TRIGONOMETRY PROBLEMS

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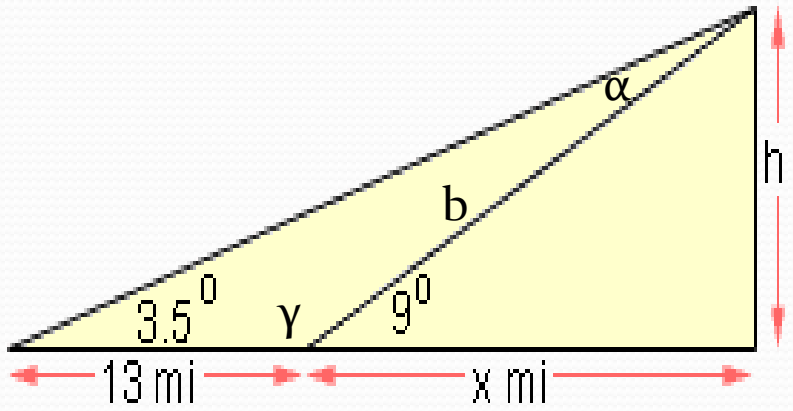
Height of a Mountain

- In traveling across flat land, you notice a mountain directly in front of you. Its angle of elevation (to the peak) is 3.5°. After you drive 13 miles closer to the mountain, the angle of elevation is 9°. Approximate the height of the mountain.



Resolution

Law of sines: $\frac{13mi}{\sin\alpha} = \frac{b}{\sin 3.5°}$

$\gamma = 180° - 9° = 171°$ $\alpha = 180° - (171° + 3{,}5°) = 5.5°$

$$\frac{13mi}{\sin 5.5°} = \frac{b}{\sin 3.5°}$$

$$b = \frac{13mi \cdot \sin 3.5°}{\sin 5.5°} = 8.280mi$$

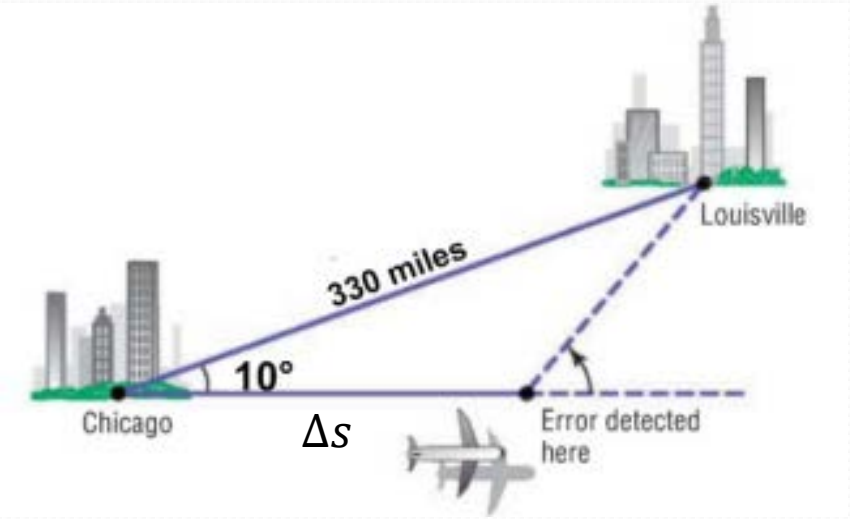
1st right triangle theorem: $h = b \cdot \sin 9° = 1.295mi$

Revising a flight plan

- In attempting to fly from Chicago to Loisville, a distance of 330 miles, a pilot inadvertently took a course that was 10° in error, as indicate in the figure.
- a) If the aircraft maintains an average speed of 220 miles per hour and if the error in direction is discovered after 15 minutes, through what angle should the pilot turn to head towars Louisville?
- b) What new average speed should the pilot maintain so that the total time of the trip in 90 minutes?

