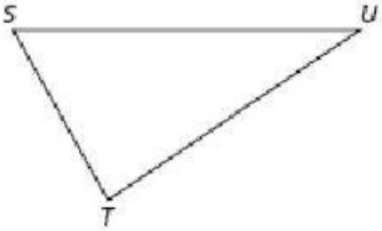
J → O
K → N
L → M

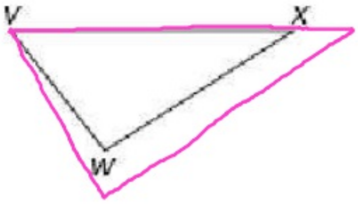


- Rotate 90° ccw. around point J
- Reflect across the vertical line through J
- translate so that J → O

E. Are triangles *STU* and *VWX* congruent?

not congruent



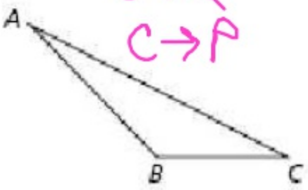


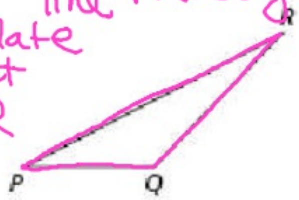
F. Are triangles *ABC* and *PQR* congruent?

Congruent

A → R
B → Q
C → P

- Reflect across the vertical line through A
- translate so that A → R





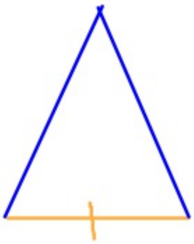
Name .... **Date** .... **Class** ....

Labsheet 2.3

A Can you be sure that two triangles are congruent if you know only

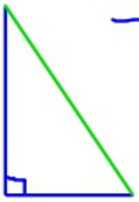
1. one pair of congruent corresponding sides?

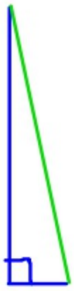
No not enough info



2. one pair of congruent corresponding angles?

No

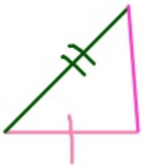


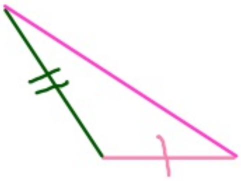


B Can you be sure that two triangles are congruent if you know only

1. two pairs of congruent corresponding sides?

NO





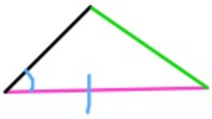
2. two pairs of congruent corresponding angles?

No

mini me

3. one pair of congruent corresponding sides and one pair of congruent corresponding angles?

No

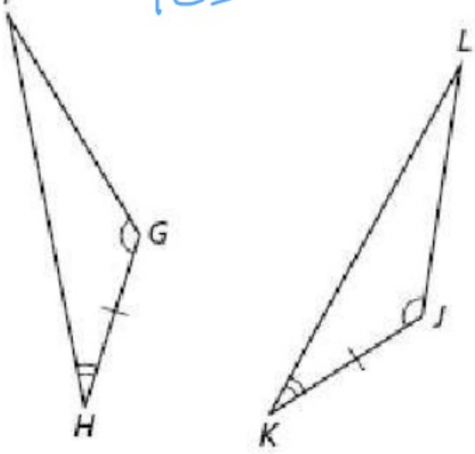


Note
SSS proves
they are ≅

C. 1.

Yes

Angle-Side-Angle
ASA



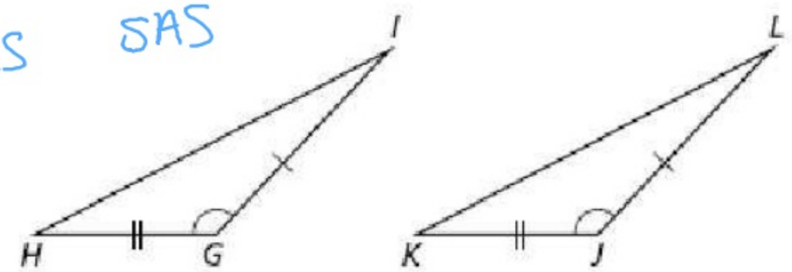
2.

