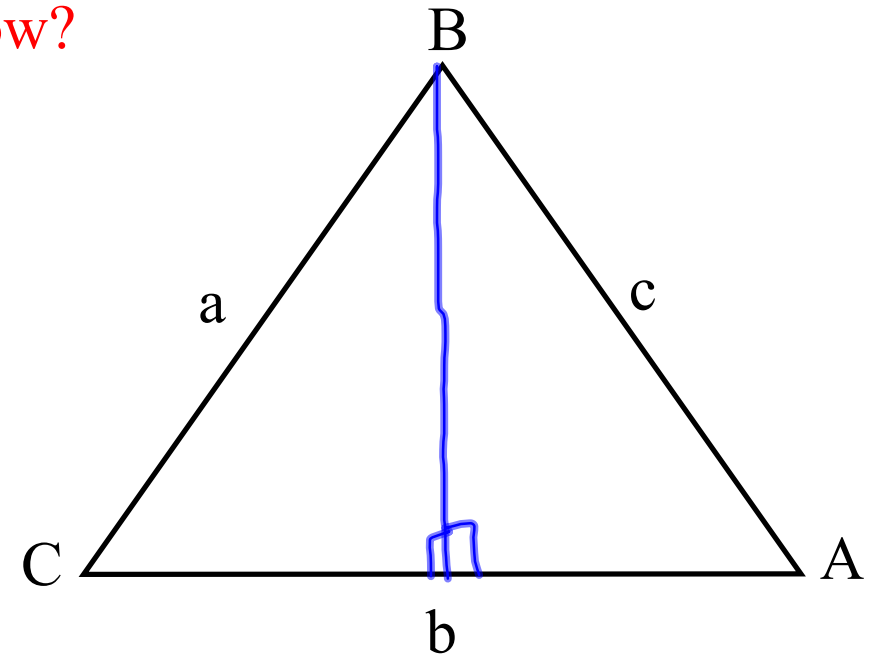
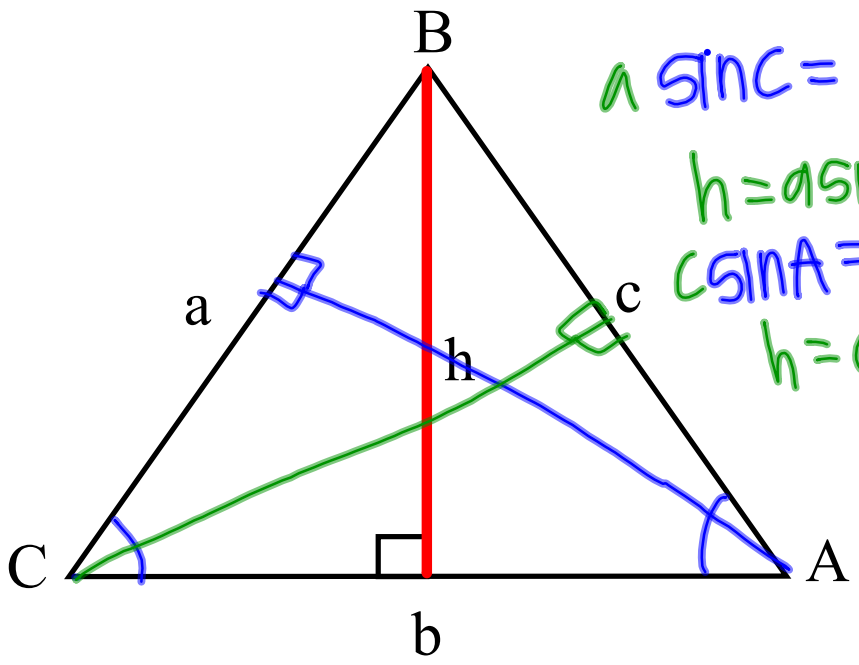
5.5 Law of Sines

If we want to find the area of a triangle, what do we need to know?

