LAB 1.2 – Modelling One-Dimensional Motion

Aim: To use the equations of motion to produce animations of motion in one-dimension.

Open your browser (preferably chrome) and go to the website www.physgl.org . You do not need to make an account. Move the windows so that you can clearly see the code, graphics and graph panes.

Either copy-n-paste the code below into the code window, or type it out. Note that the displacement, velocity and acceleration variables are in a vector format, but we are only going to use the *x*-dimension for this exercise. As computer animations work by stepping forward in time by small time intervals, *dt*, we will be using the time-dependent equations:

$$v = v_0 + at$$

$$x = v_0 t + \frac{1}{2}at^2$$

```
x = <-100,0,0>
v = <20,0,0>
a = <0,0,0>
t = 0
dt = 1

camera(<0,0,500>,<0,0,0>)
new_multi_graph("time", "displacement", "velocity", "acceleration")

while t < 20 animate
        draw_sphere(x, 5, "red")
        draw_sphere(x, 1, "white", true)
        go_multi_graph(t, x.x, v.x, a.x)
        x = x + (v*dt) + 0.5*a*dt^2
        v = v + a*dt
        t = t + dt
end
```

Initial variables – note that the acceleration is set to zero. The time step interval is called *dt*

Camera command sets the viewpoint for the animation, graph command allows us to label the axes.
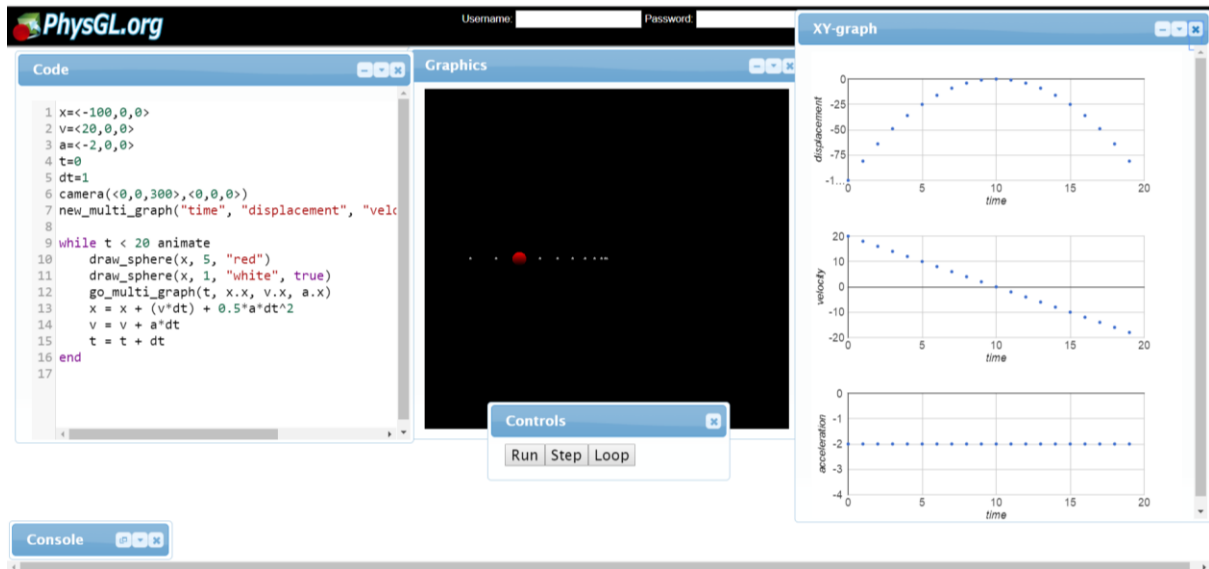
The animation loop. The spheres are drawn at the position of the object, the second number defines its radius. The word true tells the animation not to delete the sphere for the next iteration.

Note the equations of motion look a bit weird in this format.

Graph – the format for taking the value of the x-component of the 3D vector is *#.x*

Experiment with changing the values of the initial positions, velocities and accelerations of the sphere. Do the animations and graphs match what you thought that it be? How does changing the time step interval affect the animation? How could you get a similar image in real life?

Try changing the motion to be vertical instead of horizontal – note that you will need to edit the graphing variables slightly. What about the z-dimension?

Challenge: Can you make an animation that appears to be a ball thrown upwards into the air and landing at the same place that it started from?