Yes

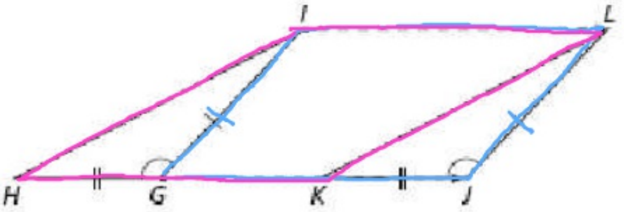
SAS
Side-Angle-Side

Labsheet 2.3 Questions C–E

D. 1. Yes SAS



2.



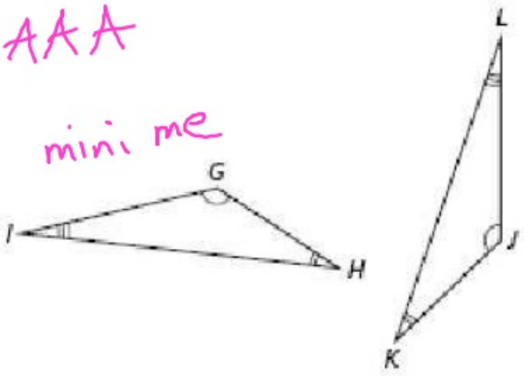
To prove 2 △'s ≅

- SAS
- ASA
- SSS

E. 1. AAA

No

mini me



What doesn't work

AAA
SSA

Name .... **Date** .... **Class** ....

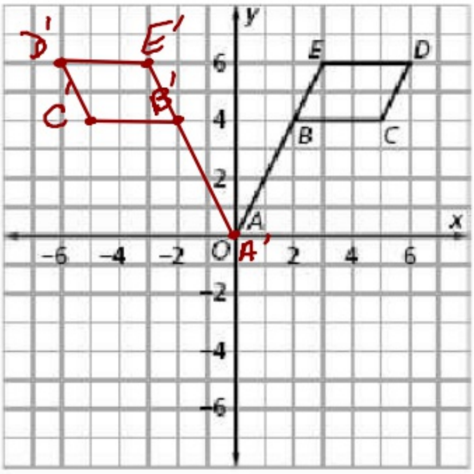
Labsheet 3.1 Reflection

A. Complete the table showing coordinates of points *A*–*E* and their images under a reflection in the *y*-axis

over, across

$(x, y) \rightarrow (-x, y)$

Change the sign of the x-coordinate



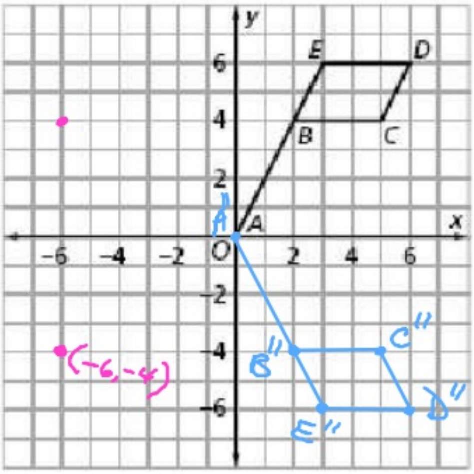
Point	*A*	*B*	*C*	*D*	*E*
Original Coordinates	(0, 0)	(2, 4)	(5,4)	(6,6)	(3,6)
Coordinates After a Reflection	(0,0)	(-2,4)	(-5,4)	(-6,6)	(-3,6)

B. Complete the table showing coordinates of points *A*–*E* and their images under a reflection in the *x*-axis

$(x, y) \rightarrow (x, -y)$

$(-6, -4) \rightarrow (-6, 4)$

Change the sign of the y-coordinate



Point	*A*	*B*	*C*	*D*	*E*
Original Coordinates	(0, 0)	(2, 4)	(5,4)	(6,6)	(3,6)
Coordinates After a Reflection	(0,0)	(2,-4)	(5,-4)	(6,-6)	(3,-6)

