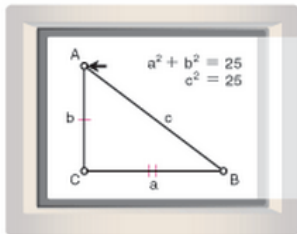
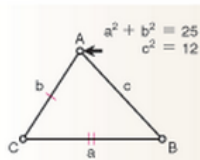


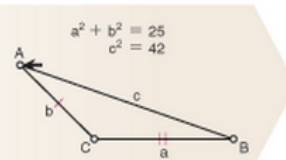
12.4 - Law of Cosines



In this right triangle
 $c^2 = a^2 + b^2$



In this acute triangle
 $c^2 < a^2 + b^2$



In this obtuse triangle
 $c^2 > a^2 + b^2$

$$c^2 = a^2 + b^2 - \textit{something}$$

Use the pythagorean theorem to write 2 equations

$$h^2 + x^2 = b^2$$

$$(a-x)^2 + h^2 = c^2$$

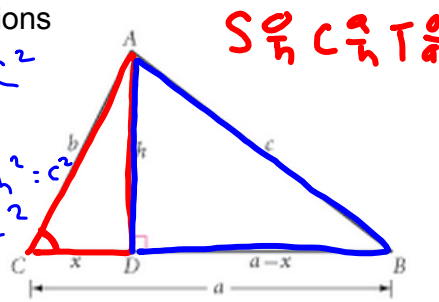
$$(a-x)(a-x)$$

$$a^2 - ax - ax + x^2 + h^2 = c^2$$

$$a^2 + x^2 + h^2 - 2ax = c^2$$

Substitute

$$a^2 + b^2 - 2ax = c^2$$



Replace x using Cos C

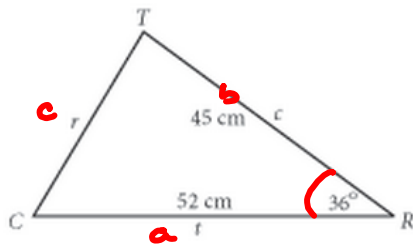
$$b \cdot \cos C = \frac{x}{b} \cdot b$$

$$b \cos C = x$$

Law of Cosines: For any triangle with said a , b and c , and with C being the angle opposite of side length C

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

Use with acute triangles if you are given all three sides or two sides and the angle between them



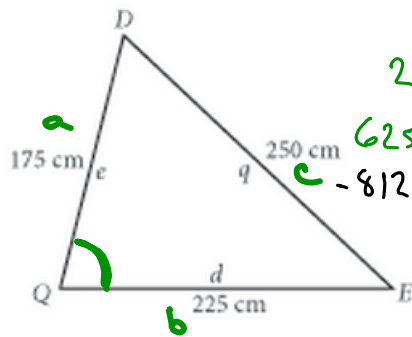
$$c^2 = 52^2 + 45^2 - 2(52)(45)\cos 36^\circ$$

$$c^2 = 4729 - 3786.2$$

$$\sqrt{c^2} = \sqrt{942.8}$$

$$c = 30.7 \text{ cm}$$

Find the measure of $\angle Q$ in triangle QED .



$$250^2 = 175^2 + 225^2 - 2(175)(225)\cos Q$$

$$62500 = 81250 - 78750\cos Q$$

$$\begin{aligned} -18750 &= -78750\cos Q \\ \frac{-18750}{-78750} &= \frac{-78750\cos Q}{-78750} \end{aligned}$$

$$\cos Q = .2381$$

$$\cos^{-1}(.2381)$$

$$Q = 76^\circ$$