$\frac{1}{2}bh$



What is the height of the triangle??



$a\sin C = \frac{h}{a} \cdot a$

$h = a\sin C$

$c\sin A = \frac{h}{c} \cdot c$

$h = c\sin A$

$h = a\sin C$ $\qquad$ $h = c\sin A$

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

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

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

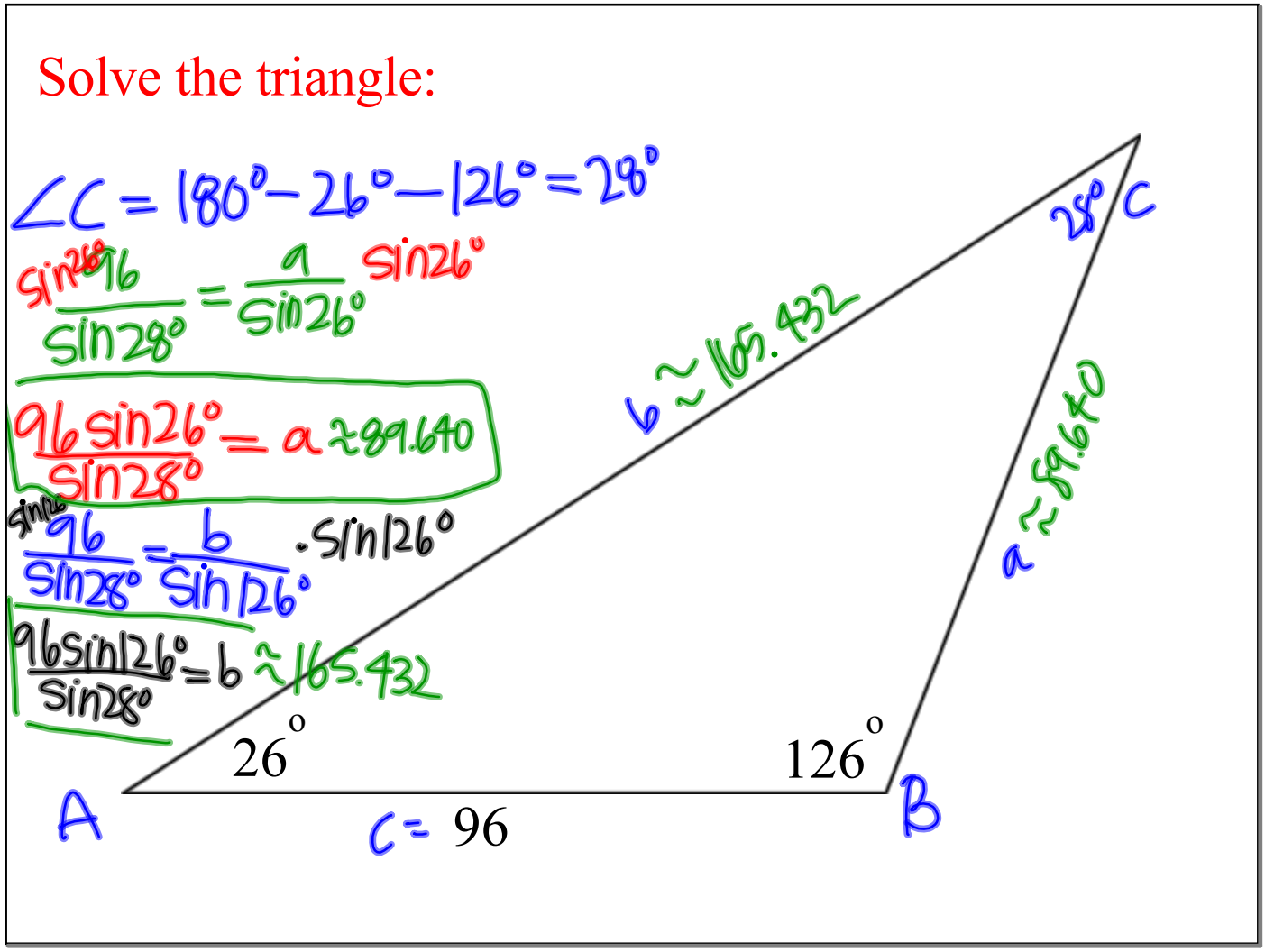
Law of Sines

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

Use when you know AAS or ASA.