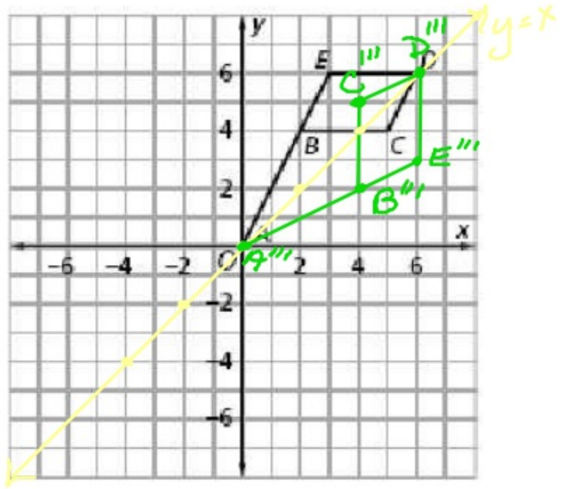
Name .... **Date** .... **Class** ....

Labsheet 3.1 Reflection

C. Complete the table showing coordinates of points *A*–*E* and their images under a reflection in the line $y = x$

$(x, y) \rightarrow (y, x)$

x and y coordinates switch



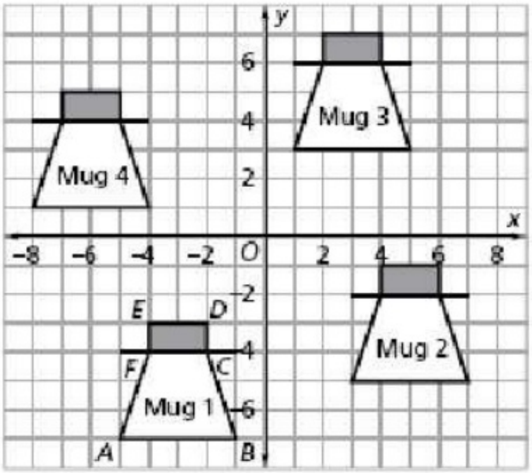
Point	*A*	*B*	*C*	*D*	*E*
Original Coordinates	(0, 0)	(2, 4)	(5,4)	(6,6)	(3,6)
Coordinates After a Reflection	(0,0)	(4,2)	(4,5)	(6,6)	(6,3)

Name .... **Date** .... **Class** ....

Labsheet 3.2

Translation

Make a table of the coordinates of key points for Mug 1 and his images under the translations. Look for patterns



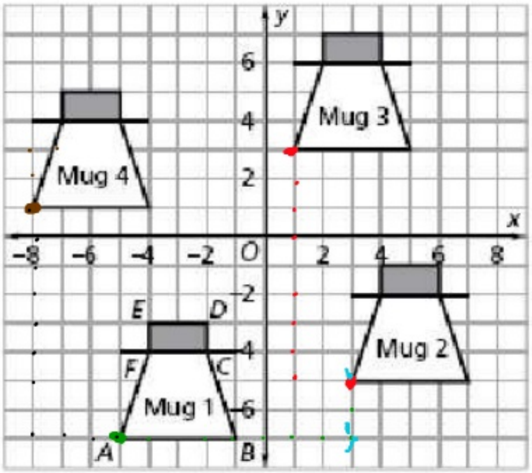
Point	*A*	*B*	*C*	*D*	*E*	*F*
Coordinates of Mug 1	(–5, –7)	(–1, –7)				
Coordinates of Mug 2	(3, –5)					
Coordinates of Mug 3						
Coordinates of Mug 4						

Name .... Date .... Class ....

