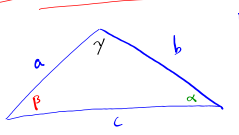


8.2. Law of Cosines



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

$\gamma = 90^\circ$

$$c^2 = a^2 + b^2 - 2ab \cos(90^\circ)$$

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

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

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

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

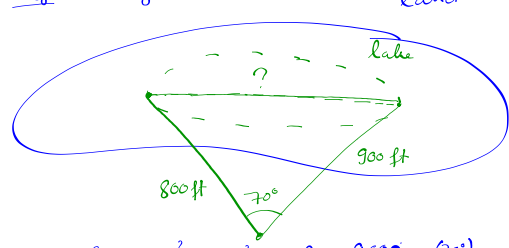
$$\cos \gamma = \frac{a^2 + b^2 - c^2}{2ab}$$

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

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

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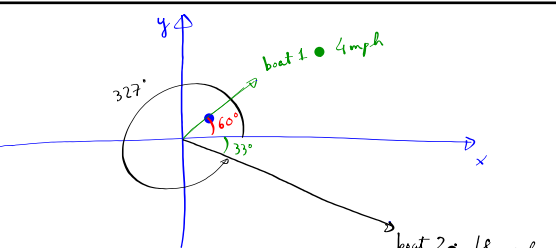
Eg. surveyor



$$?^2 = 800^2 + 900^2 - 2 \cdot 800 \cdot 900 \cdot \cos(70^\circ)$$

$$? = \sqrt{800^2 + 900^2 - 2 \cdot 800 \cdot 900 \cdot \cos(70^\circ)}$$

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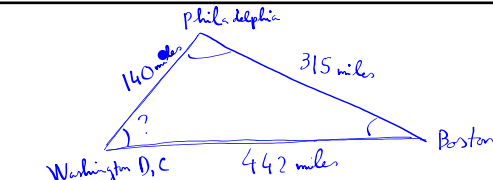
Question: Find the distance between the 2 boats after 2 hours.

$$?^2 = 8^2 + 36^2 - 2 \cdot 8 \cdot 36 \cdot \cos(96^\circ)$$

$$? = \sqrt{?}$$

$$? = 37.280 \text{ miles}$$

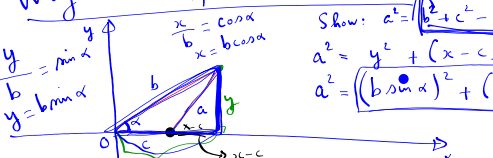
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$$\cos(?) = \frac{140^2 + 442^2 - 315^2}{2 \cdot 140 \cdot 442}$$

Why the law of cosines is true?

Show:  $a^2 = b^2 + c^2 - 2bc \cos(\alpha)$



$$y = b \sin \alpha$$

$$x = b \cos \alpha$$

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

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

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

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

$$a^2 = b^2 \sin^2 \alpha + b^2 \cos^2 \alpha - bc \cos \alpha - cb \cos \alpha + c^2$$

$$= b^2 \sin^2 \alpha + b^2 \cos^2 \alpha - 2bc \cos \alpha + c^2$$

$$= b^2 (\sin^2 \alpha + \cos^2 \alpha) + c^2 - 2bc \cos \alpha$$

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

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