Name ____ Date____________________

Lesson 1: Construct an Equilateral Triangle

Exit Ticket

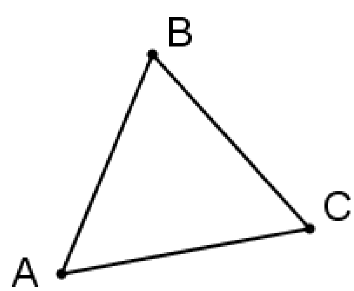
We saw two different scenarios where we used the construction of an equilateral triangle to help determine a needed location (i.e., the friends playing catch in the park and the sitting cats). Can you think of another scenario where the construction of an equilateral triangle might be useful? Articulate how you would find the needed location using an equilateral triangle.

Name ____ Date____________________

Lesson 2: Construct an Equilateral Triangle

Exit Ticket

$\triangle ABC$ is shown below. Is it an equilateral triangle? Justify your response.

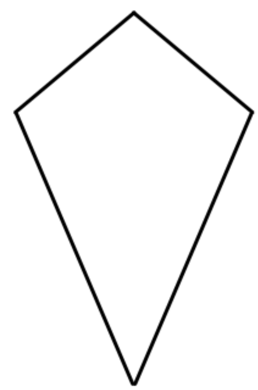


Name ____ Date____________________

Lesson 3: Copy and Bisect an Angle

Exit Ticket

Later that day, Jimmy and Joey were working together to build a kite with sticks, newspapers, tape, and string. After they fastened the sticks together in the overall shape of the kite, Jimmy looked at the position of the sticks and said that each of the four corners of the kite is bisected; Joey said that they would only be able to bisect the top and bottom angles of the kite. Who is correct? Explain.



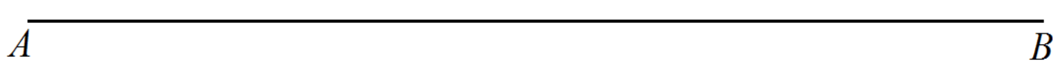
Draw circle B: center B, any radius.
Label the intersections of circle B with the sides of the angle as A and C.
Label the vertex of the original angle as B.
Draw $\overrightarrow{ED}$.
Draw $\overrightarrow{EG}$ as one side of the angle to be drawn.
Draw circle F: center F, radius FA.
Draw circle E: center E, radius EA.
Label intersection of circle E with $\overrightarrow{EG}$ as F.
Label either intersection of circle E and circle F as D.

Name ____ Date____________________

Lesson 4: Construct a Perpendicular Bisector

Exit Ticket

Divide the following segment AB into four segments of equal length.

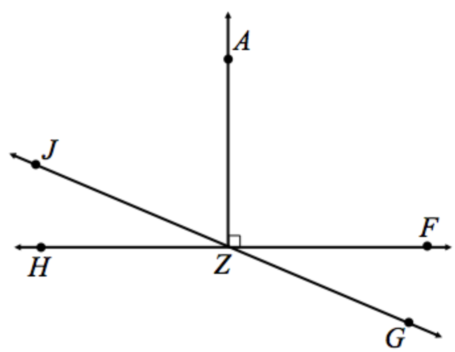


Name ____ Date____________________

Lesson 6: Solve for Unknown Angles—Angles and Lines at a Point

Exit Ticket

Use the following diagram to answer the questions below:



1.
   a. Name an angle supplementary to $\angle HZJ$ and provide the reason for your calculation.

   b. Name an angle complementary to $\angle HZJ$ and provide the reason for your calculation.

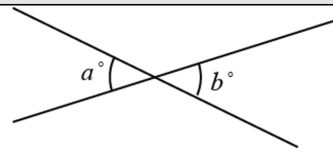
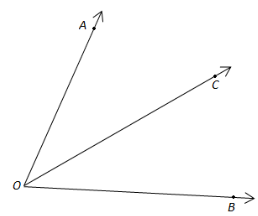
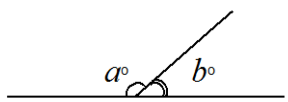
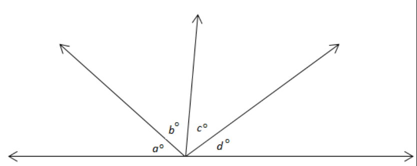
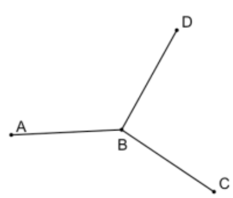
2. If $m\angle HZJ = 38°$, what is the measure of each of the following angles? Provide reasons for your calculations.

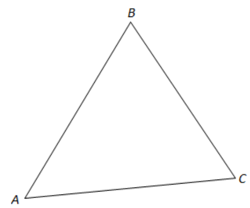
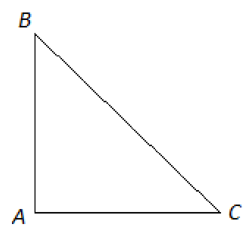
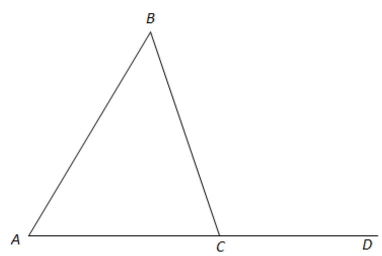
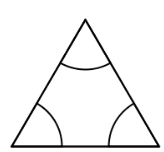
   a. $\angle FZG$

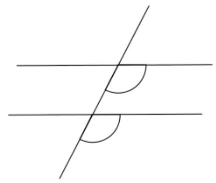
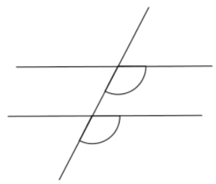
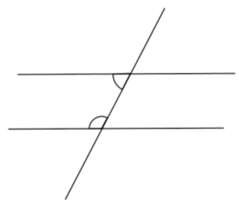
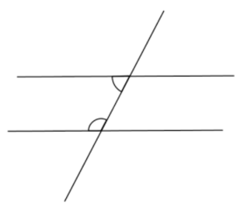
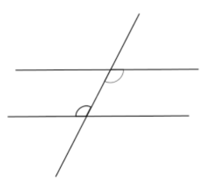
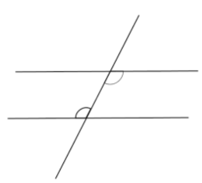
   b. $\angle HZG$

   c. $\angle AZJ$

Key Facts and Discoveries from Earlier Grades

Facts (With Abbreviations Used in Grades 4–9)	Diagram/Example	How to State as a Reason in an Exercise or Proof
Vertical angles are equal in measure. (vert. $\angle$s)	 $a = b$	"Vertical angles are equal in measure"
If C is a point in the interior of $\angle AOB$, then $\mathrm{m}\angle AOC + \mathrm{m}\angle COB = \mathrm{m}\angle AOB$. ($\angle$s add)	 $\mathrm{m}\angle AOB = \mathrm{m}\angle AOC + \mathrm{m}\angle COB$	"Angle addition postulate"
Two angles that form a linear pair are supplementary. ($\angle$s on a line)	 $a + b = 180$	"Linear pairs form supplementary angles"
Given a sequence of n consecutive adjacent angles whose interiors are all disjoint such that the angle formed by the first $n - 1$ angles and the last angle are a linear pair, then the sum of all of the angle measures is $180°$. ($\angle s$ on a line)	 $a + b + c + d = 180$	"Consecutive adjacent angles on a line sum to $180°$"
The sum of the measures of all angles formed by three or more rays with the same vertex and whose interiors do not overlap is $360°$. ($\angle$s at a point)	 $\mathrm{m}\angle ABC + \mathrm{m}\angle CBD + \mathrm{m}\angle DBA = 360^\circ$	"Angles at a point sum to $360°$"

Facts (With Abbreviations Used in Grades 4–9)	Diagram/Example	How to State as a Reason in an Exercise or Proof
The sum of the 3 angle measures of any triangle is $180°$. ($\angle$ sum of Δ)	 $m\angle A + m\angle B + m\angle C = 180°$	"Sum of the angle measures in a triangle is $180°$"
When one angle of a triangle is a right angle, the sum of the measures of the other two angles is $90°$. ($\angle$ sum of rt. Δ)	 $m\angle A = 90°$; $m\angle B + m\angle C = 90°$	"Acute angles in a right triangle sum to $90°$"
The sum of the measures of two angles of a triangle equals the measure of the opposite exterior angle. (ext. $\angle$ of Δ)	 $m\angle BAC + m\angle ABC = m\angle BCD$	"Exterior angle of a triangle equals the sum of the two interior opposite angles"
Base angles of an isosceles triangle are equal in measure. (base $\angle$s of isos. Δ)		"Base angles of an isosceles triangle are equal in measure"
All angles in an equilateral triangle have equal measure. (equilat. Δ)		"All angles in an equilateral triangle have equal measure"

