8.3 Law of Sines

Monday, September 23, 2019 7:46 AM

Warm Up

Solve the proportion. Round your answer to the nearest tenth.

$a = \frac{21 \cdot \sin(28^\circ)}{\sin(65^\circ)}$ $\boxed{\approx 10.9}$

$b = \frac{63 \cdot \sin(9^\circ)}{\sin(105^\circ)}$ $\boxed{\approx 10.2}$

1. $\frac{a}{\sin 28^\circ} = \frac{21}{\sin 65^\circ}$ **2.** $\frac{15}{\sin 40^\circ} = \frac{c}{\sin 94^\circ}$ **3.** $\frac{b}{\sin 9^\circ} = \frac{63}{\sin 105^\circ}$

$C = \frac{15 \cdot \sin(94^\circ)}{\sin(40^\circ)}$ $\boxed{\approx 23.3}$

4. $\frac{54}{\sin B} = \frac{61}{\sin 73^\circ}$ **5.** $\frac{16}{\sin 81^\circ} = \frac{15}{\sin A}$ **6.** $\frac{110}{\sin C} = \frac{85}{\sin 36^\circ}$

$B = \sin^{-1}\left(\frac{54 \cdot \sin(73^\circ)}{61}\right)$ $\boxed{B \approx 57.8^\circ}$

$A = \sin^{-1}\left(\frac{15 \cdot \sin(81^\circ)}{16}\right)$ $\boxed{A \approx 67.8^\circ}$

$C = \sin^{-1}\left(\frac{110 \cdot \sin(36^\circ)}{85}\right)$ $\boxed{C \approx 49.5^\circ}$

Essential Question

How can the Law of Sines be used to determine side lengths and angle measures in acute and obtuse triangles?

Needed Vocab:

- **Law of Sines**

Goal: "I can...

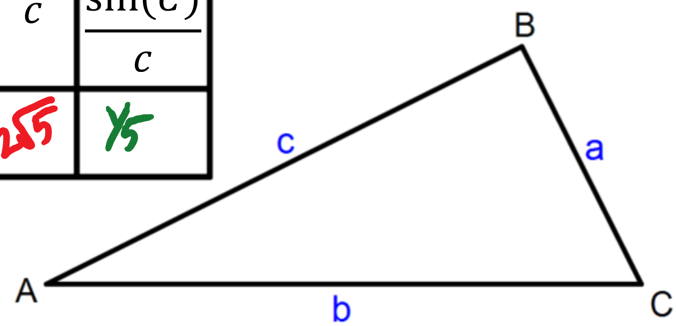
Use the Law of Sines to solve problems."

With your Table

Given the following coordinates, and following information, find the lengths of all sides (rounded to the nearest tenth) and measure of all angels (rounded to the nearest tenth) and find the ratios so you can fill out the following table. (Round all answers to the nearest Tenth)

A(0,0), B(4,2), C(5,0)

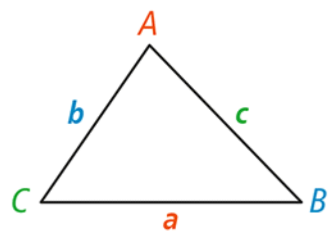
$m\angle A$	a	$\frac{\sin(A)}{a}$	$m\angle B$	b	$\frac{\sin(B)}{b}$	$m\angle C$	c	$\frac{\sin(C)}{c}$
26.6°	$\sqrt{5}$	$1/5$	90°	5	$1/5$	63.4°	$2\sqrt{5}$	$1/5$



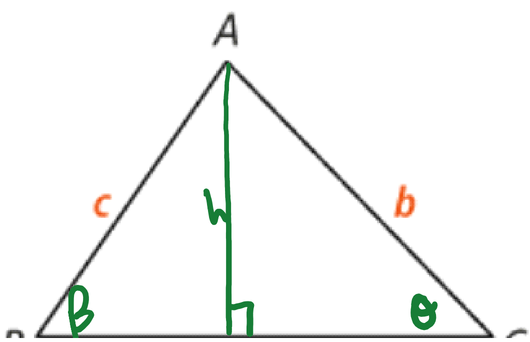
Law of Sines

For any $\triangle ABC$ with side lengths a, b, and c opposite angles A, B, and C, respectively, the **Law of Sines** relates the sine of each angle to the length of the opposite side.

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



If we didn't have coordinate points to prove the Law of Sines what could we have done?

