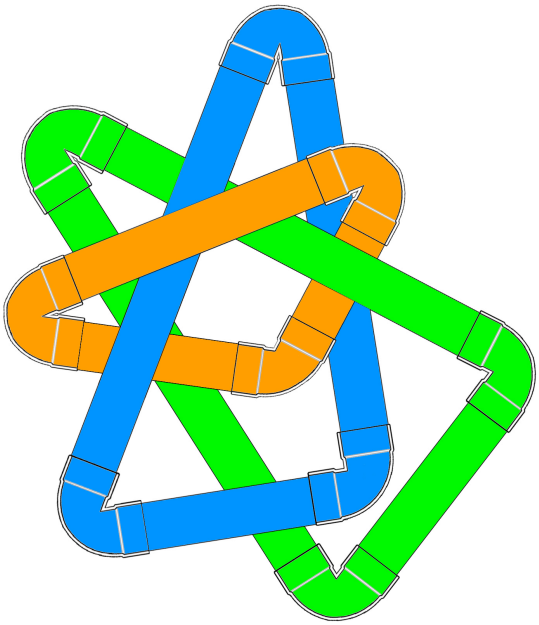
Geometry 21 Unit 2: Polygons Name: _____

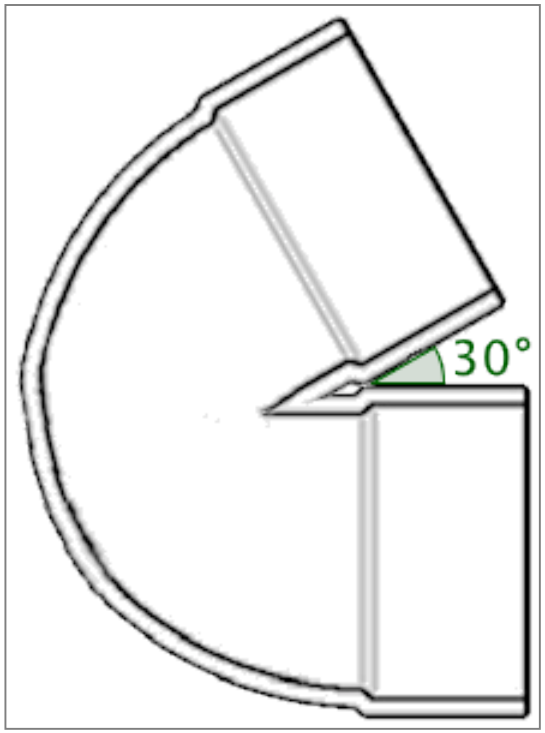
2.1.0 Get Ready – Pipe Art Date: _____ Period: _____

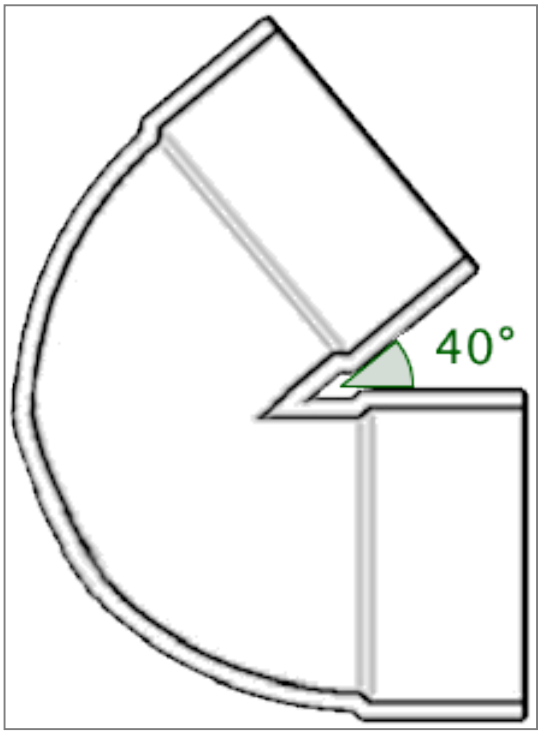
Latasha is an artist and a teacher. She just watched this cool video about Theo Jansen's Strandbeests. http://youtu.be/HSKyHmjyrkA. She was inspired to start building things with PVC pipe, like Theo had done. (PVC pipe is used for plumbing in homes and other buildings.) Here is one of Latasha's pieces:

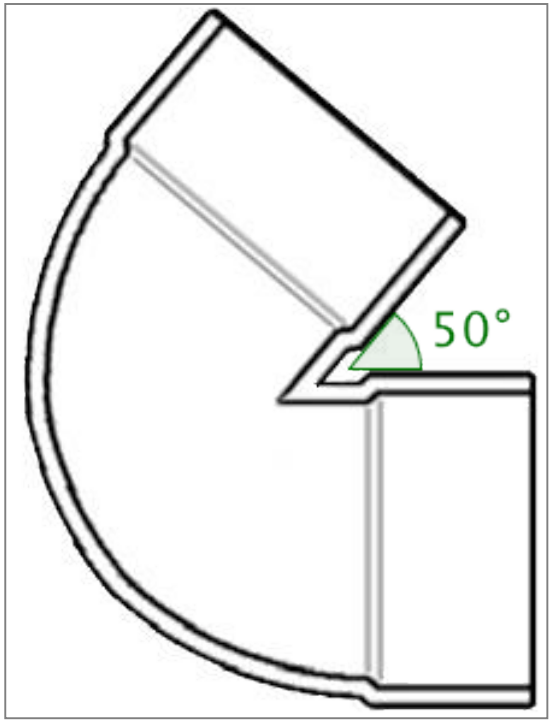


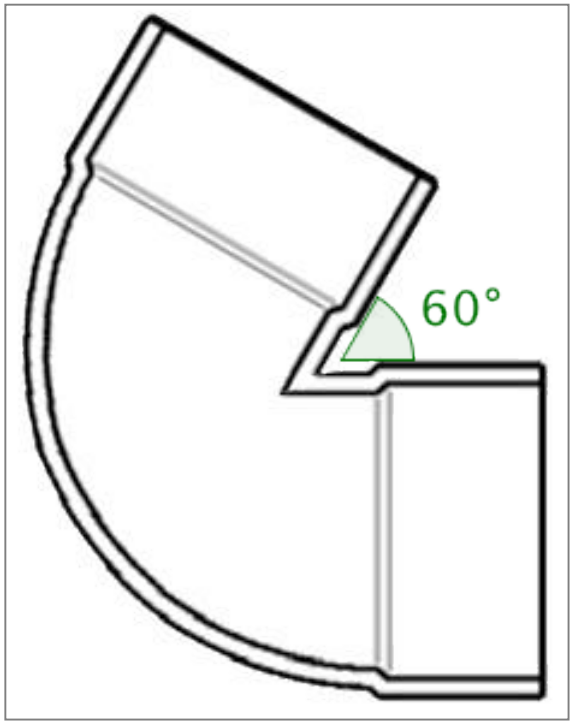
Latasha made her own corners that join the straight pieces, called elbows, in angle measures from 30° to 150°**.** Some of the straight pipe is cut already, and some she can cut to any length she needs. Before she begins, she makes a pattern for each triangle. Try making some yourself.

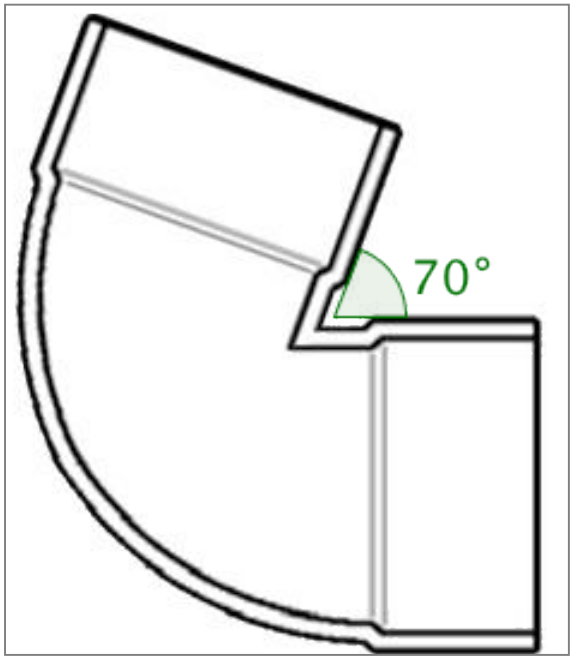
- Cut out the pipe pattern pieces that your teacher gave you. Cut along the "ends" of each pipe elbow.
- Make some triangles with the pieces, adjusting the length of each pipe as needed.
- Sketch the triangles you make. Record everything you notice about them.

