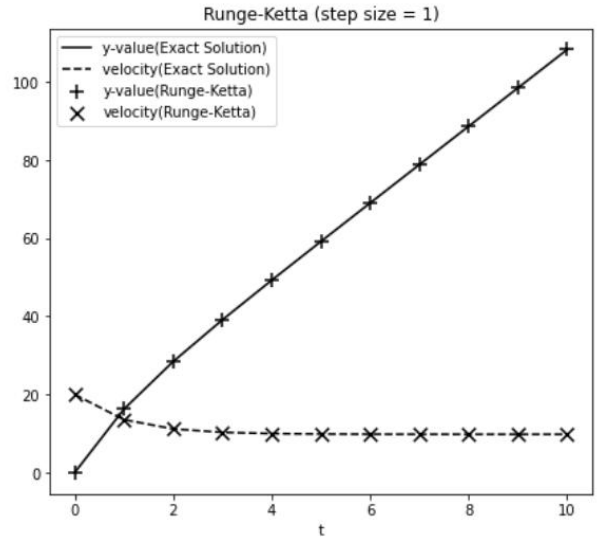
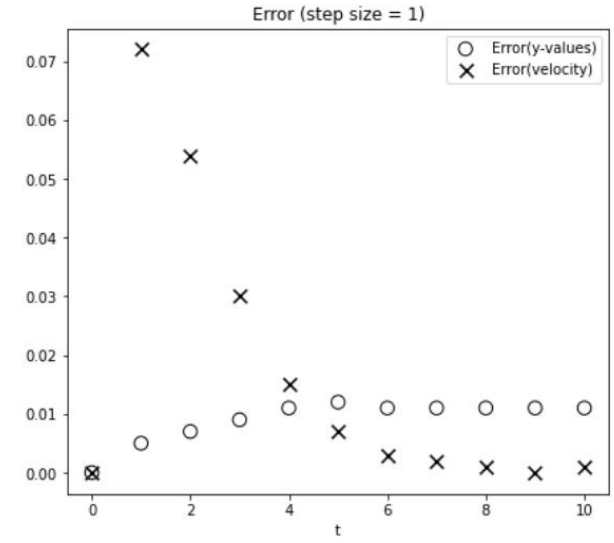
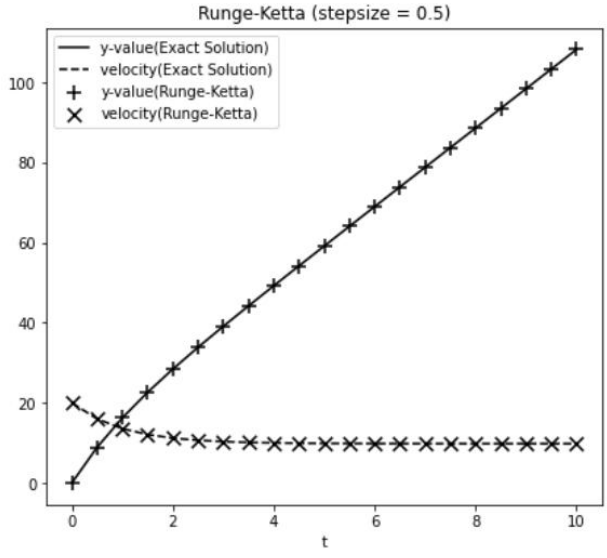
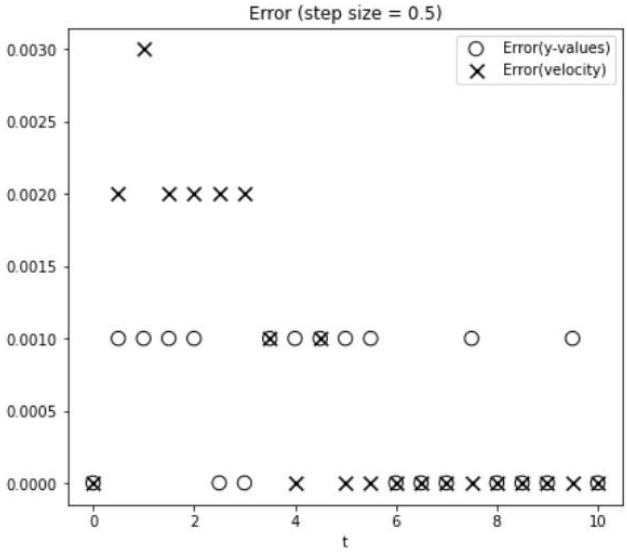
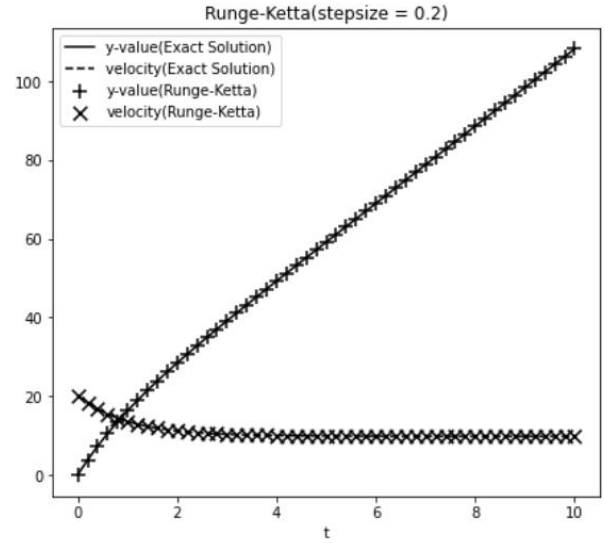
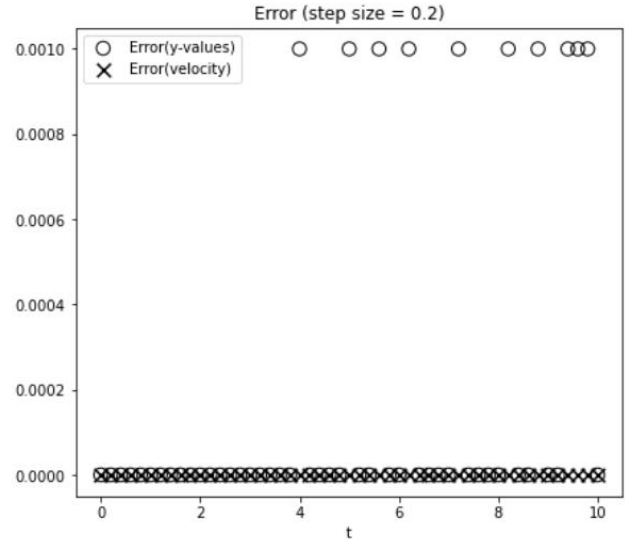