or with Ambiguous Case: SSA

Solve the triangle:

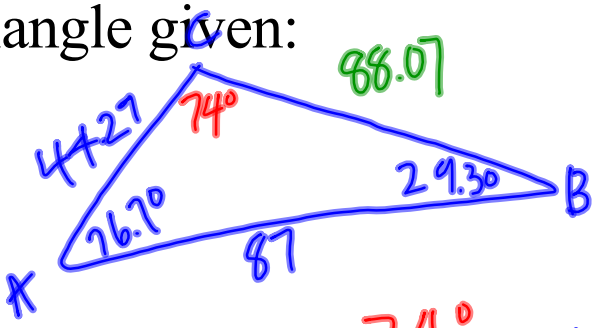


Solve the triangle given:

$A = 76.7^{o}$

$B = 29.3^{o}$

$c = 87$



$\angle C = 180° - 76.7° - 29.3° = 74°$

$\frac{87}{\sin 74} = \frac{a}{\sin 76.7}$

$44.29 \approx \frac{87 \sin 29.3}{\sin 74}$

$\frac{87 \sin 76.7}{\sin 74} = a \approx 88.07$

SSA

(butt case)

What do you remember from Geometry??

There are 3 possible situations:

0 triangles

1 triangle

2 triangles

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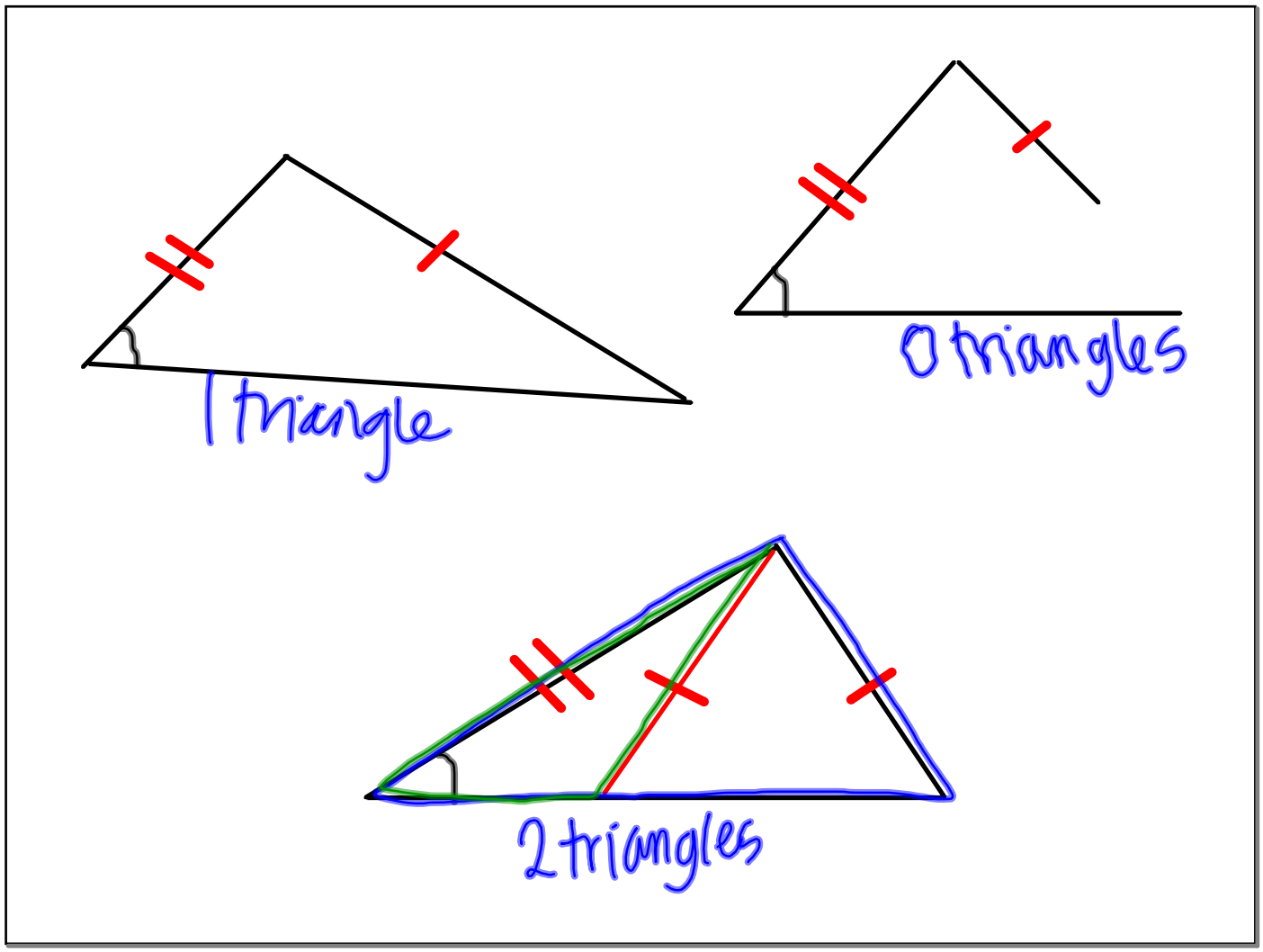
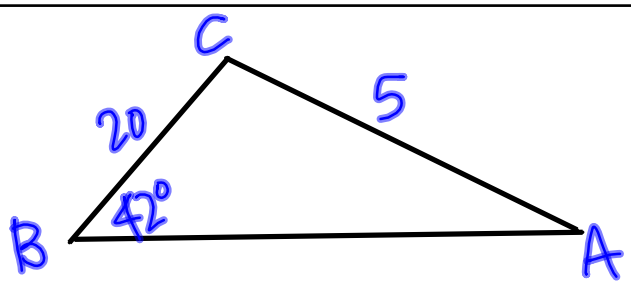
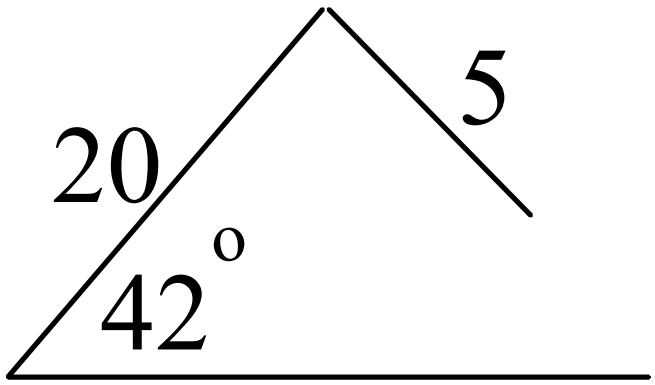


