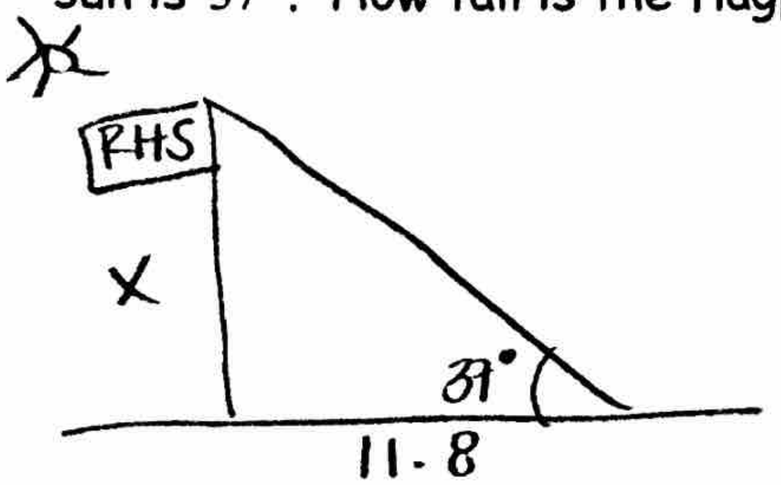
1.3 Right Triangle Applications Name:_____

**Draw a diagram and solve each problem. Round all side measures to two decimal places and all angles measures to the nearest degree.**

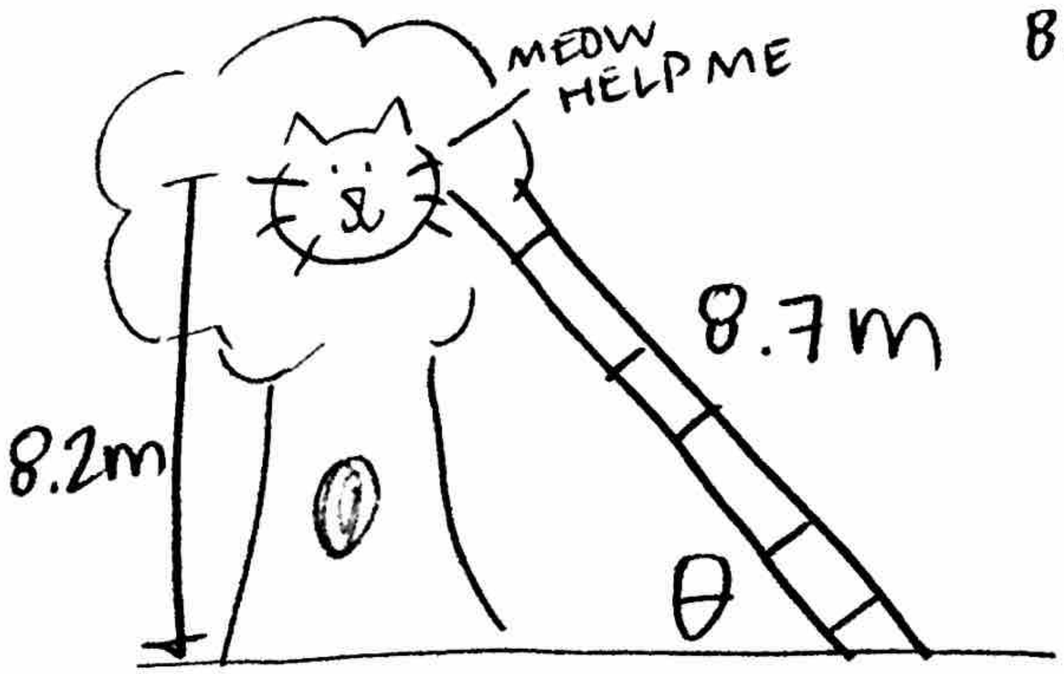
1. You must order a new rope for the flagpole at your school. To find out the length of the rope that is needed, you must first determine the height of the flagpole. You observe that the pole casts a shadow 11.8 meters long when the angle of elevation of the sun is $37°$. How tall is the flagpole?

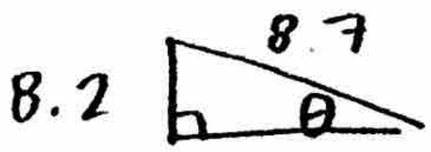



$$\tan 37° = \frac{x}{11.8}$$

$$x = 8.89 \text{ m}$$

2. Your cat Fuzzy is trapped in tree 8.2 meters above the ground. Your ladder is only 8.7 meters long. If you place the ladder's tip right next to Fuzzy, what angle will the ladder make with the ground?



