

Recall:  $b = d + e$   
 $\rightarrow e = b - d$   
 $d = b - e$

$$\cos(\angle C) = \frac{d}{a}$$

$$d = a \cos(\angle C)$$

$$\sin(\angle C) = \frac{h}{a}$$

$$h = a \sin(\angle C)$$

By the Pythagorean Theorem,

$$c^2 = h^2 + e^2$$

$$c^2 = h^2 + (b - d)^2$$

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

$$c^2 = a^2 \sin^2(\angle C) + (b^2 + a^2 \cos^2(\angle C) - 2ab \cos(\angle C))$$

$$c^2 = a^2 \sin^2(\angle C) + a^2 \cos^2(\angle C) + b^2 - 2ab \cos(\angle C)$$

$$c^2 = a^2 (\sin^2(\angle C) + \cos^2(\angle C)) + b^2 - 2ab \cos(\angle C)$$

$$c^2 = a^2 (1) + b^2 - 2ab \cos(\angle C)$$

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

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

(by similar logic)

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

\* The Law of Cosines

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

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$$-(a^2 + b^2) \quad -(a^2 + b^2)$$

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

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

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

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

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

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

SSS



3 sides find angle

SAS



2 sides  
angle in between  
Find Last side.

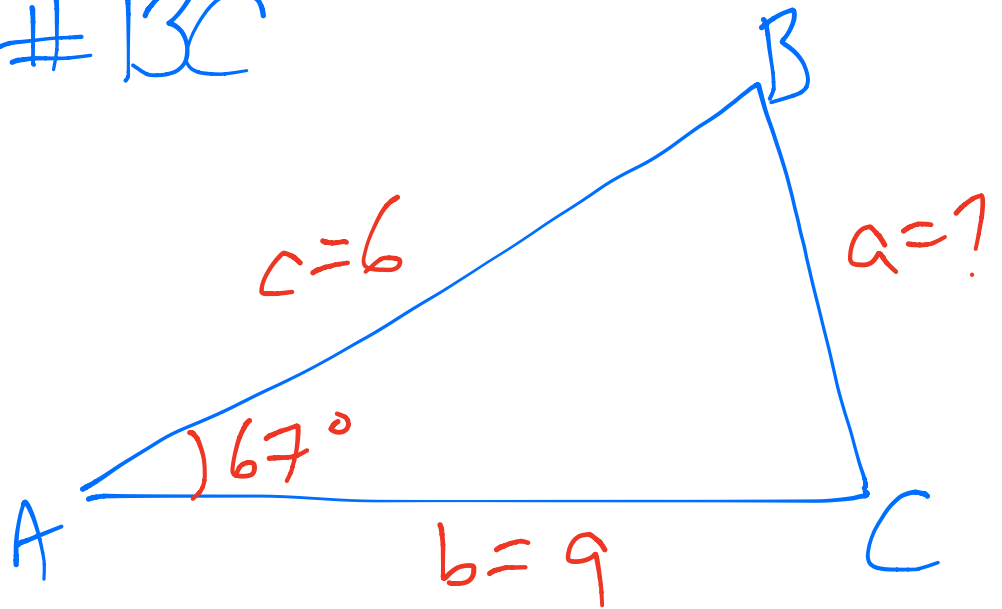
# FE Review #13C

$$b=9$$

$$c=6$$

$$\angle A = 67^\circ$$

Find side A



SAS  $\rightarrow$  Law of Cosines

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

$$a^2 = (9)^2 + (6)^2 - 2(9)(6) \cos(67)$$

$$a^2 = 117 - 108 \cos(67)$$

$$a^2 = \sqrt{117 - 108 \cos(67)}$$

$$a \approx 8.649$$

# FE Review #13A

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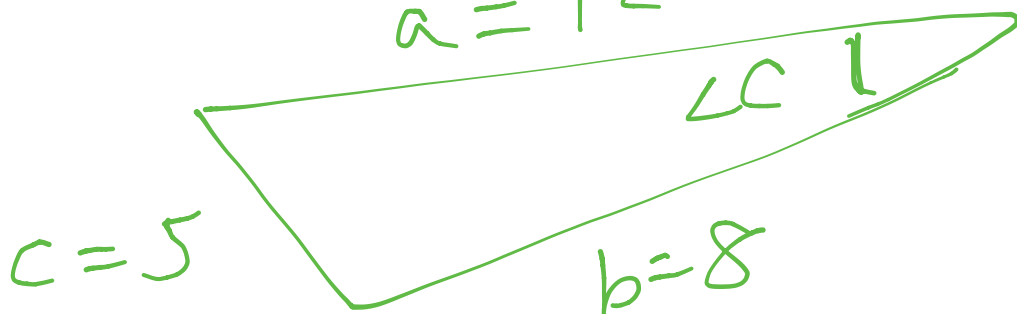
$$a = 12$$

$$b = 8$$

$$c = 5$$

Find  $\angle C$

$$a = 12$$



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

$$(5)^2 = (12)^2 + (8)^2 - 2(12)(8) \cos(\angle C)$$

$$25 = 208 - 192 \cos(\angle C)$$

$$-208 \quad -208$$

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$$\frac{-183}{-192} = \frac{-192 \cos(\angle C)}{-192}$$

$$\cos(\angle C) = \frac{183}{192}$$

$$\angle C = \cos^{-1}\left(\frac{183}{192}\right)$$
$$\angle C \approx 17.612^\circ$$