Technical Physics 1 Kinematics

Quantities Used:

x = the displacement (the distance from the starting point).
t = the elapsed time.
v_0 = the initial velocity (velocity at time = 0).
v_f = the final velocity (velocity after time t).
a = the acceleration (the amount by which the velocity increases per second).
$\overline{v}$ = the average velocity (the equivalent constant velocity required to move the given distance in the given time).

Formulas:

The kinematical formulas for motion along a straight line at constant acceleration (uniformly increases its velocity):

$x = v_0 t + \frac{1}{2} a t^2$ (missing v_f)
$v_f = v_0 + at$ (missing x)
$v_f^2 = v_0^2 + 2ax$ (missing t)
$\overline{v} \equiv x/t = (v_f + v_0)/2$ (missing a)

The above formulas must be memorized!

℞ Prescription for solving kinematics problems:

1) Write down the given in terms of the above quantities.
2) Write down that to be found in terms of one or more of the above quantities.
3) Determine which of the above equations to use (use the equation missing the quantity that is not mentioned in the problem).
4) Write the equation just determned.
5) Substitute into the equation, and solve.

Problems:

1. An object moving along a straight line has a constant acceleration. It has a velocity of 40 m/s at time = 0 and has a velocity of 120 m/s after 4 s.

   a) Calculate its acceleration a.
   b) Calculate its average velocity $\overline{v}$ during the first 4 s.
   c) Calculate its displacement after 2 s.

2. An object moving along a straight line has an initial velocity of 20 m/s and a constant acceleration of 4 m/s^2.

   a) What will be its velocity after 2 s?
   b) How far has it traveled during 2 s?
   c) What will be its velocity after it moves 150 m?