Labsheet 3.2

Translation

Make a table of the coordinates of key points for Mug 1 and his images under the translations. Look for patterns



Point	A	B	C	D	E	F
Coordinates of Mug 1	(–5, –7)	(–1, –7)	(-2,-4)	(-2,-3)	(-4,-3)	(-4,-4)
Coordinates of Mug 2	(3, –5)	(7,-5)	(6,-2)	(6,-1)	(4,-1)	(4,-2)
Coordinates of Mug 3	(1,3)	(5,3)	(4,6)	(4,7)	(2,7)	(2,6)
Coordinates of Mug 4	(-8,1)	(-4,1)	(-5,4)	(-5,5)	(-7,5)	(-7,4)

Find Rules for:

M1 → M2 $(x,y) \rightarrow (x+8, y+2)$ right 8, up 2

M2 → M3 $(x,y) \rightarrow (x-2, y+8)$ left 2, up 8

M3 → M4 $(x,y) \rightarrow (x-9, y-2)$ left 9, down 2

M1 → M4 $(x,y) \rightarrow (x-3, y+8)$ left 3, up 8

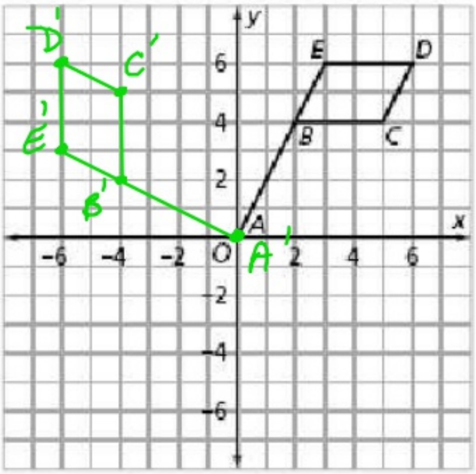
Name .... **Date** .... **Class** ....

Labsheet 3.3

Rotations of 90° and 180°

A did not move because it is the center of rotation.

A. Rotate points *A*–*E* 90° counterclockwise about the origin. Complete the table showing the coordinates of points *A*′–*E*′, which are the images of points *A*–*E*

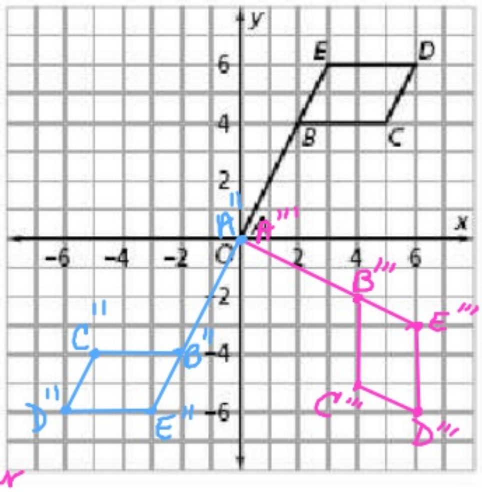


$(x,y) \rightarrow (-y, x)$

Change the sign of the y and then switch the order.

Point	*A*	*B*	*C*	*D*	*E*
Original Coordinates	(0, 0)	(2, 4)	(5,4)	(6,6)	(3,6)
Coordinates After a 90° Rotation	(0,0)	(-4,2)	(-4,5)	(-6,6)	(-6,3)

B. Rotate points *A*–*E* another 90° counterclockwise about the origin so that they rotate a total of 180°. Complete the table showing the coordinates of points *A*″–*E*″, which are the images of points *A*′–*E*′



$(x,y) \rightarrow (-x,-y)$

Change the sign of both

90° clockwise $(x,y) \rightarrow (y,-x)$

Change the sign of the x coordinate & change order

Point	*A*	*B*	*C*	*D*	*E*
Original Coordinates	(0, 0)	(2, 4)	(5,4)	(6,6)	(3,6)
Coordinates After a 180° Rotation	(0,0)	(-2,-4)	(-5,-4)	(-6,-6)	(-3,-6)
Clockwise 90° Rotation	(0,0)	(4,-2)	(4,-5)	(6,-6)	(6,-3)

$y=mx+b$

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

Name .... **Date** .... **Class** ....