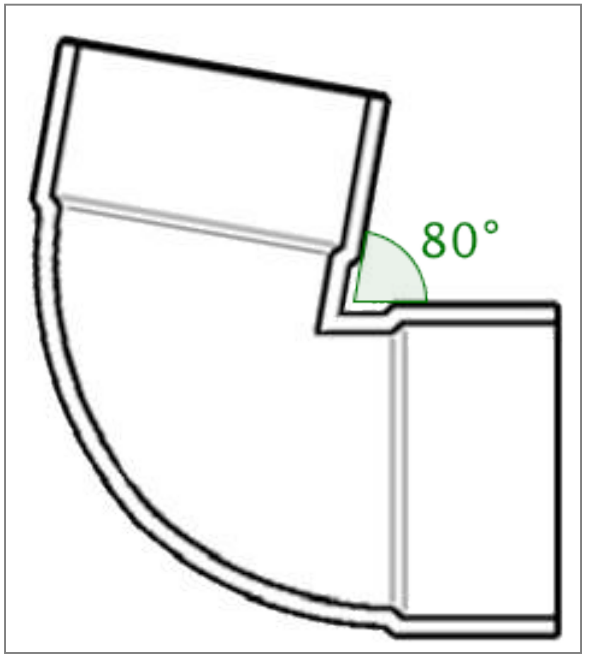

30°

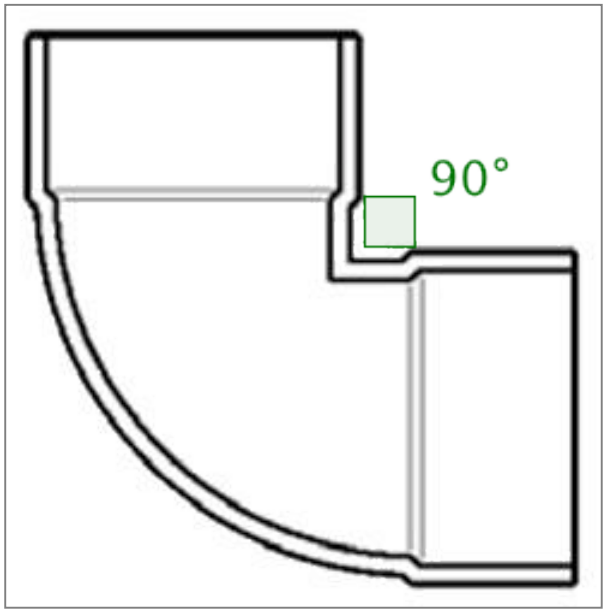

40°

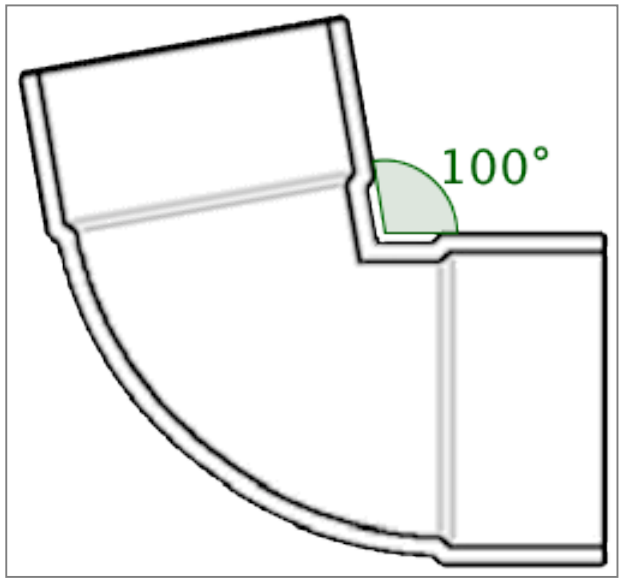

50°

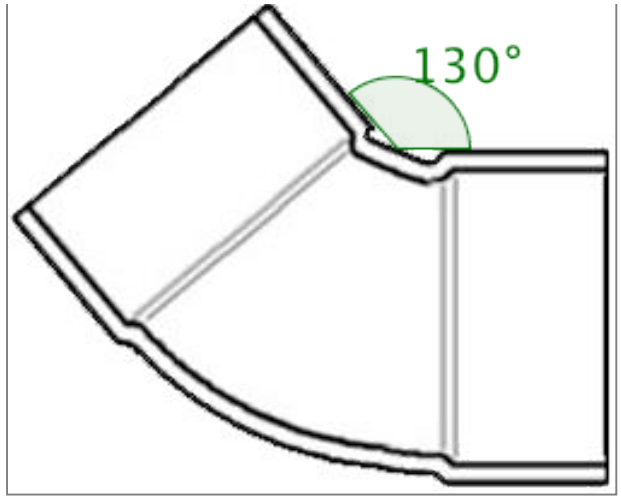

60°

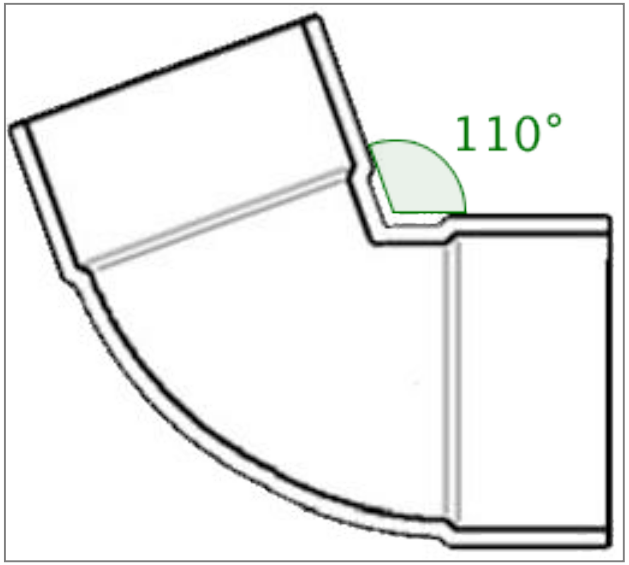

70°

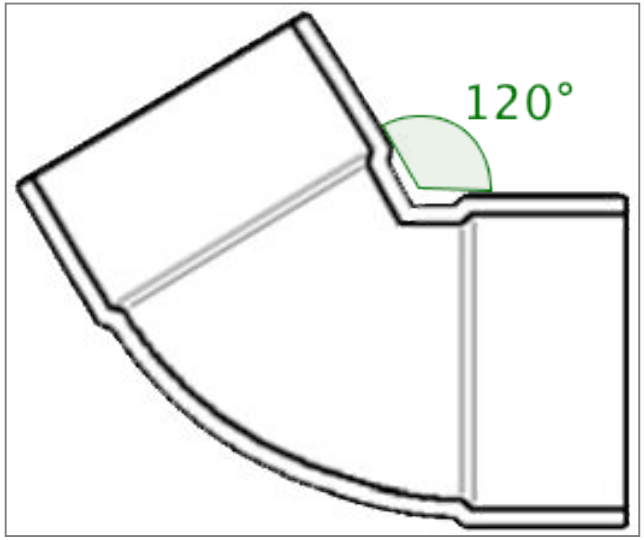

80°

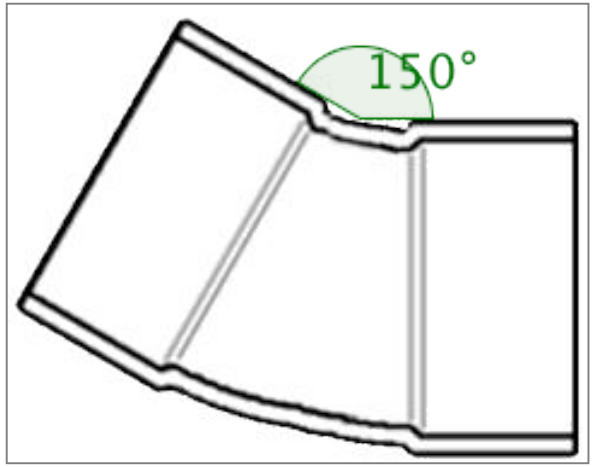

90°

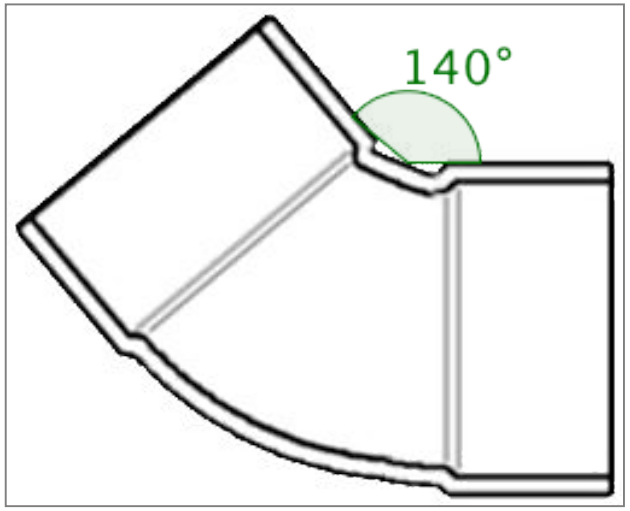

100°

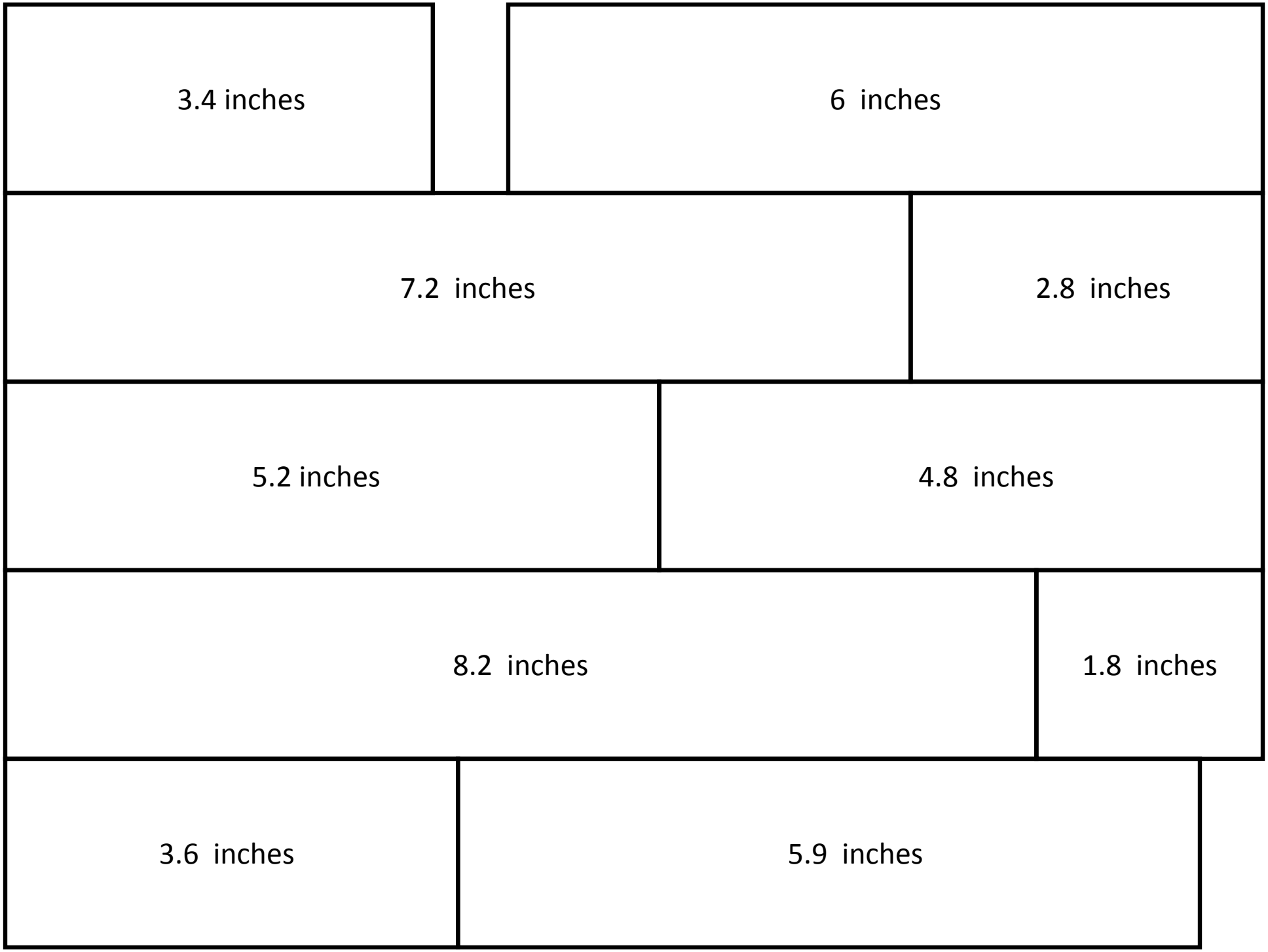

130°


110°


120°


150°

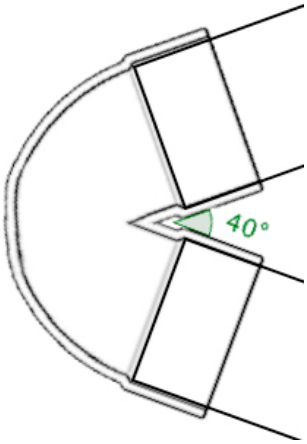

140°


3.4 inches
6 inches
7.2 inches
2.8 inches
5.2 inches
4.8 inches
8.2 inches
1.8 inches
3.6 inches
