Problem Solving Guide: Complex 1D kinematics w/ constant accel. Intervals

The Model

Analytical problems involving one dimensional motion are problems where the details of the motion are described by equations. Assumptions are:

- Objects are treated as point particles, with only a single, definite position.
- The motions of the object or objects have constant acceleration over given intervals. Acceleration may change, however, from interval to interval. If this occurs, we assume such a change is instantaneous.
- The motion is strictly along one straight line.

Problem Solving Steps

1) Organize and plan
   a) Use diagrams, graphs, or other tools to visualize the situation. Label ket instants in time clearly.
   b) Define all variables clearly, using subscripts to denote the time and the object referred to. Note down known variables.
   c) Identify what strategies will solve the problem.
   d) Identify relationships between variables at key times or positions.
2) Solve
   a) Apply the constant accel. equations to intervals of constant accel. in order to solve for unknowns. This often involves repeated application of these equations.
3) Reflect
   a) Do your answers make sense?
   b) Are the units correct?
   c) Did you use any new techniques?
   d) Any other insights?

Constant Acceleration Motion Equations

$$v_B = v_A + a_{AB}\Delta t_{AB} \qquad x_B = x_A + v_A\Delta t_{AB} + \frac{a_{AB}}{2}\Delta t_{AB}{}^2$$

$$v_B^2 = v_A^2 + 2a_{AB}\Delta x_{AB} \qquad x_B = x_A + \left(\frac{v_A + v_B}{2}\right)\Delta t_{AB}$$