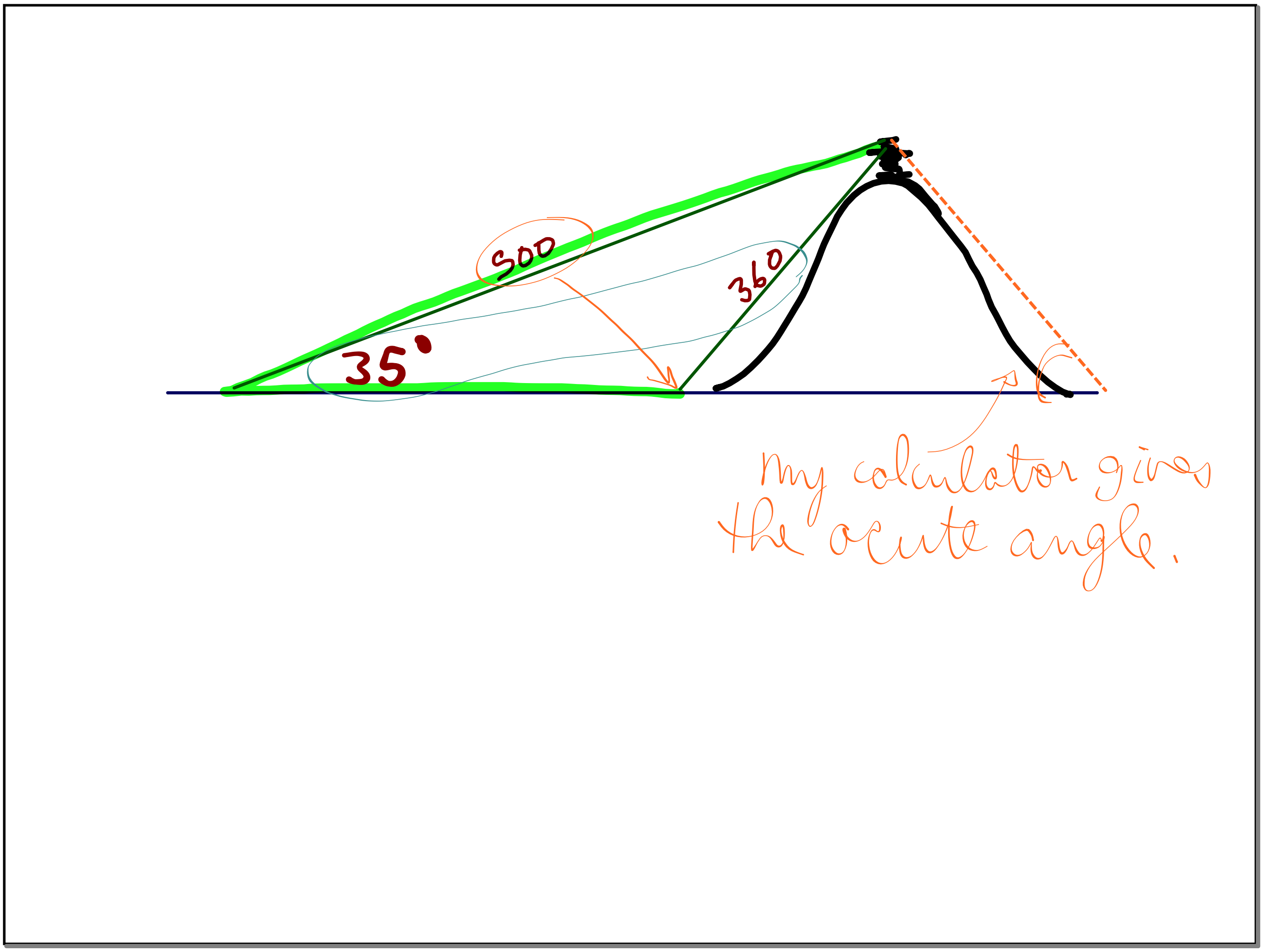
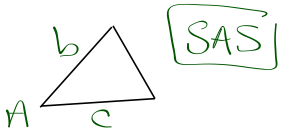
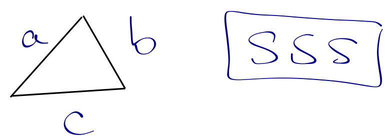

500
360
35°
my calculator gives
the acute angle.