Facts (With Abbreviations Used in Grades 4–9)	**Diagram/Example**	**How to State as a Reason in an Exercise or Proof**
If two parallel lines are intersected by a transversal, then corrsponding angles are equal in measure. (corr. $\angle$s, $\overline{AB} \parallel \overline{CD}$)		"If parallel lines are cut by a transversal, then corresponding angles are equal in measure"
If two lines are intersected by a transversal such that a pair of corresponding angles are equal in meaure, then the lines are parallel. (corr. $\angle$s converse)		"If two lines are cut by a transversal such that a pair of corresponding angles are equal in meaure, then the lines are parallel"
If two parallel lines are intersected by a transversal, then interior angles on the same side of the transversal are supplementary. (int. $\angle$s, $\overline{AB} \parallel \overline{CD}$)		"If parallel lines are cut by a transversal, then interior angles on the same side are supplementary"
If two lines are intersected by a transversal such that a pair of interior angles on the same side of the transversal are supplementary, then the lines are parallel. (int. $\angle$s converse)		"If two lines are cut by a transversal such that a pair of interior angles on the same side are supplementary, then the lines are parallel"
If two parallel lines are intersected by a transversal, then alternate interior angles are equal in measure. (alt. $\angle$s, $\overline{AB} \parallel \overline{CD}$)		"If parallel lines are cut by a transversal, then alternate interior angles are equal in measure"
If two lines are intersected by a transversal such that a pair of alternate interior angles are equal in meaure, then the lines are parallel. (alt. $\angle$s converse)		"If two lines are cut by a transversal such that a pair of alternate interior angles are equal in meaure, then the lines are parallel"

Name ____ Date____________________

Lesson 7: Solving for Unknown Angles—Transversals

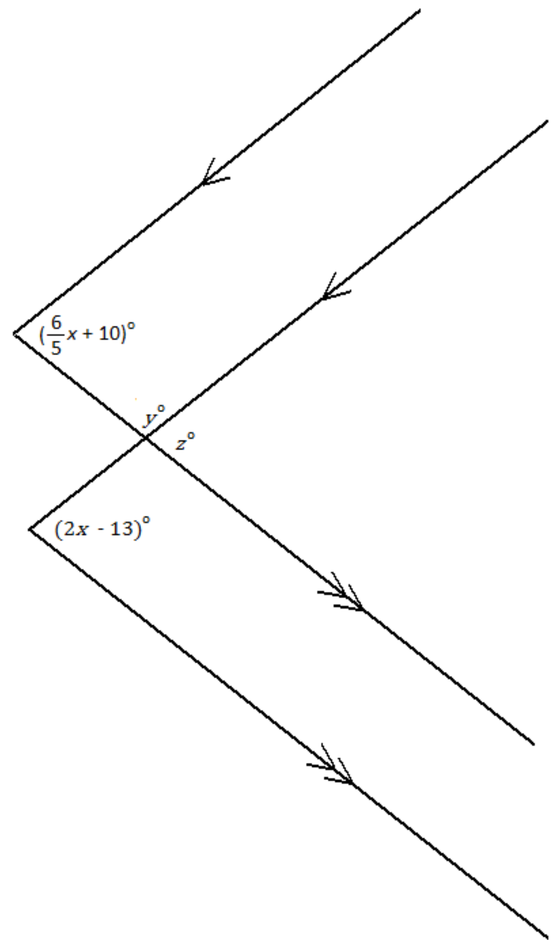
Exit Ticket

Determine the value of each variable.

$x =$ __________

$y =$ __________

$z =$ __________

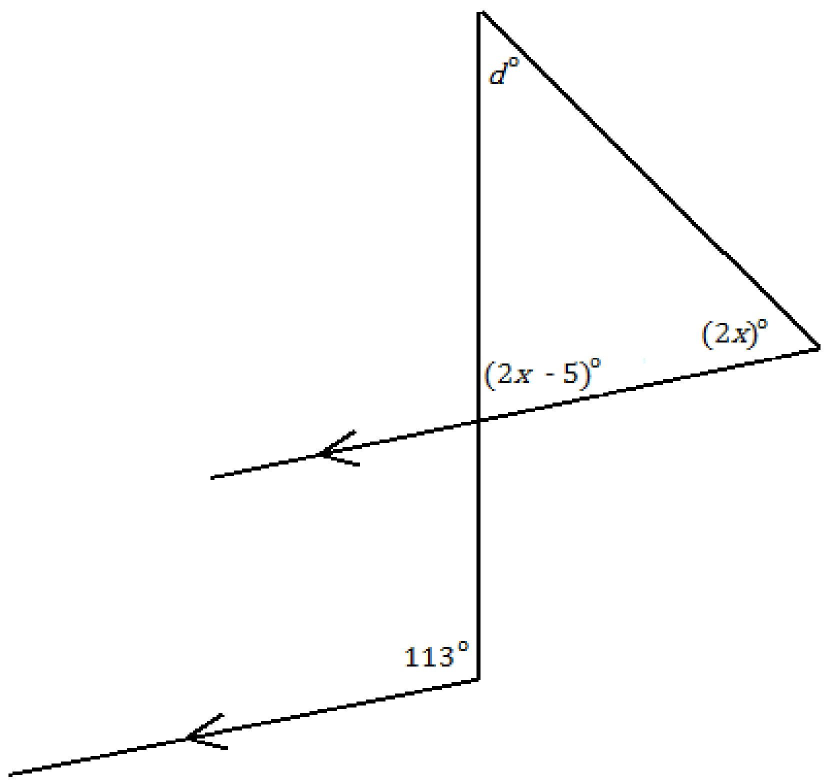


Name ____ Date____________________

Lesson 8: Solve for Unknown Angles—Angles in a Triangle

Exit Ticket

Find the value of d and x.



$d =$ ________

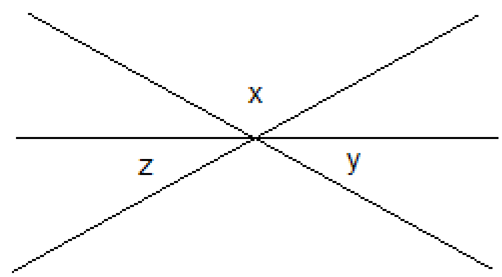
$x =$ ________

Name ____ Date ____________________

Lesson 9: Unknown Angle Proofs—Writing Proofs

Exit Ticket

In the diagram to the right, prove that the sum of the labeled angles is $180°$.



Basic Properties Reference Chart

Property	Meaning	Geometry Example
Reflexive Property	A quantity is equal to itself.	$AB = AB$
Transitive Property	If two quantities are equal to the same quantity, then they are equal to each other.	If $AB = BC$ and $BC = EF$, then $AB = EF$.
Symmetric Property	If a quantity is equal to a second quantity, then the second quantity is equal to the first.	If $OA = AB$, then $AB = OA$.
Addition Property of Equality	If equal quantities are added to equal quantities, then the sums are equal.	If $AB = DF$ and $BC = CD$, then $AB + BC = DF + CD$.
Subtraction Property of Equality	If equal quantities are subtracted from equal quantities, the differences are equal.	If $AB + BC = CD + DE$ and $BC = DE$, then $AB = CD$.
Multiplication Property of Equality	If equal quantities are multiplied by equal quantities, then the products are equal.	If $\mathrm{m}\angle ABC = \mathrm{m}\angle XYZ$, then $2(\mathrm{m}\angle ABC) = 2(\mathrm{m}\angle XYZ)$.
Division Property of Equality	If equal quantities are divided by equal quantities, then the quotients are equal.	If $AB = XY$, then $\frac{AB}{2} = \frac{XY}{2}$.
Substitution Property of Equality	A quantity may be substituted for its equal.	If $DE + CD = CE$ and $CD = AB$, then $DE + AB = CE$.
Partition Property (includes "Angle Addition Postulate," "Segments add," "Betweenness of Points," etc.)	A whole is equal to the sum of its parts.	If point C is on $\overline{AB}$, then $AC + CB = AB$.

