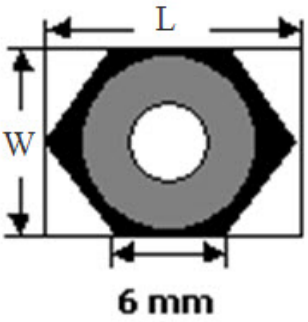
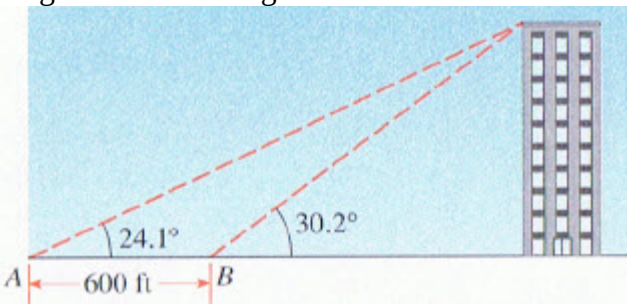
SOML MEET 4 **NAME: _____**
EVENT 1 **TEAM: _____**
Applications of Trigonometry **SCHOOL: _____**

1. [2 points] A regular hexagonal nut needs to be recessed into a rectangular hole as shown below. If each side of the nut is 6 mm long, find the <u>exact</u> dimensions, L and W, for the smallest hole into which the nut will fit.



ANS: L = _____ mm
W= _____ mm

2. [3 points] From a point A on the ground, the angle of elevation to the top of a tall building is 24.1°. From a point B, which is 600 ft closer to the building, the angle of elevation is measured to be 30.2°. Find the height of the building to the nearest foot.



ANS: _____ ft

3. [5 points] A bungee jumper plummets from a high bridge to a river below and then bounces back over and over again. At time t seconds after his jump, his height (in meters) above the river is given by $H(t) = 100 + 75e^{-t/20}\cos(\frac{\pi}{4}t)$

Find the time t when his height is at 100 meters for the first time. Give an exact answer

ANS: _____ seconds

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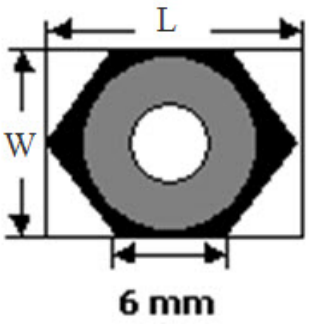
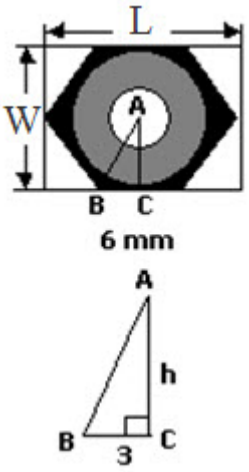
1. [2 points] A regular hexagonal nut needs to be recessed into a rectangular hole as shown below. If each side of the nut is 6 mm long, find the exact dimensions, L and W, for the smallest hole into which the nut will fit.





$\angle ABC = 60°$

$\tan 60° = \frac{h}{3}$

$h = 3\tan 60°$

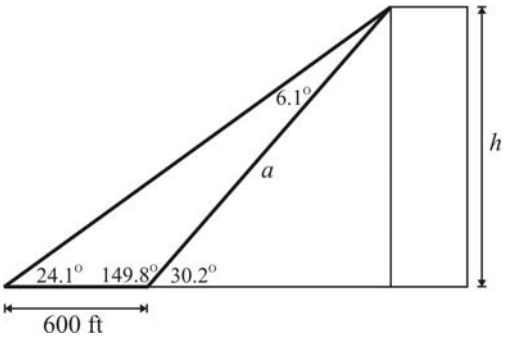
W = $2h = 6\sqrt{3}$ *mm*

L = (2)(6) = 12 *mm*

ANS: L = 12 mm
W= $6\sqrt{3}$ mm

2. [3 points] From a point A on the ground, the angle of elevation to the top of a tall building is 24.1°. From a point B, which is 600 ft closer to the building, the angle of elevation is measured to be 30.2°. Find the height of the building to the nearest foot.

Solution:



$\frac{\sin(6.1°)}{600} = \frac{\sin(24.1°)}{a}$ $a = \frac{600\sin(24.1°)}{\sin(6.1°)} \approx 2305.56079$

Then: $\sin(30.2°) \approx \frac{h}{2305.56079}$

$h \approx 2305.56079\sin(30.2°) \approx 1159.74 \approx 1160$ *feet*

ANS: 1160 ft

3. [5 points] A bungee jumper plummets from a high bridge to a river below and then bounces back over and over again. At time t seconds after his jump, his height (in meters) above the river is given by $H(t) = 100 + 75e^{-t/20}\cos(\frac{\pi}{4}t)$ Find the time t when his height is at 100 meters for the first time.

Solution:

Find the least time t such that H(t)=100. Then we have

$75e^{-t/20}\cos(\frac{\pi}{4}t) = 0$ Since $75e^{-t/20} \neq 0$, we should have $\cos(\frac{\pi}{4}t) = 0$.

This means that $\frac{\pi}{4}t = \frac{\pi}{2}$, and therefore $t = 2$ **(**seconds**).**

ANS: 2 seconds