KEY

Sections 6.1 & 6.2 Word Problems

What I will give you:

Area of triangle:

$$\text{Area} = \frac{1}{2}bc\sin A$$

and

Heron's formula for the area of a triangle:

$$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$$

$$\text{where } s = \frac{a+b+c}{2}$$

What you need to memorize:

Law of Sines – used with AAS, ASA, and SSA:

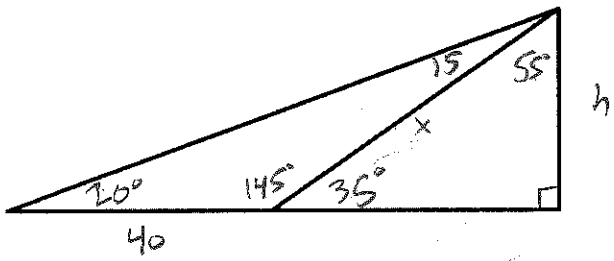
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

and

Law of Cosines – used with SAS & SSS

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

1. From a certain distance, the angle of elevation to the top of a building is 20°. At a point 40 meters closer to the building, the angle of elevation is 35°. Approximate the height of the building to three decimals.



$$\frac{x}{\sin 20^\circ} = \frac{40}{\sin 15^\circ}$$

$$\Rightarrow x = \sin 20^\circ \left(\frac{40}{\sin 15^\circ}\right)$$

$$\approx 52.86$$

$$\frac{h}{\sin 35^\circ} = \frac{52.86}{\sin 90^\circ}$$

$$h = \sin 35^\circ (52.86)$$

$$\approx 30.319 \text{ m}$$

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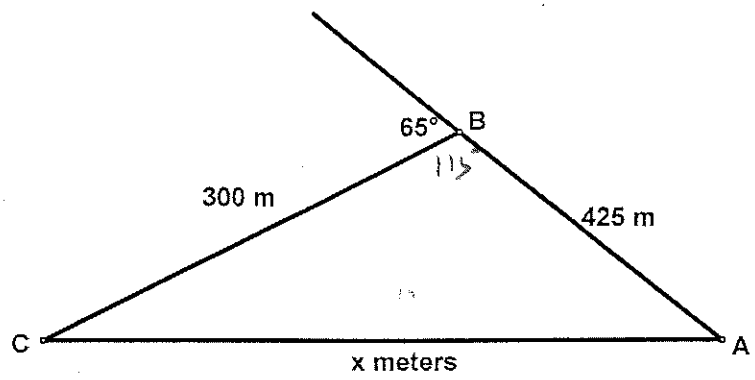
2. To approximate the length of a marsh, a surveyor walks 425 meters from point A to point B. Then the surveyor turns 65° and walks 300 meters to point C. Approximate the length AC of the marsh:



$x^2 = 425^2 + 300^2 - 2(425)(300)\cos 155$

$\approx 378{,}392.6567$

$\Rightarrow$ $x \approx 615.14$ m

3. A ski jump that is 17 feet long rises at an angle of 10.4° from the horizontal. New regulations indicate that the jump is too dangerous, so the angle is lessened to 7.5° and the ramp is lengthened.

   How much longer is the new ramp?

$\frac{h}{\sin 10.4°} = \frac{17}{\sin 90°}$

$h = \sin 10.4° \cdot 17 \approx 3.0688$

$\frac{x}{\sin 90°} = \frac{3.0688}{\sin 7.5°}$

$x \approx 23.51$ ft

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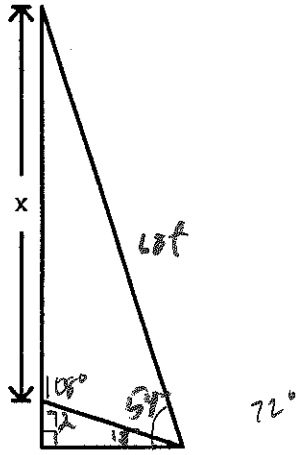
4. Charlotte is flying a kite such that the kite is up a hill from where she is standing. The angle of elevation of the kite is 72° and the length of the string is 68 ft. If the slope of the hill is 18°, find the height of the kite (x) relative to the ground on the hill.

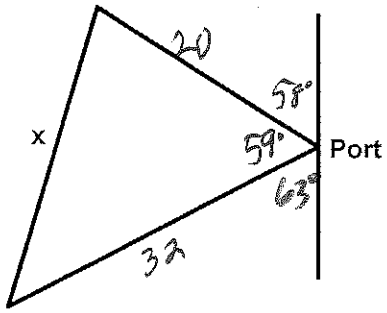


$$\frac{x}{\sin 54^\circ} = \frac{68}{\sin 108^\circ}$$

$$x = \sin 54^\circ \left(\frac{68}{\sin 108^\circ}\right)$$

$$\approx 57.84 \text{ ft}$$

5. Two ships leave port at 9am. One ship travels at a bearing of N 58° W at 10 knots per hour and the other travels at a bearing of S 63° W at 16 knots per hour. How far apart are the ships at 11am?



$$x^2 = 20^2 + 32^2 - 2(20)(30)\cos 59^\circ$$

$$x^2 \approx 764.75$$

$$\Rightarrow x \approx 27.65 \text{ knots}$$

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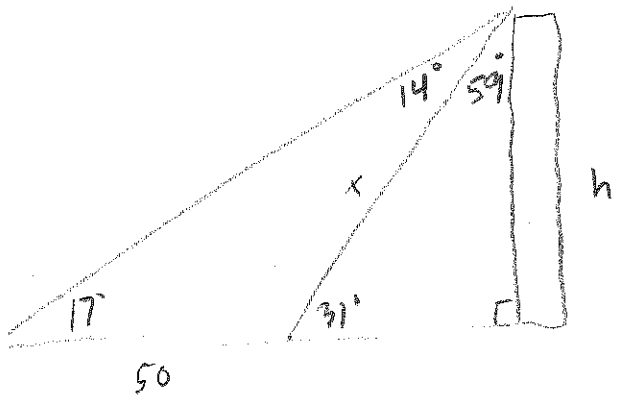
6. From a certain distance, the angle of elevation to the top of a building is 17°. At a point 50 meters closer to the building, the angle of elevation is 31°. Approximate the height of the building using the law of sine (rather than just right triangle trig).



$$\frac{x}{\sin 17^\circ} = \frac{50}{\sin 14^\circ}$$

$$x = \sin 17^\circ \left(\frac{50}{\sin 14^\circ}\right)$$

$$\approx 60.43$$

$$\frac{h}{\sin 31^\circ} = \frac{60.43}{\sin 90^\circ}$$

$$h = \sin 31^\circ (60.43)$$

$$\approx 31.12 \text{ m}$$