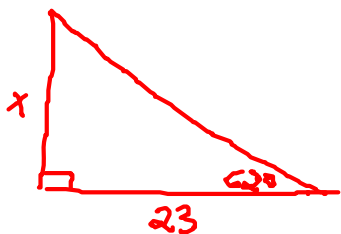# Trigonometry Word Problems

Right Triangle Trigonometry

1. A tree casts a shadow 23 feet long when the angle of elevation of the sun is 62°. How tall is the tree?

$$\tan x = \frac{opp}{adj}$$

$$\frac{\tan 62°}{1} = \frac{x}{23}$$

$$x = 23 \cdot \tan 62$$

$$\boxed{x = 43.3 \text{ feet}}$$

2. In designing a new building, a doorway is 3.5 feet above the ground. A ramp for the disabled is to be built to the doorway at an angle of 6° with the ground. How long will the ramp be?
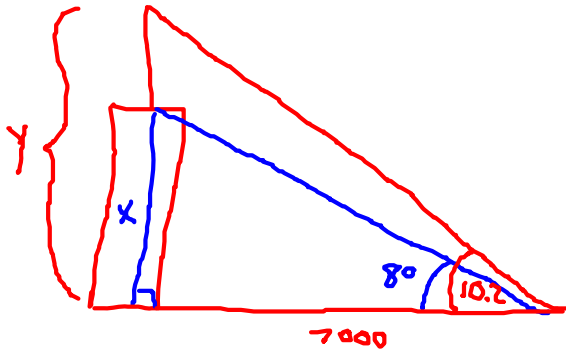
$$\sin x = \frac{opp}{hyp}$$

$$\frac{\sin 6}{1} = \frac{3.5}{x}$$

$$\frac{x \cdot \sin 6}{\sin 6} = \frac{3.5}{\sin 6}$$

$$\boxed{x = 33.5 \text{ feet}}$$

3. An antenna is on top of a building. From a point 7,000 feet from the building, the angles of elevation to the top and bottom of the antenna are 10.2° and 8° respectively. How tall is the antenna?

$$\tan x = \frac{opp}{adj}$$

$$\tan x = \frac{opp}{adj}$$

$$\tan 8 = \frac{x}{7000}$$

$$\tan 10.2 = \frac{y}{7000}$$

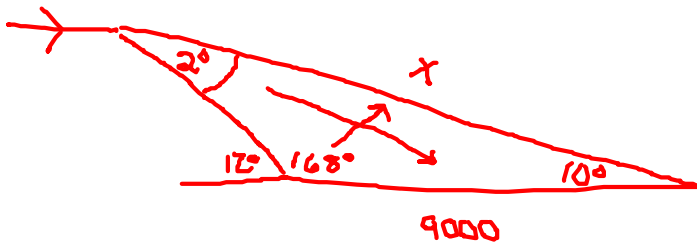$x = 7000 \cdot \tan 8$

$x = 983.8$ feet
(height of building)

$y = 7000 \cdot \tan 10.2$

$y = 1259.5$ feet
(height of building and the antenna)

$1259.5 - 983.8 = \boxed{275.7 \text{ feet}}$

Law of Sines

4. When an airplane is landing on a 9,000-foot runway, the angles of depression to the ends of the runway are 10° and 12°. How far is the plane from the far end of the runway?
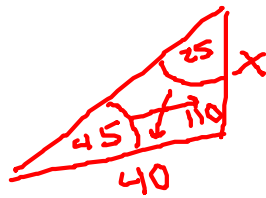
$$\frac{\sin 2}{9000} = \frac{\sin 168}{x}$$

$$\frac{x \sin 2}{\sin 2} = \frac{9000 \sin 168}{\sin 2}$$

$$\boxed{x = 53,616.97 \text{ feet}}$$

5. A flagpole is located on a slope that makes an angle of 20° with the horizontal. The pole casts a 40-foot shadow down the hill when the angle of elevation to the top of the pole is 45°. Find the height of the flagpole.

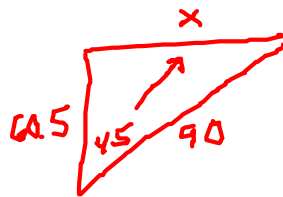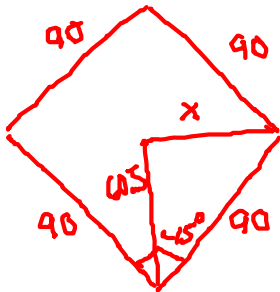$$\frac{\sin 25}{40} = \frac{\sin 45}{x}$$

$$\frac{x \sin 25}{\sin 25} = \frac{40 \sin 45}{\sin 25}$$

$$x = 46.9 \text{ feet}$$

Law of Cosines

6. On a baseball field, the four bases are located at the vertices of a square 90 feet on each side. If the pitcher's mound is 60.5 feet from home plate, how far is the mound from first base?
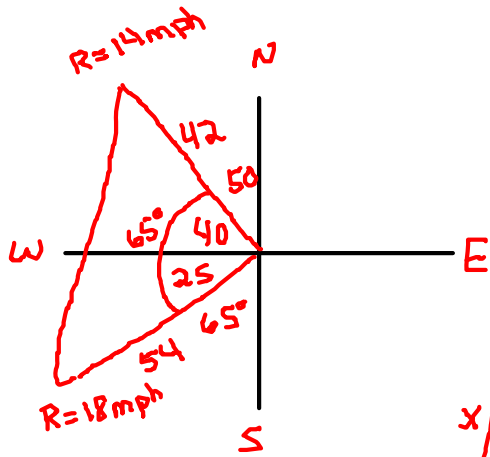
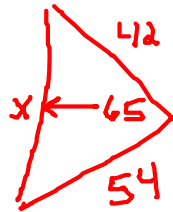$$x^2 = 60.5^2 + 90^2 - 2(60.5)(90)\cos 45°$$
$$\sqrt{x^2} = \sqrt{4059.86}$$
$$x = 63.7 \text{ feet}$$

7. Two ships leave a port at 9:00 AM. One ship travels at a bearing of N50°W at a speed of 14 miles per hour and the other travels at a bearing of S65°W at a speed of 18 miles per hour. How far apart are the ships at noon?

$R = 14$
$T = 3$
$D = RT$
$D = 14 \times 3$
$D = 42m$

$R = 18$
$T = 3$
$D = RT$
$D = 18 \times 3$
$D = 54m$

$x^2 = 42^2 + 54^2 - 2(42)(54)\cos 65$

$\sqrt{x^2} = \sqrt{2763}$

$x = 52.6 \text{ miles}$