

A ball is thrown straight up with an initial velocity of 25 meters per second and is released 2 meters off the ground.

1. Write the equations for the vertical velocity of the ball and its position above the ground.
2. When does the ball hit the ground?
3. When does it hit its highest point? How high does it go?

## Example

A particular trebuchet is able to launch its flaming projectiles at a velocity of 65 m/s.

If the projectile is released 10 m above ground at an angle of  $30^\circ$  with the horizontal, how long is it in the air? How far does it travel?

You throw a tangerine southward off the astronomy observation deck of the Mars Center with an initial velocity of 30 m/s and at an angle of  $60^\circ$  with the horizontal.

The deck is approximately 20 meters above ground.

1. How long is the tangerine in the air? How far from the Mars Center will it travel?
2. How does your answer change if the angle is  $45^\circ$ ?
3. How does your answer change if the angle is  $40^\circ$ ?
4. How would you go about finding the angle that maximizes the horizontal distance traveled?