5.9 inches

Geometry 21 Unit 2: Polygons Name: _____

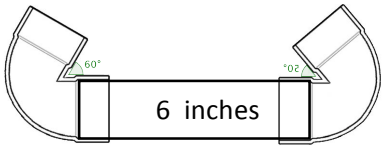
2.1.1 How many triangles? Date: _____ Period: _____

Latasha is curious about how many different triangles she could make if she starts with some specific pieces.



With a partner, try the following investigations. Each partner should start with the same pieces, in the same order. Then try to make as many different triangles as you can. Try to align the pipe in the fitting as shown to the right.

1. 60° elbow, 6 inch pipe, 50° elbow



Sketches:

2. 3.4 inch pipe, 100° elbow, 5.2 inch pipe (in that order)

Sketches:

3. 40° elbow, 5.9 inch pipe, 3.6 inch pipe (in that order)

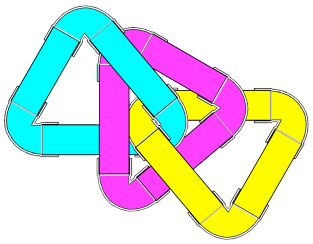
Sketches:

4. 7.2 inch pipe, 3.4 inch pipe, 5.2 inch pipe (in any order)

Sketches:

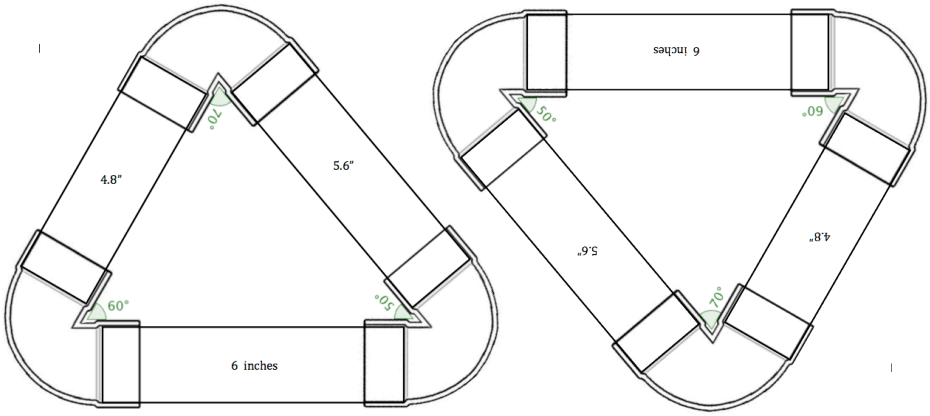
Geometry 21 Unit 2: Polygons Name: _____

2.1.2 How many DIFFERENT triangles? Date: _____ Period: _____



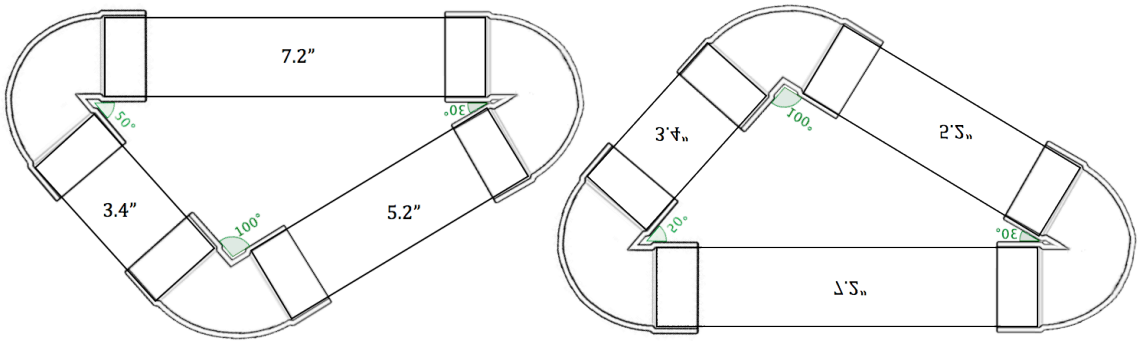
With your classmates, you created triangles from Latasha's pipe parts. Below, Identify whether or not the samples given are isometric. If they are, you've created two versions of the same triangle.

