Exercise 1

The current \( i \) through a capacitor is related to the voltage \( v \) across a capacitor by the following equations:

\[
v = \frac{1}{C} \int i \, dt \quad \text{and} \quad i = C \, v'.
\]

1a: The following plots show the voltage over time across a capacitor with \( C = 2 \times 10^{-6} \, \text{F} \).

In these two plots, the slope will be in units of Volts/second.

Sketch the current over the same time periods.
1b: The following plot shows the current through a capacitor with C=2.

Plot the voltage across the capacitor over the same time period.

Assume that the voltage at time = 0 is 0 Volts.
Exercise 2

Assume that a small rocket produces constant thrust (acceleration) as long as it has fuel to burn. Once the fuel is exhausted, the only force on the rocket is gravity (-9.8 m/s$^2$).

The fuel burns for 10 seconds, during which time the acceleration is 10 m/s$^2$. (The rocket thrust produces 29.8 m/s$^2$, which is reduced by gravity.)

Plot the velocity and the height of the rocket for 20 seconds. Assume the initial velocity of the rocket is 0 m/s and the initial height of the rocket is 0 meters. Also assume that the rocket flies (falls) straight up (down).
Exercise 3

The following plot shows the distance of a vehicle from some arbitrary point on a long straight road.

Plot the velocity and the acceleration of the vehicle over this six hour period.