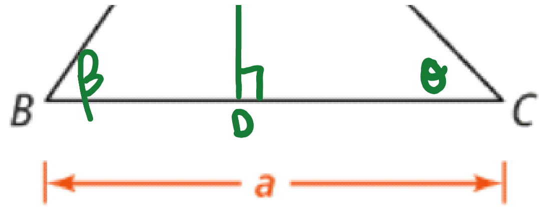


$\sin \beta = \frac{h}{c} \rightarrow h = c \cdot \sin(\beta)$

$\sin \theta = \frac{h}{b} \rightarrow h = b \cdot \sin(\theta)$

$b \cdot \sin(\theta) = c \cdot \sin(\beta)$

$\sin(\theta) \quad \sin(\beta)$



$b \cdot \sin(\theta) = c \cdot \sin(\beta)$

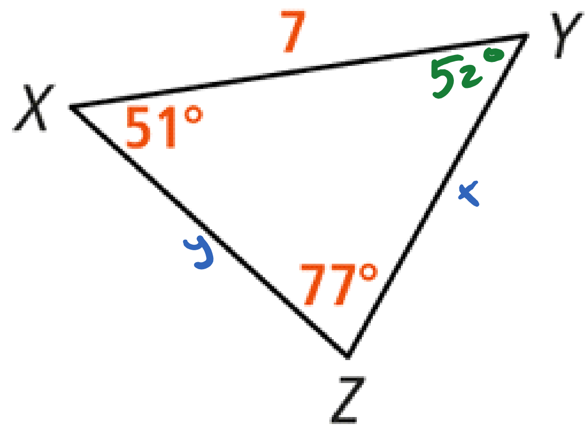
$\frac{\sin(\theta)}{c} = \frac{\sin(\beta)}{b}$

EXAMPLE 1

For $\triangle XYZ$, what is YZ to the nearest tenth?

$51 + 77 = 128$

$180 - 128 = 52$



$\frac{\sin(77°)}{7} = \frac{\sin(51°)}{x} = \frac{\sin(52°)}{y}$

$x = \frac{7 \cdot \sin(51°)}{\sin(77°)}$

$\boxed{x \approx 5.6}$

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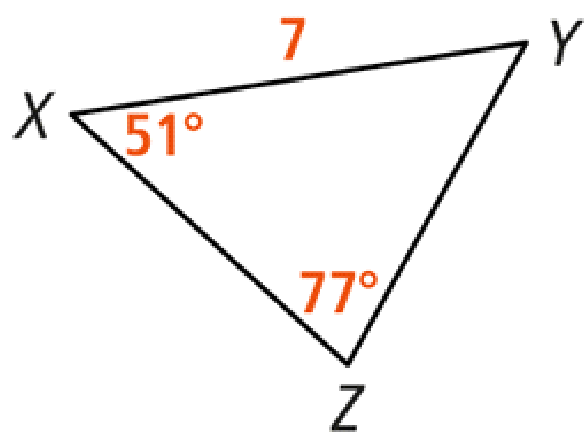
2. What is *XZ* to the nearest tenth?

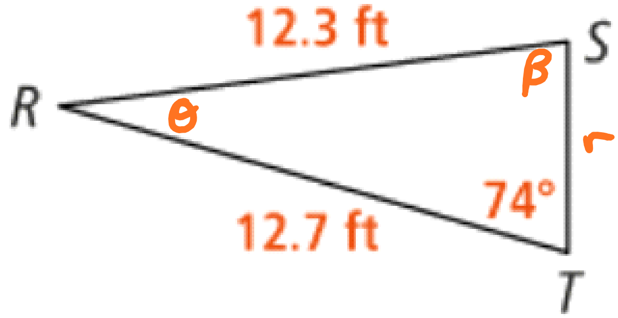


$y = \frac{7 \cdot \sin(52°)}{\sin(77°)}$

$y \approx 5.7$

Example 2

What are $m\angle R$ and $m\angle S$ in $\triangle RST$?



