Kinematics Problem

A particle is traveling in a path in the xy plane defined by two functions as described below:

$$x(t) = 2t^3 - t^2 + 5t$$

$$y(x,t) = -t^2 + 3xt$$

Notice that the y component of position is dependent on the x component.

Begin by analyzing the motion at specific points in the time interval (0,t), where t>0.

The last component of the problem is the height of the particle (in the z direction). This is a function of both the x and y variables. This can be modeled by the following equations:

$$z(v_z, x, y, t) = -.5x^2 + y^{.5} + \frac{3xv_z t}{2y} - 2{v_z}^{\frac{1}{4}}$$

$$v_z(z,t) = \frac{v_0}{3} - \frac{7z}{2t} + 5t^{\frac{2}{3}}$$

The initial values for v_z are to be selected based on application the Impulse-momentum relationship.

Let the value of t in the equations above be after the impulse of a force has been subjected to the particle described above. The mass of the particle is 10 mg and is subjected to a force of 1.51 MN.

Take the time that force is applied for is equal to the time it takes a 1500 kg vehicle to come to rest on a flat surface with a coefficient of friction between the tires and the surface to be equal to .38 that is initially at a cruising speed of 45 mph. Assume that a braking force (applied in addition to friction) is applied during the entire duration of the stop to be equal to:

$$F(v) = .27v^3$$

Write a program in JavaScript that has the ability to calculate the following measurements of the particle: (1) position in x, y, and z, (2) the velocity in each direction x, y, and z, (3) the kinetic and potential energy (relative to starting position) of the particle as it travels throughout the time interval (0,t).

Specific guidelines will further be explained. Good luck!