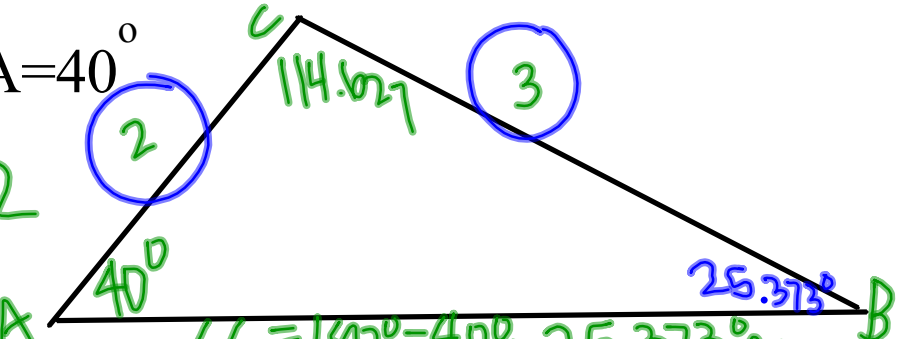
0 triangles:
given a=20, b=5, B=42°





1 triangle

given: a=3, b=2, A=40°



$\frac{2\sin 40°}{3} = \frac{\sin B}{2}$ · 2

$\sin^{-1}\left(\frac{2\sin 40°}{3}\right) = \sin^{-1}(\sin B)$

$\sin^{-1}\left(\frac{2\sin 40°}{3}\right) = B \approx 25.373°$

