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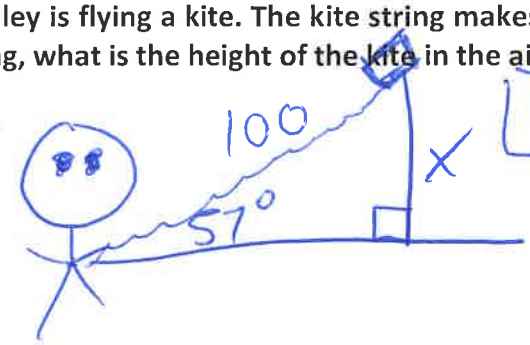
HansenMath Pre-calc: 6.1 Law of Sines

OLD SCHOOL

Stanley is flying a kite. The kite string makes an angle of 57° with the ground. If Stanley lets out 100 feet of string, what is the height of the kite in the air?



$100 \cdot \sin 57 = \frac{X}{100} \cdot 100$

$X = 83.9$ Ft

But what about oblique triangles? That is, they have No Right Angle.

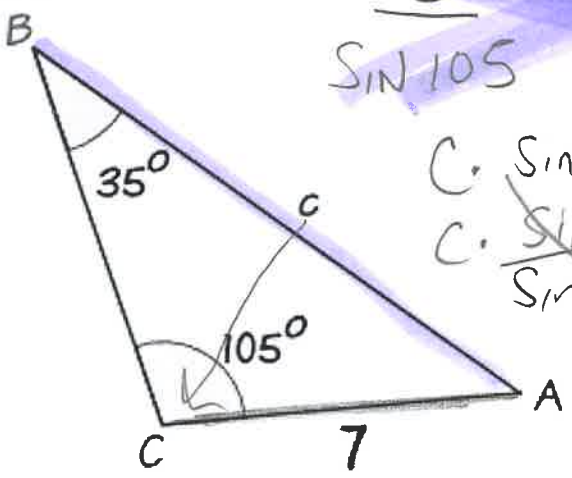
Law of Sines

In any triangle, the ratio of a side length to the sine of its opposite angle is the same for all three sides. As a formula:

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

Okay great.... what does this look like in practice?

Ex #1



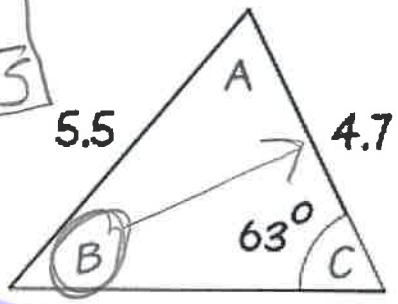
$\frac{c}{\sin 105} = \frac{7}{\sin 35}$

$c \cdot \sin 35 = 7 \cdot \sin 105$

$\frac{c \cdot \sin 35}{\sin 35} = \frac{6.8}{\sin 35}$

$C = 11.8$ Length

Ex #2



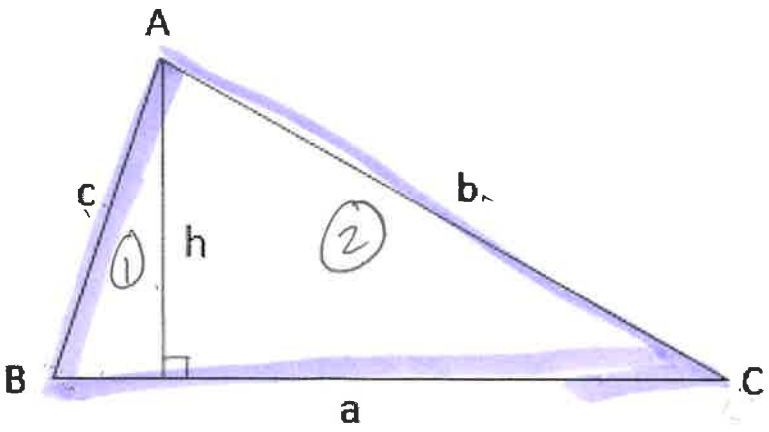
$\frac{4.7}{\sin B} = \frac{5.5}{\sin 63}$

$\frac{5.5}{5.5} \sin B = \frac{4.7 \sin 63}{5.5}$

$\sin B = .76$

2ND $\sin^{-1}(.76) = 49.5^\circ$

But I thought Sine only works on RIGHT TRIANGLES. Say what!?