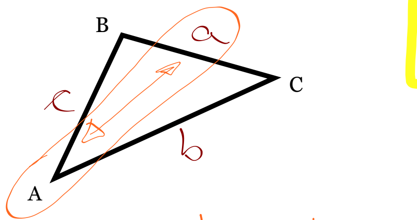
2.4 The Cosine Law

Two situations where the Sine Law WILL NOT work...





So we therefore need a new strategy... called the COSINE LAW.



$$\boxed{a^2 = b^2 + c^2 - 2bc\cos A}$$

opposites

or to solve for an angle

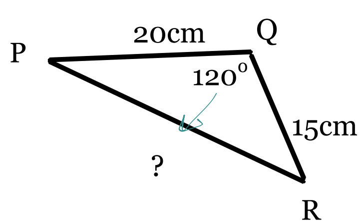
$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\boxed{\frac{a^2-b^2-c^2}{-2bc}} = \frac{\cancel{-2bc}\cos A}{\cancel{-2bc}} \qquad \frac{-1}{-1}$$

$$\boxed{\cos A = \frac{b^2+c^2-a^2}{2bc}}$$

Solving for a side with the COSINE law...

Example...



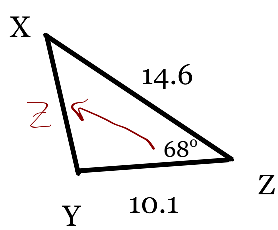
$q^2 = 20^2 + 15^2 - 2(20)(15)\cos 120°$

$q^2 = 400 + 225 - 600(-0.5)$

$\sqrt{q^2} = \sqrt{925}$

$\boxed{q = 30.41 \text{ cm}}$

Your Turn...



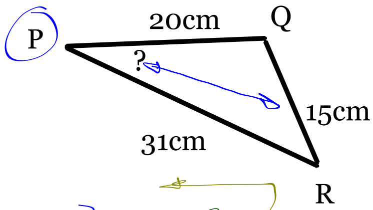
$z^2 = 14.6^2 + 10.1^2 - 2(14.6)(10.1)\cos 68°$

$z^2 \doteq 204.69$

$z \doteq 14.31$

Solving for an angle with the COSINE law...

Example...



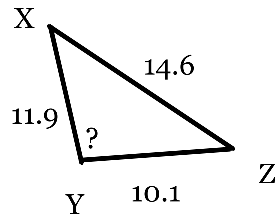
$$15^2 = 20^2 + 31^2 - 2(20)(31)\cos P$$

$$\frac{15^2 - 20^2 - 31^2}{-2(20)(31)} = \cos\angle P$$

$$\left(\frac{-1136}{-1240} = \cos P\right)\cos^{-1}$$

$$\boxed{P \doteq 23.6°}$$

Your Turn...



$$14.6^2 = 10.1^2 + 11.9^2 - 2(10.1)(11.9)\cos Y$$

$$\frac{14.6^2 - 10.1^2 - 11.9^2}{-2(10.1)(11.9)} = \cos Y$$

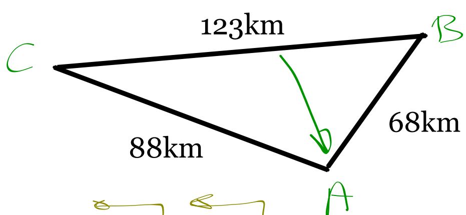
$$\cos Y = \frac{-30.46}{-240.38}$$

$$\boxed{Y = 82.72°}$$

Note: If you have to choose an angle to solve for, choose the largest one!

→ to avoid the ambiguous case with the sine law in step 2.

