4.4 - Congruence and Transformations

Find the coordinates of point *P* along the directed line segment *AB* so that *AP* to *PB* is the given ratio.

1. *A*(4, −3), *B*(9, −1); 2 to 3 $= \frac{2}{5}$

2. *A*(−1, −5), *B*(7, 0); 4 to 1

1. $+5\begin{pmatrix} 4,-3 \\ 9,-1 \end{pmatrix}+2$

$\frac{2 \cdot 2/5}{5 \cdot 2/5} = \frac{0.8}{2} \ \frac{\Delta Y}{\Delta X}$

$P(4+2, -3+0.8)$

$\boxed{P(6, -2.2)}$

2. $+8\begin{pmatrix} (-1,-5) \\ (7,0) \end{pmatrix}+5$

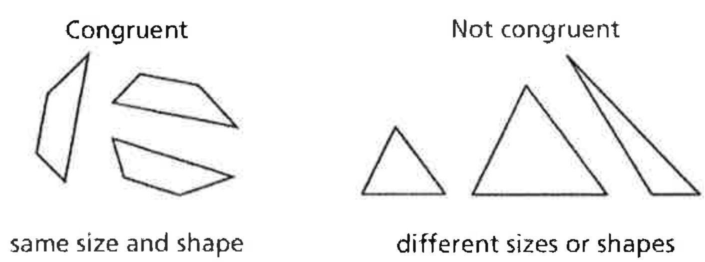
$\frac{5 \cdot 4/5}{8 \cdot 4/5} = \frac{4}{6.4} \ \frac{\Delta y}{\Delta x}$

$(-1+6.4, -5+4)$

$\boxed{P(5.4, -1)}$

Cumulative Warm Up

Congruent Figures have the same size and shape. All sides and angles are congruent.



Two geometric figures are congruent iff there is a rigid motion or composition of rigid motions that maps one of the figures onto the other.

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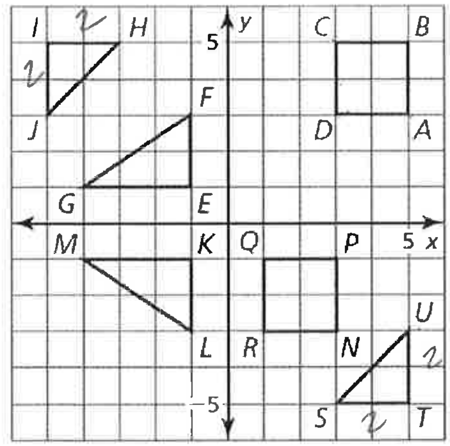
Identify any congruent figures in the coordinate plane. Explain.



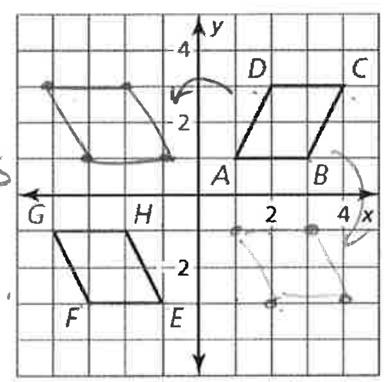
$\triangle$ JIH $\cong$ $\triangle$UTS are 180° rotation's. of each other

$\triangle$ EFG $\cong$ $\triangle$ KLM
- reflection over the x-axis

$\square$ BCDA $\cong$ PQRN
translation 6units down and 2units left

Example 1

Describe a congruence transformation that maps ▱ABCD to ▱EFGH.



reflected over the y-axis then translated down 4units.

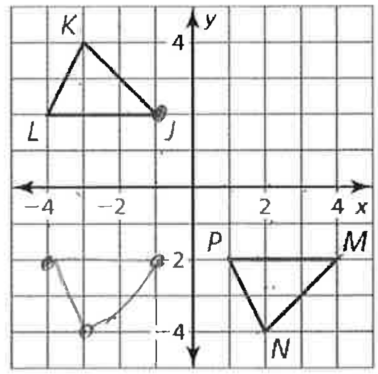
oe #2

2. Describe another congruence transformation that maps ▱*ABCD* to ▱*EFGH*.

- reflected over the x-axis then translated 5units left.

