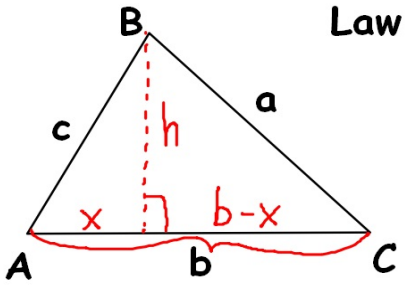
## 13-6 Law of Cosines

April 18




**Law of Cosines (for non-right triangles)**

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

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

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

Proof: $x^2 + h^2 = c^2 \rightarrow h^2 = c^2 - x^2$

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

$$(c^2 - x^2) + b^2 - 2bx + x^2 = a^2$$

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

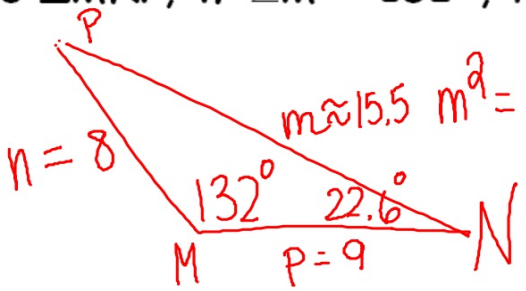
$$c^2 + b^2 - 2bc(\cos A) = a^2$$

$$\cos A = \frac{x}{c}$$

$$x = c(\cos A)$$

**ex. 1** Solve $\Delta MNP$, if $\angle M = 132°$, $n = 8$, $p = 9$.

SAS $\Delta$




$m^2 = 8^2 + 9^2 - 2(8)(9)\cos 132°$

$145 - 144\cos 132°$

$m \approx 15.5$

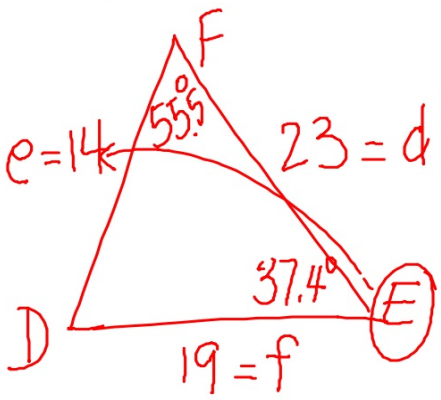
$$\frac{\sin N}{8} = \frac{\sin 132°}{15.5}$$

$\angle N \approx 22.6°$

$\angle P \approx 25.4°$

**ex. 2** Solve $\Delta DEF$, if $d = 23$, $e = 14$, $f = 19$.

SSS $\Delta$




$14^2 = 19^2 + 23^2 - 2(19)(23)\cos E$

$196 = 890 - 874\cos E$

$\frac{+694}{+874} = \cos E$

$\frac{\sin F}{19} = \frac{\sin 37.4^\circ}{14}$

$\angle F \approx 55.5^\circ$

$\angle D \approx$