

Cosine Law

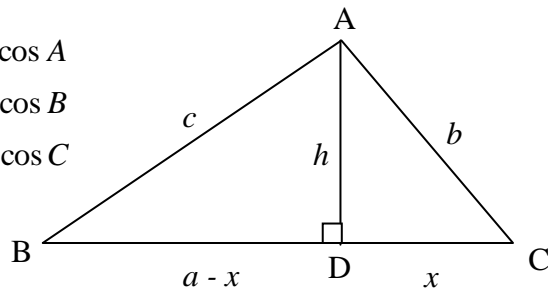
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Cosine Law:

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

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

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



<p><u>In $\triangle ADC$</u></p> $\cos C = \frac{x}{b}$ $x = b \cos C$ $b^2 = x^2 + h^2$	<p><u>In $\triangle ABD$</u></p> $c^2 = h^2 + (a-x)^2$ $= h^2 + a^2 - 2ax + x^2$ $= a^2 - 2ax + x^2 + h^2$ $c^2 = a^2 + b^2 - 2ab \cos C$
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Using Cosine Law to find the angles

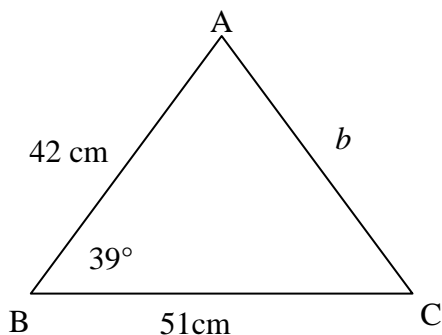
$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

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

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

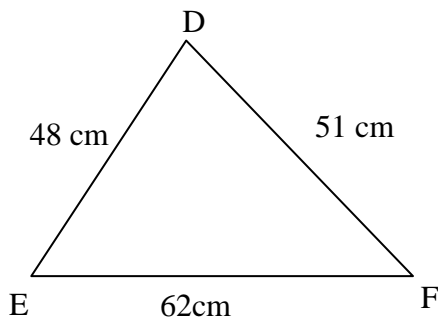
Example 1: Cosine Law (SAS)

Solve the triangle if $a = 51\text{cm}$, $\angle B = 39^\circ$ and $c = 42\text{cm}$.



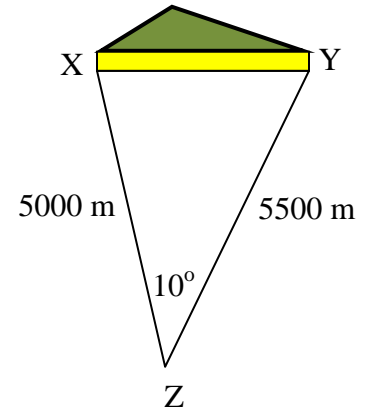
Example 2: Cosine Law (SSS)

In $\triangle DEF$, $d = 62\text{ cm}$, $e = 51\text{ cm}$, and $f = 48\text{ cm}$. Find each angle of the triangle, to the nearest tenth-degree.



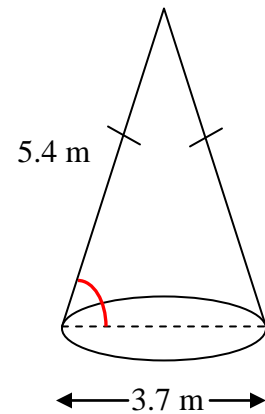
Example 3:

Peter is 5000 m away from the entrance of a tunnel and 5500 m away from the exit of the tunnel, if the angle from his position to the entrance and exit of the tunnel is 10° , find the length of the tunnel, XY, to the nearest metre.



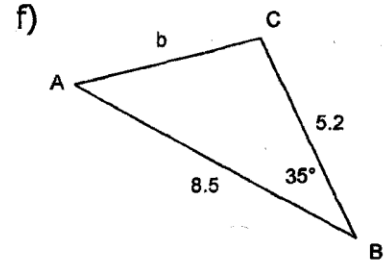
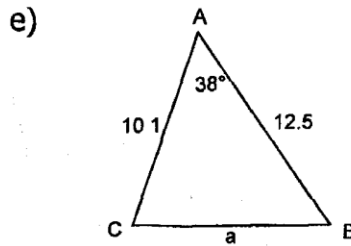
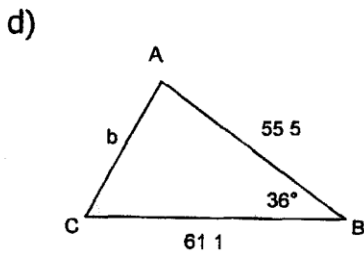
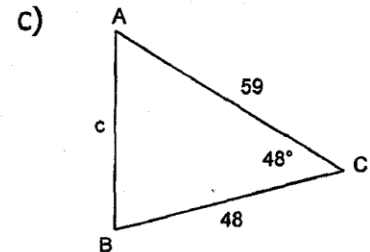
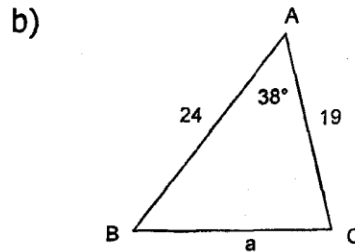
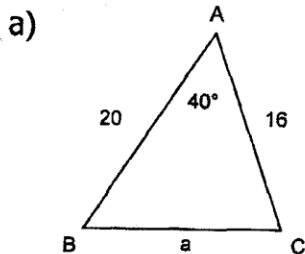
Example 4:

The tops of the solid rocket boosters used to launch the space shuttle are cones of diameter 3.7 m and slant height 5.4 m. Find the angle that the curved surface of the cone makes with a diameter, to the nearest tenth of a degree.

