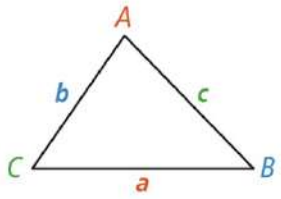
Law of Sines

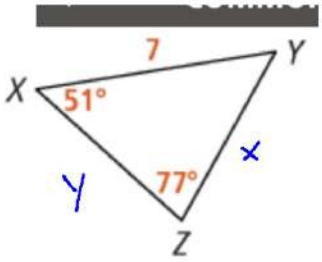
For any $\triangle ABC$ with side lengths a, b, and c opposite angles A, B, and C, respectively, the **Law of Sines** relates the sine of each angle to the length of the opposite side.



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

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

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



SOLUTION

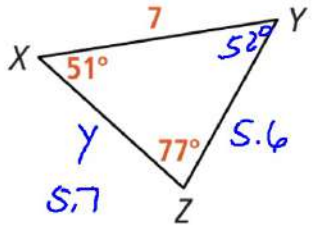
$$\frac{7}{\sin 77^\circ} = \frac{X}{\sin 51^\circ}$$

$$\frac{X \sin 77^\circ}{\sin 77} = \frac{7 \sin 51^\circ}{\sin 77}$$

$$X = \frac{7 \sin 51^\circ}{\sin 77}$$

$$X = 5.6$$

What is XZ to the nearest tenth?



Enter your answer.

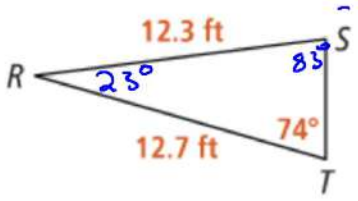
$$\frac{7}{\sin 77} = \frac{y}{\sin 52^\circ}$$

$$7 \sin 52^\circ = y \sin 77$$

$$y = \frac{7 \sin 52}{\sin 77}$$

$$= 5.7$$

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



SOLUTION

$$\frac{t}{\sin T} = \frac{s}{\sin S}$$

$$\frac{12.3}{\sin 74} = \frac{12.7}{\sin S}$$

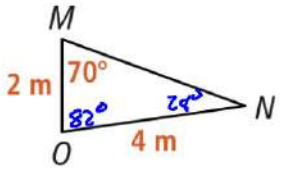
$$12.3 \sin S = 12.7 \sin 74$$

$$\sin S = \frac{12.7 \sin 74}{12.3}$$

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

$$m\angle S = 83^\circ$$

3. a. What is $m\angle N$?



Enter your answer

$\frac{4}{\sin 70^\circ} = \frac{2}{\sin N}$

$2\sin 70 = 4\sin N$

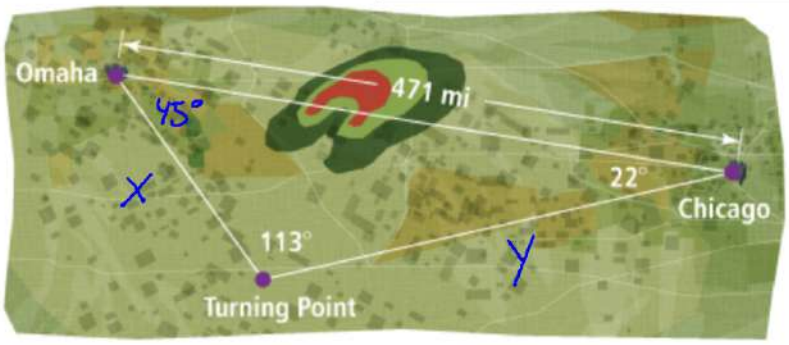
$\sin N = \frac{2\sin 70}{4}$

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

$m\angle N = 28^\circ$

b. What is $m\angle O$?

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?



$$\frac{X}{\sin 22} = \frac{471}{\sin 113}$$

$$X \sin 113 = 471 \sin 22$$

$$X = \frac{471 \sin 22}{\sin 113}$$

$$= 191.7 \text{ mi}$$

$$\frac{Y}{\sin 45} = \frac{471}{\sin 113}$$

$$Y \sin 113 = 471 \sin 45$$

$$Y = \frac{471 \sin 45}{\sin 113}$$

$$= 361.9 \text{ mi}$$

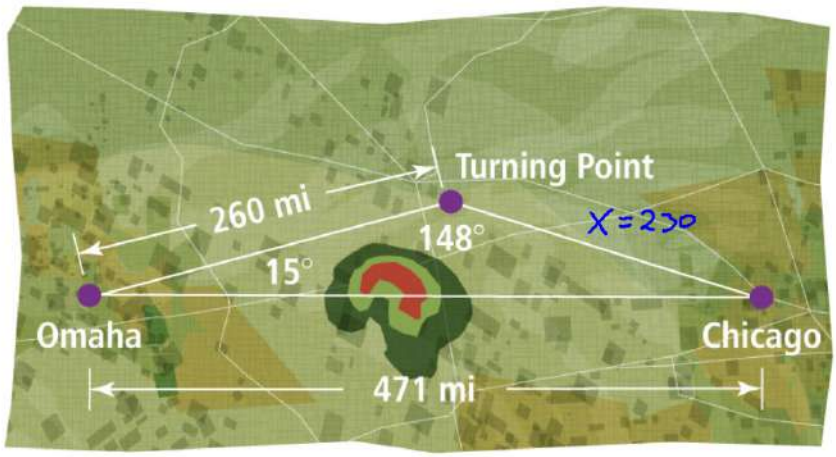
$X + Y = 553.6$ mi

$- \ 471$

82.6

The pilot had to fly 82.6 miles more

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



$\frac{X}{\sin 15} = \frac{471}{\sin 148}$

$X \sin 148 = 471 \sin 15$

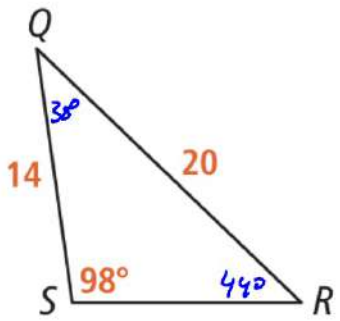
$X = \frac{471 \sin 15}{148}$

$= 230 \text{ mi}$

490
$-\ 471$
19 miles

Pilot flew 19 extra miles

7. What are $m\angle Q$ and $m\angle R$?



$$\frac{20}{\sin 98} = \frac{14}{\sin R}$$

$$20 \sin R = 14 \sin 98$$

$$\sin R = \frac{14 \sin 98}{20}$$

$$\sin^{-1}\left(\frac{14 \sin 98}{20}\right)$$