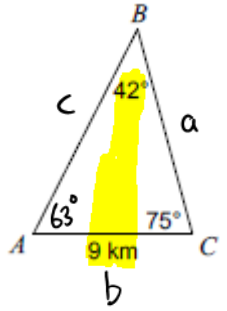
5.7: Applications of Sine, Cosine Law & Others

Learning Goal: We are learning to solve problems involving triangles using all of the tools at our disposal: similar triangles, SOHCAHTOA, Pythagorean theorem, Angle sum theorem, Sine law, and Cosine law.

Sometimes you will be asked to "Solve" a triangle. This means to find all three side lengths and all 3 angles using whatever tools you can.

Example 1: Solve each triangle. Round angles to the nearest whole number, and sides to 1 decimal place.



$\angle A = 180 - 42 - 75$

$A = 63°$

$\frac{c}{\sin 75} = \frac{9}{\sin 42}$

$\frac{c}{0.9659} = \frac{9}{0.6691} \times 0.9659$

$c = 12.99$

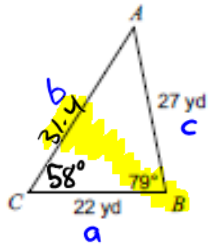
$c = 13.0$ km

$\frac{a}{\sin 63} = \frac{9}{\sin 42}$

$\frac{a}{0.9910} = \frac{9}{0.6691}$

$a = 11.98$

$a = 12.0$ km



$b^2 = a^2 + c^2 - 2ac \cos B$

$b^2 = (22)^2 + (27)^2 - 2(22)(27) \cos 79$

$b^2 = 1213 - 1188 \cos 79$

$\sqrt{b^2} = \sqrt{986.3189}$

$b = 31.4$ yd

$\frac{\sin C}{27} = \frac{\sin 79}{31.4} \times 27$

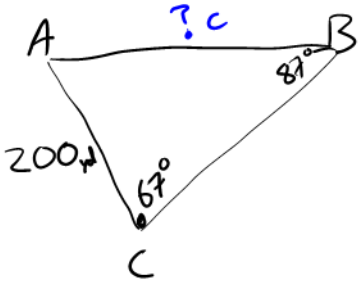
$\sin C = 0.8441$

$C = \sin^{-1}(0.8441)$

$C = 58°$

$\angle A = 180 - 58 - 79 = 43°$

Example 2: Points A and B are on opposite sides of the Grand Canyon. Point C is 200 yards from A. Angle B measures 87° and angle C measures 67°. What is the distance between A and B?



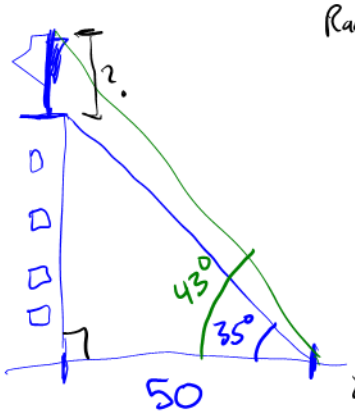
$\frac{c}{\sin 67} = \frac{200}{\sin 87}$

$\frac{c}{0.9205} = \frac{200}{0.9986} \times 0.9205$

$c = 184.4$ yd

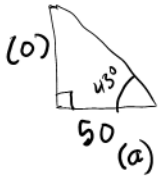
∴ The distance between A & B is 184.4 yd.

Example #3: A surveyor is 50 meters from the base of a building. He measures the angle to the top of the building to be 35 degrees. He then measures the angle to the top of the radio tower on top of the building and finds it to be 43 degrees. How tall is the radio tower?



Radio Tower = Total Height − Building

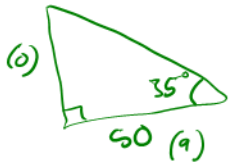
Total



$\tan 43 = \frac{o}{50}$ ×50 ×50

$46.6\ m = o$

Building



$\tan 35° = \frac{o}{50}$ ×50 ×50

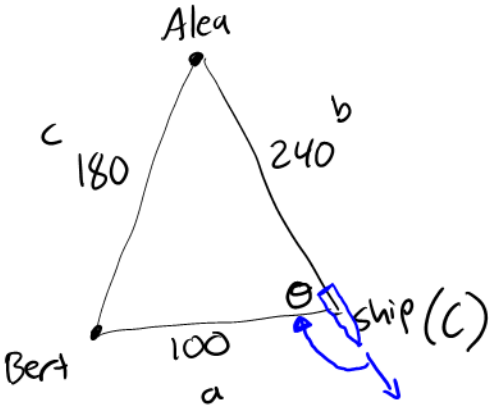
$350\ m = o$

∴ The tower is 11.6 m tall.

Radio Tower = 46.6 − 35

= 11.6 m

Example #4: Island Alea is 180 miles from island Bert. A ship captain leaves Alea and travels 240 miles, then realizes he is off course and 100 miles from island Bert. What angle, in degrees, must the captain turn the ship in order to head straight to island Bert?



$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$

$\cos C = \frac{(100)^2 + (240)^2 - (180)^2}{2(100)(240)}$

$\cos C = \frac{35{,}200}{48{,}000}$

$\cos C = 0.7333$

$C = \cos^{-1}(0.7333)$

$C = 43°$

The ship must turn!

$180 - 43 = 137°$

The captain needs to turn 137°.

Success Criteria

- I can sketch a diagram that models a given word problem.
- I can determine a strategy to solve a word problem