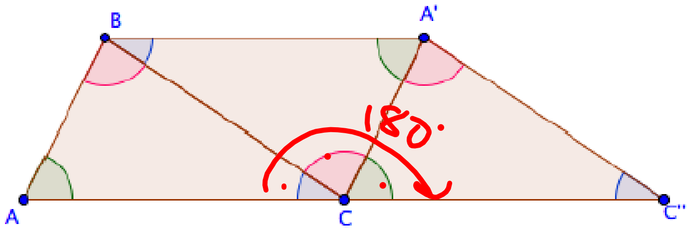
5.2 Do You See What I See?

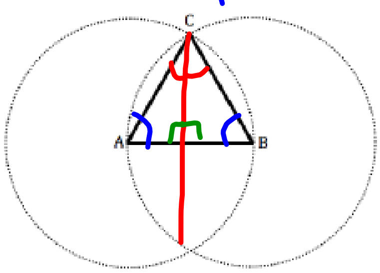
A Develop Understanding Task

In the previous task, *How Do You Know That*, we saw how the following diagram could be constructed by rotating a triangle about the midpoint of two of its sides. The final diagram suggests that the sum of the three angles of a triangle is 180°. This diagram "tells a story" because you saw how it was constructed through a sequence of steps. You may even have carried out those steps yourself.



Sometimes we are asked to draw a conclusion from a diagram when we are given the last diagram in a sequence steps. We may have to mentally reconstruct the steps that got us to this last diagram, so we can believe in the claim the diagram wants us to see.

AAA



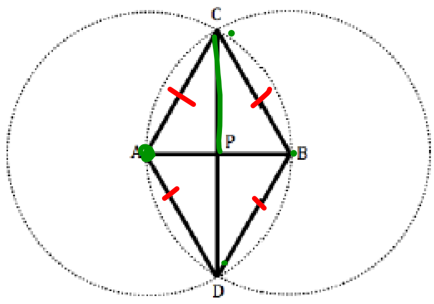
1. For example, what can you say about the triangle in this diagram?

2. What convinces you that you can make this claim? What assumptions, if any, are you making about the other figures in the diagram?

3. What is the sequence of steps that led to this final diagram?

4. What can you say about the triangles, quadrilateral, or diagonals of the quadrilateral that appear in the following diagram? List several conjectures that you believe are true.

Given: $\odot A \cong \odot B$



$\triangle ABC \cong \triangle ABD$

$\triangle ADC \cong \triangle BDC$

$\overline{AB} \cong \overline{BA}$

$\overleftrightarrow{CD}$ is a line of reflection

$\angle P$ is the same all $\triangle$'s.

$\odot A$ intersects points C, B, and D

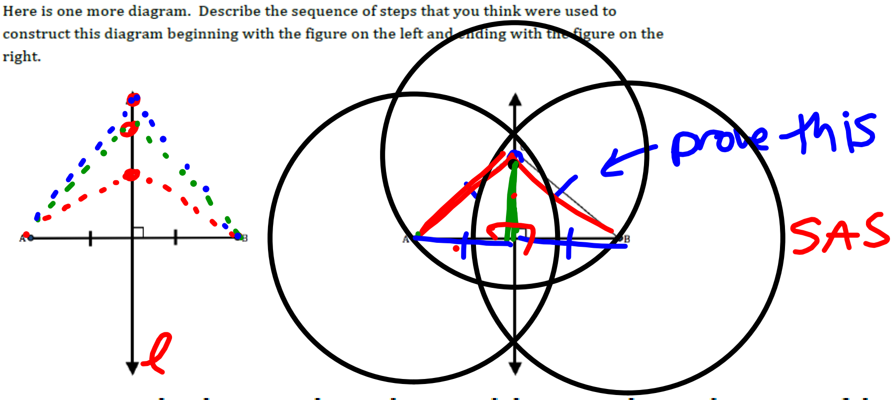
ACBD creates a rhombus

$\overline{PD} \cong \overline{CP}$

5. Select one of your conjectures and write a paragraph convincing someone else that your conjecture is true. Think about the sequence of statements you need to make to tell your story in a way that someone else can follow the steps and construct the images you want them to see.

6. Now pick a second claim and write a paragraph convincing someone else that this claim is true. You can refer to your previous paragraph, if you think it supports the new story you are trying to tell.

7. Here is one more diagram. Describe the sequence of steps that you think were used to construct this diagram beginning with the figure on the left and ending with the figure on the right.



Travis and Tehani are doing their math homework together. One of the questions asks them to prove the following statement.

