

Precalculus  
Triangle Trigonometry Applications

Name \_\_\_\_\_ Period \_\_\_\_\_

Show ALL work for full credit. If there is not a labeled diagram, you must draw one.

1. Ladder Problem 1:

Suppose you have a ladder 6.7 m long.

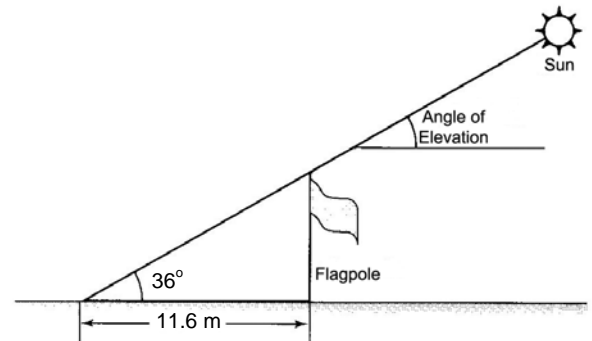
a. If the ladder makes an angle of  $63^\circ$  with the level ground when you lean it against a vertical wall, how high up the wall is the top of the ladder?

b. Your cat is trapped on a tree branch 6.5 m above the ground. If you place the ladder's top on the branch, what angle does the bottom of the ladder make with the level ground?



2. Flagpole Problem:

You must order a new rope for the flagpole. To find out what length of rope is needed, you observe that the pole casts a shadow 11.6 m long on the ground. The angle of elevation of the Sun is  $36^\circ$  at this time of day. How tall is the pole?



3. Tallest Skyscraper Problem:

The Petronas Twin Towers in Kuala Lumpur, Malaysia, are two of the world's tallest skyscrapers. The towers reach 451.9 m above the ground. Suppose that at a particular time the towers cast shadows on the ground 950 m long. What is the angle of elevation of the Sun at this time?

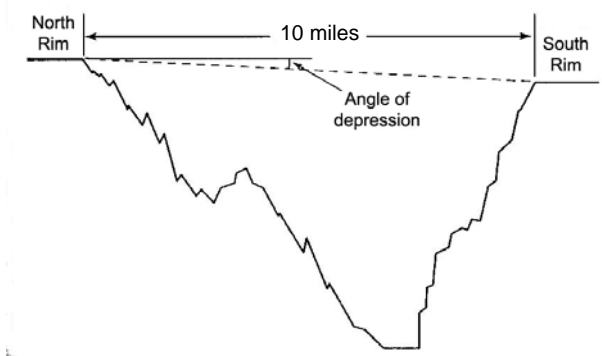
4. The Grapevine Problem:

Interstate 5 in California enters the San Joaquin Valley through a mountain pass called the Grapevine. The road descends from an altitude of 3000 ft above sea level to 500 ft above sea level in a slant distance of 6 mi.

- a. Approximately what angle does the roadway make with the horizontal?
- b. What assumption must you make about how the road slopes?

5. Grand Canyon Problem:

From a point on the North Rim of the Grand Canyon, a surveyor measures an angle of depression of  $1.3^\circ$  to a point on the South Rim. From an aerial photograph she determines that the horizontal distance between the two points is 10 mi. How many feet is the South Rim below the North Rim?



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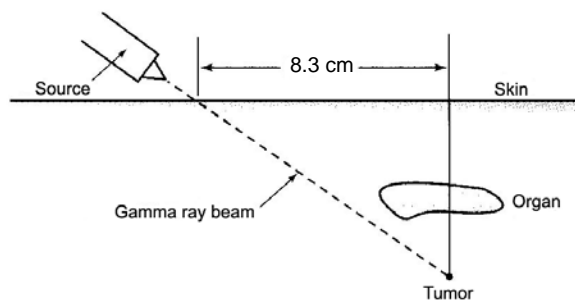
6. Airplane Landing Problem:

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

- If the pilot wants the plane's path to make an angle of  $3^\circ$  with the ground, at what horizontal distance from the airport must she start descending?
- If she starts descending when the plane is at a horizontal distance of 300 km from the airport, what angle will the plane's path make with the horizontal?

