Name _____ Date_____ Period_____

WORKSHEET – RIGHT TRIANGLE PROBLEMS

Use trigonometry to solve each problem. **Round all lengths to three decimal places.**
Round all angles to the nearest degree.

1. **Ladder Problem:** You lean a ladder 6.7m long against the wall. It makes an angle of 63° with the level ground. How high up is the top of the ladder?

answer: 5.970 m

$$\sin 63° = \frac{x}{6.7}$$
$$x = 6.7 \sin 63°$$

2. **Cat problem:** Your cat is trapped on a tree branch 6.5m above the ground. Your ladder is only 6.7m long. If you place the ladder's tip on the tree branch, what angle will the ladder make with the ground?

answer: $76°$

$$\sin x = \frac{6.5}{6.7}$$
$$x = \sin^{-1}(6.5/6.7)$$

3. **Submarine Problem:** A submarine at the surface of the ocean makes an emergency dive, making an angle of 21° with the surface. If the submarine travels 300 m, how deep will it be?

answer: 107.510 m

$$\sin 21 = \frac{x}{300}$$
$$x = 300 \sin 21$$

4. **Grand Canyon Problem:** From a point on the North Rim of the Grand Canyon, a surveyor measures an angle of depression of 1° to a point on the South Rim. From an aerial photograph, he determines that the horizontal distance between the two points is 10 miles. How many **feet** is the South Rim below the North Rim to the nearest foot? (Note: 1 mile = 5280 feet)

answer: 921.627 ft

$$\tan 1° = \frac{x}{52800}$$
$$52800 \tan 1° = x$$

5. **Height Problems: a)** From the top of a lighthouse the angles of depression of the top and bottom of a flagpole are 23° and 42°, respectively. If the flagpole is 75 feet from the lighthouse, how tall is the pole?

answer: 35.695 ft

$$\tan 23 = \frac{b}{75}$$
$$b = 75 \tan 23$$
$$\tan 42 = \frac{A}{75}$$
$$A = 75 \tan 42$$
$$x = A - b$$

b) From the top of a building 150 feet high the angles of elevation and depression of the top and bottom of another building are 22° and 36°, respectively. What are the height and distance of the second building?

$$h = 150 + a$$
$$\tan 36 = \frac{150}{d}$$
$$d = \frac{150}{\tan 36}$$
$$d = 206.457$$

$$\tan 22 = \frac{a}{206.457}$$
$$a = 206.457 \tan 22$$

Height: 233.414 ft

Distance: 206.457 ft

6. **Airplane Landing Problem:** Commercial airliners fly at an altitude of about 10 km. 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° with the ground, at what horizontal distance must she start descending?

answer: 190.811 Km

$$\tan 3 = \frac{10}{x}$$
$$x = \frac{10}{\tan 3}$$

b) If the pilot starts descending a ground distance of 300 km from the airport, what angle will the plane's path make with the horizontal?
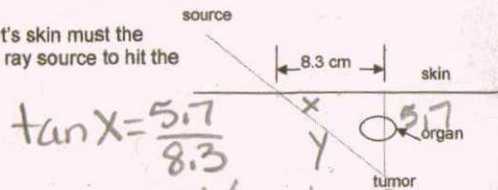
answer: $2°$

$$\tan x = \frac{10}{300}$$
$$x = \tan^{-1}(10/300)$$

7. **Radiotherapy Problem:** 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 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?

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

$$x = \tan^{-1}(5.7/8.3)$$

answer: $34°$

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

$$5.7^2 + 8.3^2 = y^2$$

answer: 10.069 cm

8. **Surveying Problem:** When surveyors measure land that slopes significantly, the distance which is measured will be longer than the horizontal distance which must be drawn on the map. Suppose that the distance from the top edge of the Cibolo Creek bed to the edge of the water is 37.8 m. The land slopes downward at 28° to the horizontal.

a) What is the horizontal distance from the top of the bank to the edge of the creek?
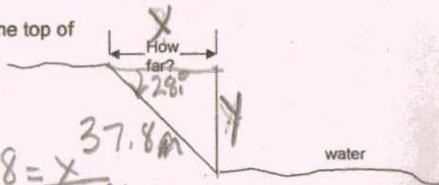
$$\cos 28 = \frac{x}{37.8}$$

$$x = 37.8 \cos 28$$

answer: 33.375 m

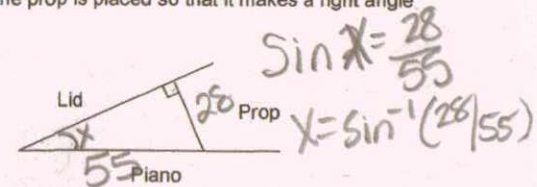b) How far is the surface of the creek below the level of the surrounding land?

$$37.8^2 - 33.375^2 = y^2$$

answer: 17.746 m

9. **Grand Piano Problem:** The lid on a grand piano is held open by a prop 28 in long. The base of the prop is 55 in from the lid's hinge.

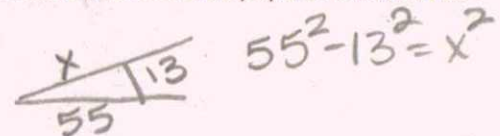a) At what angle will the lid open when the prop is placed so that it makes a right angle with the lid?

$$\sin x = \frac{28}{55}$$

$$x = \sin^{-1}(28/55)$$

answer: $31°$

b) The piano also has a shorter prop 13 in long. Where on the lid should this prop be placed to make a right angle with the lid if the base of the prop is 55 in from the lid's hinge?
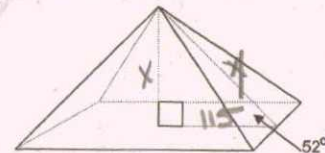
$$55^2 - 13^2 = x^2$$

answer: 53.442 in

10. **Pyramid Problem:** The Great Pyramid of Cheops in Egypt has a square base 230 m on each side. The faces of the pyramid make an angle of 52° with the horizontal.

a) How tall is the pyramid?

answer: 147.193 m

$$\tan 52 = \frac{x}{115}$$

$$x = 115 \tan 52$$

b) What is the shortest distance you would have to climb up a face to reach the top?

$$115^2 + 147.193^2 = y^2$$

answer: 186.791 m

Answers:
1. 5.970 m
2. 76°
3. 107.510 m
4. 922 ft
5. a) 35.694 ft b) 233.414 ft, 206.457 ft
6. a) 190.811 km b) 2°
7. a) 34° b) 10.069 cm
8. a) 33.375 m b) 17.746 m
9. a) 31° b) 53.442 in
10. a) 147.193 m b) 186.791 m