Labsheet 3.4

Special Property of Translations and 180° Rotations

#1 A(-1, 5)

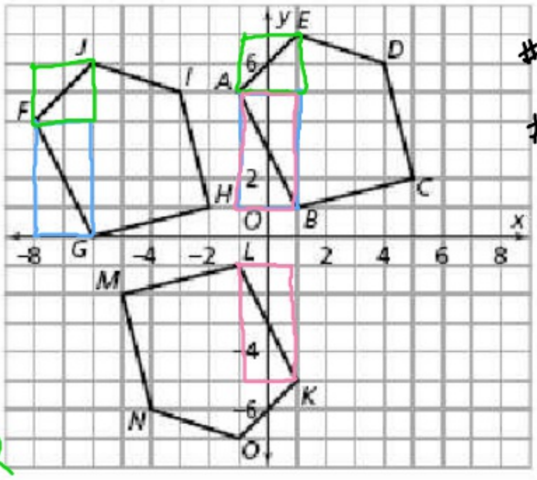
#2 B(1, 1)

$m=\frac{1-5}{1-^-1}=\frac{-4}{2}=-2$

#1 F(-8,4)

#2 G(-6,0)

$m=\frac{0-4}{-6-^-8}=\frac{-4}{2}=-2$



#1 K(1,-5)

#2 L(-1,-1)

$m=\frac{-1-^-5}{-1-1}=\frac{4}{-2}=-2$

Parallel lines have the same slope.

A. Look at $\overline{AB}$ and its image after a translation, $\overline{FG}$

1. In Investigation 1, you observed that a segment and its image after a translation appear to be congruent and parallel. Use the coordinates of the endpoints and slopes of lines to prove that your observation is correct

Since $\overline{AB}$ and $\overline{FG}$ are the diagonals of 4 x 2 rectangles, they must be congruent.

The line segments are parallel because they both have a slope of -2.

2. Are other pairs of segments in pentagons *ABCDE* and *FGHIJ* related in the same way?

Yes

Name .... **Date** .... **Class** ....

Labsheet 3.4 Special Property of Translations and 180° Rotations

B. Look at $\overline{AB}$ and its image after a half-turn, $\overline{KL}$

1. How do the two segments appear to be related?

The segments are congruent (diagonal of a 4×2 rectangle) and parallel (slope = -2).

2. Use the coordinates of the endpoints to test your conjecture

✓

3. Are other pairs of segments in pentagons *ABCDE* and *FGHIJ* related in the same way?

Yes!

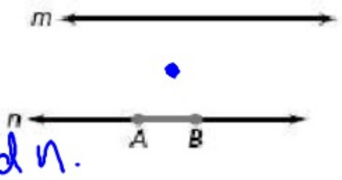
C. Complete the following sentences to describe the pattern you found:

1. A translation "moves" every line *m* to a line *n* so that they are parallel

2. A half-turn (180° rotation) "moves" every line *m* to a line *n* so that they are parallel.

D. If lines *m* and *n* are parallel, will it always be possible to find a translation or half-turn that "moves" one line onto the other? If so, what point should you choose for the center of the rotation? Explain

The center of rotation must be exactly between m and n.

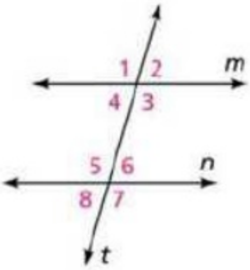


Name .... **Date** .... **Class** ....

Labsheet 3.5

180° Rotation Around Midpoints

If a transversal cuts two parallel lines, many pairs of angles formed are congruent.



