Worksheet 1-3: Angle of Elevation vs. Angle of Depression
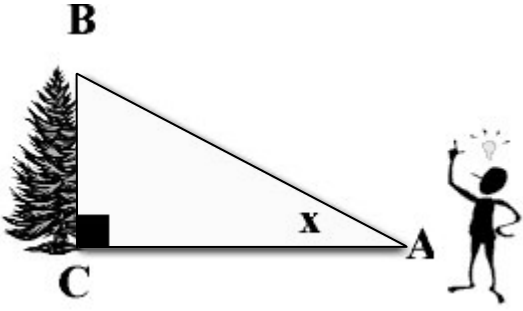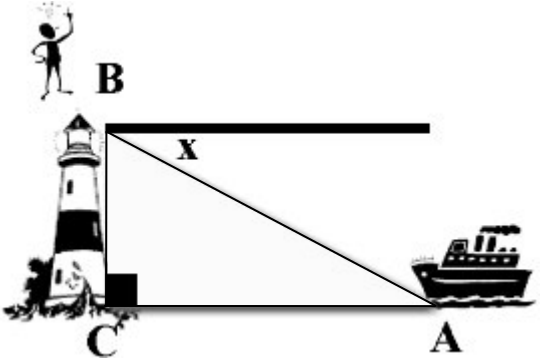
Trigonometry is used on a daily basis in the workplace. Since trigonometry means "triangle measure", any profession that deals with measurement deals with trigonometry as well. Carpenters, construction workers and engineers, for example, must possess a thorough understanding of trigonometry.

Word problems introduce two new vocabulary terms:

"Angle of Elevation" **(Angle of Inclination)**	The **angle of elevation** is always measured from the ground up. Think of it like an elevator that only goes up. It is always **INSIDE** the triangle.
	In the diagram at the left, **x** marks the angle of elevation of the top of the tree as seen from a point on the ground.
	You can think of the angle of elevation in relation to the movement of your eyes. You are looking straight ahead and you must raise (elevate) your eyes to see the top of the tree.
"Angle of Depression" **(Angle of Descent)**	The **angle of depression** is always **OUTSIDE** the triangle. It is never inside the triangle.
	In the diagram at the left, **x** marks the angle of depression of a boat at sea from the top of a lighthouse.
	You can think of the angle of depression in relation to the movement of your eyes. You are standing at the top of the lighthouse and you are looking straight ahead. You must lower (depress) your eyes to see the boat in the water.

As seen in the diagram above, the dark black horizontal line is parallel to side CA of triangle ABC. This forms two alternate interior angles which are equal in measure. This tells us that:

the angle of elevation = the angle of depression.

Assigned Work: WS 1-3; p. 21 #1, #4-5, #9

"Angle of Elevation" is the angle formed between the horizontal and the line of sight when looking upward.

"Angle of Depression" is the angle formed between the horizontal and the line of sight when looking downward.

So what do we do with this angle of depression that is OUTSIDE of our triangle?
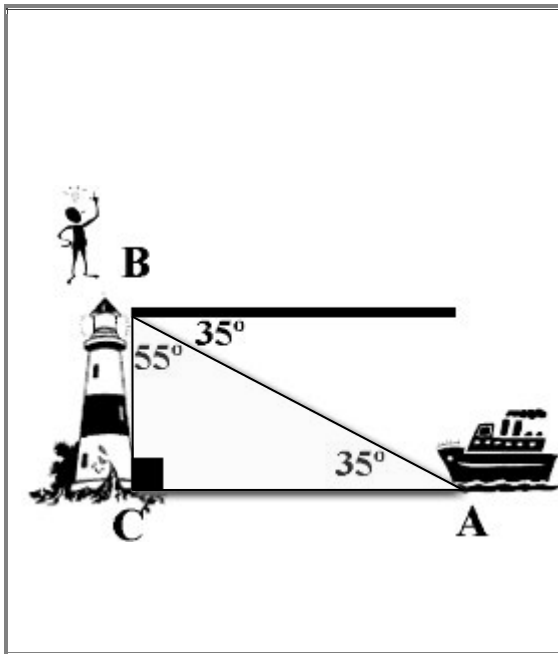
There are two possible ways to use our **angle of depression** to obtain an angle INSIDE the triangle.

