

Are you ready for the QUIZ?

## The Cosine Law

### Learning Goals

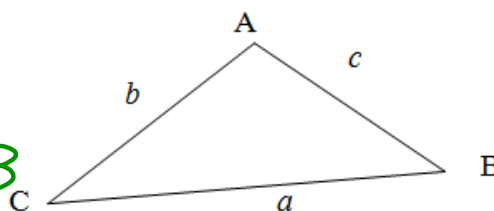
- review formula
- use the formula to find angles and sides

The cosine law says that for any  $\triangle ABC$ ,

$$c^2 = a^2 + b^2 - 2ab \cos C$$

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

$$b^2 = a^2 + c^2 - 2ac \cos B$$



\*\*\* To use the cosine law you need to know at least 3 info.

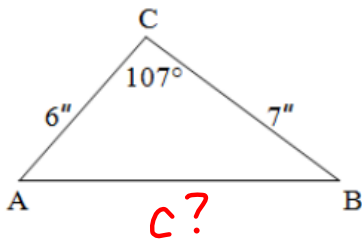
→ 3 sides

OR

→ 2 sides and 1 angle

\* use with non-right angled  $\triangle$

Ex 1) Find the value of side c.



$$c^2 = a^2 + b^2 - 2ab \cos C$$

$$c^2 = 7^2 + 6^2 - 2(7)(6) \cos 107^\circ$$

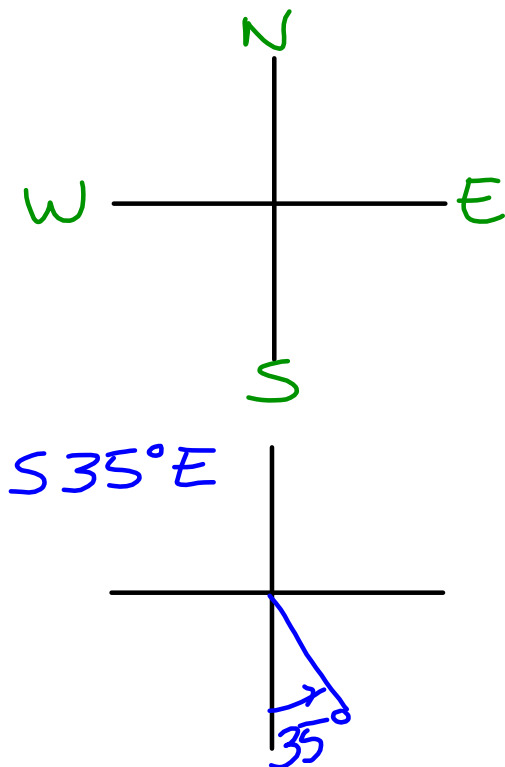
$$\sqrt{c^2} = \sqrt{109.56}$$

$$c = 10.5$$

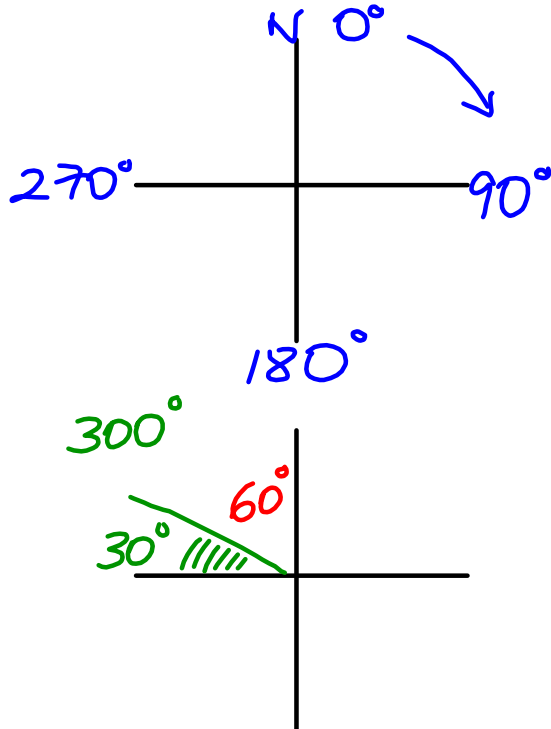
Reflect: If  $\angle C$  is obtuse, what happens to the ratio  $\cos C$ ? How does that affect the calculations in the Cosine Law?