Runge-Ketta (step size = 1)
y-value(Exact Solution)
velocity(Exact Solution)
y-value(Runge-Ketta)
velocity(Runge-Ketta)
t


Error (step size = 1)
Error(y-values)
Error(velocity)
t


Runge-Ketta (stepsize = 0.5)
y-value(Exact Solution)
velocity(Exact Solution)
y-value(Runge-Ketta)
velocity(Runge-Ketta)
t


Error (step size = 0.5)
Error(y-values)
Error(velocity)
t


Runge-Ketta(stepsize = 0.2)
y-value(Exact Solution)
velocity(Exact Solution)
y-value(Runge-Ketta)
velocity(Runge-Ketta)
t


Error (step size = 0.2)
Error(y-values)
Error(velocity)
t

The graphs above show the position (y) and velocity (v) of a projectile in vertical motion under linear drag calculated using the fourth order Runge-Ketta (RK4) method with three different time steps used (0.2, 0.5 and 1.0). These numerical values are plotted as markers (+ and x) and compared with the position and velocity calculated using the exact solution for the given differential equation which are plotted using solid and dashed lines. Beside each y(t) & v(t) graph is the plot for the error that is equal to the difference between the RK4 values and the exact values. As seen in these error graphs, the maximum error for the RK4 method for y(t) at time steps 0.2, 0.5 & 1.0 are all almost equal to 0.001. However, as the time step decreased, more RK4 y(t) values become equal to the exact values. For the case of v(t), the maximum error for the RK4 method at time steps 0.2, 0.5 & 1.0 are 0, 0.03 & 0.07 respectively. This suggests that lowering the value of step-size decreases the error for the v(t) calculation using the RK4 method.