R *The points on the perpendicular bisector of a segment are equidistant from the endpoints of the segment?*

Travis and Tehani think the diagram above will be helpful to prove this statement, but they know they will need to say more than just describe how to create this diagram. Travis starts by describing the things they know, and Tehani tries to keep a written record by jotting notes down on a piece of paper.

8. In the table below, record in symbolic notation what Tehani may have written to keep track of Travis' statements. In the examples given, note how Tehani is introducing symbols for the lines and points in the diagram, so she can reference them again without using a lot of words.

Tehani's Notes	**Travis' Statements**
Draw $\overline{AB}$. Locate its midpoint M, and draw a perpendicular line ℓ through the midpoint	We need to start with a segment and its perpendicular bisector already drawn.
Pick any point C on line ℓ	We need to show that *any* point on the perpendicular bisector is equidistant from the two endpoints, so I can pick any arbitrary point on the perpendicular bisector. Let's call it C.
Prove:	We need to show that this point is the same distance from the two endpoints.
First prove:	If we knew the two triangles were congruent, we could say that the point on the perpendicular bisector is the same distance from each endpoint. So, what do we know about the two triangles that would let us say that they are congruent?
	We know that both triangles contain a right angle.
	And we know that the perpendicular bisector cuts segment AB into two congruent segments.
	Obviously, the segment from C to the midpoint of segment AB is a side of both triangles.
	So, the triangles are congruent by the SAS triangle congruence criteria.
	Since the triangles are congruent, segments AC and BC are congruent.
Any point C on line ℓ, the perpendicular bisector of $\overline{AB}$, is equidistant from the endpoints A and B.	And, that proves that point C is equidistant from the two endpoints!

9. Tehani thinks Travis is brilliant, but she would like the ideas to flow more smoothly from start to finish. Arrange Tehani's symbolic notes in a way that someone else could follow the argument and see the connections between ideas.

10. Would your justification be true regardless of where point C is chosen on the perpendicular bisector? Why?

SECONDARY MATH II // MODULE 5
GEOMETRIC FIGURES - 5.2

5.2

READY, SET, GO! Name Period Date

READY

Topic: Symbols in Geometry

Throughout the study of mathematics, you have encountered many symbols that help you write mathematical sentences and phrases without using words. Symbols help the mathematician calculate efficiently and communicate concisely.

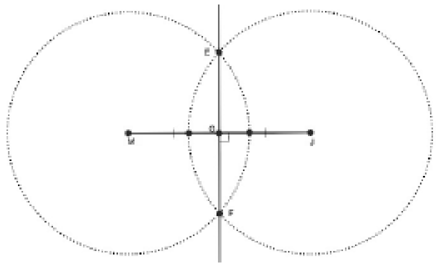
Below is a set of common mathematical symbols. Your job is to match them to their definitions. Are the symbols logical?

Symbol	Definitions
____1. =	A. **Absolute value** – it is always equal to the positive value of the number inside the lines. It represents distance from zero.
____2. $m\angle C$	B. **Congruent** – Figures that are the same size and shape are said to be congruent.
N 3. GH	C. **Parallel** – used between segments, lines, rays, or planes
____4. ΔABC	D. **Line segment with endpoints G and H.** Line segments can be congruent to each other. You would not say they were equal.
____5. $\perp$	E. **Ray GH** – The letter on the left indicates the endpoint of the ray.
____6. $\angle ABC$	F. Used when comparing numbers of **equal value.**
____7. $\overleftrightarrow{GH}$	G. **Plus or minus** – indicates 2 values, the positive value and the negative value
____8. $\cong$	H. **Triangle ABC**
____9. $\sim$	J. Indicates the **measure of an angle.** It would be set equal to a number.
____10. $\overline{GH}$	K. **Perpendicular** - Lines, rays, segments, and planes can all be perpendicular
E 11. $\overrightarrow{GH}$	L. **Angle ABC** – The middle letter is always the vertex of the angle.
____12. $\parallel$	M. **Similar** – Figures that have been dilated are similar.
____13. $\pm$	N. **The length of GH.** It would equal a number.
____14. $\lvert x \rvert$	P. Refers to the **infinite line GH.** Lines are not equal or congruent to other lines.

SET

Topic: Construction of midpoint, perpendicular bisector, and angle bisector, using "givens" to solve problems.

The figure on the right demonstrates the construction of a perpendicular bisector of a segment.

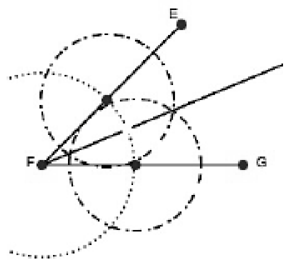


Use the diagram to guide you in constructing the perpendicular of the following line segments. Mark the right angle with the correct symbol for right angles. Indicate the segments are congruent by using slash marks.