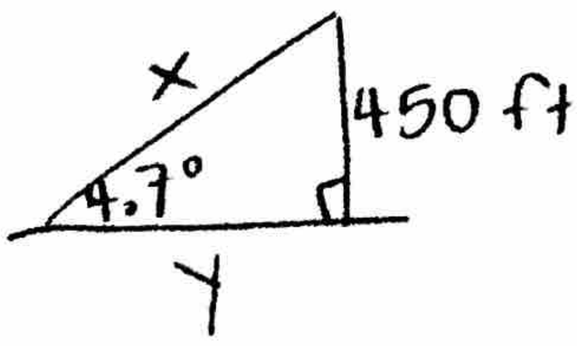




$$\sin\theta = \frac{8.2}{8.7}$$

$$\theta = \sin^{-1}\left(\frac{8.2}{8.7}\right)$$

$$\theta = 70°$$

3. The Rocky Mountain Turnpike has a steady uphill slope of $4.7°$. How long must a straight uphill segment of road be in order to allow a vertical rise of 450 feet? What is the horizontal distance of this segment?




$$\sin 4.7° = \frac{450}{x}$$

$$x = \frac{450}{\sin 4.7}$$

$$x = 5491.92 \text{ ft}$$

length of road

$$(450)^2 + y^2 = (5491.92)^2$$

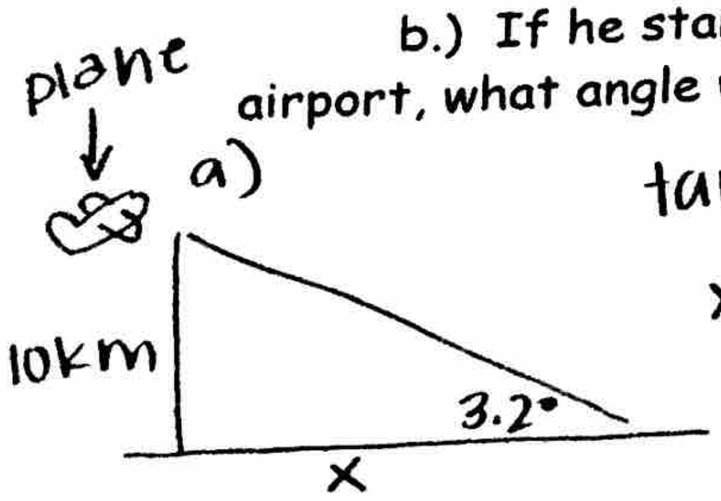
$$y = 5473.46 \text{ ft}$$

horizontal distance

4. Commercial airliners fly at an altitude of about 10 kilometers. They start descending toward the airport when they are far away, so that they will not have to dive at a steep angle.

a.) If the pilot wants the plane's path to make an angle of $3.2°$ with the ground, at what horizontal distance from the airport must he start descending?

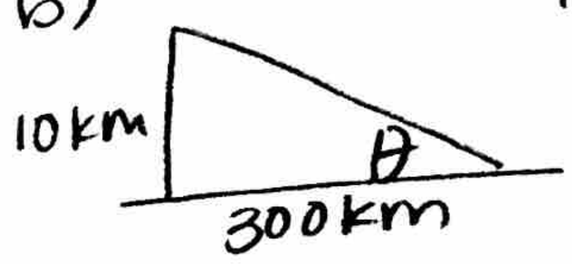
b.) If he starts descending at a horizontal distance of 300 kilometers from the airport, what angle will the plane's path make with the horizontal?




a) $\tan 3.2° = \frac{10}{x}$

$x = \frac{10}{\tan 3.2}$

$x = 178.86\text{km}$




b) $\tan\theta = \frac{10}{300}$

$\theta = \tan^{-1}\left(\frac{10}{300}\right)$

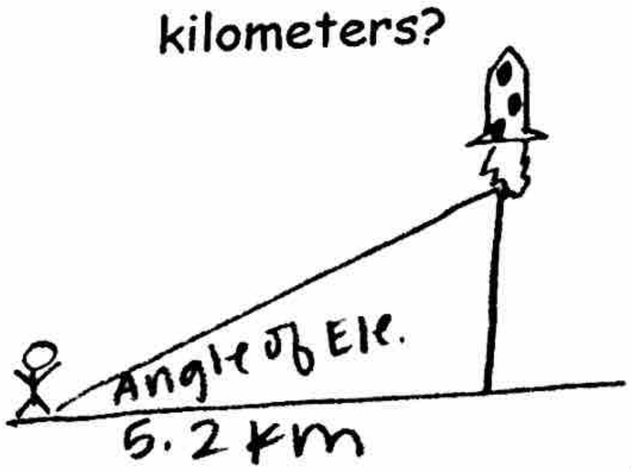
$\theta = 2°$

5. An observer 5.2 kilometers from the launch pad at Cape Canaveral observes the Discovery space shuttle take off. (Discovery ascends vertically for some time after take-off.)

