Range

& Type II Problems

Key: x and y motion are **independent!**

- Recipe:

1. Draw a diagram
2. Put the origin on the ground
3. Make an x and y chart. Include appropriate subscripts (i.e. v_{y0}, a_y, etc.)
4. Pick the appropriate equations and solve.

*Note: With zero acceleration in the x-direction, only one of our formulas will be helpful:

Ex 1: A cannonball is launched at 40 m/s at a 30^0 angle above the horizontal and lands at the same height.

A) What is its initial x velocity?

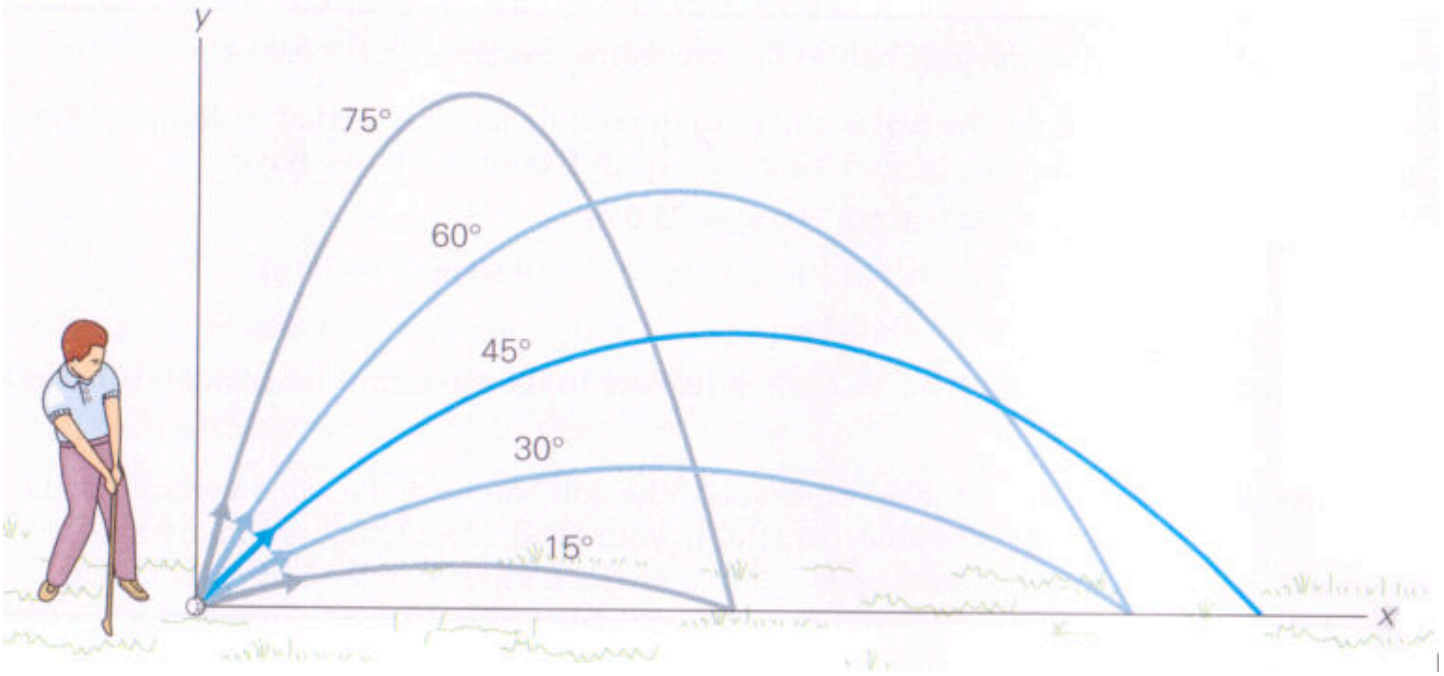
B) What is its initial y velocity?

C) How long is it in the air?

D) How far away does it land?

E) What is its velocity at the top of its path?

- **<u>Range</u>** = how far a projectile travels horizontally = x



- We (should have) found that complementary angles lead to the same range.

  $x = v_{0x}t$ for max range, you want high v_{0x} and max t

- Small angles have high horizontal velocity but small t.
- Big angles have small horizontal velocity but big t.

Derivation of the "Range Equation"

$$R = x = v_{0x}t$$

We can use this equation any time a projectile is launched at an angle and returns to the same height.

Ex 2: A rabbit decides to jump a canyon of width 4 m. To do so, he runs up the side of a hill sloped at a 15^o angle. What minimum speed must he have in order to clear the canyon?