Kinematics Algorithm For homework and exams you get points for doing these things. So today you must label each of these 9 steps with your work. Anything in bold is my addition to the normal algorithm and should also be done.

1. Read and re-read the whole problem carefully. **Read it aloud as a group.**
2. Visualize the scenario. Mentally try to understand what the object is doing. **Physically act it out.**

   Motion diagrams are a great tool here for visual cues as to what the motion of an object looks like.
3. Draw a physical representation of the scenario; include initial and final velocity vectors, acceleration vectors, position vectors, and displacement vectors.
4. Define a coordinate system; place the origin on the physical representation where you want the zero location of the x and y components of position.
5. Identify and write down the knowns and unknowns.
6. Identify and write down any connecting pieces of information. **Also label any separate stages (when a changes).**
7. Determine which kinematic equation(s) will provide you with the proper ratio of equations to number of unknowns; you need at least the same number of unique equations as unknowns to be able to solve for an unknown.
8. Carry out the algebraic process of solving the equation(s).

   If simple, desired unknown can be directly solved for.

   May have to solve for intermediate unknown to solve for desired known.

   May have to solve multiple equations and multiple unknowns.

   May have to refer to the geometry to create another equation.

   If multiple objects or constant acceleration stages or dimensions, there is a set of kinematic equations for each. Something will connect them.
9. Evaluate your answer, make sure units are correct and the results are within reason.

Motorcycle A motorcycle starts from rest. First, it accelerates at $4\frac{m}{s^2}$ for some time, to a velocity, v_1. Then, in the same amount of time, it accelerates up to a final velocity that is twice v_1. What is the magnitude of the second acceleration?

Be sure to do and label all of the steps of the algorithm!

Challenge Question: Find an equation that represents the total distance traveled.

[0]Select problems may be modified from Walsh, Harrison, or the Internet.

Catch Me If You Can Andy is waiting for her friend, Cathy, so that they can ride their bikes together. Cathy rides past Andy at a speed of $\vec{v}_C = 6$ mph and says "catch me if you can". Andy accelerates at $\vec{a}_A = 4\frac{mph}{s}$ to catch up and Cathy accelerates at a rate of $\vec{a}_C = 1\frac{mph}{s}$ to try and stay ahead.

Be sure to do and label all of the steps of the algorithm!

How fast is Andy going when she catches up to Cathy?
When she catches up how far is Andy from where she was originally waiting for Cathy?

Spaceflight A spaceship is traveling due east with a speed of $20\frac{m}{s}$. The spaceship's thrusters suddenly turn on and provide a constant acceleration in the southwest direction for $44 seconds$. The crew was able to determine only the south component of acceleration, which was $3\frac{m}{s^2}$, and that they had an east component of displacement that was $40m$. What was the magnitude and direction of the acceleration?

River Trip A boat can travel at v_b in still water. The captain of the boat wishes to cross a river that is x_r wide. If the boat is pointed directly West across the river, and the river runs from North to South with a speed of v_r.

- What is the resultant velocity of the boat?
- How far downstream does the boat land?
- *Challenge Question: If the captain wants to land the boat directly across the river at what angle must she steer the boat?*