

Solving Projectile Motion Problems

To succeed, the student must first memorize the kinematics formulae.

$$x = x_0 + v_0t + \frac{1}{2}at^2 \quad v_{\text{avg}} = \frac{x}{t} = \frac{v + v_0}{2}$$
$$v = v_0 + at \quad v^2 = (v_0)^2 + 2ax$$

To use these formulae correctly, the right signs must be applied and these two rules obeyed.

- (1) $x_0 = 0$ at the beginning of the motion
- (2) v_0 ALWAYS points in the positive direction.

Rules for Signs Displacement

The vector for displacement starts at X_0 .

When the displacement vector points in the same direction as v_0 , "x" is positive in the formulae. Otherwise it is negative.

Velocity

When the velocity vector points in the same direction as v_0 , "v" is positive in the formulae. Otherwise it is negative.

Acceleration

When the acceleration vector points in the same direction as v_0 , "a" is positive in the formulae. Otherwise it is negative.

When solving problems, select two locations. These two locations will be where the final and initial positions and velocities come from. The time, "t" variable, will be measured between these two locations.

One of the locations should be the location to answer the question.

Example:

...How high did the arrow travel? (The top of the motion.)

...How fast was the bullet traveling when it left the gun barrel? (At the gun barrel)

...How fast was the swimmer traveling when she landed in the water? (At the water.)

The other location should be either determined by other parts of the question or a location that you inherently know a lot about ...like apogee.

Example

...How long was the Arrow in the air? (The point where the arrow was launched and the point where it is landed)

...How high did the bullet travel from the ground? (Use the ground as one location of variables and the highest point as the other location.)

The motion can also be broken up into sections. The following may help with identifying variables.