1. 60° elbow, 6 inch pipe, 50° elbow



Are they isometric? _____ If so, what transformation(s) would map the first image onto the second?

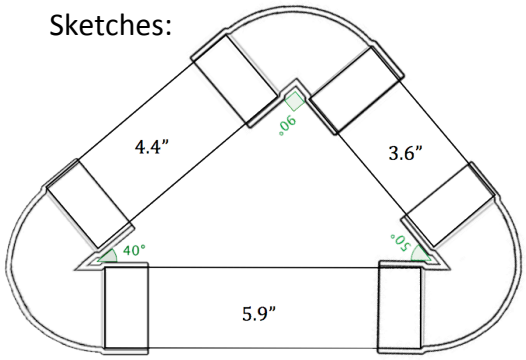
2. 3.4 inch pipe, 100° elbow, 5.2 inch pipe (in that order)

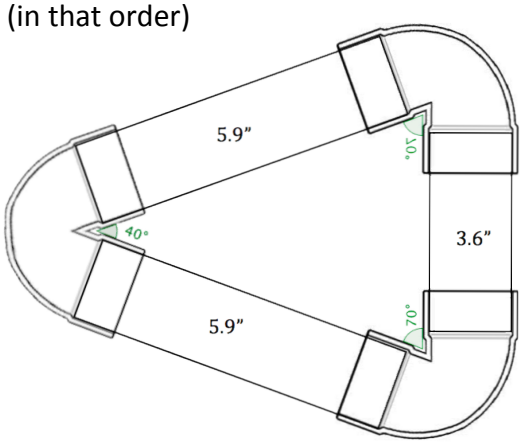


Are they isometric? _____ If so, what transformation(s) would map the first image onto the second?

3. 40° elbow, 5.9 inch pipe, 3.6 inch pipe (in that order)

Sketches:

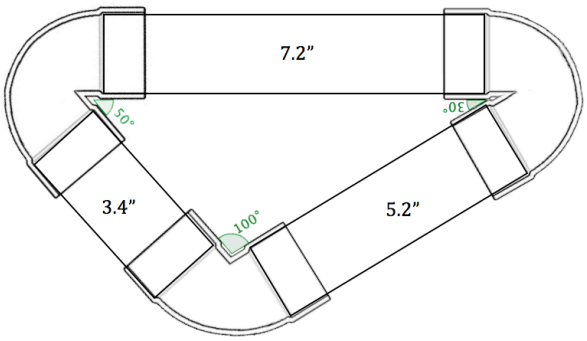


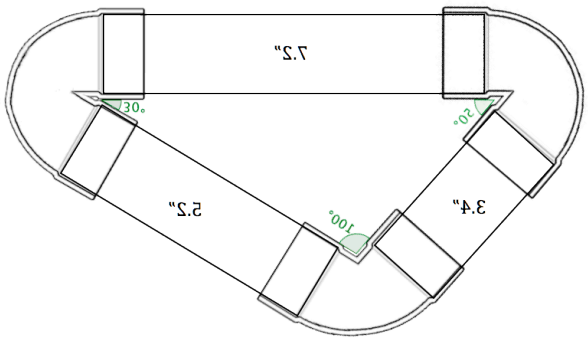


Are they isometric? _____ If so, what transformation(s) would map the first image onto the second?

4. 7.2 inch pipe, 3.4 inch pipe, 5.2 inch pipe (in any order)

Sketches:





Are they isometric? _____ If so, what transformation(s) would map the first image onto the second?

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2.1.3 Proving Triangles Congruent (Part 1) Date: _____ Period: _____

Recall that two figures are **congruent** if they are the same size and shape. If one is the result of a transformation of the other, they are also called **isometric**. For two triangles to be congruent, all three pairs of corresponding angles and all three pairs of corresponding sides must be congruent. (Corresponding just means in the same relative position.)

Identify the parts of ΔDEF that correspond to the parts of ΔABC. Note the symbols used to name angles and segments; be sure to name yours properly.

1. Angles:

_____ corresponds to ∠A

_____ corresponds to ∠B

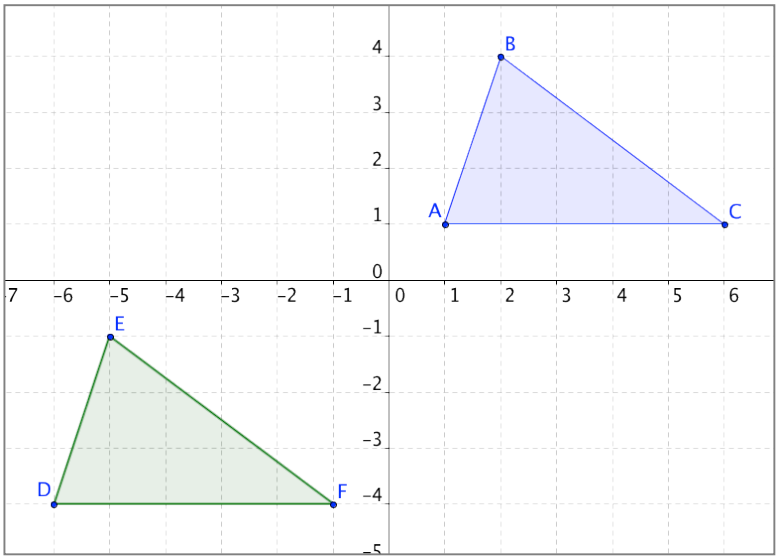
_____ corresponds to ∠C

Sides:

