Recipe for Success: 1-D Algebraic Kinematics

One-Dimensional Problem-Solving Procedures

1. Read the problem carefully to determine whether the motion is **Uniform Motion** or **Uniform Accelerated Motion**. The first step of your solution is to write down "UM" or "UAM."

2. If solving a Uniform Motion problem, write out

$x =$
$v =$
$t =$

If solving a Uniform Accelerated Motion problem, write out

$x =$
$v_0 =$
$v =$
$a =$
$t =$

3. Read the problem again and fill in as many values as you can (e.g., $x = 25$ m, $v_0 = 5$ m/s, $t = 7$ s, etc.).

4. From the problem, determine which quantity you are asked to calculate and draw a box around it.

5. If UM, write out the UM equation: $v = x/t$. If UAM, select the correct equation for your problem from the five UAM equations by the "who cares" quantity method: choose the equation that doesn't include the "who cares" quantity (the quantity you don't know and *aren't* looking for). See "PhyzGuide: Algebraic Kinematics" for equations and further details.

6. After writing the correct equation for your problem, WAIT! Don't put the numbers in just yet! Arrange the equation to solve for the quantity you're seeking (i.e., if you have a UM problem in which you are given v and t and asked to find x, you must rearrange the UM equation $v = x/t$ to $x = vt$ before substituting the values of v and t). SOLVE FOR THE LETTERS FIRST!!!

7. **SOLVE FOR THE LETTERS FIRST!** ***REALLY, I MEAN IT!!!***

8. **DON'T PUT THE NUMBERS IN UNTIL YOU HAVE AN EQUATION THAT SOLVES FOR THE UNKNOWN QUANTITY IN TERMS OF THE KNOWN QUANTITIES!** ***I'M NOT KIDDING!!!***

9. *After* you have an equation for the unknown quantity in terms of the known quantities, rewrite the equation substituting the values for the variables (i.e., if $v = 15$ m/s and $t = 3$ s, $x = vt$ is rewritten as $x = 15 \text{ m/s} \cdot 3 \text{ s}$).

10. Calculate, write down the final answer, and box it!

Recipe for Success: 2-D Algebraic Kinematics

Two-Dimensional Problem-Solving Procedures

1. In a two-dimensional problem, you are given some sort of projectile that moves with constant speed in the horizontal (x) direction while accelerating due to gravity in the vertical (y) direction. Therefore, you have two simultaneous problems: an x problem (UM), and a y problem (UAM).

2. So write out

x: UM		y: UAM
$x =$		$y =$
$v_x =$		$v_{0y} =$
		$v_y =$
		$a =$
	$t =$	

3. List all the quantities as you would in a 1-D problem. There is a probability (which borders on certainty) that the time of the projectile's flight will not be given. Time is the link between the x and y motions: the projectile's flight lasts for a certain amount of time. Time is not an x-quantity nor is it a y-quantity; time is a unifying quantity. So the trick of these problems is usually to determine the time using one motion (the x or y) then substitute that information to solve for an unknown quantity involving the other motion (y or x).

The key to solving the problem is often finding the time of flight for the projectile. To do this, you must ask yourself this: When the flight ended, was it prevented from advancing in the x-direction or in the y-direction? For example, when a dart is thrown, its motion is eventually hindered in the x-direction—the dartboard stops the dart from advancing further. If a ball rolls off a table and becomes a projectile, its y-motion is eventually prevented from advancing by the floor. If the x-motion is hindered, use the x motion (UM) to determine the time; if the y-motion is hindered, use the y-motion (UAM) to determine the time.

4. Once you've developed an expression for time t using one motion (ex: y-motion), use that expression for t when solving the other motion (ex: x-motion).

5. Treat that "other" motion as if it were a one-dimensional kinematics problem. See "Recipe for Success: 1-D Algebraic Kinematics" for details.

6. Calculate, write down the final answer, and box it!