1.) c. Sin B = $\frac{h}{c}$ b. Sin C = $\frac{h}{b}$

2.) Eliminate fractions $c \cdot \sin B = h$ $b \cdot \sin C = h$

3.) Since they both equal h, we have: $\frac{c \cdot \sin B}{\sin B \sin C} = \frac{b \cdot \sin C}{\sin B \sin C}$

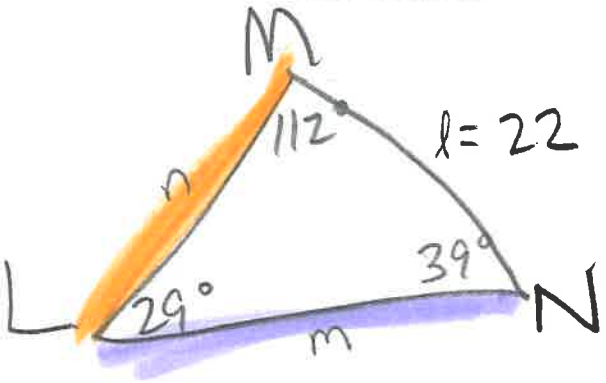
4.) Divide through by Sin B and Sin C

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

That's a quick proof, of sorts!

Law of Sines

Solve triangle LMN if L=29°, M=112°, and l=22.



$$\frac{m}{\sin 112} = \frac{22}{\sin 29^\circ}$$

$m = 42.1$

$n =$ ☐

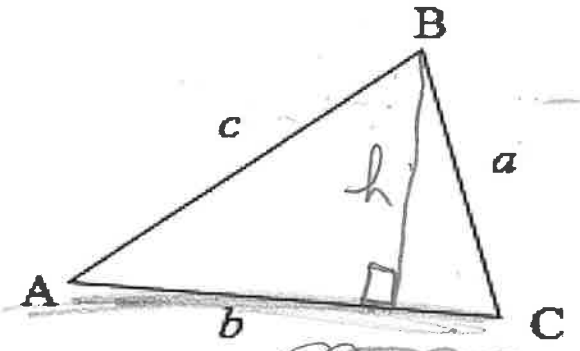
Try these:

Solve each triangle. Round to the nearest tenth.

1. A=40°, C=70°, a=20.
2. b=12, A=25°, B=35°.
3. B=100°, C=50°, c=30
4. a=8.2, B=24.8°, C=61.3°

Using Law of Sines to find AREA

How would you find the area of this Triangle?



$\text{Area}_{\triangle} = \frac{1}{2} \cdot \text{base} \cdot \text{height}$

$= \frac{1}{2} \cdot b \cdot c \cdot \sin A$

$c \cdot \sin A = h$

$c \cdot \sin A = h$

Thus:

Area of a Triangle

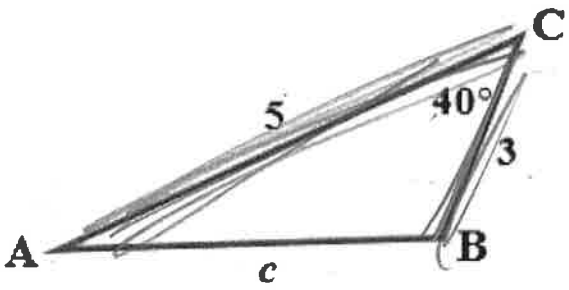
The area of any triangle is given by one half the product of the lengths of two sides times the sine of their included angle.

$$Area = \frac{1}{2}bc\sin A$$

$$Area = \frac{1}{2}ab\sin C$$

$$Area = \frac{1}{2}ac\sin B$$

$a = 3, \quad b = 5, \quad m\angle C = 40^\circ$



$\text{Area} = \frac{1}{2} \cdot 5 \cdot 3 \cdot \sin 40^\circ$

$= 4.8 \text{ units}^2$