Please answer the questions below to the best of your ability either in the space provided. Everything should be scanned or photographed and submitted through `gradescope.com`. Please remember to tell gradescope what pages correspond to what problems after you upload!

> **Objective:** *I can utilize the momentum principle and iteration method to determine the future positions of an object given initial conditions and forces.*

1. NASA is launching a new test rocket which has a mass of $5000\,\text{kg}$. The main rocket thruster burns for $30\,\text{s}$, outputing a constant force of $\langle 50, 120, 0 \rangle\,\text{kN}$. After the main stage ends, the rocket remains in free fall until it returns to the ground.

(1)   (a) What is the net force acting on the rocket during the main thruster burn?

(1)   (b) What is the net force acting on the rocket after the main thruster burn?

(8)   (c) Assume the rocket starts at the position $\langle 0, 0, 0 \rangle\,\text{m}$ and is initially stationary. Use the iteration method to look at the positions of the rocket over the first 2 minutes of it's journey. You can use a step size of $30\,\text{s}$ and approximate $\vec{\mathbf{v}}_{avg}$ with $\frac{\vec{\mathbf{p}}_{future}}{m}$. Be careful with using the correct net force in each iteration!

(1)   (d) Plot the positions of the rocket at each time point.

X Distance in km