

**Worksheet 1-6: The Cosine Law (Non-Right Triangles)**

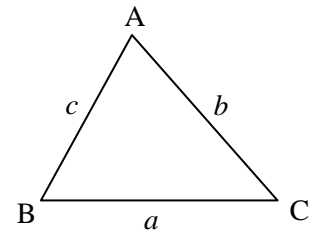
The cosine law can be used to solve a non-right triangle when given:

- (a) the measures of **two sides and the “contained” angle**  
 (b) the measures of **three sides**

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

for side lengths

for angles

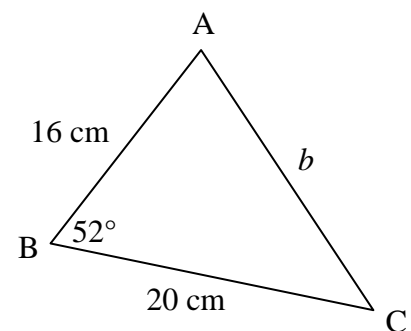
**When do we need to use it?**

We use it when the given information is **insufficient** for us to use sine law to solve the acute triangle.

**For Rule (a) above, why do we need the contained angle to use the cosine law?**

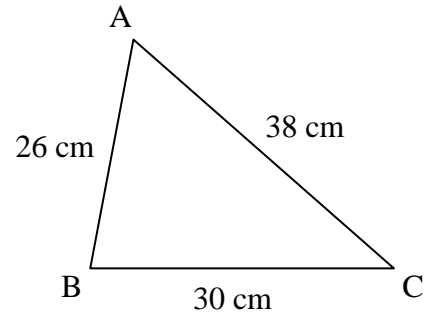
**Find the Measure of a Side:**

1. Find the measure of side  $b$  to the nearest tenth of a centimetre.



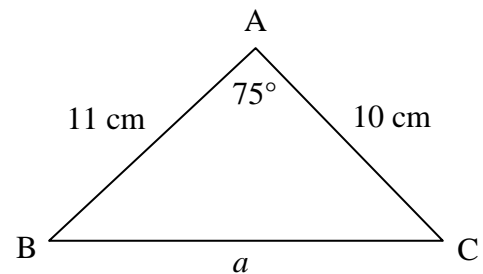
**Find the Measure of an Angle:**

2. Find the measure of  $\angle A$  to the nearest degree.

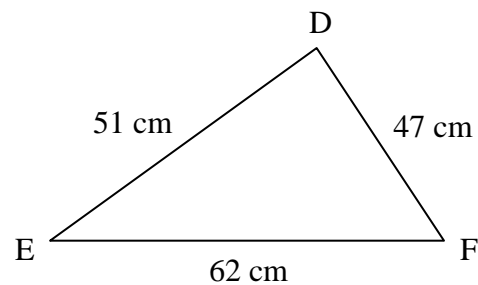


3. Solve each triangle, side lengths to the nearest tenth of a centimetre and angle to the nearest degree.

(a) **When Two Sides and the Contained Angle are Given**

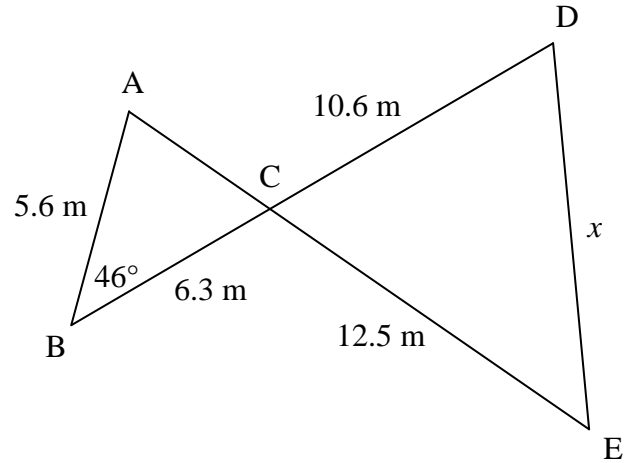


**(b) When Three Side Lengths are Given**



4. For  $\Delta RST$ ,  $\angle R = 72^\circ$ ,  $s = 12$  m, and  $t = 10$  m. Solve the triangle, to the nearest degree and metre.

5. Solve for  $x$  to the nearest tenth of a metre.

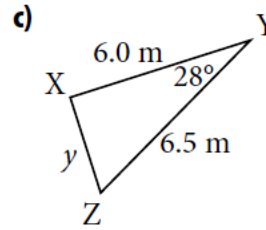
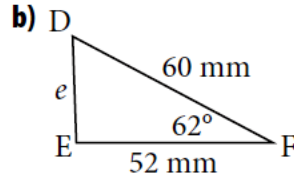
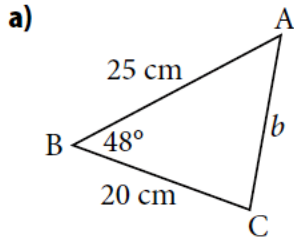


6. What information about a triangle do you need to know to use the cosine law?

- Answers:** 1. 16.2 cm; 2.  $52^\circ$ ; 3. (a)  $a = 12.8$  cm,  $\angle B = 49^\circ$ ,  $\angle C = 56^\circ$ , (b)  $\angle D = 78^\circ$ ,  $\angle E = 48^\circ$ ,  $\angle F = 54^\circ$ ;  
 4.  $r = 13$  m,  $\angle S = 61^\circ$ ,  $\angle T = 47^\circ$ ; 5.  $x = 11.5$  m ( $AC = 4.7$  m,  $\angle ACB = 59^\circ$ );  
 6. measures of all three sides or measures of two sides and the contained angle (angle in between).

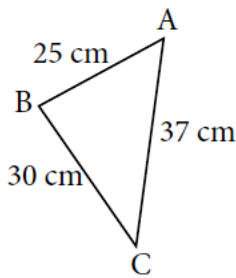
**Practise**

1. Find the measure of the unknown side.

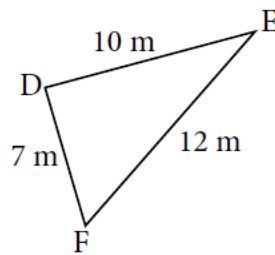


2. Find the measure of the unknown angle as indicated.

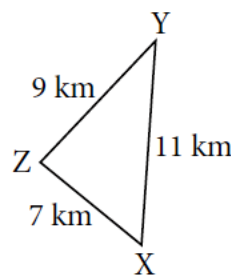
a) Find  $\angle A$ .



b) Find  $\angle D$ .



c) Find  $\angle X$ .



3. Find the measures of the unknown sides and angles in  $\triangle ABC$ , given  $\angle A = 32^\circ$ ,  $b = 25.5$  m, and  $c = 22.5$  m. Round side lengths to the nearest tenth of a metre and angles to the nearest degree.

4. Find the measures of the unknown angles in  $\triangle ABC$ , given  $a = 14$  m,  $b = 15$  m, and  $c = 8$  m. Round angles to the nearest degree.

**Answers**

1. a) 18.9 cm                      b) 58.1 mm                      c) 3.1 m  
 2. a)  $53.7^\circ$                       b)  $88.0^\circ$                       c)  $54.7^\circ$   
 3.  $\angle B = 86^\circ$ ,  $\angle C = 62^\circ$ ,  $a = 13.5$  m  
 4.  $\angle A = 67^\circ$ ,  $\angle B = 81^\circ$ ,  $\angle C = 32^\circ$