Example: Solve the triangle.



$$123^2 = 88^2 + 68^2 - 2(88)(68)\cos A$$

$$\frac{123^2 - 88^2 - 68^2}{-2(88)(68)} = \cos A$$

$$\left((-0.2307) = \cos A\right)\cos^{-1}$$

$$\boxed{A = 103.34°}$$

Now I can use the Sine Law to get ∠B

$$\frac{\sin\angle B}{88} = \frac{\sin 103.34°}{123}$$

$$\sin\angle B = \frac{88\sin 103.34°}{123}$$

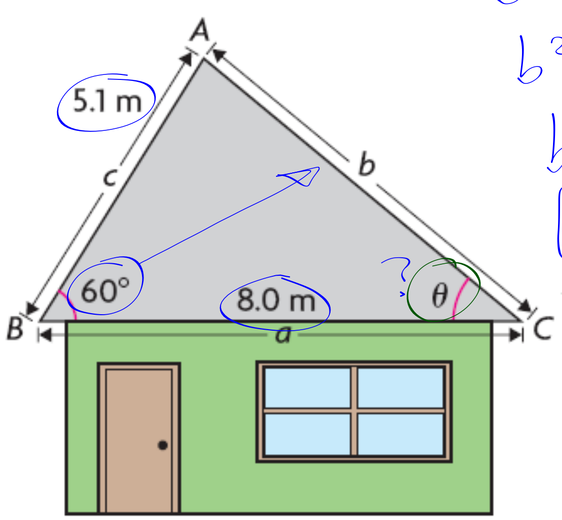
$$\left(\sin\angle B \doteq 0.696\right)\sin^{-1}$$

$$\boxed{\angle B \doteq 44.11°}$$

$$\angle C = 180° - 103.34 - 44.11$$

$$\boxed{\angle C = 32.55°}$$

Mitchell wants his 8.0 wide house to be heated with a solar hot-water system. The tubes form an array that is 5.1 m long. In order for the system to be effective, the array must be installed on the south side of the roof and the roof needs to be inclined by 60°. If the north side of the roof is inclined more than 40°, the roof will be too steep for Mitchell to install the system himself. Will Mitchell be able to install this system by himself?



$b^2 = 8^2 + 5.1^2 - 2(8)(5.1)\cos 60°$

$b^2 = 64 + 26.01 - 40.8$

$b^2 = 49.21$

$\boxed{b \doteq 7.01 \text{ m}}$

$\dfrac{\sin\theta}{5.1} = \dfrac{\sin 60°}{7.01}$

$\sin\theta = \dfrac{5.1 \sin 60°}{7.01}$

$(\sin\theta = 0.6296)\ \sin^{-1}$

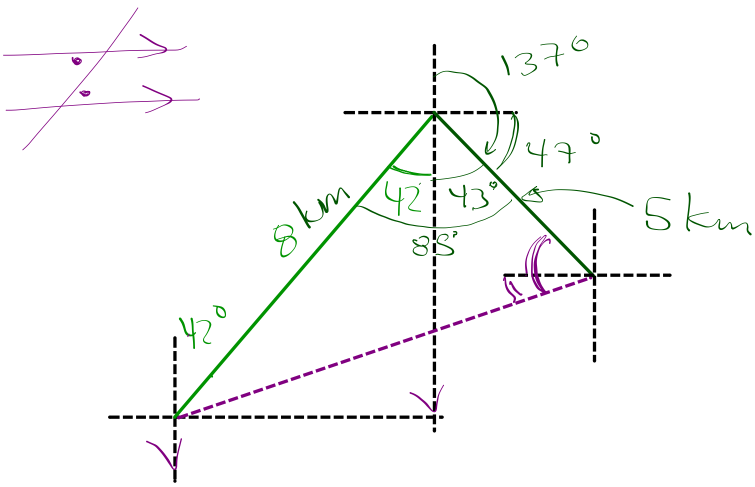
$\boxed{\theta = 39.02°}$

Yay, since $\theta < 40°$ Mitch can instal the roof himself

Let's draw a diagram together before you start!

Homefun

Pg 119 #(1, 2, 4, 5)ac, 7, 8, 10, 14, 15, 20, 23



a bearing of 137° = [E 47° S]
from N clockwise

Key Idea

- Given any triangle, the cosine law can be used if you know
  - two sides and the angle contained between those sides (SAS) or
  - all three sides (SSS)

Need to Know

- The cosine law states that in any $\triangle ABC$,

$$a^2 = b^2 + c^2 - 2bc\cos A$$
$$b^2 = a^2 + c^2 - 2ac\cos B$$
$$c^2 = a^2 + b^2 - 2ab\cos C$$