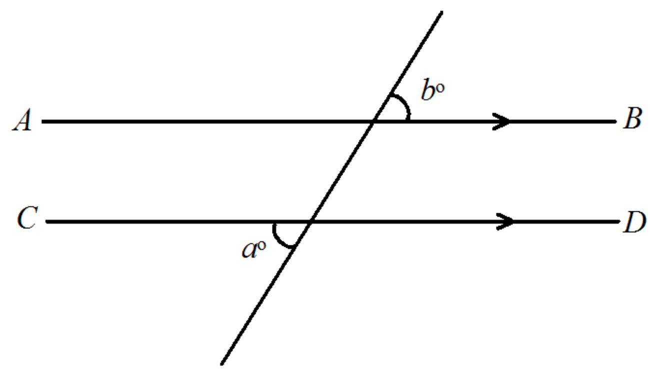
Name ____ Date____________________

Lesson 10: Unknown Angle Proofs—Proofs with Constructions

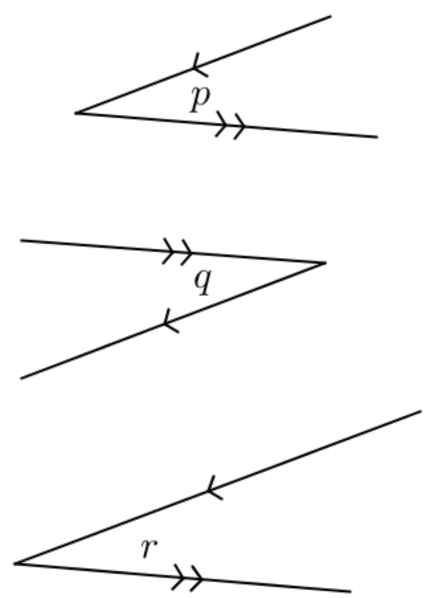
Exit Ticket

Write a proof for each question.

1. In the figure at the right, $\overline{AB} \parallel \overline{CD}$. Prove that $a = b$.



2. Prove $\mathrm{m}\angle p = \mathrm{m}\angle r$.

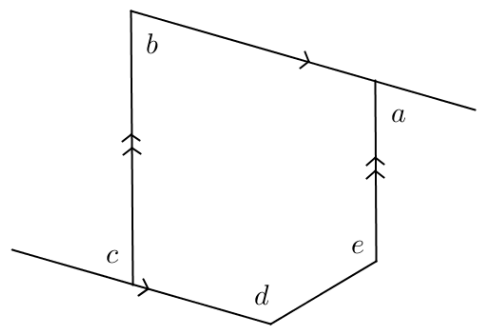


Name ____ Date____________________

Lesson 11: Unknown Angle Proofs—Proofs of Known Facts

Exit Ticket

In the diagram at the right, prove that $m\angle d + m\angle e - m\angle a = 180^\circ$.

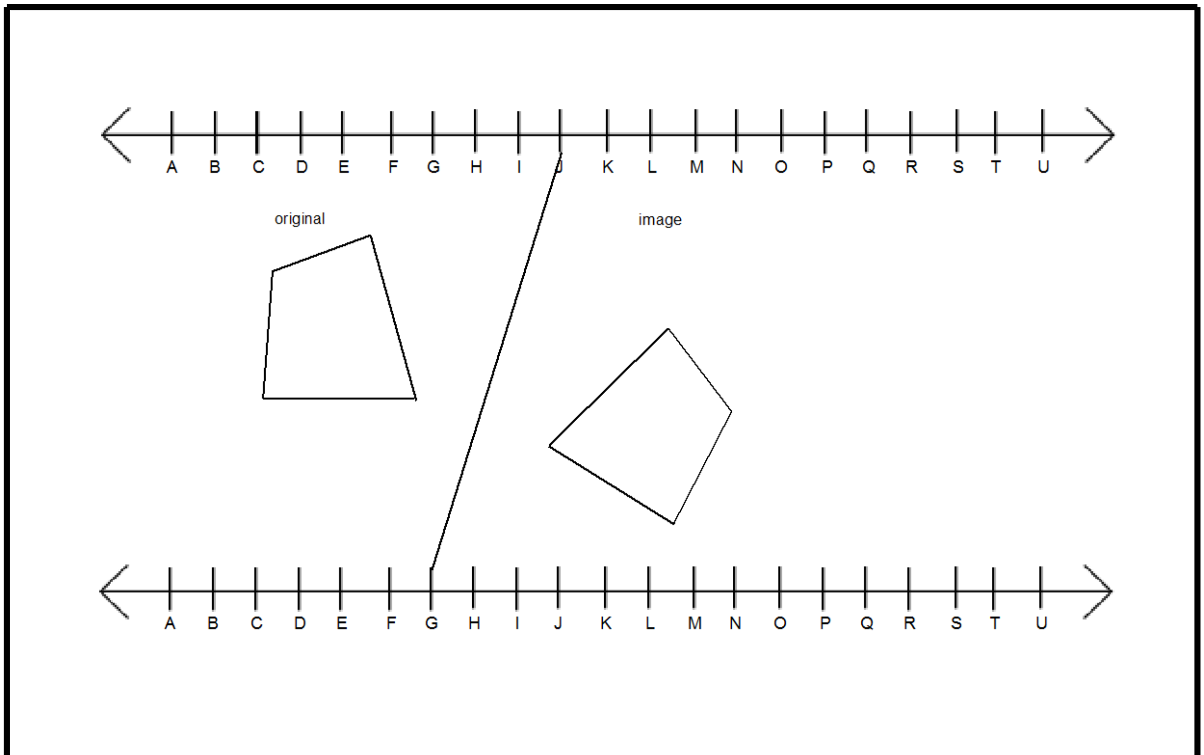


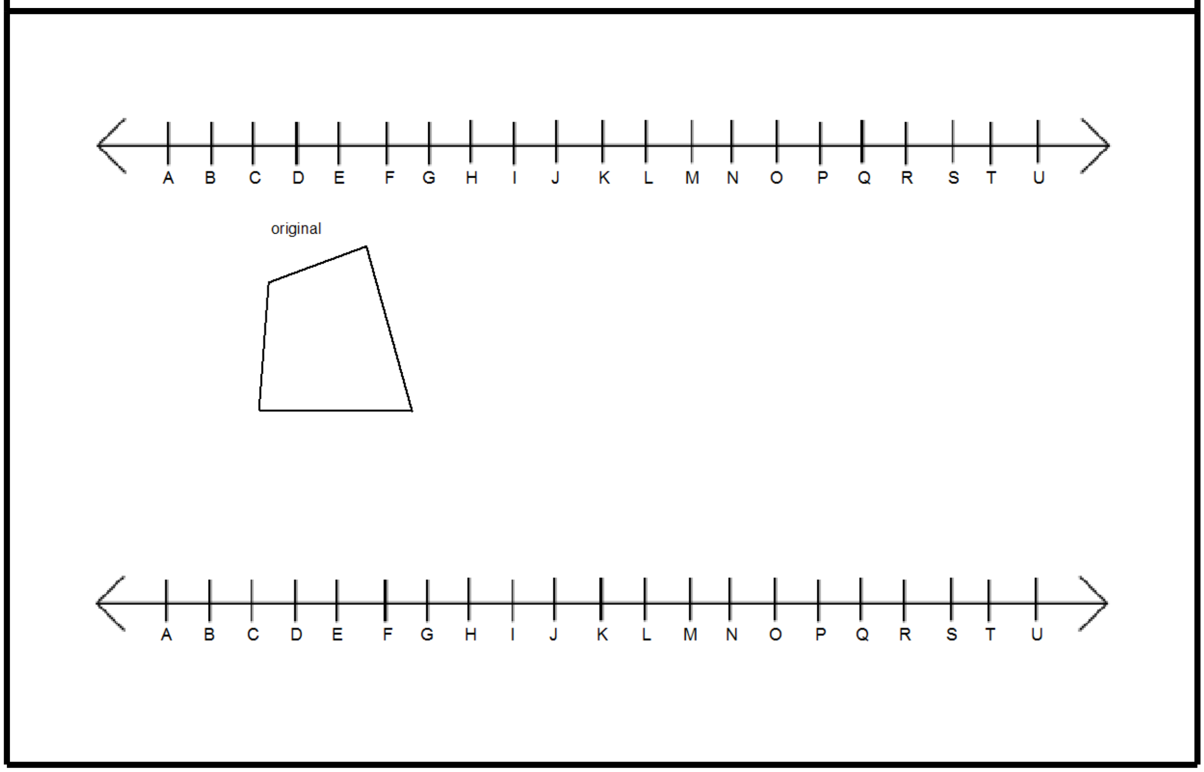
Name ____ Date____________________

Lesson 12: Transformations—The Next Level

Exit Ticket

How are transformations and functions related? Provide a specific example to support your reasoning.


