Projectile Paths Due to Different Launch Velocities

To launch a projectile from a known \((x_0, y_0)\) to a specified \((x_L, y_L)\), many trajectories are possible.

The minimum launch velocity, \(v_{\text{Min}}\), has a unique trajectory.

For each launch velocity greater than \(v_{\text{Min}}\), two trajectories are possible.

**Projectile Problem Variables:**
- Launch Location: \((x_0, y_0)\)
- Launch Velocity and Angle: \(v_0 \text{ at } \theta\)
- Landing Location and Time: \((x_L, y_L)\) at time, \(t_L\).

### Class B Projectile Problems:

For these, you are given the launch location \((x_0, y_0)\), the landing location \((x_L, y_L)\), and **one** of \((v_0, \theta, t_L)\).

Find: The **remaining two** of \((v_0, \theta, t_L)\).

6. **Given:** \([ (x_0, y_0), (x_L, y_L), \text{ and } \theta ] \) Find: \((v_0, t_L)\)
   (This is the most common, and the easiest, of these cases. Write the two position equations,
   \[
   x = x_0 + v_x t \\
   y = y_0 + v_y t - \frac{1}{2} gt^2
   \]
   and solve for \(v_0\) and \(t_L\).

7. **Given:** \([ (x_0, y_0), (x_L, y_L), \text{ and } t_L ] \) Find: \((v_0, \theta)\)

8. **Given:** \([ (x_0, y_0), (x_L, y_L)] \)
   Find: Minimum \(v_0\), and corresponding \(\theta\) and \(t_L\).

9. **Given:** \([ (x_0, y_0), (x_L, y_L), \text{ and } v_0 ] \)
   Find: Two \(\theta\)'s and two \(t_L\)'s for this \(v_0\).