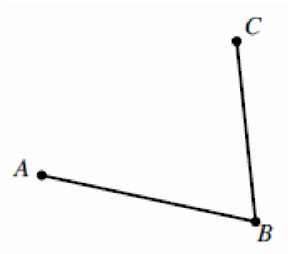
15.

16.

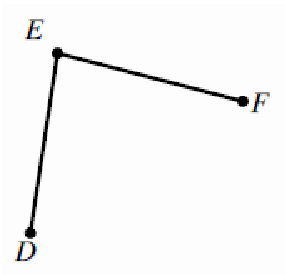
The figure on the right demonstrates the construction of an angle bisector.
Use the diagram to guide you in constructing the angle bisector of the following angles. Mark your bisected angles as congruent.



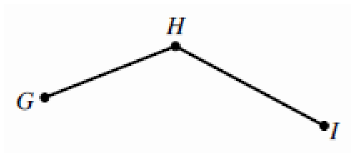
17.



18.

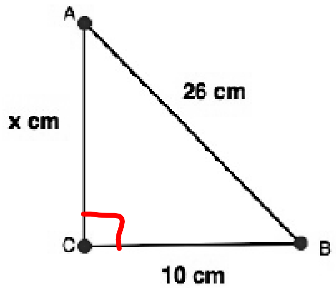


19.

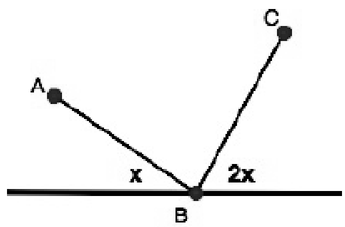


Examine the diagram and add any information that you are given. Think how you can use what you have been given and what you know to answer the question. Plan a strategy for finding the value of x. Follow your plan. Justify each step.

20. Given: $m\angle C = 90°$



21. Given $m\angle ABC = 90°$



22. Given: $\Delta BEC, \Delta CED, and\ \Delta DAB$ are right triangles.

Use pythagorean theorem to get BD, BE, and CD

$BE^2 + 6^2 = 14^2$

$36 \quad 196$

$BE = \sqrt{160}$

$8^2 + 15^2 = BD^2$

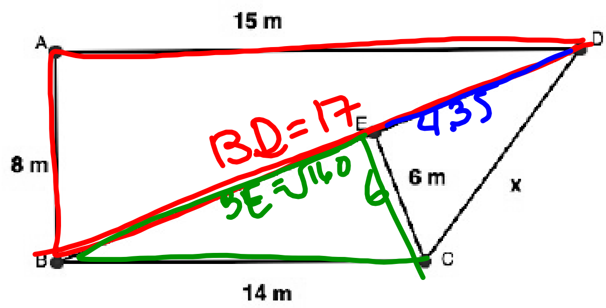
$64 + 225 =$

$289 = BD^2$

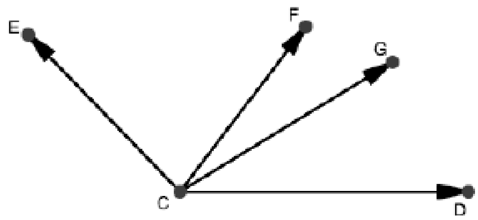
$17 = BD$

$(4.35)^2 + 6^2 = x^2$

$\boxed{7.41 = x}$



23. Given: $\overrightarrow{CF}$ bisects $\angle ECD$, $m\angle ECF = 2x + 10$, and $m\angle FCD = 3x - 18$. Find $m\angle FCE$.



Have you answered the question?
This problem asks you to do more than find the value of x.

GO

Topic: Translations, reflections, rotations

Perform the following transformations on the diagram below.

24. Label points C, E, D with the correct ordered pairs.

25. Translate ΔCED down 4 and right 6. Label the image as $\Delta C'E'D'$ and include the new ordered pairs.

26. Draw $\overline{CC'}$, $\overline{EE'}$, and $\overline{DD'}$. What is the slope of each of these line segments?

27. Reflect ΔCED across the x = 0 line. Label the image $\Delta C''E''D''$. Include the new ordered pairs.
Draw $\overline{CC''}$ and $\overline{EE''}$ Why didn't you need to draw $\overline{DD''}$?
What is the relationship between $\overline{CC''}$ and $\overline{EE''}$ to the $x = 0$ line?

28. Rotate ΔCED 180º about the point (-2, 0). Label the image $\Delta C'''E'''D'''$.
Include the new ordered pairs.