A B C D E F G H I J K L M N O P Q R S T U
original
image
A B C D E F G H I J K L M N O P Q R S T U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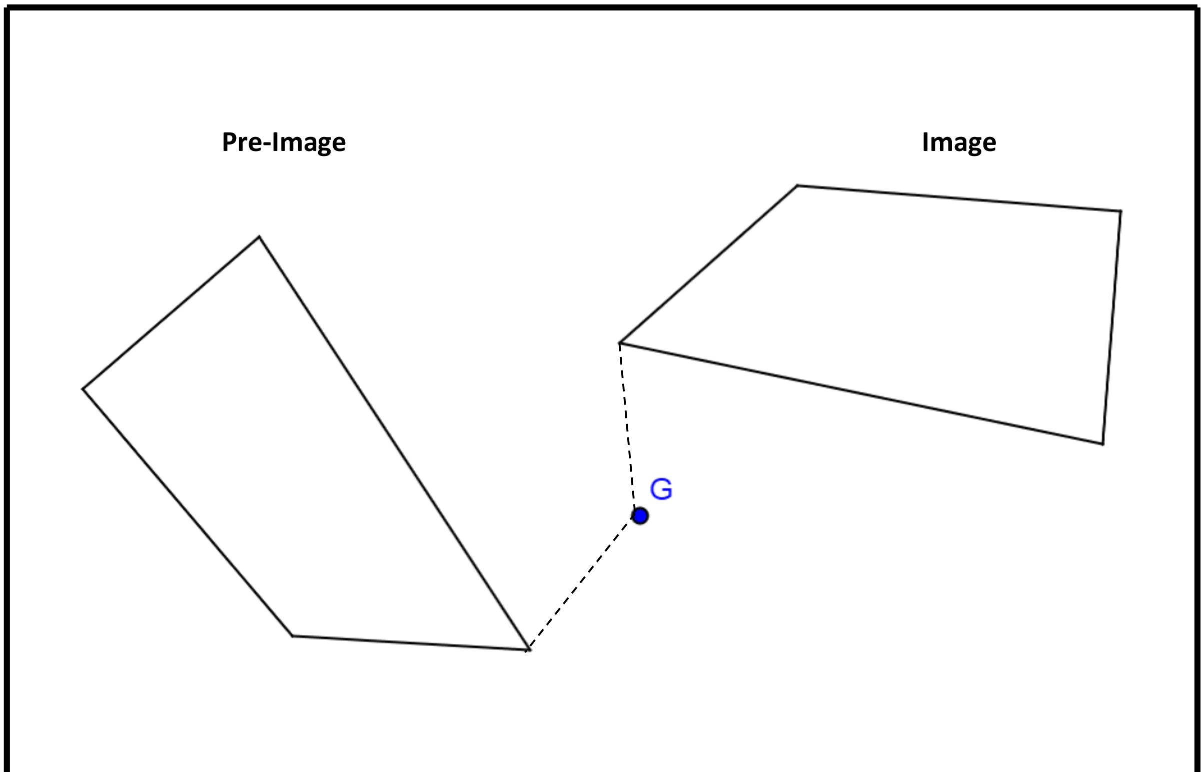
A B C D E F G H I J K L M N O P Q R S T U


Pre-Image
Image
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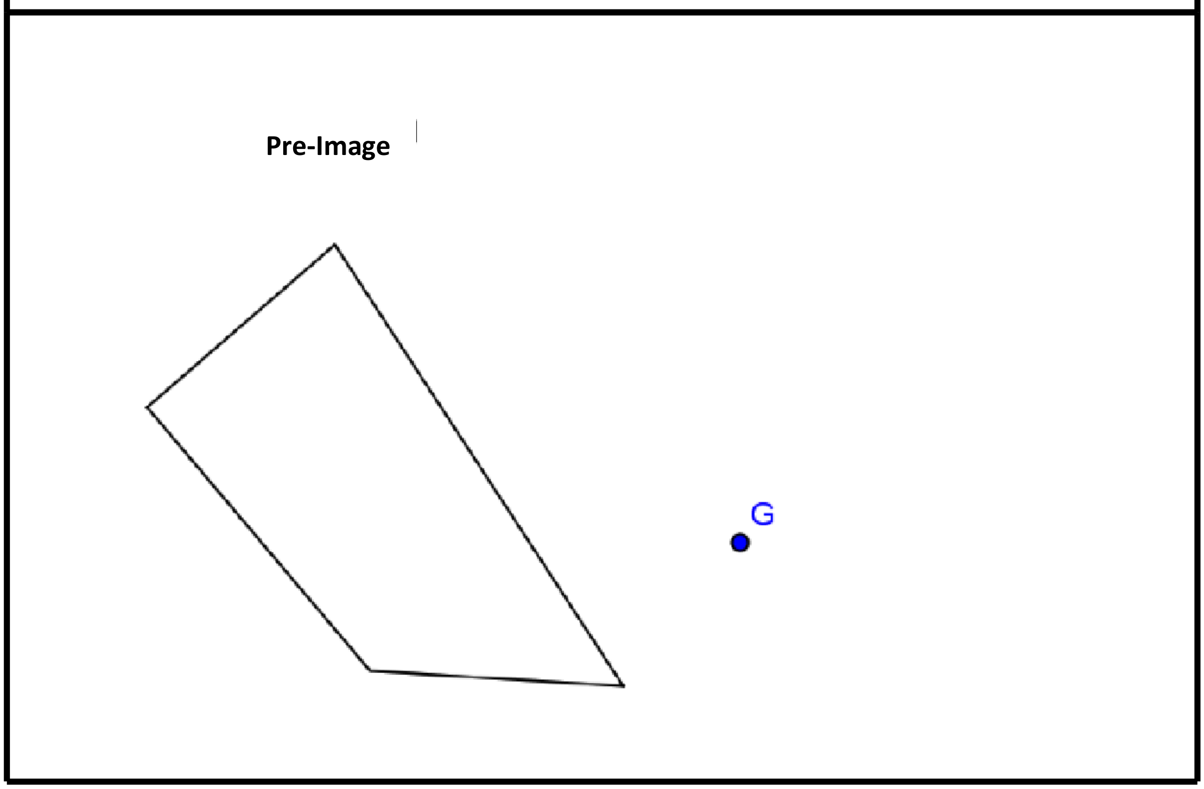
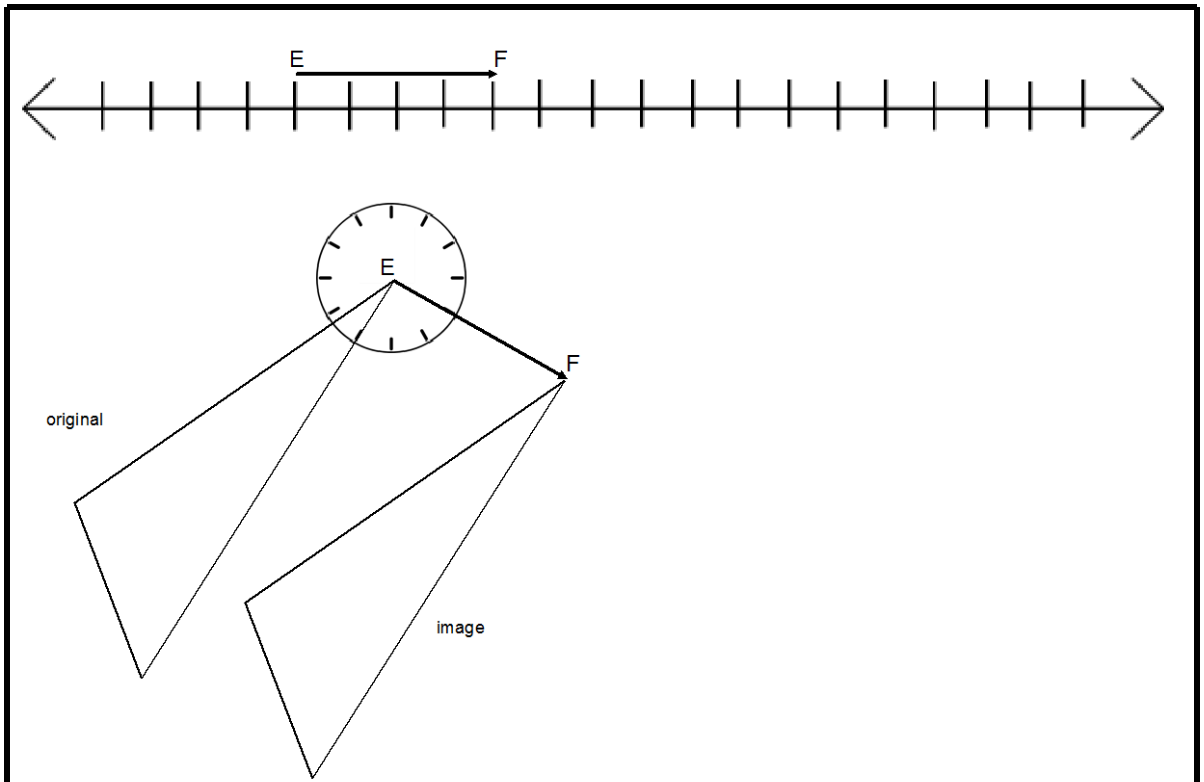

