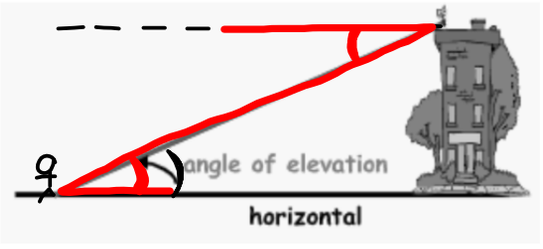
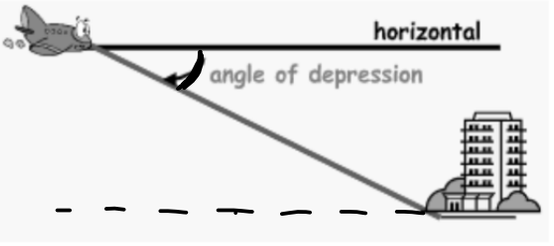
# 1.2 Applications of Right Triangles

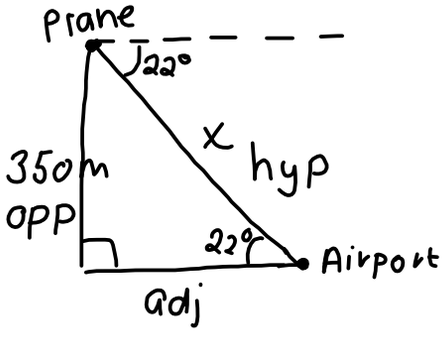
Learning Goals: I am learning to…
- ☐ Apply right angle trigonometry to solve real-world application problems
- ☐ Set up diagrams and solve problems involving the angles of elevation and depression

## Angles of Elevation and Depression

| Angle of Elevation | Angle of Depression |
|---|---|
| The **Angle of Elevation** is the angle measured from the horizontal looking UP. | The **Angle of Depression** is the angle measured from the horizontal looking down. |
|   |   |
| $\boldsymbol{Angle\ of\ elevation = Angle\ of\ Depression}$<br>Recall: Alternating angles (the z pattern) | |

**Do not forget the following when solving an application problem:**
- Always draw a well-labeled diagram, especially if one has not bee included in the initial problem
- If you are introducing a new variable (unknown) define this using a let statement
- Label everything you know as well as everything you want to determine
- Remember to include units and a therefore statement at the end of your solution

**Example 1:** A plane is coming into land at Pearson airport. The angle of depression is 22° and the plane is 350m from the ground. Determine the distance from the plane to the airport.




let x rep. the distance from the plane to airport.

SOH CAH TOA

$\sin\theta = \frac{opp}{hyp}$

$\frac{\sin 22°}{1} = \frac{350}{x}$

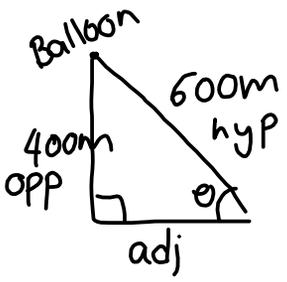
$\frac{x(\sin 22°)}{\sin 22°} = \frac{350}{\sin 22°}$

$x = 934.3$

∴ The distance from the plane to the airport is 934.3m

MAP4C1 Unit 1: Trigonometry

**Example 2:** A weather balloon is tethered to a rope that is 600m long.
**a)** What is the angle of elevation of the balloon, when it is 400m high?
**b)** What do you have to assume about the rope in order to answer this question?




let θ rep. the angle of elevation

a) SOH CAH TOA

$\sin\theta = \frac{opp}{hyp}$

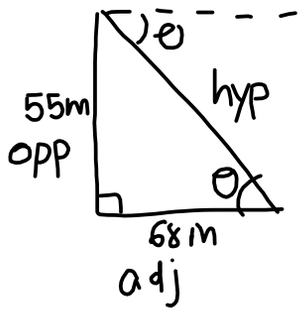
$\sin\theta = \frac{400}{600}$

$\theta = \sin^{-1}\left(\frac{400}{600}\right)$

$\theta = 41.8°$

∴ The angle of elevation is 41.8°

**Example 3:** An observer in a 55m tall lighthouse spots a ship in distress 68 m from shore. What is the angle of depression from the lighthouse to the ship?




let θ rep. the angle of depression

SOH CAH TOA

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

$\tan\theta = \frac{55}{68}$

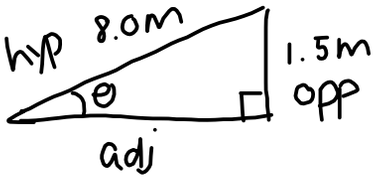
$\theta = \tan^{-1}\left(\frac{55}{68}\right)$

$\theta = 39.0°$

∴ The angle of depression is 39.0°

**Example 4:** A wheelchair ramp must have an angle of elevation of no more than 12°. A wooden ramp is available that is 8.0m long and 1.5 m high. Will this ramp meet the requirements?

*We are checking the AOE to see if it is more or less than 12°




let θ rep. the angle of elevation

SOH CAH TOA

$\sin\theta = \frac{opp}{hyp}$

$\sin\theta = \frac{1.5}{8.0}$

$\theta = \sin^{-1}\left(\frac{1.5}{8.0}\right)$

$\theta = 10.8°$

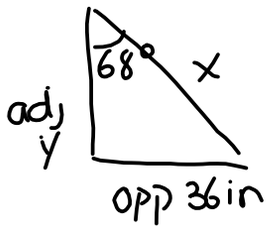
∴ The AOE is 10.8°, which meets the design requirements

MAP4C1 Unit 1: Trigonometry

**Example 5:** A carpenter leans a ladder against a wall at an angle of 68°. The distance from the foot of the ladder to the wall is 36 inches.

**a)** How long is the ladder in inches?

**b)** How high up the wall does the ladder reach in inches?




a) let x rep. the length of the ladder

SOH CAH TOA

$\sin\theta = \frac{opp}{hyp}$

$\frac{\sin 68°}{1} = \frac{36}{x}$

$\frac{x(\sin 68°)}{\sin 68°} = \frac{36}{\sin 68°}$

$x = 38.8°$

∴ The ladder is 38.8 inches long

b) let y rep. the height of the ladder up the wall.

SOH CAH TOA

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

$\frac{\tan 68°}{1} = \frac{36}{y}$

$\frac{y(\tan 68°)}{\tan 68°} = \frac{36}{\tan 68°}$

$y = 14.5$ in

∴ The ladder is 14.5 in. up the wall.

* you could also solve part (b) with the Pythagorean Theorem.