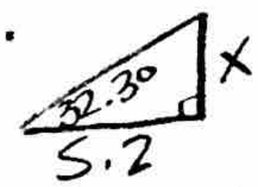
a.) At a particular time, the angle of elevation of Discovery is $32.3°$. How high is the space shuttle?

b.) How far is Discovery from the observer?

c.) What will the angle of elevation be when the space shuttle reaches 28 kilometers?




a.




$\tan 32.3 = \frac{x}{5.2}$

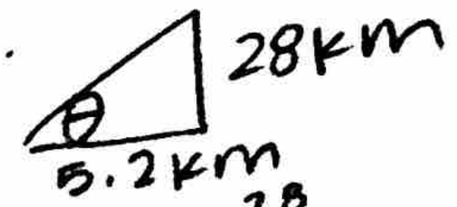
$x = 3.29\text{km}$

b. hypotenuse

$(5.2)^2 + (3.29)^2 = c^2$

$6.15\text{km}$

c.




$\tan\theta = \frac{28}{5.2}$

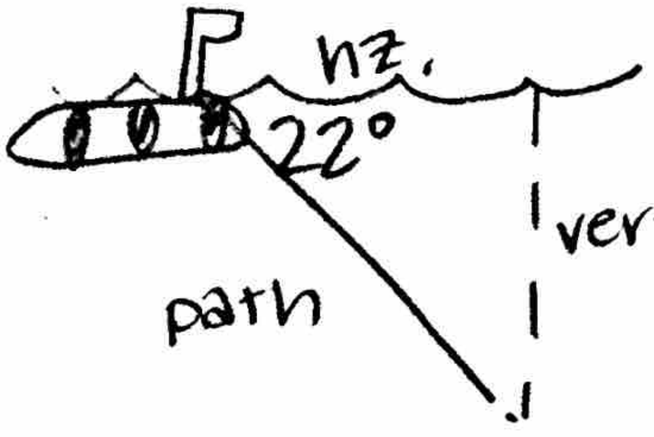
$\theta = 79°$

6. A submarine on the surface of the ocean makes an emergency dive, and its path makes an angle of $22°$ with the surface of the ocean.

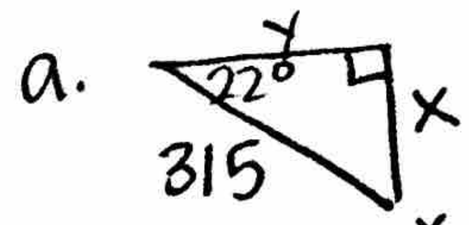
a.) If it travels for 315 meters along its downward path, how deep will it be?

b.) What horizontal distance is it from its starting point?

c.) How many meters must it go along its downward path to reach a depth of 1000 meters?




a.




$\sin 22 = \frac{x}{315}$

$315\sin 22 = x$

$118\text{ m}$

b. $\cos 22 = \frac{y}{315}$

$y = 292.06\text{m}$

c.


$\sin 22° = \frac{1000}{x}$

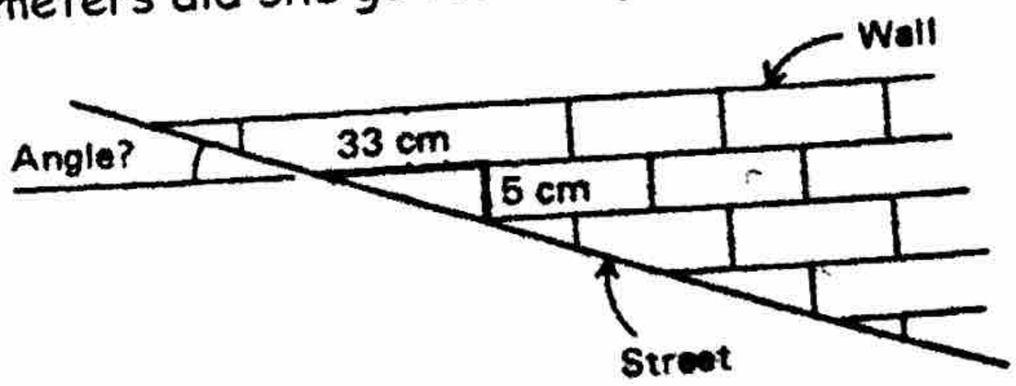
$x = \frac{1000}{\sin 22}$

$2669.47\text{m}$

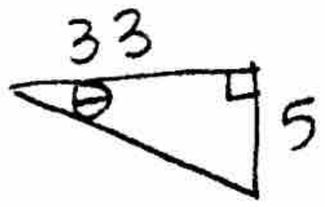
7. Judy is waiting for the cable car on Powell Street in San Francisco. The street is extremely steep, and to pass the time she decides to find out what angle the street makes with the horizontal. On the wall of a house, she measures a horizontal distance of 33 centimeters and a vertical distance of 5 centimeters along the slope of the street.

a.) What angle does Powell Street make with the horizontal?

b.) While she waited, Judy went walked up to the top of the block, counting 101 paces (approximately 101 meters). How many meters did she go vertically?




a.

