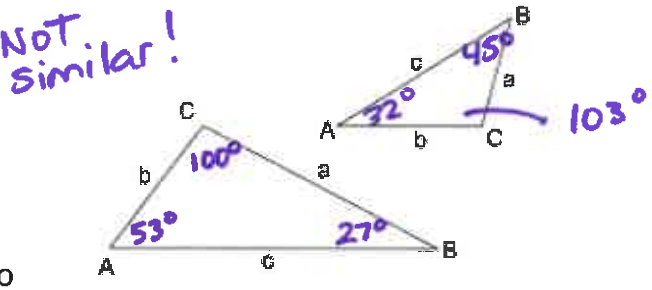
NOTES: The Sine Law

Date: Dec. 8

Neither of the triangles shown are **right** triangles.



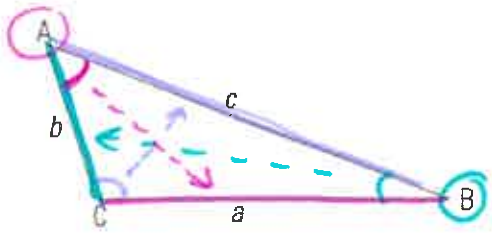
We cannot use the Pythagorean theorem or trigonometric ratios (sine, cosine, and tangent) to solve these types of triangles.

In certain situations, we can use the **sine law** to solve for an unknown length or an unknown angle of an oblique triangle.

↳ does not have a 90° angle (not a RIGHT Δ)

The Sine Law

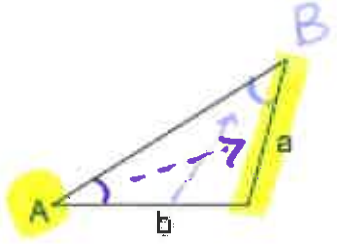
For **all** triangles, the ratio of the sine of an angle to the length of the side opposite is equal for all angle/opposite side pairs.



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

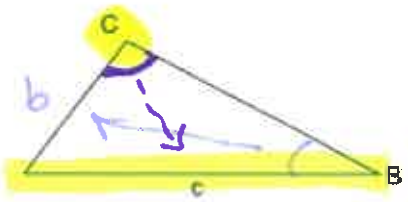
You can use the sine law when you know an angle/opposite side pair and one other side or angle.

- If you know two sides and the angle opposite one of them, you can find the angle opposite the other known side.



know ∠A and side a
can calculate ∠B
(know side b)

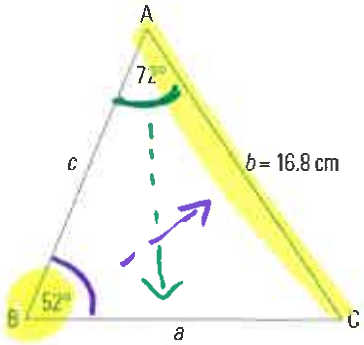
- If you know two angles and the side opposite one of them, you can find the side opposite the other known angle.



know ∠C and side c
can calculate side b
(know ∠B)

Example

Use the sine law to calculate the length of side a.



$$\frac{\sin 52^\circ}{16.8} = \frac{\sin 72^\circ}{a}$$

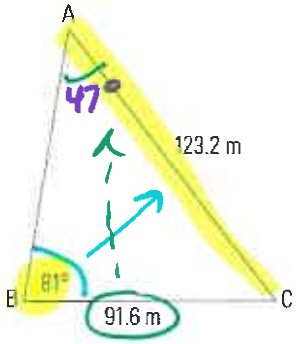
$$a = \frac{16.8 \times \sin 72^\circ}{\sin 52^\circ}$$

$$= 20.276\ldots$$

$$= 20.3\text{ cm}$$

Example

Calculate the sizes of ∠A and ∠C.



$$\frac{\sin 81^\circ}{123.2} = \frac{\sin A}{91.6}$$

$$\sin A = \frac{\sin 81 \times 91.6}{123.2}$$

$$= 0.7344$$

$$\angle A = \sin^{-1}(0.7344)$$

$$= 47^\circ$$

OR

$$\angle A = \sin^{-1}\left(\frac{\sin 81^\circ \times 91.6}{123.2}\right)$$

$$= 47^\circ$$

$\angle A = 47^\circ$

$\angle C = 180 - 81 - 47$

$\angle C = 52^\circ$