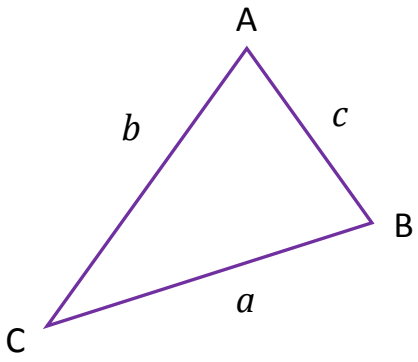
Law of Sines

For any ΔABC:

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

or

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

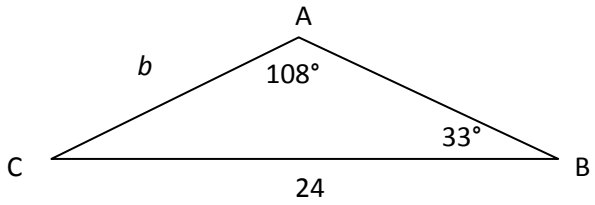


I. Model Problems

In the following example you will find the length of a side of a triangle using Law of Sines.

Example 1:

Find the length of *b*.



Write down known. $a = 24, m\angle A = 108°2, m\angle B = 33°$

Law of Sines $\frac{a}{\sin A} = \frac{b}{\sin B}$

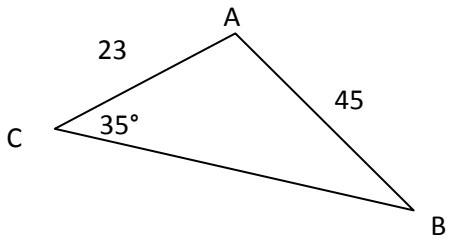
Substitute. $\frac{24}{\sin 108°} = \frac{b}{\sin 33°}$

Simplify. $(\sin 33°)\left(\frac{24}{\sin 108°}\right) = b$

Round to the nearest hundredth. $b \approx 13.74$

In the following example you will find the measure of an angle of a triangle using Law of Sines.

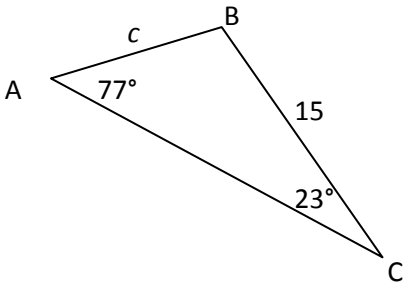
Example 2:
Find m∠B.



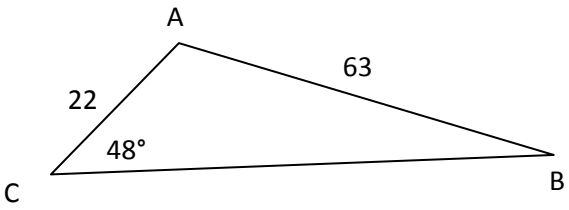
Write down known.	$b = 23, c = 45, \text{m}\angle C = 35°$
Law of Sines	$\frac{\sin B}{b} = \frac{\sin C}{c}$
Substitute.	$\frac{\sin B}{23} = \frac{\sin 35°}{45}$
Isolate $\sin B$.	$\sin B = \left(\frac{\sin 35°}{45}\right)(23)$
Find the inverse.	$\sin B = \frac{23}{45}(\sin 35°)$
Round to the nearest whole degree.	$\text{m}\angle B \approx 17°$

II. Find the length of a side or measure of an angle using Law of Sines.

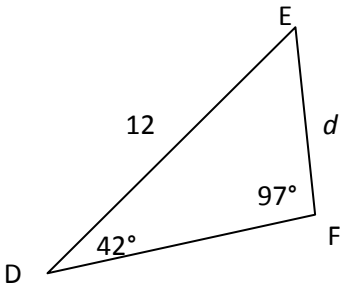
1. For ΔABC find c to the nearest hundredth.



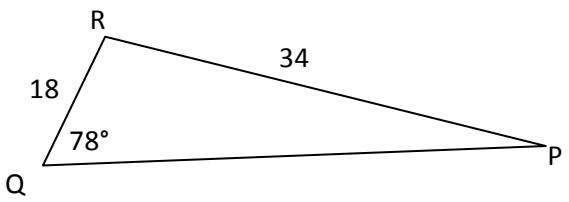
2. For ΔABC find $\text{m}\angle B$ to the nearest whole degree.



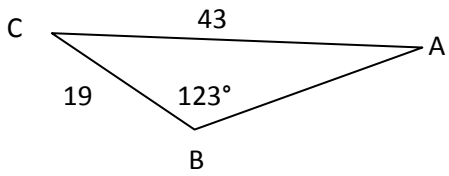
3. For ΔDEF find *d* to the nearest hundredth.