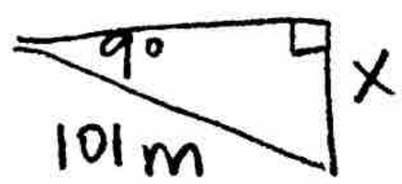



$\tan\theta = \frac{5}{33}$

$\theta = \tan^{-1}\left(\frac{5}{33}\right)$

$\theta = \boxed{9^\circ}$

b)



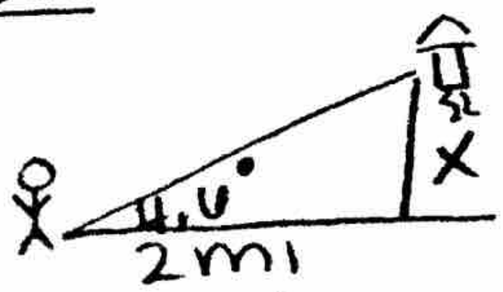

$\sin 9^\circ = \frac{x}{101}$

$101 \sin 9 = x$

$\boxed{15.8\text{m}}$

8. A rocket shoots straight up from a launch pad. Five seconds after lift-off, Billy, who is standing 2 miles away, notes that the rocket's angle of elevation is 4.6°. Four seconds after that, the angle of elevation is 38°. How far did the rocket rise during those four seconds?

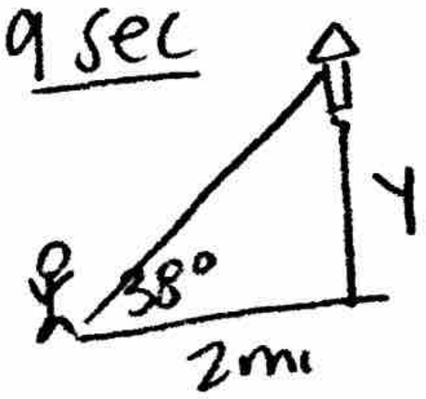
5 sec




$\tan 4.6 = \frac{x}{2}$

$x = .16 \text{ miles}$

9 sec




$\tan 38 = \frac{y}{2}$

$y = 1.56\text{mi}$

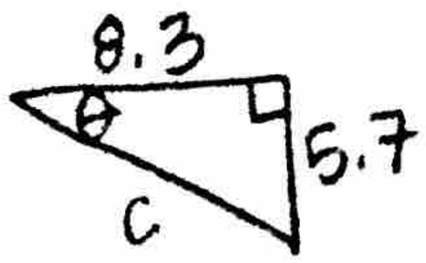
$y - x = \boxed{1.4 \text{ miles}}$

9. A beam of gamma rays is to be used to treat a tumor known to be 5.7 cm beneath the patient's skin. To avoid damaging a vital organ, the radiologist moves the radiation source over 8.3 cm.

a.) At what angle to the patient's skin must the radiologist aim the gamma ray source to hit the tumor?

b.) How far will the beam have to travel through the patient's body before reaching the tumor?

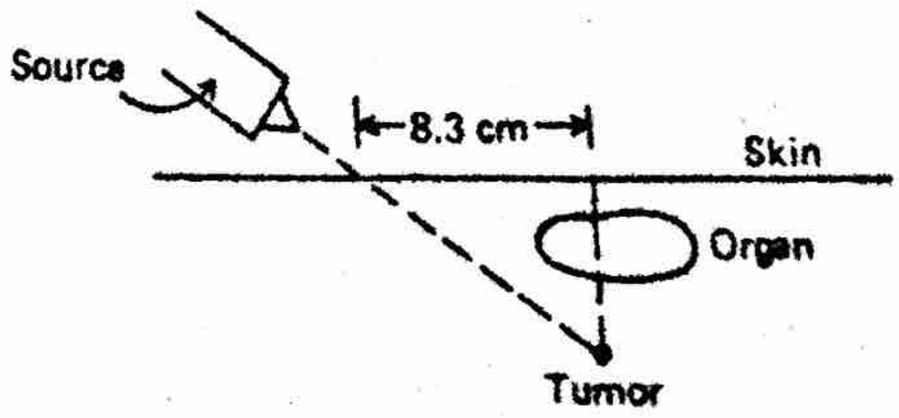
a.




$\tan\theta = \frac{5.7}{8.3}$

$\theta = \tan^{-1}\left(\frac{5.7}{8.3}\right)$

$\boxed{\theta = 34^\circ}$




b. $(8.3)^2 + (5.7)^2 = c^2$

$\boxed{c = 10.07\text{cm}}$