Pre-Image
G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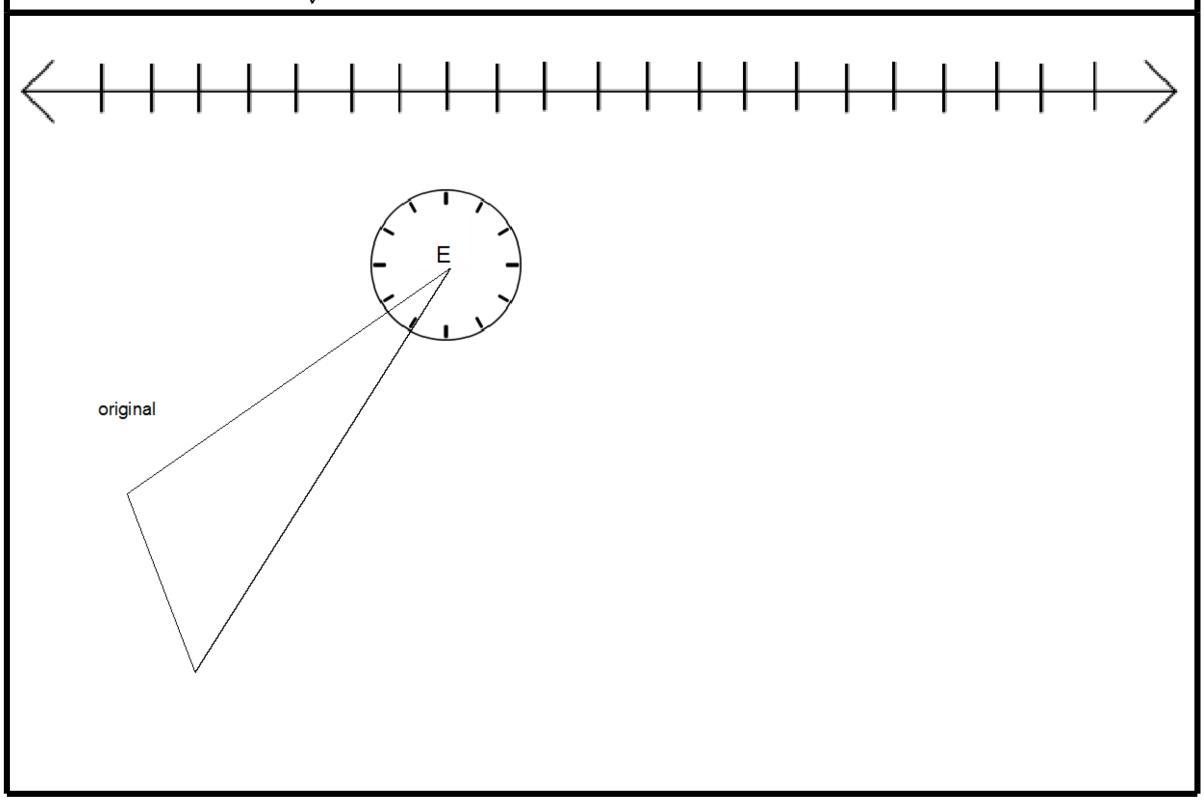
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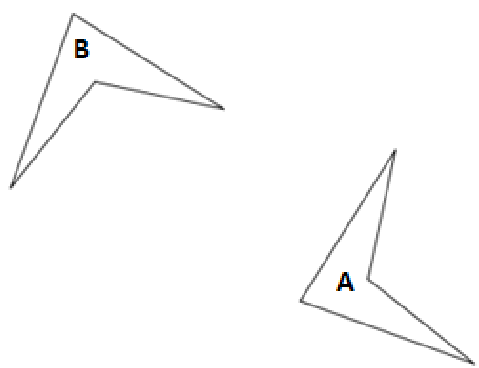
Name ____ Date____________________

Lesson 13: Rotations

Exit Ticket

Find the center of rotation and the angle of rotation for the transformation below that carries A onto B.

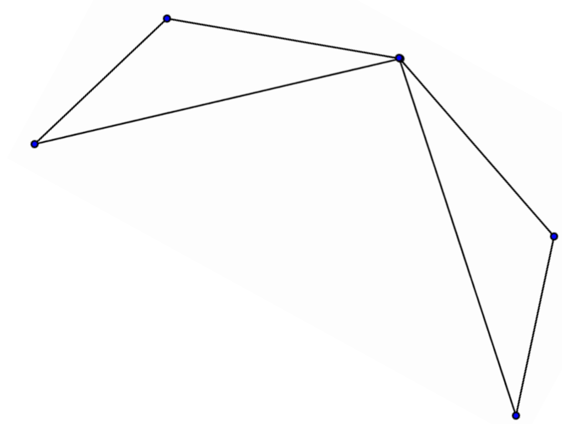


Name ____ Date____________________

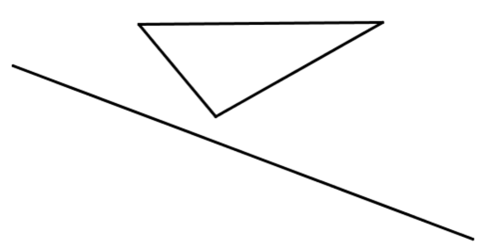
Lesson 14: Reflections

Exit Ticket

1. Construct the line of reflection for the figures.



2. Reflect the given figure across the line of reflection provided.



Name ____ Date____________________

Lesson 15: Rotations, Reflections, and Symmetry

Exit Ticket

What is the relationship between a rotation and reflection? Sketch a diagram that supports your explanation.

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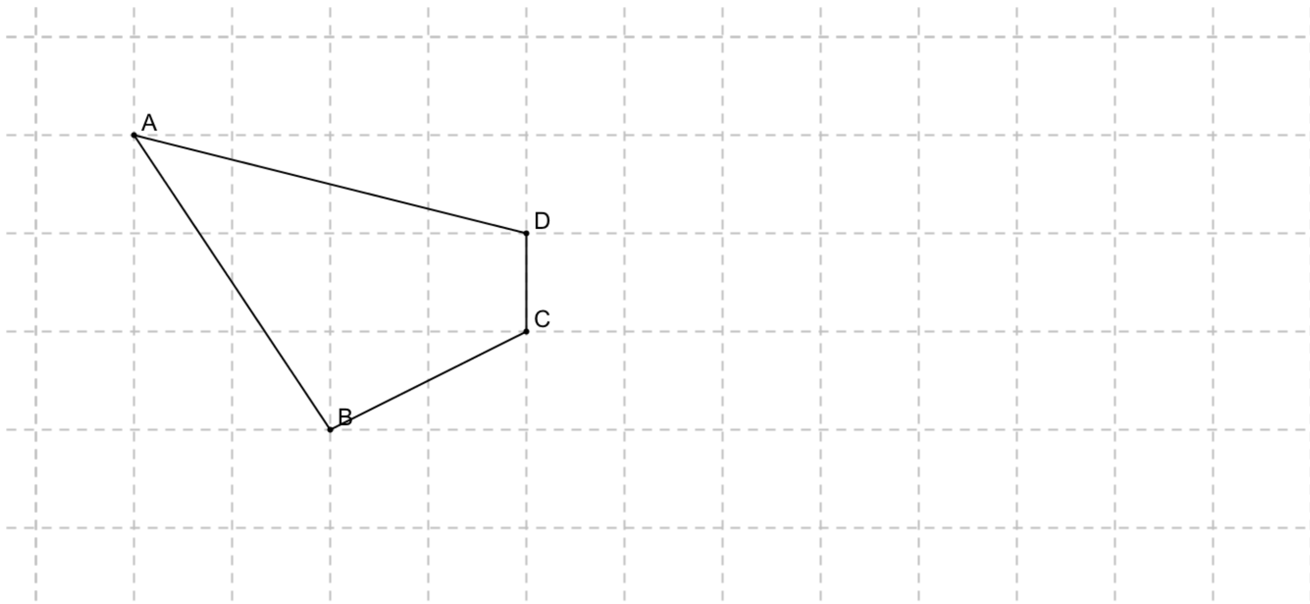
Lesson 16: Translations

Exit Ticket

Translate the image one unit down and three units right. Draw the vector that defines the translation.