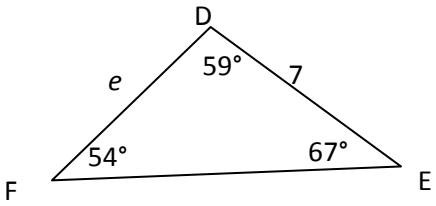
4. For ΔPQR find $m\angle P$ to the nearest whole degree.



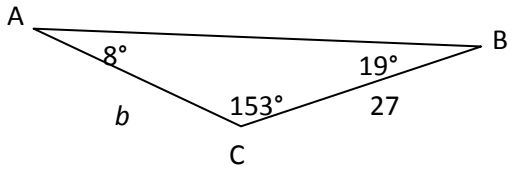
5. For ΔABC find $m\angle A$ to the nearest whole degree.



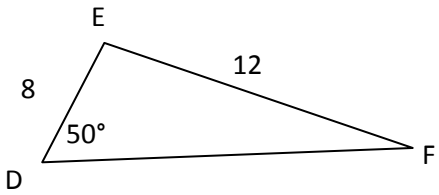
6. For ΔDEF find *e* to the nearest hundredth.



7. For ΔABC find *b* to the nearest hundredth.



8. For ΔDEF find $m\angle F$ to the nearest whole degree.



9. For $\Delta ABC, a = 18, b = 6,$ and $m\angle A = 28°$. Find $m\angle B$ to the nearest whole degree.

10. For ΔDEF, $d = 24$, $m\angle D = 37°$, and $m\angle E = 49°$. Find *e* to the nearest whole degree.

11. For $\Delta DEF, d = 54, f = 27,$ $m\angle D = 20°$. Find $m\angle F$ to the nearest whole degree.

12. For ΔABC, $a = 42, c = 72$, and $m\angle C = 41°$. Find $m\angle A$ to the nearest whole degree.

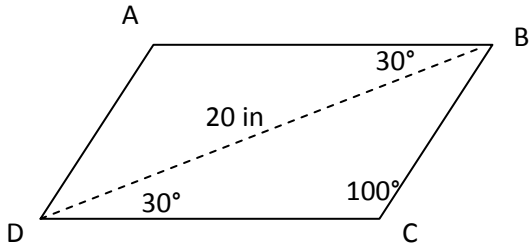
13. For ΔDEF, $e = 34$, $m\angle D = 36°$, $m\angle E = 72°$, and $m\angle F = 72°$. Find *e* to the nearest whole degree.

14. For ΔXYZ, $x = 17$, $m\angle X = 24°$, $m\angle Y = 44°$, and $m\angle Z = 112°$. Find *z* to the nearest whole degree.

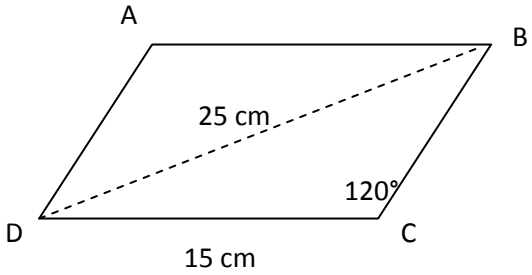
15. For ΔABC, $b = 45, c = 11$, and $m\angle B = 123°$. Find $m\angle C$ to the nearest whole degree.

16. For ΔDEF, $e = 98$, $m\angle D = 52°$, $m\angle E = 71°$, and $m\angle F = 57°$. Find *d* to the nearest whole degree.