$$\frac{\sin(74°)}{12.3} = \frac{\sin(\beta)}{12.7} = \frac{\sin(\theta)}{r}$$

$$\sin(\beta) = \frac{12.7 \cdot \sin(74°)}{12.3}$$

$$\beta = \sin^{-1}\left(\frac{12.7 \cdot \sin(74°)}{12.3}\right)$$

$$\boxed{\beta \approx 83°} \quad \boxed{\theta \approx 23°}$$

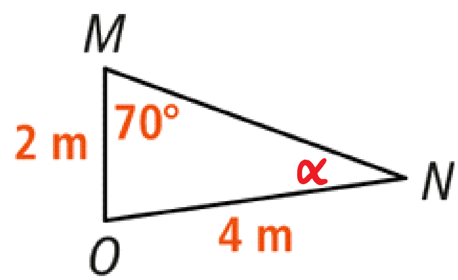
$$\frac{r}{\sin(23°)} = \frac{12.3}{\sin(74°)}$$

$$r = \frac{12.3 \cdot \sin(23°)}{\sin(74°)}$$

$$\boxed{r \approx 5}$$

3. **a.** What is $m\angle N$?
α

b. What is $m\angle O$?
θ



$$\frac{\sin(\alpha)}{2} = \frac{\sin(70°)}{4}$$

$$\alpha = \sin^{-1}\left(\frac{2 \cdot \sin(70°)}{4}\right)$$

$$\boxed{\alpha \approx 28°}$$

$$\theta + 70 + \alpha = 180°$$

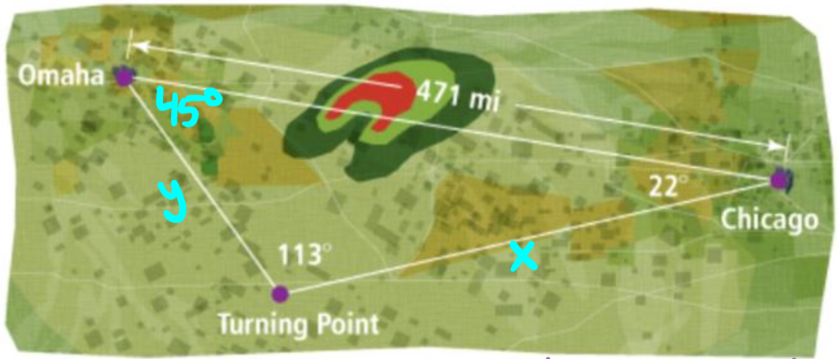
$$\theta + 70 + 28 = 180°$$

$$\theta + 98 = 180°$$

$$\boxed{\theta = 82°}$$

Example 3

The map shows the path a pilot flew between Omaha and Chicago in order to avoid a thunderstorm. How much longer is this route than the direct route to Chicago?



Set it up so the variables are on top.

Solve each individually

Apply to problem

$$\frac{x}{\sin(45)} = \frac{471}{\sin(113)} = \frac{y}{\sin(22)}$$

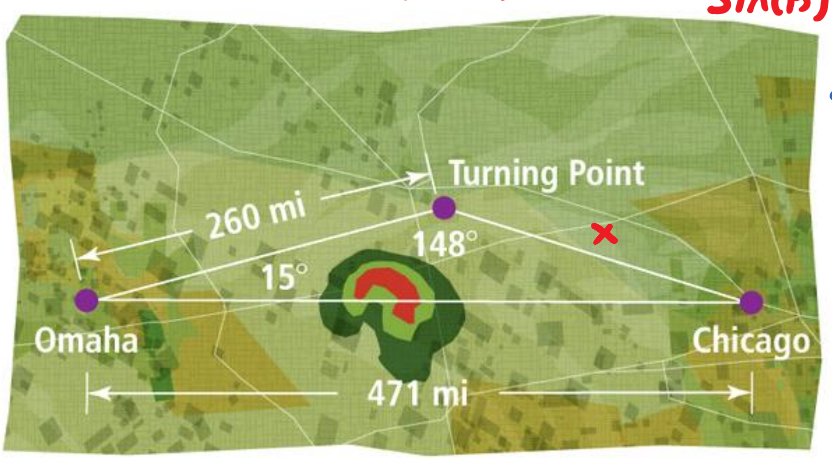
$$x = \frac{471 \cdot \sin(45)}{\sin(113)} \approx 362 \qquad y = \frac{471 \cdot \sin(22)}{\sin(113)} \approx 192$$

$362 + 192 - 471$

$\boxed{83 \text{ mi farther}}$

4. Suppose the pilot chose to fly north of the storm. How much farther is that route than the direct route?

Setup $\frac{x}{\sin(15)} = \frac{471}{\sin(148)}$



Solve $x = \frac{471 \cdot \sin(15)}{\sin(148)}$

$x \approx 230$

Apply $230 + 260 - 471$

$\boxed{19 \text{ mi farther}}$

https://tinyurl.com/wcwbach

Homework

Pg. 365
13, 18-29, 32, 34, 37