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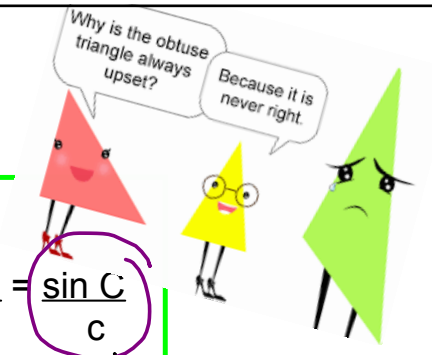


8.1 and 8.2 The Sine Law

Sine Law:

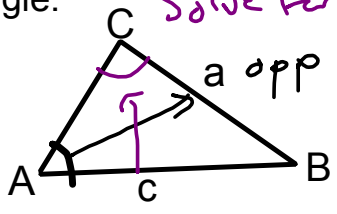
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \quad \text{OR} \quad \frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

To solve for a side — To solve for an angle

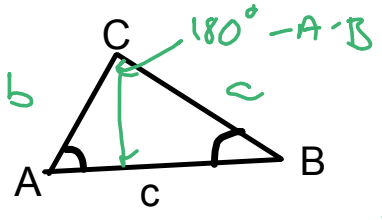
Conditions for Using the Sine Law

1) We know two sides and an opposite angle.

Solve for C.



2) We know two angles and any side



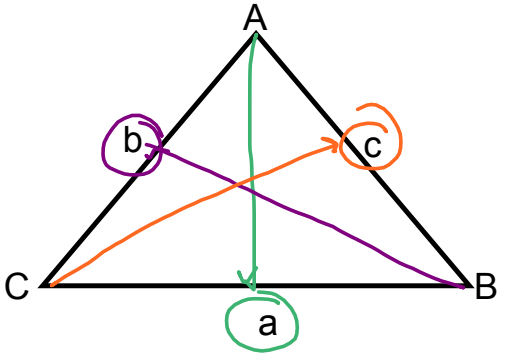
Solve for side a or b

A Note About Notation

When you are labelling the sides of a non-right triangle, opposite, adjacent, and hypotenuse are meaningless. So that people label sides and angles consistently, we must learn a new convention.

In non - right triangles:

- angles are labelled with a capital letter;
- sides are labelled with the lower case letter corresponding to the angle opposite to the side.



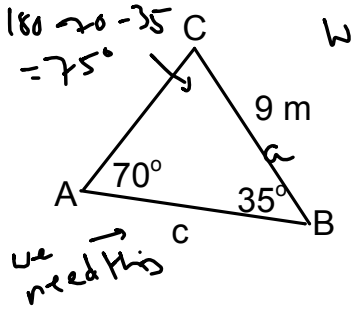
In any triangle, the shortest side is opposite the smallest angle, and the longest side is opposite the largest angle.

2) Drawing Diagrams for Non-Right Triangles

* You must be sure to label all vertices and place your side and angle measures correctly.
* Remember that the side opposite an angle is named using the lower case angle letter.
* In any triangle, the longest side is opposite the largest angle and the shortest side is opposite the smallest angle.

Examples:

1. Solve for the indicated value in each of the following triangles.



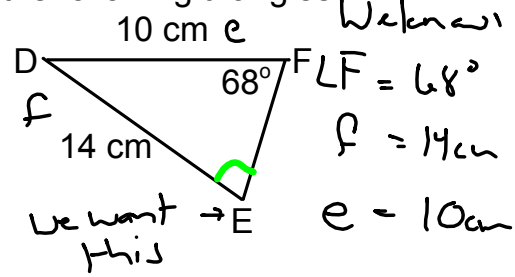
We know
A = 70°, a = 9 m

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

$$\sin 75° \left(\frac{c}{\sin 75°}\right) = \left(\frac{9}{\sin 70°}\right) \sin 75°$$

$$c = \frac{9 \sin 75°}{\sin 70°}$$

$$c = 9.3 \text{ m}$$



We know
∠F = 68°
f = 14 cm
e = 10 cm

$$\frac{\sin E}{e} = \frac{\sin F}{f}$$

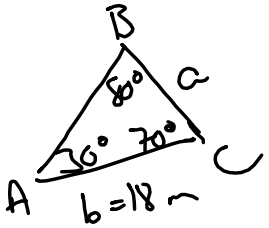
$$10\left(\frac{\sin E}{10}\right) = 10\left(\frac{\sin 68°}{14}\right)$$

$$\sin E = \frac{10 \sin 68°}{14}$$

$$\sin^{-1}(\quad) \quad E = 41.5°$$

2. Two angles of a triangle are 30° and 70°. The longest side is 18 m. Find the length of the shortest side.

↳ across from largest angle.

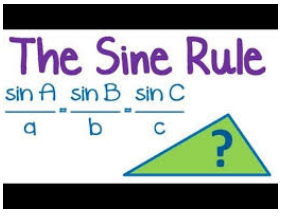


$$\frac{a}{\sin A} = \frac{b}{\sin B}$$

$$\frac{a}{\sin 30°} = \frac{18}{\sin 80°}$$

$$a = \frac{18 \sin 30°}{\sin 80°}$$

$$a = 9.1 \text{ m}$$



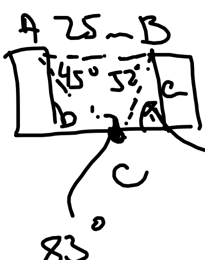
General Tips for Solving Word Problems Using the Sine Law

- **Draw a diagram**.
- Label it properly. Make sure it makes sense!
- **Write a let statement** to clearly define your unknown values. This will help you to choose the appropriate formula.
- Do not round until your last step so that your answer is accurate!
- **Write a concluding statement** that relates back to your let statement.

3. Two people are standing on different buildings that are the same height. They are 25 m apart. A car accident occurs on the road below. The angles of depression from the observers to the accident are 45° and 52°. Which person is closer and by how much?

Let c be the distance from Person B to the crash. Let b be the distance from Person A to the crash.

Person B is closer by 2 m.



Shorter side

$\frac{a}{\sin 45°} = \frac{25}{\sin 83°}$

$a = \frac{25 \sin 45°}{\sin 85°}$

$a = 17.8$ m

$\frac{b}{\sin 52°} = \frac{25}{\sin 83°}$

$b = 25 \sin 52° / \sin 83°$

$b = 19.8$ m

4. The roof of a dog house has rafters at the front of the house that are to be inclined at an angle of 26°. The house is 2 m wide. Determine the length of the rafters.

$\angle C = 180 - 26 - 26$
$= 128°$

Let a & b be the length of the rafters.

$\frac{b}{\sin 26°} = \frac{2}{\sin 128°}$

$b = \frac{2 \sin 26°}{\sin 128°}$

$= 1.1$ m

∴ The rafters are 1.1 m long.