Finding Angles & Angles of Elevation / Depression

Right triangles have many applications. To solve a problem, we draw a right triangle and for the part associated with the application question solve the triangle.

To solve a triangle problem:
1) Draw a sketch of the problem situation.
2) Look for triangles and sketch them in.
3) Mark the known and unknown sides and angles.
4) Express the desired side or angle in terms of known trigonometric ratios.
5) Solve.
6) Answer the question being asked. (use appropriate labels)

Example 1: An observer stands on level ground, 200 meters from the base of a TV tower, and looks up at an angle of 26.5° to see the top of the tower. How high is the tower above the observer’s eye level?

Example 2: A kite flies at a height of 60 feet when 130 feet of string is out. Assuming that the string is in a straight line, what is the angle that it makes with the ground?
A 25 foot tall flagpole casts a 42 foot shadow. What is the angle that the sun hits the flagpole?

Draw a picture. The angle that the sun hits the flagpole is $x^\circ$. We need to use the inverse tangent ratio.
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**Angle of Elevation** - the angle between the horizontal and the line from the object to the observer's eye (the line of sight).

**Angle of Depression** - object is below the level of the observer, then the angle between the horizontal and the observer's line of sight.

Show two parallel lines being cut by a transversal.

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*Example 1:* A surveyor is standing 50 feet from the base of a large tree, as shown below. The surveyor measures the angle of elevation to the top of the tree as $71.5^\circ$. How tall is the tree if the surveyor is 6 feet tall?
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Elise is standing on top of a 50 foot building and sees her friend, Molly. If Molly is 30 feet away from the base of the building, what is the angle of depression from Elise to Molly? Elise’s eye height is 4.5 feet.

Because of parallel lines, the angle of depression is equal to the angle at Molly, or $x^\circ$. We can use the inverse tangent ratio.

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**Example 2:** From the fire tower in Flatlands National Park, a forest ranger sighted a fire. To measure the angle of depression of the fire, the ranger used an instrument that was known to be 32 meters above the ground. The angle of depression from the tower to the fire was $2.1^\circ$. What was the distance $d$ between the fire and the base of the tower?
A surveyor is standing 50 feet from the base of a large tree, as shown in Figure 4.29. The surveyor measures the angle of elevation to the top of the tree as 71.5°. How tall is the tree?

**Height of a Mountain** In traveling across flat land you notice a mountain directly in front of you. Its angle of elevation (to the peak) is 3.5°. After you drive 13 miles closer to the mountain, the angle of elevation is 9° (see figure). Approximate the height of the mountain.
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Homework:

14. Distance From a 150-foot observation tower on the coast, a Coast Guard officer sights a boat in difficulty. The angle of depression of the boat is 4° (see figure). How far is the boat from the shoreline?

15. Angle of elevation A ramp 17 \( \frac{1}{2} \) feet high in length rises to a loading platform that is 3 \( \frac{1}{3} \) feet off the ground. (see figure). Find the angle \( \theta \).

SET 4: More Trig Applications

1. The hypotenuse of a right triangle is 3 feet. If one leg is 1 foot, find the degree measure of each angle.

2. A right triangle contains a 25° angle. If one leg is of length 5 inches, what is the length of the hypotenuse? (There are two answers)

3. Suppose you are headed toward a plateau 50 meters high. If the angle of elevation to the top of the plateau is 20°, how far are you from the base of the plateau?

4. A 22-foot extension ladder leaning against a building makes a 70° angle with the ground. How far up the building does the ladder touch?

5. At 10 am on April 26, 1998 a building 300 feet high cast a shadow 50 feet long. What was the angle of elevation of the sun?

6. To measure the height of Lincoln’s caricature on Mt. Rushmore, two sightings 800 feet from the base of the mountain are taken. If the angle of elevation to the bottom of Lincoln’s face (his chin) is 32° and the angle of elevation to the top (his forehead) is 35°, how long is Lincoln’s face on the mountain?