7. Radiotherapy Problem: A doctor may use a beam of gamma rays to treat a tumor that is 5.7 cm beneath the patient's skin. To avoid damaging a vital organ, the radiologist moves the source over 8.3 cm.

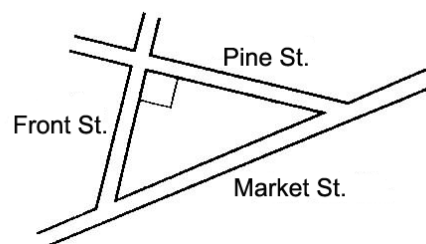
- At what angle  $\theta$  to the patient's skin must the radiologist aim the source to hit the tumor?
- How far will the beam travel before reaching the tumor?



8. Triangular Block Problem:

A block bordering Market Street is a right triangle. You take 125 paces on Market Street and 102 paces on Pine Street as you walk around the block.

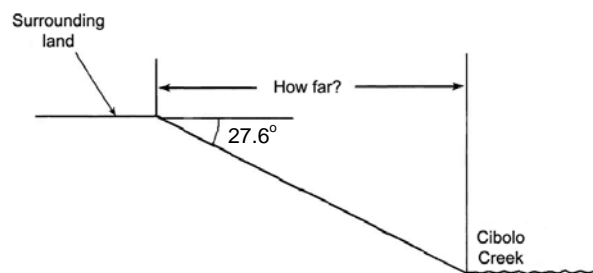
- At what angle do Pine and Market Streets intersect?
- How many paces must you take on Front Street to complete the trip?



9. Surveying Problem:

When surveyors measure land that slopes significantly, the slant distance they measure is longer than the horizontal distance they must draw on the map. Suppose that the slant distance from the top edge of Cibolo Creek bed to the edge of the water is 37.8 m. The land slopes downward at an angle of  $27.6^\circ$  to the horizontal.

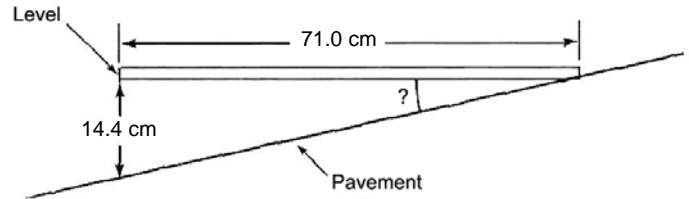
- What is the horizontal distance from the top of the creek bed to the edge of the creek?
- How far below the level of the surrounding land is the surface of the water in the creek?



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10. Highland Drive Problem:

One of the steeper streets in the United States is the 500 block Highland Drive on Queen Anne Hill in Seattle. To measure the slope of the street, Tyline held a builder's level so that one end touched the pavement. The pavement was 14.4 cm below the level at the other end. The level itself was 71 cm long.



- What angle does the pavement make with the level?
- A map of Seattle shows that the horizontal length of this block of Highland Drive is 365 ft. How much longer than 365 ft is the slant distance up this hill?
- How high does the street rise up in this block?

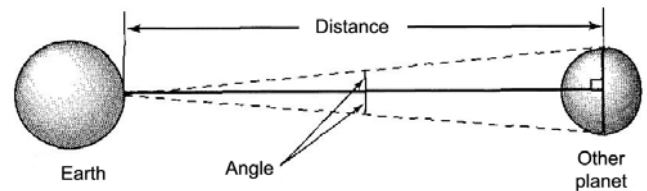
11. Submarine Problem:

As a submarine at the surface of the ocean makes a dive, its path makes a  $21^\circ$  angle with the surface.

- If the submarine goes for 300 m along its downward path, how deep will it be? What horizontal distance is it from its starting point?
- How many meters must it go along its downward path to reach a depth of 1000 m?

12. Planet Diameter Problem:

You can find the approximate diameter of a planet by measuring the angle between the lines of sight to the two sides of the planet.



- When Venus is closest to Earth (25,000,000mi), the angle is  $0^\circ 1' 2.5''$ . Find the approximate diameter of Venus.
- When Jupiter is closest to Earth (390,000,000 mi), the angle is  $0^\circ 0' 46.9''$ . Find the approximate diameter of Jupiter.