$\rightarrow$  negative

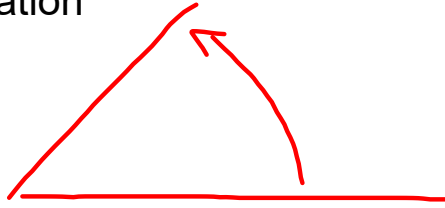
Directions (Geography)



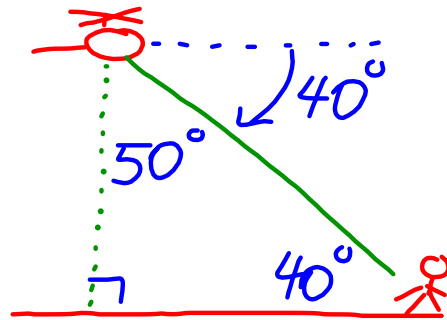
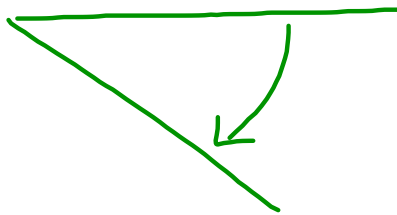
Bearing - a way to navigate in the air or in water



Angle of Elevation

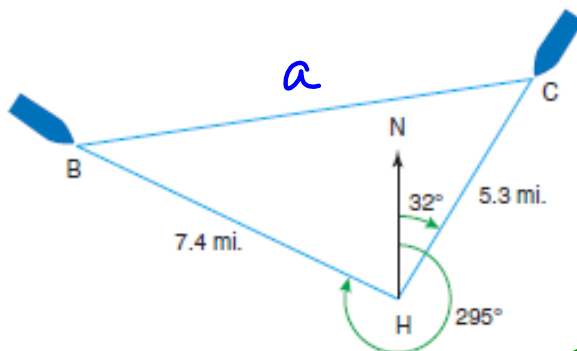


Angle of Depression



A harbour master uses a radar to monitor two ships, B and C, as they approach the harbour, H. One ship is 5.3 miles from the harbour on a bearing of  $032^\circ$ . The other ship is 7.4 miles away from the harbour on a bearing of  $295^\circ$ .

- How are the bearings shown in the diagram?
- How far apart are the two ships?



$$\begin{aligned}
 a^2 &= b^2 + c^2 - 2bc \cos A \\
 &= 5.3^2 + 7.4^2 \\
 &\quad - 2(5.3)(7.4)\cos 97^\circ \\
 a^2 &= 92.4 \\
 a &= 9.6
 \end{aligned}$$

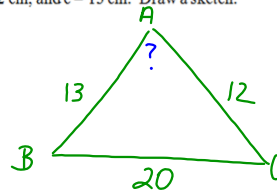
**On the Boards...**

Calculate  $\angle A$  for  $\triangle ABC$  if  $a = 20$  cm,  $b = 12$  cm, and  $c = 13$  cm. Draw a sketch.

What law/formula we need?

cosine law

Sub in numbers



Solve

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

$$20^2 = 12^2 + 13^2 - 2(12)(13)\cos A$$

$$400 = 144 + 169 - 312 \cdot \cos A$$

stays together

$$87 = -312 \cos A$$

$$-0.2788 = \cos A$$

$$106^\circ = A$$

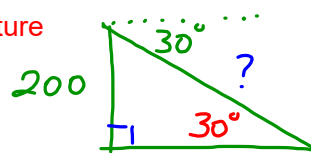
$$a^2 = b^2 + c^2 - 2bc \cos A$$

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

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

A helicopter spots some hikers at an angle of depression of  $30^\circ$ . The helicopter is 200 m in the air, how far are the hikers from the helicopter?

Draw a picture



What law/formula we need?

$$\sin \theta = \frac{\text{opp}}{\text{hyp}}$$

Sub in numbers

$$\sin 30^\circ = \frac{200}{x}$$

Solve

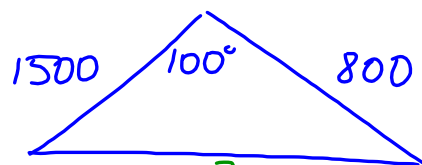
$$x (\sin 30^\circ) = 200$$

$$x = \frac{200}{\sin 30^\circ}$$

$$x = 400$$

A cottage is located 800 m from one side of the lake and 1500 m from the other side of the lake. This way the cottage and the two ends of the lake make a triangle. The angle at the cottage is  $100^\circ$ . How long is the lake?

Draw a picture



What law/formula we need?

Sub in numbers  $c^2 = a^2 + b^2 - 2ab \cos C$

$$c^2 = 800^2 + 1500^2$$

Solve

$$- 2(800)(1500)\cos 100^\circ$$

$$c^2 = 3306755.6$$

$$c = 1818.45$$

## Seatwork

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