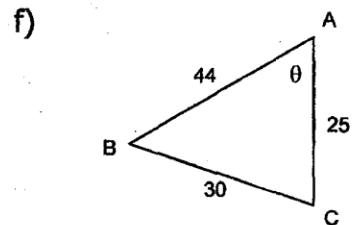
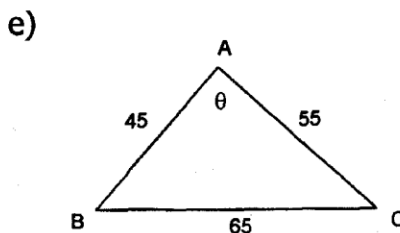
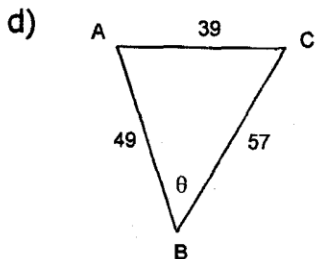
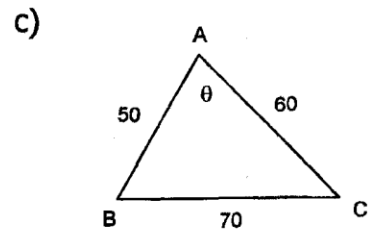
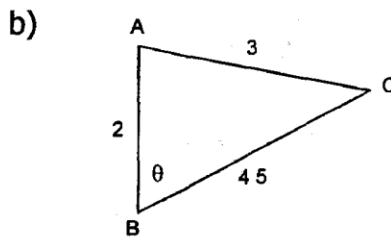
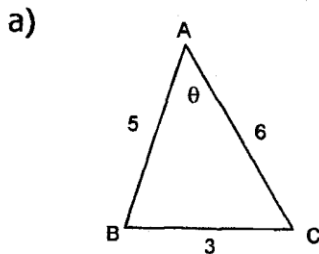


Exercise

1. Determine the indicated length. *Express answers accurate to 2 decimal places.*



2. Determine the indicated angle in each of the acute triangles below. *Express answers accurate to 1 decimal place.*



3. A triangle has sides of lengths 12 cm, 17 cm and 9.5 cm. Determine the measure of the largest angle in the triangle.

Answers

1. a) 12.87 b) 14.78 c) 44.67 d) 36.42 e) 7.70 f) 5.18
 2. a) 29.93° b) 32.09° c) 78.46° d) 42.34° e) 80.41° f) 40.97°
 3. 103.89°

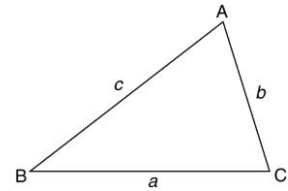
THE LAWS OF SINES AND COSINES

• **LAW OF SINES:** $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$, or $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$

The sine law can be used to solve triangles given SSA or AAS (any side).

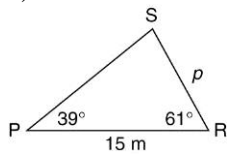
• **LAW OF COSINES:** $a^2 = b^2 + c^2 - 2bc \cos A$, or $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$

The cosine law can be used to solve triangles given SAS or SSS.

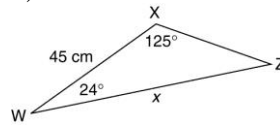


1. State the law you would need to apply to determine the measure of each indicated side, then find the indicated side.

a)



b)

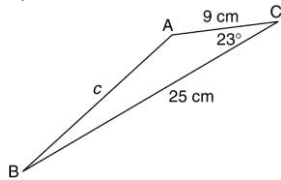


Required law

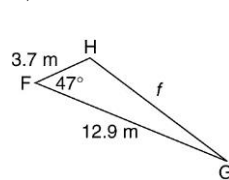
a) _____

b) _____

c)



d)

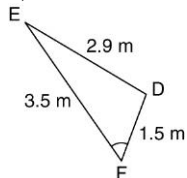


c) _____

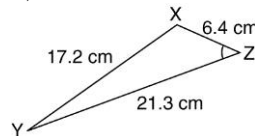
d) _____

2. Determine the measure of the indicated angle, to the nearest tenth of a degree.

a)



b)



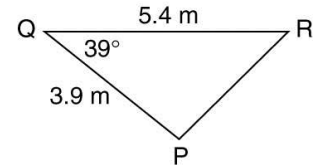
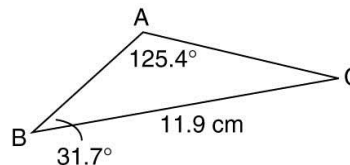
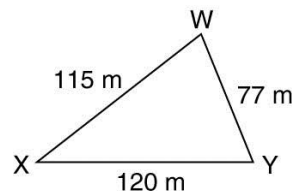
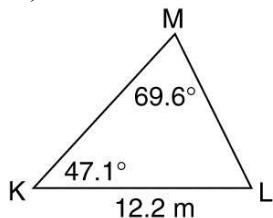
3. Determine the measure of the stated unknown for each of the following. Round each calculated value to the nearest tenth of a unit, if necessary.

a) Determine 'k'

b) Determine $\angle W$

c) Determine 'c'

d) Determine $\angle R$



Answers

1a) Sine Law, $p = 9.59m$ b) Sine Law, $x = 71.57cm$ c) Cosine Law, $c = 17.1cm$ d) Cosine Law, $f = 10.72m$

2a) $\angle F \approx 54.5^\circ$ b) $\angle Z \approx 43.2^\circ$ 3a) $k = 9.5m$ b) $\angle W \approx 74.4^\circ$ c) $c = 5.7cm$ d) $\angle R \approx 46^\circ$