Name ____ Date____________________

Lesson 17: Characterize Points on a Perpendicular Bisector

Exit Ticket

Using your understanding of rigid motions, explain why *any* point on the perpendicular bisector is equidistant from *any* pair of pre-image and image points. Use your construction tools to create a figure that supports your explanation.

Name ____ Date____________________

Lesson 18: Looking More Carefully at Parallel Lines

Exit Ticket

1. Construct a line through the point P below that is parallel to the line l by rotating l by $180°$ (using the steps outlined in Example 2).

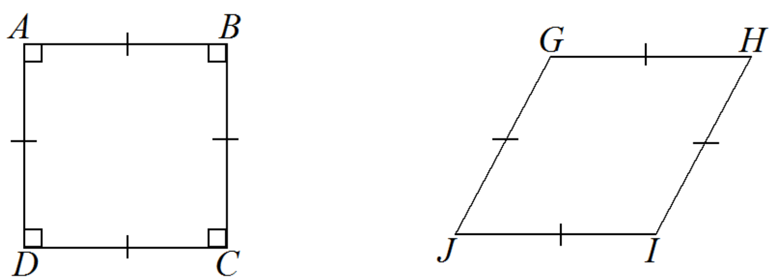
2. Why is the parallel line you constructed the only line that contains P and is parallel to l?

Name ____ Date____________________

Lesson 19: Construct and Apply a Sequence of Rigid Motions

Exit Ticket

Assume that the following figures are drawn to scale. Use your understanding of congruence to explain why square $ABCD$ and rhombus $GHIJ$ are not congruent.



Name ____ Date____________________

Lesson 20: Applications of Congruence in Terms of Rigid Motions

Exit Ticket

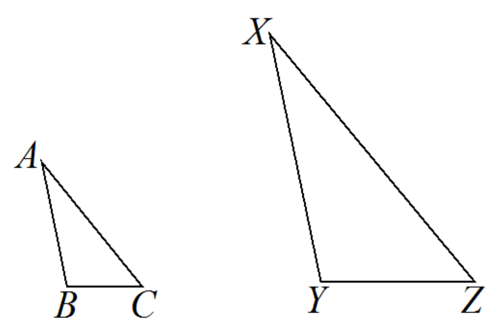
1. What is a correspondence? Why does a congruence naturally yield a correspondence?

2. Each side of $\triangle XYZ$ is twice the length of each side of $\triangle ABC$. Fill in the blanks below so that each relationship between lengths of sides is true.

$\_\_\_\_\_\_\_\_\_\_ \times \mathbf{2} = \_\_\_\_\_\_\_\_\_\_$

$\_\_\_\_\_\_\_\_\_\_ \times \mathbf{2} = \_\_\_\_\_\_\_\_\_\_$

$\_\_\_\_\_\_\_\_\_\_ \times \mathbf{2} = \_\_\_\_\_\_\_\_\_\_$

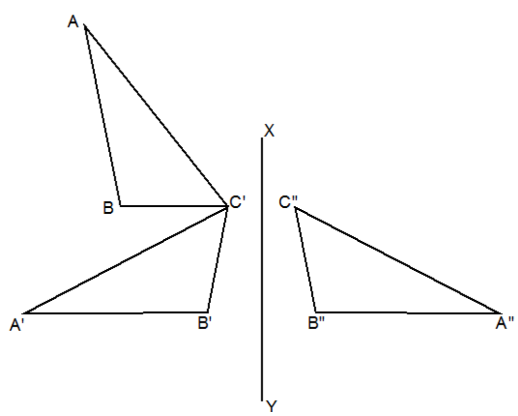


Name ____ Date____________________

Lesson 21: Correspondence and Transformations

Exit Ticket

Complete the table based on the series of rigid motions performed on $\triangle ABC$ below.



Sequence of rigid motions (2)	
Composition in function notation	
Sequence of corresponding sides	
Sequence of corresponding angles	
Triangle congruence statement	

Name ____ Date ____________________

1. State precise definitions of angle, circle, perpendicular, parallel, and line segment based on the undefined notions of point, line, distance along a line, and distance around a circular arc.

   Angle:

   Circle:

   Perpendicular:

   Parallel:

   Line segment:

2. A rigid motion, J, of the plane takes a point, A, as input and gives C as output, i.e., $J(A) = C$. Similarly, $J(B) = D$ for input point B and output point D.

   Jerry claims that knowing nothing else about J, we can be sure that $\overline{AC} \cong \overline{BD}$ because rigid motions preserve distance.

   a. Show that Jerry's claim is incorrect by giving a counterexample (hint: a counterexample would be a specific rigid motion and four points A, B, C, and D in the plane such that the motion takes A to C and B to D, yet $\overline{AC} \ncong \overline{BD}$).

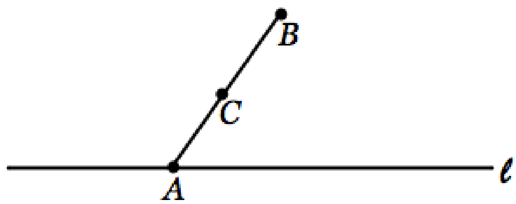
   b. There is a type of rigid motion for which Jerry's claim is always true. Which type below is it?

   Rotation Reflection Translation

   c. Suppose Jerry claimed that $\overline{AB} \cong \overline{CD}$. Would this be true for any rigid motion that satisfies the conditions described in the first paragraph? Why or why not?

3.

a. In the diagram below, l is a line, A is a point on the line, and B is a point not on the line. C is the midpoint of segment $\overline{AB}$. Show how to create a line parallel to l that passes through B by using a rotation about C.



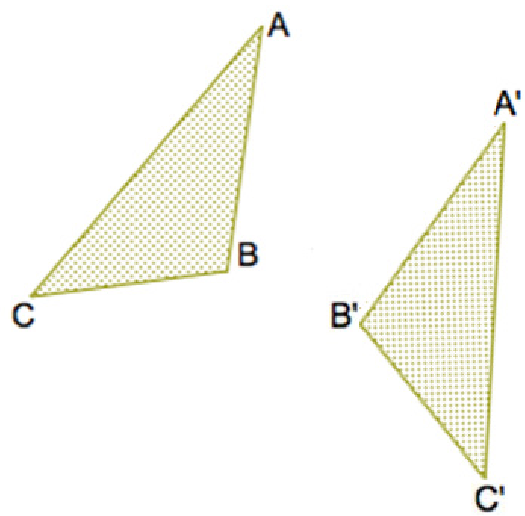
b. Suppose that four lines in a given plane, l_1, l_2, m_1, and m_2 are given, with the conditions (also given) that $l_1 \parallel l_2$, $m_1 \parallel m_2$, and l_1 is neither parallel nor perpendicular to m_1.

i. Sketch (freehand) a diagram of l_1, l_2, m_1, and m_2 to illustrate the given conditions.

ii. In any diagram that illustrates the given conditions, how many distinct angles are formed? Count only angles that measure less than $180°$**,** and count two angles as the same only if they have the same vertex and the same edges. Among these angles, how many different angle measures are formed? Justify your answer.

4. In the figure below, there is a reflection that transforms $\triangle ABC$ to triangle $\triangle A'B'C'$.

Use a straightedge and compass to construct the line of reflection and list the steps of the construction.