A) Complete the following sentences to explain why angles 1, 3, 5, and 7 are congruent.

a. Angles 1 and 3 are congruent because

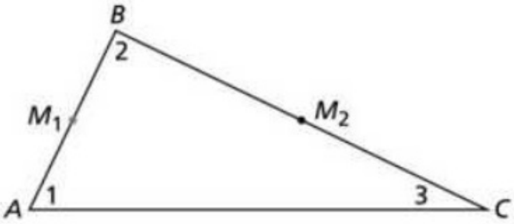
b. Angles 5 and 7 are congruent because

c. Angles 1 and 5 are congruent because

d. What transformation moves angle 5 exactly onto angle 1?

e. Angles 3 and 5 are congruent because

f. Angles 1 and 7 are congruent because



Trace the triangle above. Be sure to label the angle measurements as 1, 2, and 3. Cut it out.

Rotate the triangle 180° around point M_1. Trace it onto your paper. Label the angles. Label A', B', and C'.

Are any of the line segments parallel?

Rotate the triangle 180° around point M_2. Trace it onto your paper. Label the angles. Label A", B", and C".

Are any of the line segments parallel?

Angles 1, 2, and 3 are the interior angles of the original triangle. What must be true about the sum of these angles? Why?

Name .... **Date** .... **Class** ....

Labsheet 4.1

Dilation:

Remember the Wumps!!

A. Draw the image of quadrilateral *PQRS* after a dilation with center (0, 0) and scale factor 3. Label corresponding points *P'*, *Q'*, *R'* and *S'*.

$(x,y) \to (3x,3y)$

P(2,4)	P'(6,12)
Q(2,2)	Q'(6,6)
R(5,2)	R'(15,6)
S(4,4)	S'(12,12)

1) The corresponding side lengths of P'Q'R'S' are 3 times longer than PQRS.

2) Corresponding ∠'s are ≅.

The shapes are similar

3) Perimeter of the image is 3x bigger.

4) Area of the image is 9x bigger

5) The slopes of corresponding sides are equal.

6)

B. 1)

2)a.

b.

C. Draw the image of quadrilateral *PQRS* after a dilation with center (0, 0) and scale factor $\frac{1}{2}$.

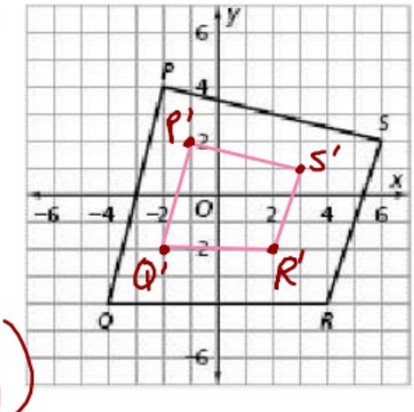
$P(-2,4) \rightarrow P'(-1,2)$

$Q(-4,-4) \rightarrow Q'(-2,-2)$

$R(4,-4) \rightarrow R'(2,-2)$

$S(6,2) \rightarrow S'(3,1)$

$(x,y) \rightarrow \left(\frac{1}{2}x, \frac{1}{2}y\right)$



1)

2)

3)

4)

5)

6)

D.

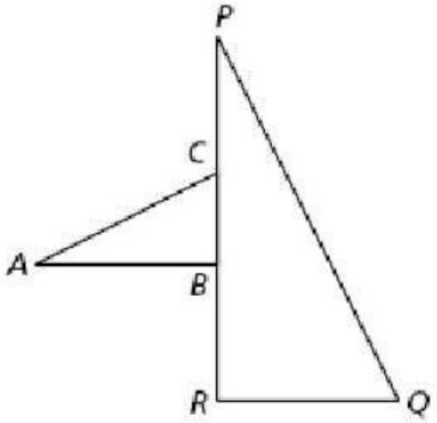
E.

Name .... Date .... Class ....