_____ corresponds to $\overline{AB}$

_____ corresponds to $\overline{BC}$

_____ corresponds to $\overline{CA}$



2. Angles:

_____ corresponds to ∠A

_____ corresponds to ∠B

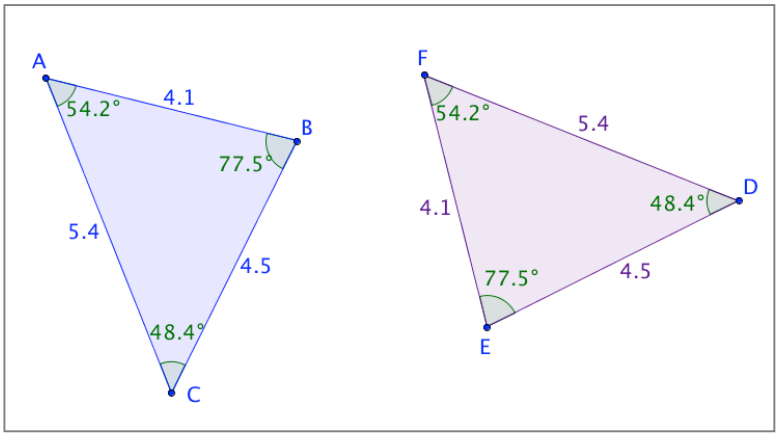
_____ corresponds to ∠C

Sides:

_____ corresponds to $\overline{AB}$

_____ corresponds to $\overline{BC}$

_____ corresponds to $\overline{CA}$



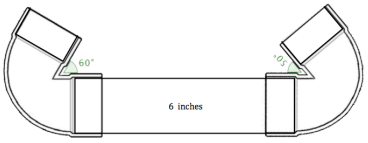
The symbol $\cong$ means "is congruent to." We can use the congruence symbol to compare angles that have the same measure or segments that have the same length. From the last example, we know the following:

$\angle A \cong \angle F$, $\angle B \cong \angle E$, $\angle C \cong \angle D$ and $\overline{AB} \cong \overline{FE}$, $\overline{BC} \cong \overline{ED}$, $\overline{CA} \cong \overline{DF}$

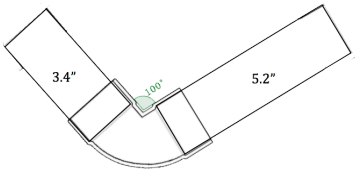
Since these are all pairs of corresponding parts, we can conclude that $\Delta ABC \cong \Delta FED$.

Question: Is it necessary to show that all six pairs of corresponding sides and angles are congruent to conclude that the triangles are congruent?

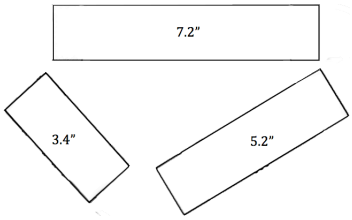
Think about the pipe pieces. When you started with each of the following sets of parts, you and your partner could only make one triangle. These combinations of parts are often referred to by the kind of part they are and the order in which they appear as shown below.



angle-side-angle (ASA)



side-angle-side (SAS)



side-side-side (SSS)

Can we extend this idea to proving that two triangles are congruent? What if we knew about these combinations of parts in two triangles? Would that be enough to determine that the triangles are congruent? Share your thoughts below – draw some examples.

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2.1.4 Proving Triangles Congruent (GeoGebra) Date: _____ Period: _____

Complete the following. Verify using the following measurement tools.

1. Go to the GeoGebraTube page http://ggbtu.be/c4530/m43039/ylyy. Open the file **Proving Triangles Congruent, Part 1**. You should see a screen like this:

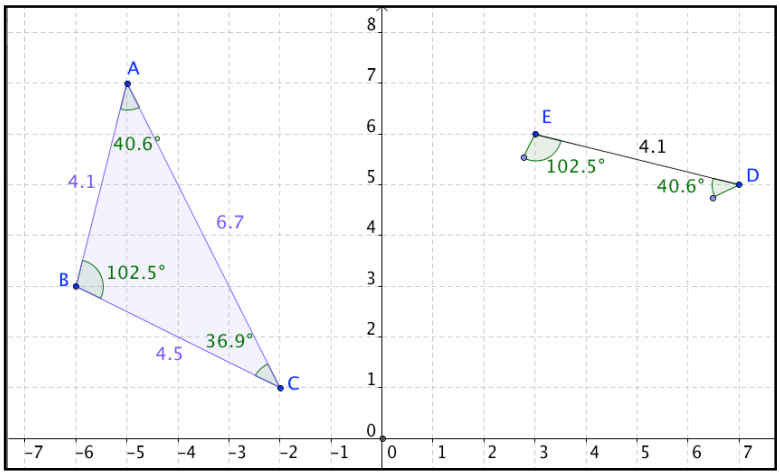
a. Use the Draw Ray tool to complete ΔDEF.

b. Sketch ΔDEF on the grid at right.

c. Use one of the transformation tools to map ΔABC onto ΔDEF.

