Problem 1 (Giancoli EX 2-21): An experimental vehicle starts from rest \( v_0 = 0 \) at \( t = 0 \) and accelerates at a rate given by \( a = a_0 t \).

a) What are the units of \( a_0 \)?

b) What is the velocity of the vehicle \( t = \tau \) later?

c) What is the displacement of the vehicle \( t = \tau \) later?

Problem 2 (Deweese SP14): From the kinematics equations...

a) Derive an expression for the time(s) \( t \) that a particle reaches a distance \( y \) above the ground when it is launched with \( \vec{v} = v_0 y \hat{y} \) with an initial position \( v_{0y} = 0 \).

b) For what value(s) of \( y \) does this expression have two solutions? One solution? No solutions?

Problem 3: Achilles and the Tortoise are playing “extreme tortoise toss.” The Tortoise has a rocket strapped to her back that supplies a constant acceleration of \( a_0 \). Achilles tosses the tortoise at an angle of \( \theta \) (between 0 and 90 degrees) at a velocity \( v_0 \) from a height of \( x_o \). Assume that the Tortoise manages to orient herself such that the rocket’s acceleration is constantly parallel with the ground, which is perfectly flat.

a) Sketch a diagram of this situation and draw suitable xy coordinate axes.

b) How far away will the Tortoise land?

c) What will the Tortoise’s velocity be when she lands?