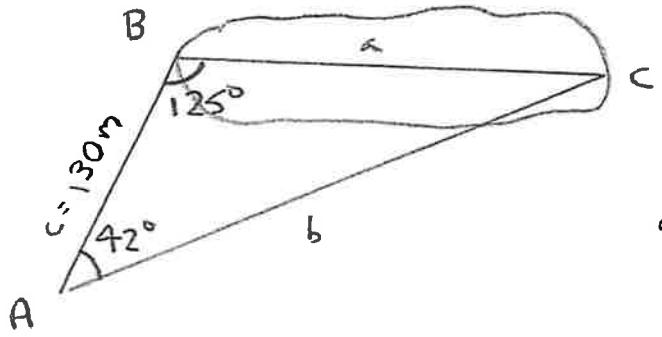
Section 7.4 – Applications of Trigonometry

- The LAW of SINES and LAW of COSINES are very useful when solving 'real' world problems
- Remember that using the LAW of COSINES for **SSS triangles**, solve for the **largest angle** first
- Remember that using the LAW of COSINES for **SAS triangles**, solve for the **smallest angle** first

Example: To measure the length of a lake, a baseline AB is set and measured at $130m$. Angles A and B are measured to be $42°$ *and* $125°$ respectively. How long is the lake?

Solution:



$\angle C = 180° - 125° - 42°$

$= 13°$

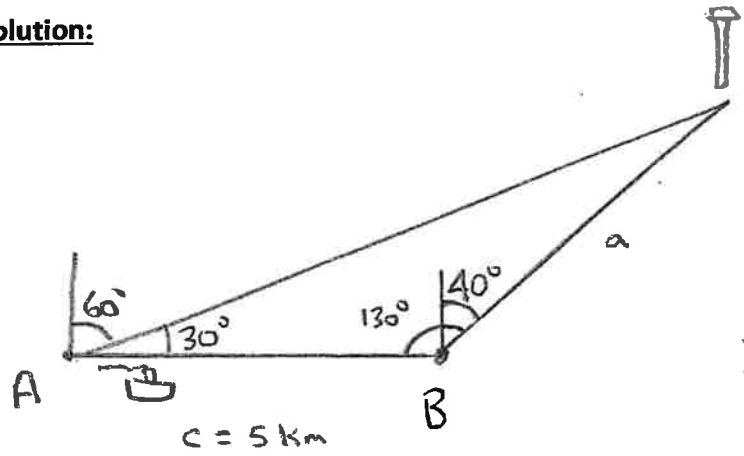
$$\frac{\sin 13°}{130} = \frac{\sin 42°}{a}$$

$$a = \frac{130 \sin 42°}{\sin 13°}$$

$a = 387\,m$

Example: A ship is heading due east and passes a rock A. At the time, the bearing to the lighthouse L is $N60°E$. After travelling 5km, the bearing is $N40°E$. How far is the ship from the lighthouse?

Solution:



$\angle C = 180° - 30° - 130°$

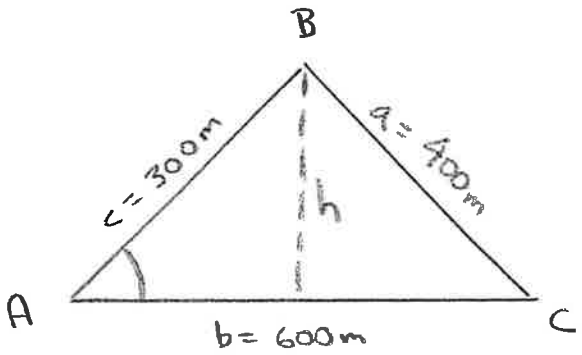
$= 20°$

$$\frac{\sin 20°}{5} = \frac{\sin 30°}{a}$$

$a = 7.3\,km$

Example: The length of the sides of a triangular parcel of land are approximately $300m, 400m, and\ 600m$. Approximate the area of the parcel of land

Solution:



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

$$400^2 = 600^2 + 300^2 - 2(600)(300)\cos A$$

$$\frac{400^2 - 600^2 - 300^2}{-2(600)(300)} = \cos A$$

$$\angle A = 36.336^\circ$$

$$h = 300 \sin 36.336^\circ$$

$$= 177.756$$

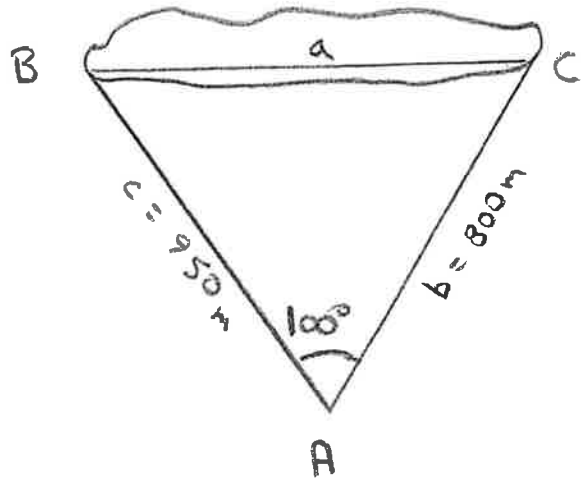
$$A_\Delta = \frac{1}{2} b h$$

$$= \frac{1}{2}(600)(177.756)$$

$$= 53327\ m^2$$

Example: To approximate the length of a lake, a surveyor triangulates the distance to one side to be $950m$ and to the other $800m$. If the angle between the two measures $100°$, how long is the lake?

Solution:



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

$$a^2 = 800^2 + 950^2 - 2(800)(950)\cos 100^\circ$$

$$a^2 = 1806445.23$$

$$a = \sqrt{1806445.23}$$

$$a = 1344\ m$$

Section 7.4 – Practice Questions

1. A hot air balloon is flying directly between two cities that are $4km$ apart. The balloonist finds that the angle of depression to one city is $38°$ and $33°$ to the other city. How high above the ground is the balloon?

2. Two planes leave airport A at the same time in different directions. One plane lands at airport B, $630km$ from airport A. The other plane lands at airport C some time later. If the $\angle ABC = 110°$ and $\angle ACB = 40°$, how far did the second plane fly.

3. A fire at C is spotted from two fire lookout stations, A and B, which are $12km$ apart. If station A reports $\angle BAC$ is $50°$, and station B reports $\angle ABC$ is $32°$, how far is the fire from station A?

4. In our solar system, the distance from the Sun (S) to planets A and B are 85 and 61 million miles respectively. When $\angle A = 20°$, how far is it from planet A to planet B?