Resolution

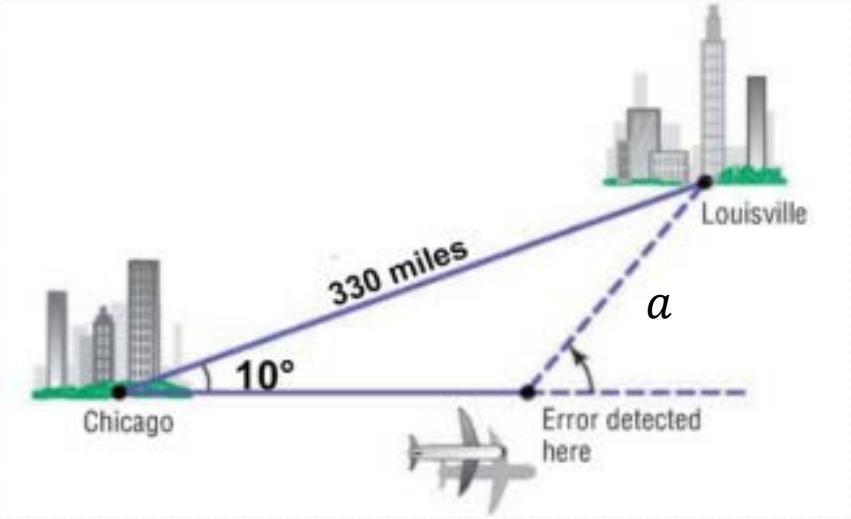
At first we can find the distance until the pilot discovers the error.



$$v = \frac{\Delta s}{\Delta t} \quad \Rightarrow \quad \Delta s = v \cdot \Delta t = 220 \frac{mi}{h} \cdot \frac{1}{4} h = 55 mi$$

Resolution

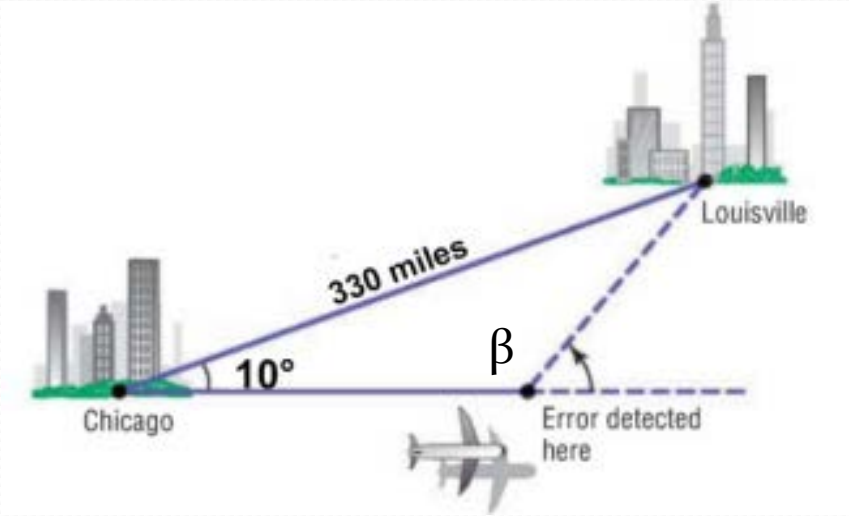
- Then we use the Law of Cosines to find a.



$$a = \sqrt{b^2 + c^2 - 2bc\cos\alpha} = \sqrt{108900 + 3025 - 35574}\, mi = 276\, mi$$

Resolution

- Then we can find the sine of β using the Law of Sines.



$$\frac{a}{\sin 10^\circ} = \frac{b}{\sin \beta} \quad \Rightarrow \quad \sin \beta = \frac{b}{a} \cdot \sin 10^\circ = \frac{330}{276} \cdot \sin 10^\circ = 0{,}20$$

Resolution

- In the last step we have to find β', using the arcsine function:

$$\beta = 180° - \arcsin 0.20 = 168.5°$$

$$\beta' = \arcsin 0.20 = 11.5°$$