PROJECTILES

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How Do Squirrels Jump So High?

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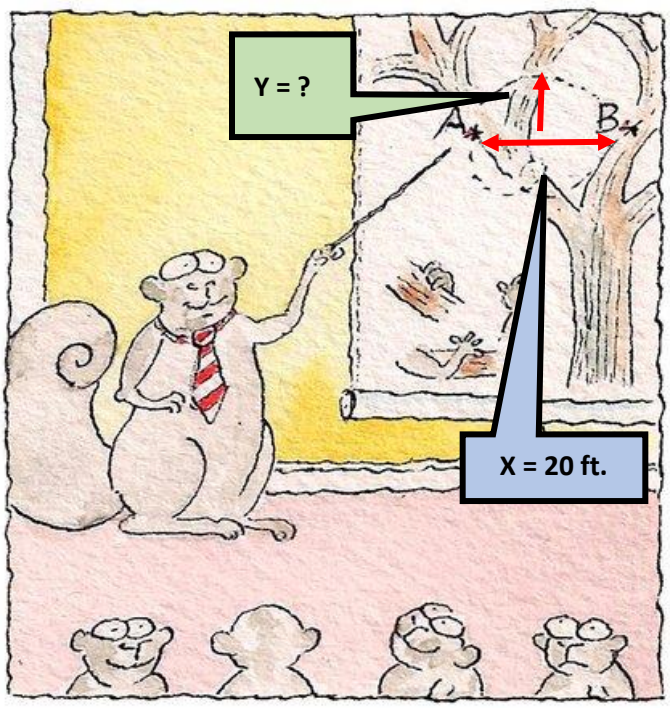

INTRODUCTION: Acceleration for a projectile on earth is only in vertical direction (g = 32 ft./s.^{2}). No acceleration Exists in the horizontal direction assuming no forces Exist on projectiles in X direction. Assume the squirrels leap branch to branch(see graphic at left) at a initial Velocity V at 45^0 to horizontal. The squirrels attain a maximum vertical height of Y.

QUESTIONS: (a) What is initial vertical component Of velocity in terms of V?, (b) What is the initial horizontal component of velocity in term of V?, (c) Find the initial velocity of squirrel's leap and time of flight from A to B(see graphic at left)., (d) Find maximum height (Y) of the squirrel's leap? (see graphic at left)

HINTS: $X = V_H t$, $y = V_{OV} t + \frac{1}{2} g t^2$, $V^2 = V_O^2 + 2 a Y$
To solve for two unknown (in this case V & t) is needed To set up two equations with two unknowns.

ANSWERS: (a) V_{OV} = 0.707 V , (b) V_H = 0.707 V, (c) V = ~ 25.3 ft., t = ~ 1.118 s., (d) Y = ~ 5 ft.

Q. **How can squirrels jump so far**? And how do they hold onto tree limbs as they gambol about?
A. Squirrels have evolved with several anatomical adaptations that help them with their acrobatics. While some estimates of their achievements seem exaggerated, like the reported **ability to jump 20 feet,** they are **obviously equipped to make vertical and horizontal leaps** that would be superhuman.
First, they have very powerful hind legs, much larger than their front limbs, giving them strong propulsion, especially in proportion to their relatively small and light bodies. Second, the "wrists" of their hind legs are double-jointed and hyper-extendable, so that they can reverse paw directions and run down a tree as easily as they run up. Cats, for one example, lack this kind of hypermobility and tend to get at least temporarily stuck after climbing a tree.Squirrels also have small and very sharp claws, and combined with their reversible hind legs, this means they can hang upside down when they want.The sharp claws also let them find a secure mooring on small irregularities on a tree trunk's bark or even on a seemingly smooth telephone pole. This gives squirrels a firm jumping-off place from which to start a vertical leap.