

# Type II Projectiles

Type II projectiles have both an initial horizontal and an initial vertical velocity.

For example, a golf ball driven from the ground and returning to the ground some distance away (the range).

Because  $v_h$  is constant, the range can be found by:

How do we find time?

The vertical component finds time.

The time for a type II (and only type II) projectile will always be:

Things to remember about type II projectiles:

- The signs in the equation are vital because they account for motions in different directions (+ is up, - is down).
- The max. height occurs at  $\frac{1}{2}$  of the total time.
- At the max. height, the vertical velocity changes from + to -.
- The maximum range occurs when the projectile is fired at  $45^\circ$ . This gives the best combination of time in the air and horizontal velocity.

ex.

A projectile is shot with a velocity of 500 m/s at an angle of  $30^\circ$  above the horizontal. Ignoring air resistance, determine:

- a.) the initial horizontal velocity
- b.) the initial vertical velocity
- c.) the maximum height
- d.) the time until it returns to the ground
- e.) the time until the maximum height is reached
- f.) the range

ex.

A missile is fired at 1200 m/s at an angle of  $60^\circ$  above the horizontal.

Ignoring air resistance, determine:

- a.) the time of flight
- b.) the range
- c.) the maximum height