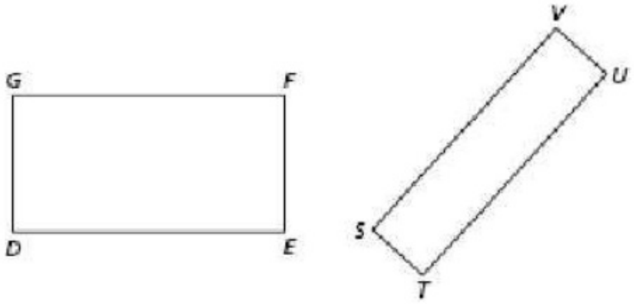
Labsheet 4.2

Similarity

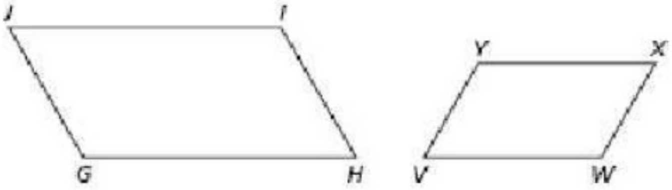
A. Are triangles *ABC* and *PQR* similar?



B. Are rectangles *DEFG* and *STUV* similar?



C. Are parallelograms *GHIJ* and *VWXY* similar?



D.

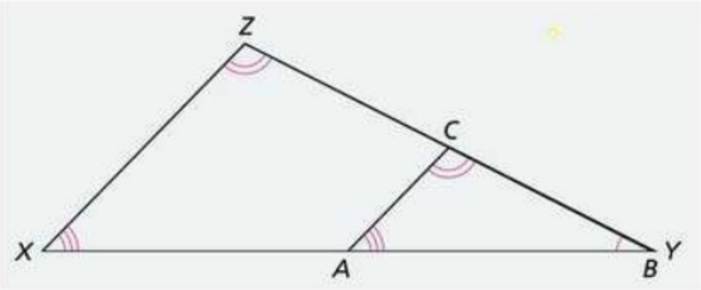
Name .... Date .... Class ....

Labsheet 4.3

Similar Triangles and Slope of a Line

A.

B.



1)

2)

3)

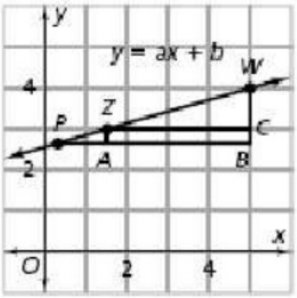
C.

D. If _____ angles in one triangle are equal in measure to ____ corresponding angles in another triangle, then

____

E. The shortcut for proving that two triangles are similar helps to verity other observations you might have made.

1. In the figure below, the equation of the line is $y = ax + b$ and points P, Z, and W are on the line. Find similar triangles and explain why they are similar.



2. How can you use the similar triangles explain why the slope of $\overline{PZ}$ equals the slope of $\overline{PW}$ (or the slope of $\overline{ZW}$)? Explain.

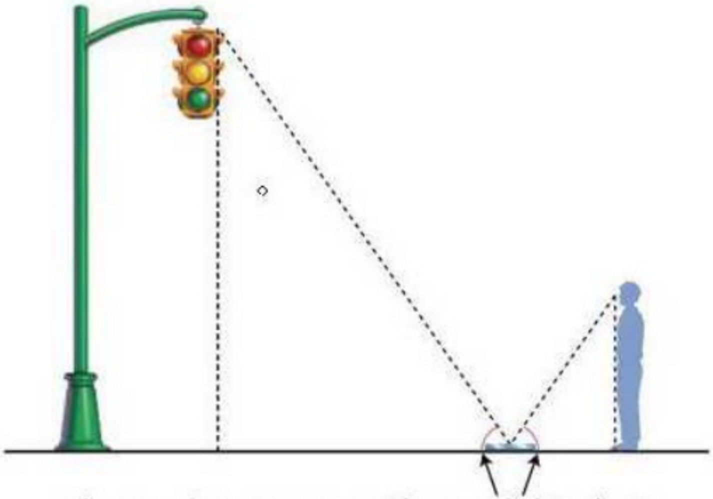
Name .... **Date** .... **Class** ....

Labsheet 4.4

Using Similar Triangles

*****Remember the Wumps from Stretching and Shrinking!!*****

A)1.



These angles are congruent because light reflects off a mirror at the same angle it hits the mirror.

Not drawn to scale

2.

3.

B) 1.

2.

C) Omit (skip)