5. Precisely define each of the three rigid motion transformations identified.

   a. $T_{\overrightarrow{AB}}(P)$ ____

   ____

   ____

   ____

   ____

   b. $r_l(P)$ ____

   ____

   ____

   ____

   ____

   c. $R_{C,30^\circ}(P)$ ____

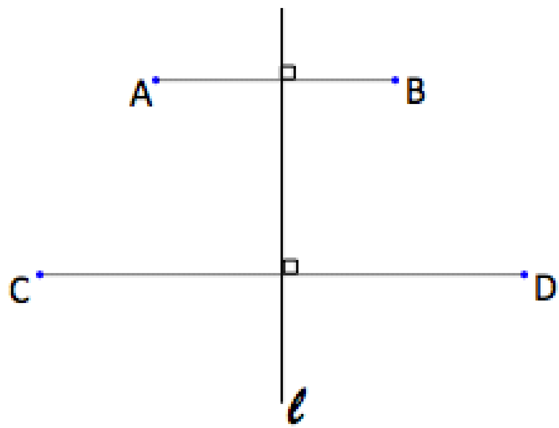
   ____

   ____

   ____

   ____

6. Given in the figure below, line l is the perpendicular bisector of $\overline{AB}$ and of $\overline{CD}$.



a. Show $\overline{AC} \cong \overline{BD}$ using rigid motions.

b. Show $\angle ACD \cong \angle BDC$.

c. Show $\overline{AB} \parallel \overline{CD}$.

Name ____ Date____________________

Lesson 22: Congruence Criteria for Triangles—SAS

Exit Ticket

If two triangles satisfy the SAS criteria, describe the rigid motion(s) that would map one onto the other in the following cases.

1. The two triangles shared a single common vertex?

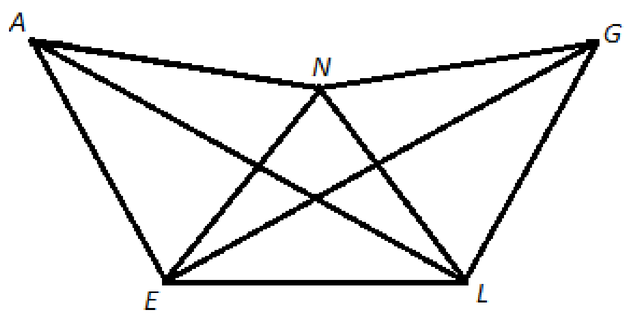
2. The two triangles were distinct from each other?

3. The two triangles shared a common side?

Name ____ Date____________________

Lesson 23: Base Angles of Isosceles Triangles

Exit Ticket



For each of the following, if the given congruence exists, name the isosceles triangle and name the pair of congruent angles for the triangle based on the image above.

1. $\overline{AE} \cong \overline{EL}$

2. $\overline{LE} \cong \overline{LG}$

3. $\overline{AN} \cong \overline{LN}$

4. $\overline{EN} \cong \overline{NG}$

5. $\overline{NG} \cong \overline{GL}$

6. $\overline{AE} \cong \overline{EN}$

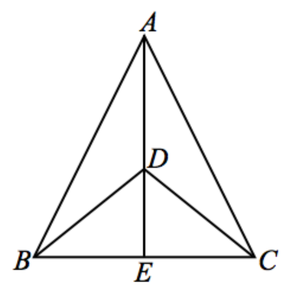
Name ____ Date____________________

Lesson 24: Congruence Criteria for Triangles—ASA and SSS

Exit Ticket

Based on the information provided, determine whether a congruence exists between triangles. If a congruence exists between triangles or if multiple congruencies exist, state the congruencies and the criteria used to determine them.

Given: $BD = CD$, E is the midpoint of $\overline{BC}$.



Name ____ Date____________________

Lesson 25: Congruence Criteria for Triangles—AAS and HL

Exit Ticket

1. Sketch an example of two triangles that meet the AAA criteria but are not congruent.

2. Sketch an example of two triangles that meet the SSA criteria that are not congruent.

Name ____ Date____________________

Lesson 26: Triangle Congruency Proofs

Exit Ticket

Identify the two triangle congruence criteria that do NOT guarantee congruence. Explain why they do not guarantee congruence and provide illustrations that support your reasoning.

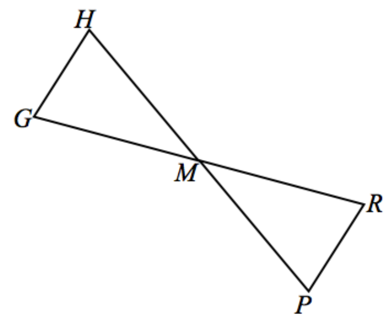
Name ____ Date____________________

Lesson 27: Triangle Congruency Proofs

Exit Ticket

Given: M is the midpoint of GR, $\angle G \cong \angle R$.

Prove: $\triangle GHM \cong \triangle RPM$.



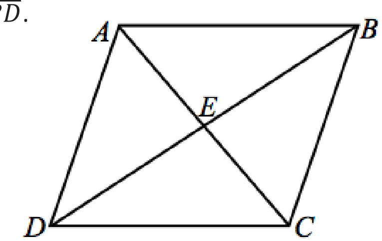
Name ____ Date____________________

Lesson 28: Properties of Parallelograms

Exit Ticket

Given: Equilateral parallelogram $ABCD$ (i.e., a rhombus) with diagonals $\overline{AC}$ and $\overline{BD}$.

Prove: Diagonals intersect perpendicularly.



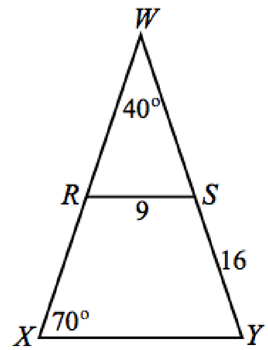
Name ____ Date____________________

Lesson 29: Special Lines in Triangles

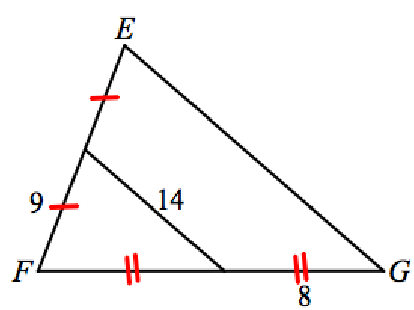
Exit Ticket

Use the properties of midsegments to solve for the unknown value in each question.

1. R and S are the midpoints of $\overline{XW}$ and $\overline{WY}$, respectively.
   What is the perimeter of $\triangle WXY$? ________________



2. What is the perimeter of $\triangle EFG$? _________________

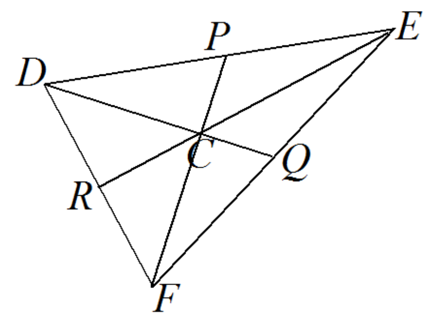


Name____ Date____________________

Lesson 30: Special Lines in Triangles

Exit Ticket

$\overline{DQ}$, $\overline{FP}$, and $\overline{RE}$ are all medians of $\triangle DEF$, and C is the centroid. $DQ = 24$, $FC = 10$, $RC = 7$. Find DC, CQ, FP, and CE.



Name ____ Date____________________

Lesson 31: Construct a Square and a Nine-Point Circle

Exit Ticket

Construct a square $ABCD$ and a square $AXYZ$ so that $\overline{AB}$ contains X and $\overline{AD}$ contains Z.

Name ____ Date____________________

Lesson 32: Construct a Nine-Point Circle

Exit Ticket

Construct a nine-point circle, and then inscribe a square in the circle (so that the vertices of the square are on the circle).

Name ____ Date____________________

Lesson 33: Review of the Assumptions

Exit Ticket

1. Which assumption(s) must be used to prove that vertical angles are congruent?

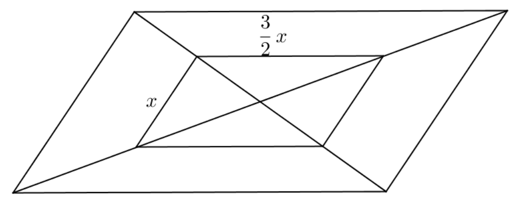
2. If two lines are cut by a transversal such that corresponding angles are NOT congruent, what must be true? Justify your response.