1. find the angle adjacent (next door) to our angle. This adjacent angle will always be the complement of our angle. Our angle and the angle next door will add to 90°. In the diagram on the left, the adjacent angle is 55°.

2. utilize the fact that the **angle of depression = the angle of elevation** and simply place 35° in angle A. (the easiest method)

Once you have created your diagram, the word problems are solved in exactly the same manner as the problems we discussed earlier.

Steps for Solving Word Problems:

Step 1- Read the question carefully. Watch out for special terms like angle of elevation, angle of inclination, angle of depression, etc.

Step 2- Draw the diagram of the right triangle described by the question.

Step 3- Label the diagram with all the information given by the question, such as angles and side lengths.

Step 4- Identify the angle in consideration and label its special sides.

Step 5- Identify the trigonometric ratio to be used to solve the triangle.

Step 6- Solve for the unknowns.

Practice:

1. A ladder leans against a vertical wall and makes an angle of 65˚ with the ground. The foot of the ladder is 2 m from the base of the wall. What is the length of the ladder, to the nearest tenth of a metre?

2. From a point on the ground 30 m from the foot of the Peace Tower, the angle of elevation of the top of the tower is 72˚. Find the height of the tower, to the nearest metre.

3. The angle of depression of the top of the Skylon Tower in Niagara Falls to a point 50 m from the base of the tower is 78˚. Find the height of the tower, to the nearest metre.

4. The towrope pulling a parasailor is 90 m long. A crew member on the boat estimates that the angle between the towrope and the water is about 40°. Find the height of the parasailor above the water, to the nearest metre.

5. A lighthouse sits at the top of a sheer cliff. The top of the lighthouse is 33 m above sea level. The angle of elevation from a small fishing boat at sea to the top of the lighthouse is 24˚. How far from the base of the cliff is the fishing boat, to the nearest metre?

6. The angle of depression from the top of the CN Tower in Toronto to a point 100 m from the base of the tower is 79.75˚. Find the height of the tower, to the nearest metre.

Answers: 1. 4.7 m**; 2.** 92 m**; 3.** 235 m**; 4.** 58 m**; 5.** 74 m**; 6.** 553 m
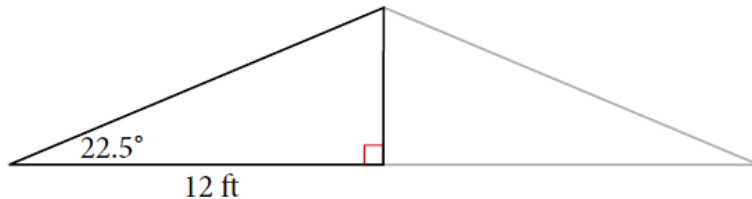
Practise

1. A wheelchair ramp is needed at the entrance of a restaurant. The ramp is to be 6.10 m long and have a rise of 0.45 m. Calculate the angle of inclination of the ramp.

6.10 m

0.45 m

4. A garage floor is made of poured concrete. The length of the garage is 6.7 m and the grade (the rise of the floor from the front to the back) is 9.1 cm. Calculate the angle of inclination of the garage floor.

9.1 cm

6.7 m
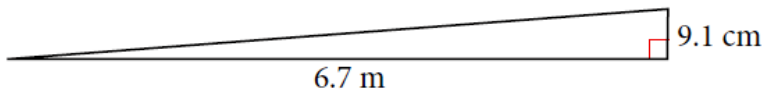
5. A rafter makes an angle of 22.5° with the roof joist, as shown. How tall is the board supporting the middle of the roof?

22.5°

12 ft

9. The expedition team decided to have a practice run prior to their North Pole trek. One team member started to walk due north. The other three travelled 65° east of north at a pace of 3 km/h. How far off the first team member's course were they after 2 h?

Answers

1. 4°

2. 67 m

3. 59°

4. 1°

5. 5 ft

6. Yes, the angle is 81°.

7. No, the angle is 68°.

8. 477 m

9. 5 km

10. Answers may vary.

11. Lina reversed the opposite and adjacent sides in the fraction; $d \doteq 2065$