

## Day 6 – Applications of the Cosine Law

To use the **Cosine Law** to solve a triangle you must know either

1. 2 sides and the contained angle
2. all 3 sides

Recall that:

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

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

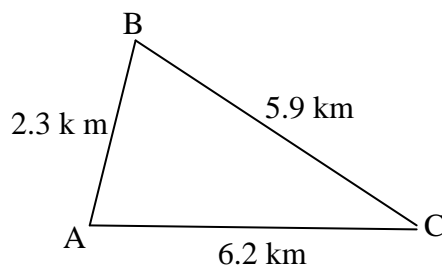
$$c^2 = a^2 + b^2 - 2ab(\cos C)$$

Work through the word problems that follow to consolidate your understanding of the cosine law and its application to real world contexts.

Then you may wish to complete the formative quiz on the cosine law.

Finally, work through some word problems assigned by your Mathematics teacher.

**Example:** A bicycle race follows a triangular course. The 3 legs of the race are, in order, 2.3 km, 5.9 km and 6.2 km. Find the angle between the starting leg and the finishing leg, to the nearest degree.



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

$$5.9^2 = 6.2^2 + 2.3^2 - 2(6.2)(2.3)(\cos A)$$

$$34.81 = 38.44 + 5.29 - 28.52 \cos A$$

$$34.81 = 43.73 - 28.52 \cos A$$

$$34.81 - 43.73 = -28.52 \cos A$$

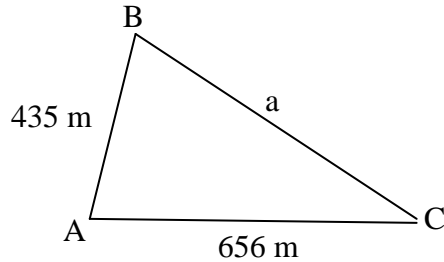
$$\frac{34.81 - 43.73}{-28.52} = \cos A$$

$$\angle A = \cos^{-1}\left(\frac{-8.92}{-28.52}\right)$$

$$\angle A \cong 72^\circ$$

$\therefore$  The angle between the starting leg and the finishing leg is  $72^\circ$ .

Example: A farmer has a field in the shape of a triangle. The farmer has asked the manufacturing class at your school to build a metal fence for his farm. From one vertex, it is 435 m to the second vertex and 656 m to the third vertex. The angle between the lines of sight to the second and third vertices is  $49^\circ$ . Calculate how much fencing he would need to enclose his entire field.



We are being asked to find the perimeter of the field.

Find  $a$ .

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

$$a^2 = 656^2 + 435^2 - 2(656)(435)(\cos 49)$$

$$a^2 = 430336 + 189225 - 570720 \cos 49$$

$$a^2 = 619561 - 570720 \cos 49$$

$$a^2 \cong 245134.991$$

$$a \cong 495m$$

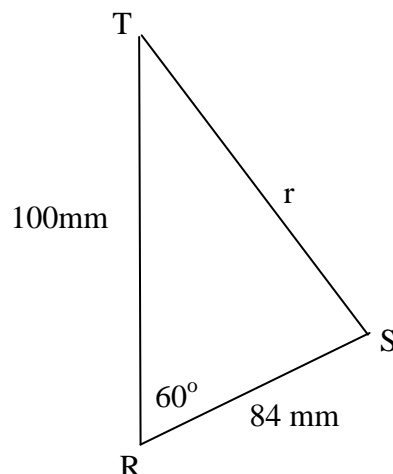
$$\text{Perimeter} = a + b + c$$

$$\text{Perimeter} = 495 + 656 + 435$$

$$\text{Perimeter} = 1586m$$

$\therefore$  The perimeter of the field is 1586 m.

Example: You've been given an assignment to mill a triangular shape on the CNC machine for a contemporary sign for the arts department. The dimensions you're given by your manufacturing teacher are shown in the following diagram. What is the measurement of TS?



$$r^2 = s^2 + t^2 - 2st(\cos R)$$

$$r^2 = 30^2 + 21^2 - 2(30)(21)(\cos 60^\circ)$$

$$r^2 = 900 + 441 - 1260 \cos 60$$

$$r^2 = 1341 - 1260 \cos 60$$

$$r^2 \cong 711$$

$$r \cong 26.7cm$$

$\therefore$  The measurement of TS is approximately 26.7 cm.