$\angle C = 180° - 40° - 25.373° \approx 114.627$

$\frac{c}{\sin 114.627} = \frac{3}{\sin 40}$

$c = \frac{3\sin 114.627}{\sin 40}$

$c \approx 4.242$

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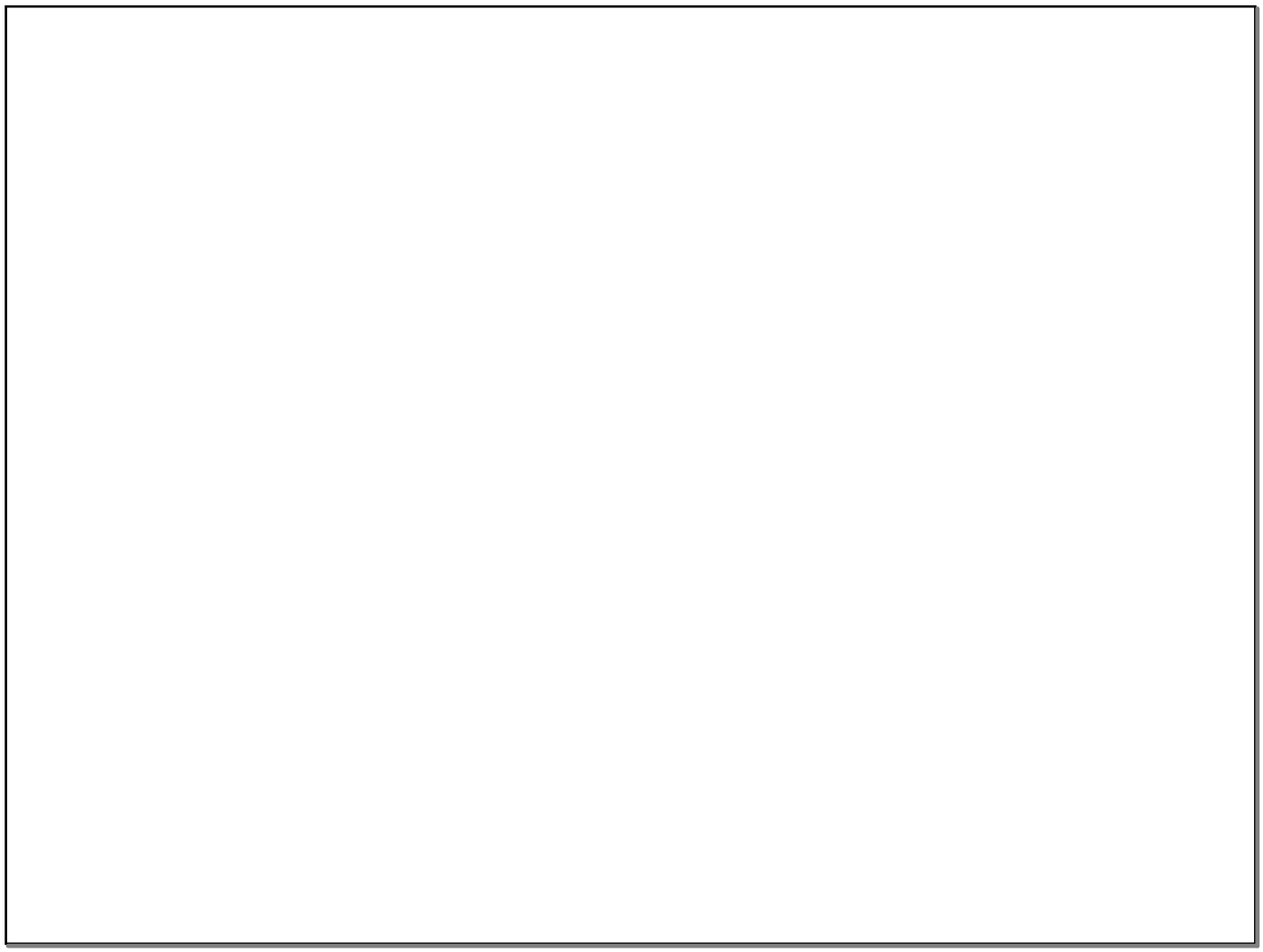
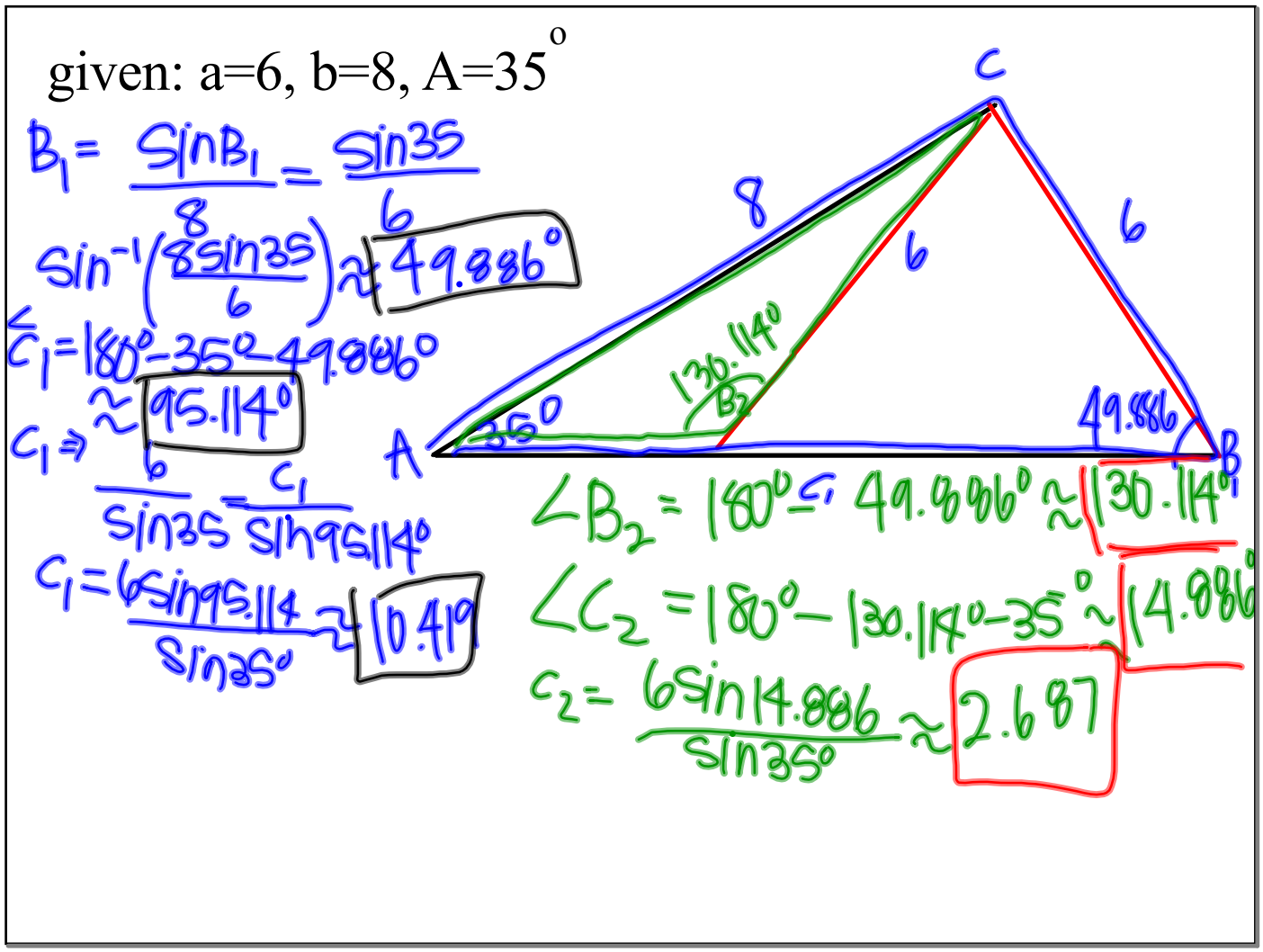