Example 2

3. Describe a congruence transformation that maps $\triangle JKL$ to $\triangle MNP$.



J (-1,2)
K (-3,4)
L (-4,2)

M (4,-2)
N (2,-4)
P (1,-2)

Step 1:
* reflect over the x-axis

translate 5 units right

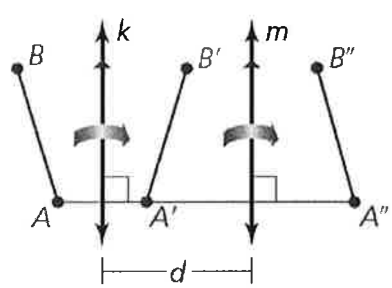
Monitoring Progress 2-3

Reflection in Parallel Lines Theorem:

The composition of two reflections over parallel lines is equivalent to a translation.

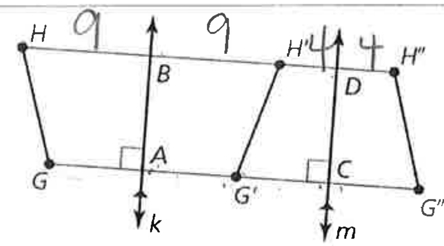
- The length of the translation is twice the distance between the two lines.

- The translation vector is perpendicular to the two parallel lines.



Theorem

In the diagram, a reflection in line k maps $\overline{GH}$ to $\overline{G'H'}$. A reflection in line m maps $\overline{G'H'}$ to $\overline{G''H''}$. Also, $HB = 9$ and $DH'' = 4$.



a. Name any segments congruent to each segment: $\overline{GH}$, $\overline{HB}$, and $\overline{GA}$.

$\overline{GH} \cong \overline{G'H'} \cong \overline{G''H''}$ $\quad \overline{HB} \cong \overline{BH'}$ $\quad \overline{GA} \cong \overline{AG'}$

b. Does $AC = BD$? Explain.

yes, BDCA is a rectangle & opposite sides of a rectangle are equal.

c. What is the length of $\overline{GG'}$?

$GG'' = HH'' = 2BD$

$26 = 2x$

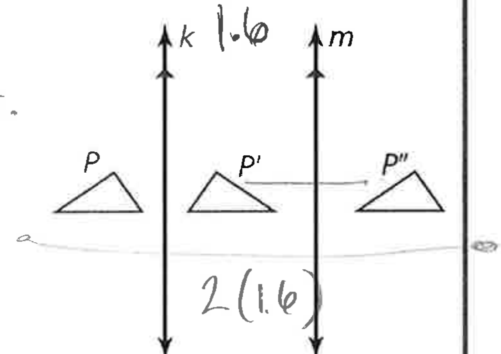
$13 = x$ $\quad BD = x$ $\quad BD = 13$

Example 3

Use the figure. The distance between line *k* and line *m* is 1.6 centimeters.

4. The preimage is reflected in line k, then in line m. Describe a single transformation that maps the blue figure to the green figure.

translation 3.2cm to the right.



5. What is the relationship between $\overline{PP'}$ and line k? Explain.

$\overline{PP'} \perp$ line k by Reflections in parallel lines.

6. What is the distance between P and P''?

3.2 cm.

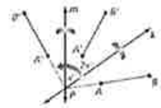
Monitoring Progress 4

<u>Reflections in Intersecting Lines Theorem:</u>

Reflecting in two intersecting lines is the same as a rotation.

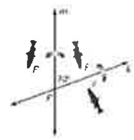
- The center of rotation is where the two lines intersect

- The angle of rotation is twice the angle formed by the intersecting lines.



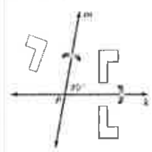
$m\angle BPB'' = 2x^\circ$

In the diagram, the figure is reflected in line k. The image is then reflected in line m. Describe a single transformation that maps F to F''.



→ a rotation of 116° about Point P.

In the diagram, the preimage is reflected in line k, then in line m. Describe a single transformation that maps the blue figure onto the green figure.



→ 7.) 160° rotation about Point P.

8. A rotation of 76° maps C to C'. To map C to C' using two reflections, what is the measure of the angle formed by the intersecting lines of reflection?

→ 8.) 38°

Theorem

Homework

HW: pg. 204 #4-16,19-22, 25-28

Closure