Figure 1: Comparision between y(t) at different step-size h

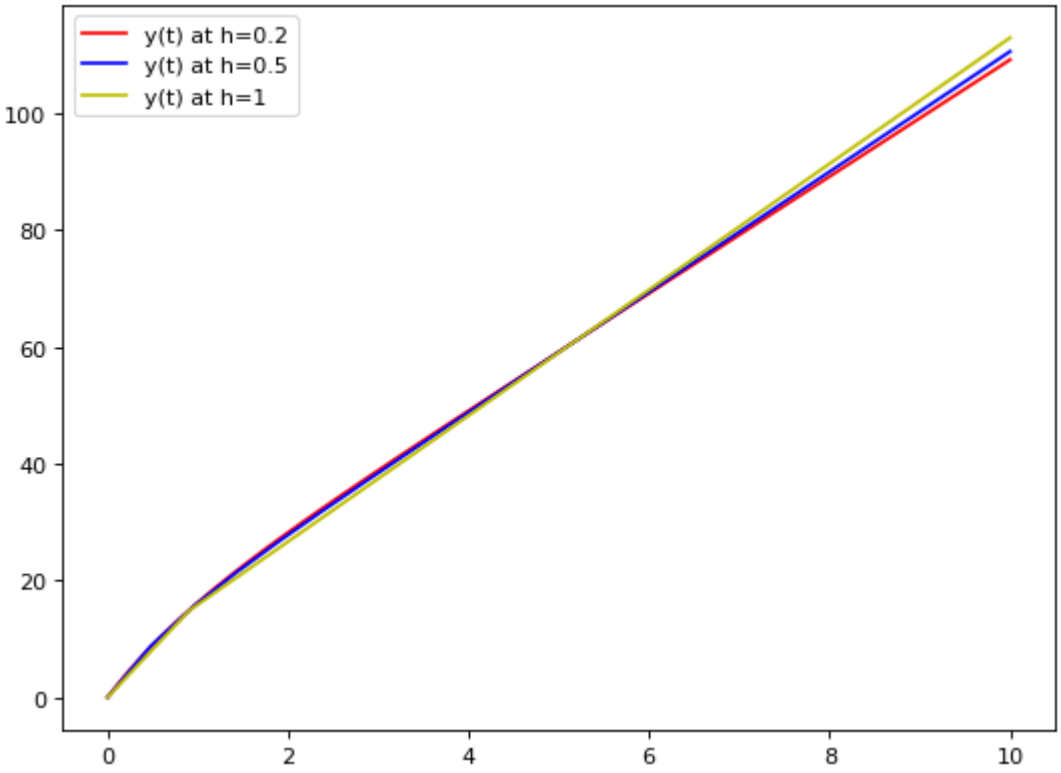
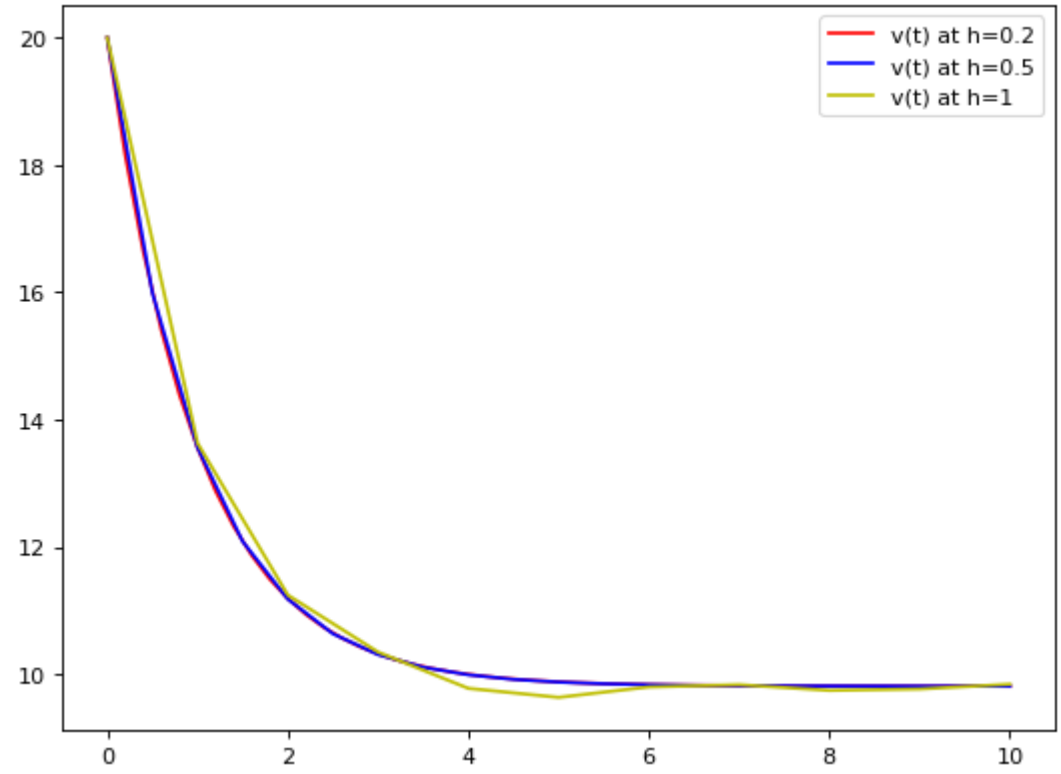


Figure 2: Comparision between v(t) at different step-size h



The plot comparison above shows the differences between all v(t) and between all y(t) using Predictor-Corrector method. In the first figure that represents y(t) at different h shows that all y(t) has some similarities and seem to unite somewhere near t = 0 and between t = 4 and t = 6. It also shows a significant difference when t = 0 and t = 10. In addition, all of the curves at the first figure looks smooth except at color yellow that is when h = 1. On the other hand, the second figure shows the differences and similarities between all values of v(t) at different value of step-size, h. The values of v(t) at different h seem to unit at t = 0, somewhere in between t = 6 and t = 8. It also shows a less significant similarites between t = 1 and t = 2. The above curves looks smooth except to color yellow that is when h = 1. As a conclusion, the authors observe that as the values of step-size h is getting smaller, the values of both y(t) and v(t) will be getting smoother. Having a step size that is equal to 1 would not be recommended.