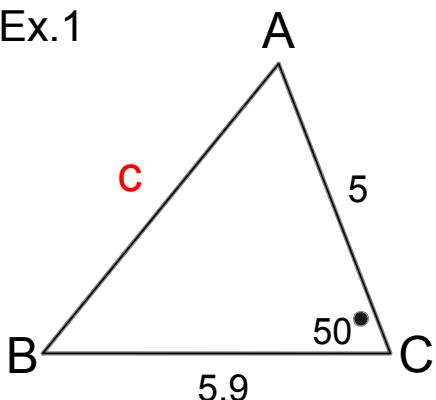


The Cosine Law

Date: May 28/2010

Ex.1



Determine the length of side c.

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

We don't have enough information to solve with the sine law.

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See p.562 in text

$$b^2 = x^2 + h^2$$
$$a^2 = y^2 + h^2$$
$$x + y = c$$
$$y = c - x$$
$$\cos A = \frac{x}{b}$$
$$x = b \cos A$$
$$a^2 = (c-x)^2 + h^2$$
$$a^2 = c^2 - 2cx + x^2 + h^2$$
$$a^2 = c^2 - 2cx + b^2$$
$$a^2 = c^2 - 2c(b \cos A) + b^2$$
$$a^2 = b^2 + c^2 - 2bc \cos A$$

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The Sine Law only works when we have certain combinations of sides and angles.

The Cosine Law provides different combinations that can be used to solve a triangle.

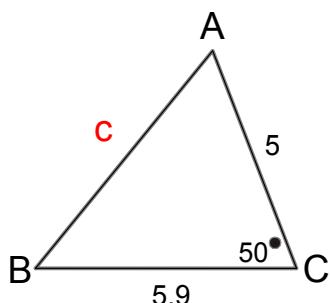
$$a^2 = b^2 + c^2 - 2 b c \cos A$$

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

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

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Solution to our original problem:



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

$$c^2 = (5.9)^2 + (5)^2 - 2(5.9)(5) \cos 50^\circ$$

$$c^2 = 34.81 + 25 - 2(5.9)(5)(0.6427)$$

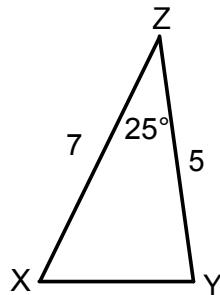
$$c^2 = 21.8855$$

$$c = \sqrt{21.8855}$$

$$c = 4.7$$

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Ex.2 Determine the length of side z:

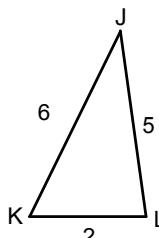


* if the triangle is labelled differently, the cosine law equations have the same pattern

$$\begin{aligned}
 z^2 &= x^2 + y^2 - 2xy \cos Z \\
 z^2 &= (5)^2 + (7)^2 - 2(5)(7) \cos 25^\circ \\
 z^2 &\doteq 25 + 49 - 70(0.906) \quad 0.906307787 \\
 z^2 &\doteq 10.558 \\
 z &\doteq \sqrt{10.558} \quad * \text{reject } -\sqrt{10.558} \\
 z &\doteq 3.2 \quad \text{because we cannot have negative length.}
 \end{aligned}$$

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Ex.3 Determine the measure of angle K:



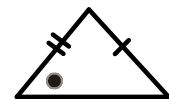
* when solving for the angle, it can be useful to rearrange the equation first

$$\begin{aligned}
 k^2 &= j^2 + l^2 - 2jl \cos K \\
 2jl \cos K &= j^2 + l^2 - k^2 \\
 \cos K &= \frac{j^2 + l^2 - k^2}{2jl} \\
 \cos K &= \frac{2^2 + 6^2 - 5^2}{2(2)(6)} \\
 \cos K &= \frac{4 + 36 - 25}{24} \\
 \cos K &= \frac{15}{24} \\
 \cos K &= 0.625 \\
 K &= \cos^{-1}(0.625) \\
 K &\doteq 51.3^\circ
 \end{aligned}$$

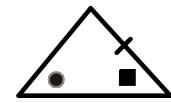
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Use the Sine Law given:

- two sides and an angle to find a second angle (SSA).

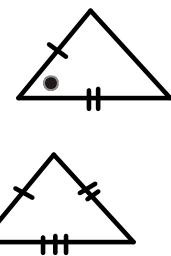


- two angles and a side to find a second side (SAA).



Use the Cosine Law given:

- two sides and the contained angle to find the third side (SAS).
- three sides, and find any angle (AAA).



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Homework:

p.566 #2-5

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