given: $a=6,\ b=8,\ A=35^\circ$



$$B_1 = \frac{\sin B_1}{8} = \frac{\sin 35}{6}$$

$$\sin^{-1}\left(\frac{8\sin 35}{6}\right) \approx 49.886^\circ$$

$$\angle C_1 = 180^\circ - 35^\circ - 49.886^\circ$$

$$C_1 \approx 95.114^\circ$$

$$\frac{6}{\sin 35} = \frac{c_1}{\sin 95.114^\circ}$$

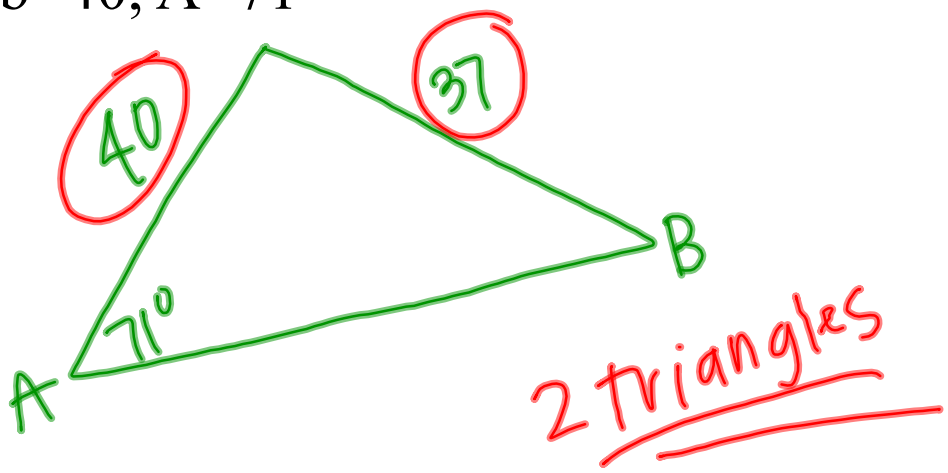
$$c_1 = \frac{6\sin 95.114}{\sin 35^\circ} \approx 10.419$$

$$\angle B_2 = 180^\circ - 49.886^\circ \approx 130.114^\circ$$

$$\angle C_2 = 180^\circ - 130.114^\circ - 35^\circ \approx 14.886^\circ$$

$$c_2 = \frac{6\sin 14.886}{\sin 35^\circ} \approx 2.687$$

given: a=37, b=40, A=71°



Solving Word Problems

Step 1: Avoid panic and confusion at all times.

Step 2: Take a deep breathe

Step 3: Draw a picture

Step 4: Label what you have

Step 5: Decide how you can use what you have to find what you don't

Step 6: just do it