Write a mapping rule and state, in words, which transformation(s) you used.

d. $(x,y)\rightarrow(_____,_____)$



e. Transformation(s):

f. Which combination of triangle parts (SSS, SAS, ASA, or SSA) were we given? _____

g. Can we conclude that $\Delta ABC \cong \Delta DEF$? Answer and explain.

2. Open the GeoGebra file, **Proving Triangles Congruent, Part 2**.

a. Complete ΔDEF and sketch on the grid.

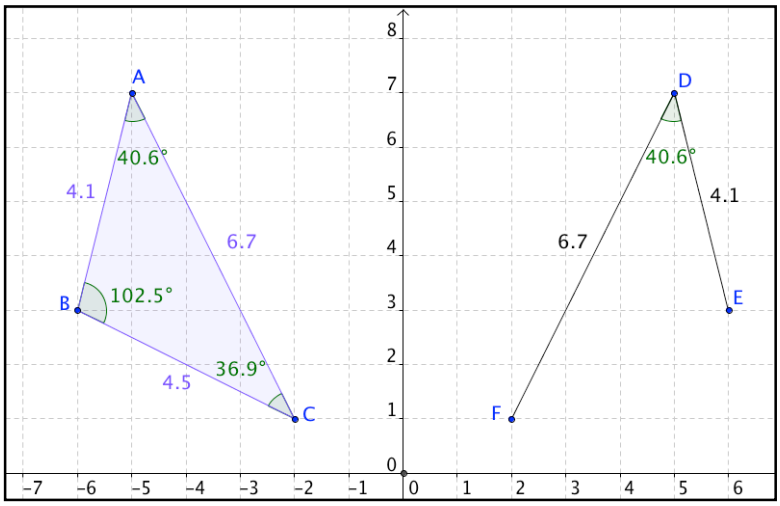
b. Use one of the transformation tools to map ΔABC onto ΔDEF.

c. $(x,y)\rightarrow(_____,_____)$

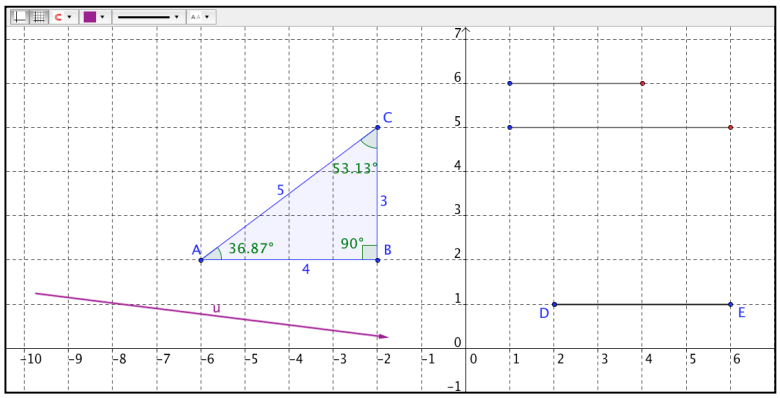
e. Transformation(s):

f. Which combination of triangle parts (SSS, SAS, ASA, or SSA) were we given? _____

g. Can we conclude that $\Delta ABC \cong \Delta DEF$? Answer and explain.



3. Open the GeoGebra file, **Proving Triangles Congruent, Part 3**. Note that $\overline{DE}$ is fixed in place.



a. Drag the endpoints (blue ones first) of the two free segments into place to complete ΔDEF and sketch it on the grid.

b. Use one of the transformation tools to map ΔABC onto ΔDEF.

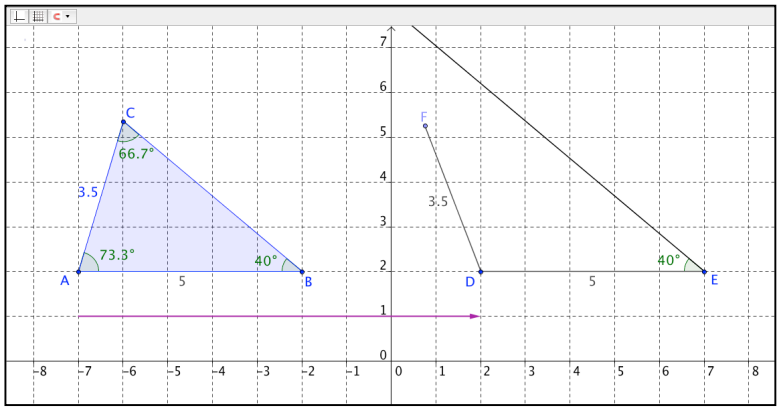
c. $(x,y)\rightarrow(_____,_____)$

e. Transformation(s):

f. Which combination of triangle parts were we given? _____

g. Can we conclude that $\Delta ABC \cong \Delta DEF$? Answer and explain.

4. Open the GeoGebra file, **Proving Triangles Congruent, Part 4**.



a. Grab point F and swing it around to complete the triangle. Sketch it.

b. Find another way to make a triangle. Sketch it.

c. Which combination of triangle parts were we given? _____

d. Can we conclude that $\Delta ABC \cong \Delta DEF$ if we are only given the following?

$\overline{AC} \cong \overline{DF}$, $\overline{AB} \cong \overline{DE}$, and $\angle B \cong \angle E$

Answer and explain.

5. Summarize what you've learned.