Name ____ Date____________________

Lesson 34: Review of the Assumptions

Exit Ticket

The inner parallelogram in the figure is formed from the midsegments of the four triangles created by the outer parallelogram's diagonals. The lengths of the smaller and larger midsegments are as indicated. If the perimeter of the outer parallelogram is 40, find the value of x.



Name ____ Date ______________________

1. Each of the illustrations on the next page shows in black a plane figure consisting of the letters F, R, E, and D evenly spaced and arranged in a row. In each illustration, an alteration of the black figure is shown in gray. In some of the illustrations, the gray figure is obtained from the black figure by a geometric transformation consisting of a single rotation. In others, this is not the case.

   a. Which illustrations show a single rotation?

   b. Some of the illustrations are not rotations or even a sequence of rigid transformations. Select one such illustration and use it to explain why it is not a sequence of rigid transformations.

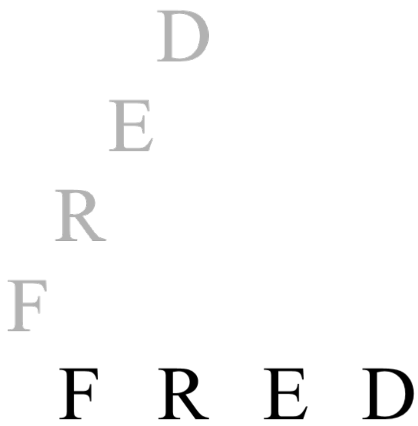


Illustration 1

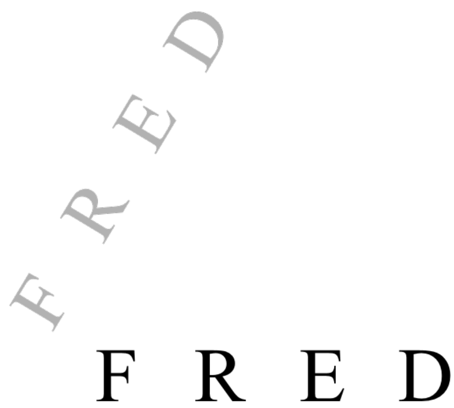


Illustration 2

Illustration 3

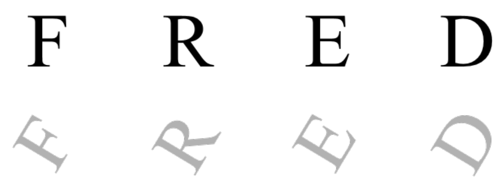


Illustration 4

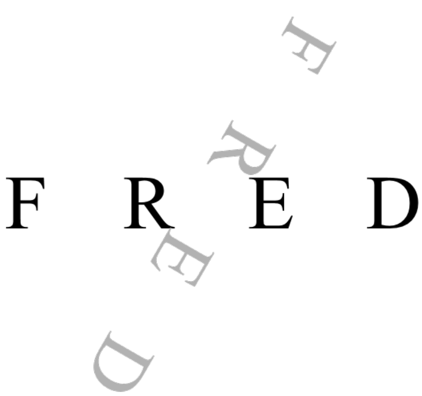


Illustration 5

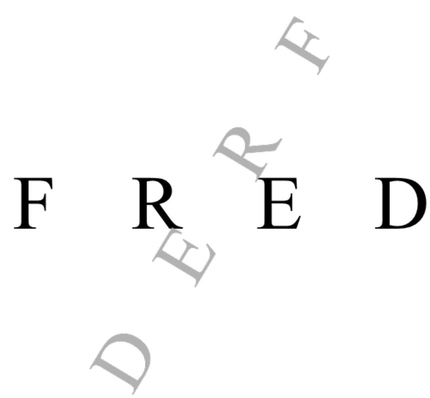
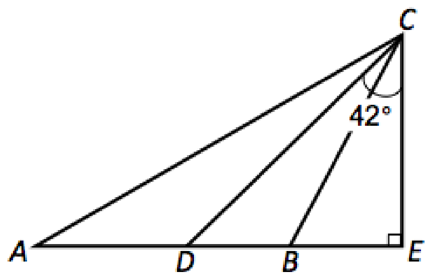


Illustration 6

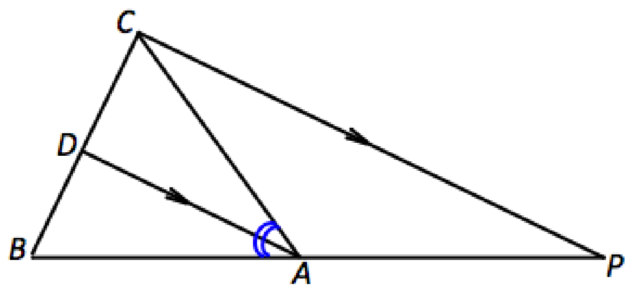
2. In the figure below, $\overline{CD}$ bisects $\angle ACB$, $AB = BC$, $\angle BEC = 90°$, and $\angle DCE = 42°$.

   Find the measure of angle $\angle A$.

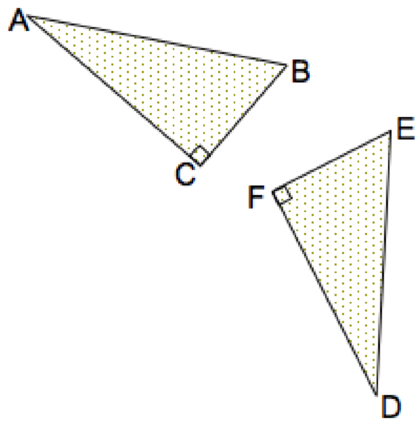


3. In the figure below, $\overline{AD}$ is the angle bisector of $\angle BAC$. $\overline{BAP}$ and $\overline{BDC}$ are straight lines, and $\overline{AD} \parallel \overline{PC}$.

   Prove that $AP = AC$.



4. The triangles ΔABC and ΔDEF in the figure below are such that $\overline{AB} \cong \overline{DE}$, $\overline{AC} \cong \overline{DF}$, and $\angle A \cong \angle D$.



a. Which criteria for triangle congruence (ASA, SAS, SSS) implies that $\Delta ABC \cong \Delta DEF$?

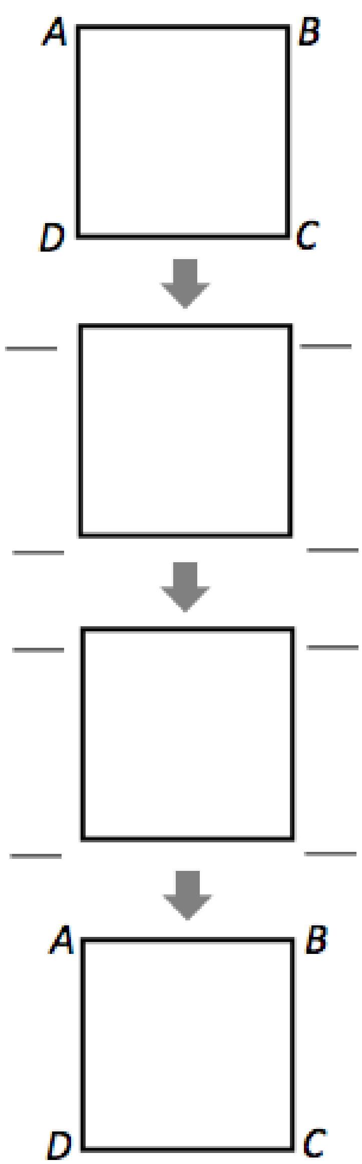
b. Describe a sequence of rigid transformations that shows $\Delta ABC \cong \Delta DEF$.

5.

a. Construct a square $ABCD$ with side $\overline{AB}$. List the steps of the construction.

b. Three rigid motions are to be performed on square $ABCD$. The first rigid motion is the reflection through line $\overline{BD}$. The second rigid motion is a $90°$ clockwise rotation around the center of the square.

Describe the third rigid motion that will ultimately map $ABCD$ back to its original position. Label the image of each rigid motion A, B, C, and D in the blanks provided.



Rigid Motion 1 Description: Reflection through line $\overline{BD}$

Rigid Motion 2 Description: $90°$ clockwise rotation around the center of the square.

Rigid Motion 3 Description: ______________________________

6. Suppose that $ABCD$ is a parallelogram and that M and N are the midpoints of $\overline{AB}$ and $\overline{CD}$, respectively. Prove that $AMCN$ is a parallelogram.