17. For parallelogram ABCD below find BC to the nearest tenth.

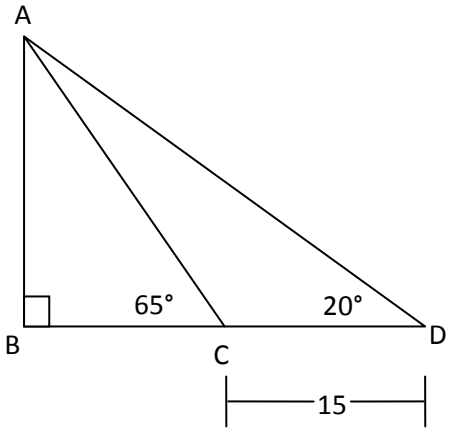


18. For parallelogram ABCD below find $m\angle DBC$ to the nearest whole degree.

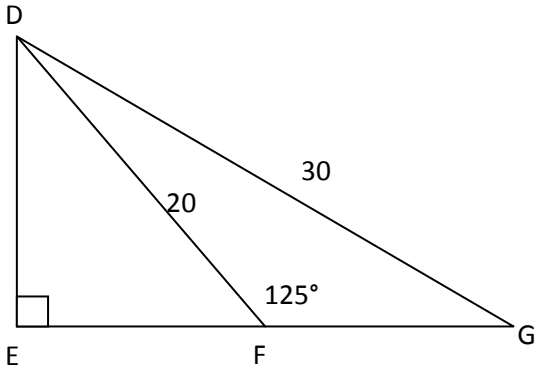


III. Challenge Problems

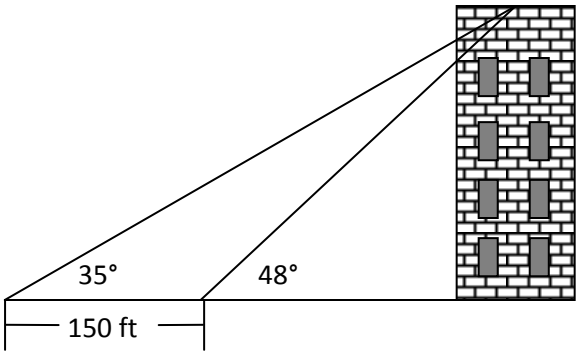
19. For the figure below find BC to the nearest whole number. $CD=15$.



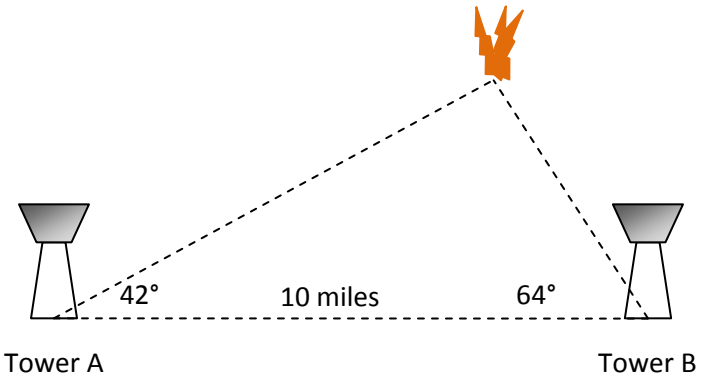
20. For the figure below find $m\angle EDG$ to the nearest whole degree.



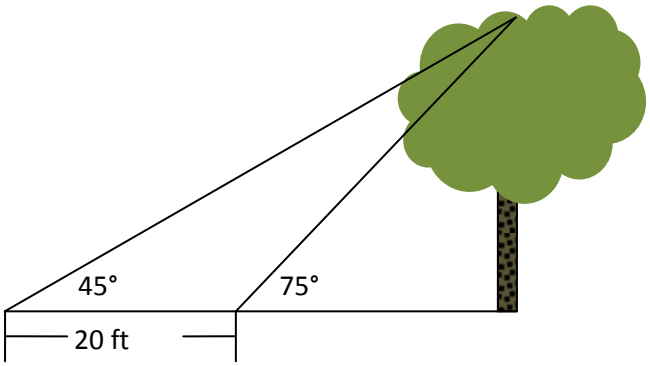
21. Find the height of the building in the figure below to the nearest foot.



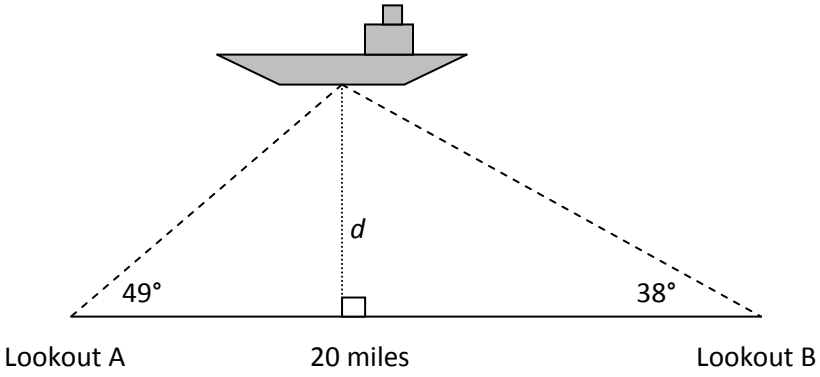
22. Fire towers A and B are located 10 miles apart. They use the direction of the other tower as 0°. Rangers at fire tower A spots a fire at 42°, and rangers at fire tower B spot the same fire at 64°. How far from tower A is the fire to the nearest tenth of a mile?



23. Find the height of the tree below to the nearest foot.



24. Triangulation can be used to find the location of an object by measuring the angles to the object from two points at the end of a baseline. Two lookouts 20 miles apart on the coast spot a ship at sea. Using the figure below find the distance, *d*, the ship is from shore to the nearest tenth of a mile.



25. $\Delta DEA \sim \Delta CBA$. Find DE to the nearest whole number.