CW#____

Name:________________________

Period: A1 A2 A3 B1 B3

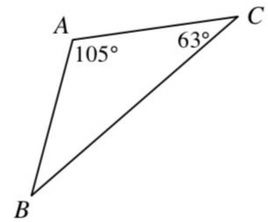
7.2.2 Is there a better way?

Law of Sines

In problem 7-53, you used a complicated strategy to calculate the side lengths and angle measures of a non-right triangle. Is there a tool you can use to directly calculate the angle measures and side lengths of non-right triangles in fewer steps? Today, you will explore the relationships that exist among the sides and angles of triangles and will develop a new tool called the Law of Sines.

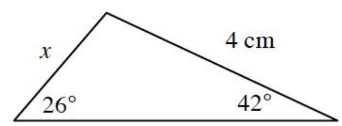
#63.

Is there a relationship between a triangle's side and the angle opposite to it? Based on the angle measures provided in the diagram, which side must be longest? Which side must be shortest? How do you know?



#64.

When Madelyn examined the triangle at right, she says, "*I don't think this diagram is drawn to scale because I think the side labeled* x *has to be longer than* 4 cm*.*"



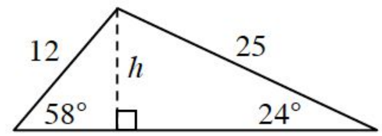
a. Do you agree with Madelyn? Why or why not?

b. Leila thinks that x can be determined by using right triangles. Review what you learned in Lesson 7.2.1 by calculating the value of x.

#65.

Thui and Ivan come up with two different ways to calculate the height of the triangle at right.

- Using the right triangle on the left, Thui writes $\sin(58^\circ) = \frac{h}{12}$.
- Ivan also uses the sine function, but his equation looks like this: $\sin(24^\circ) = \frac{h}{25}$.

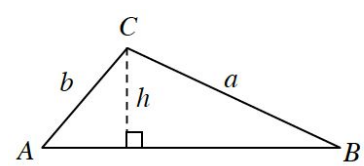


a. Which triangle did Ivan use? Use a colored pencil to trace Ivan's triangle. Then use Ivan's equation to calculate the length of *h.*

b. Use a different color to trace the triangle that Thui is using. Calculate *h* using Thui's equation. How do their answers compare?

#66. LAW OF SINES

Edwin wonders if Thui's and Ivan's methods can be used to relate the sides and angles of a non-right triangle. To calculate the height, Ivan and Thui draw a perpendicular segment from vertex C to $\overline{AB}$. Then, Ivan and Thui each use the sine ratio of a different right triangle.



a. Use the triangle above to write two expressions for h using the individual right triangles as Thui and Ivan did in problem 7-65.

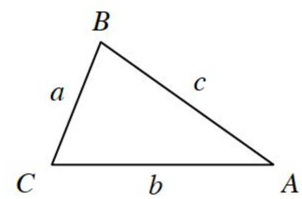
b. Use your expressions from part (a) to show that $\frac{\sin(A)}{a} = \frac{\sin(B)}{b}$.

c. Describe where $\angle B$ is located in relation to the side labeled b. How is $\angle A$ related to the side labeled a?

d. The relationship $\frac{sin(A)}{a} = \frac{sin(B)}{b}$ is called the Law of Sines. Read the Math Notes box below to learn more about this relationship. Then use this relationship to solve for x in the triangle at below.

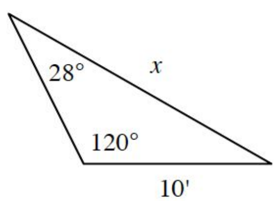
Law of Sines

For any ΔABC, the ratio of the sine of an angle to the length of the side opposite the angle is constant. This means that:



$$\frac{sin(A)}{a} = \frac{sin(B)}{b} = \frac{sin(C)}{c}$$

This property is called the Law of Sines. This is a powerful tool because you can use the sine ratio to solve for the angle measures and side lengths of *any* triangle, not just right triangles. The law works for angle measures between 0◦ and 180◦.



EXTRA PRACTICE:

1. Write the equation of an exponential function of the form $y = ab^x + k$ that passes through $(-1,-0.2)$ and $(4,2499)$ and has an asymptote at $y = -1$.