9. [8 points] This problem concerns a rocket that has been launched and is ascending. You may assume the acceleration due to gravity is $g = 9.8 \, \text{m/s}^2$.

Because it is burning fuel, the rocket’s mass is decreasing. Let $m(h)$ be the mass (in kg) of the rocket during its ascent when it is at a height of $h$ meters above the ground.

**a.** [2 points] Suppose $\Delta h$ is small. Write an expression (not involving integrals) in terms of $m$ and $h$ that approximates the work (in joules) required for the rocket to ascend from a height of $h$ meters above the ground to a height of $h + \Delta h$ meters above the ground.

**b.** [2 points] Write, but do not evaluate, an integral that gives the total work (in joules) required for the rocket to ascend from a height of 100 meters above the ground to a height of 2500 meters above the ground.

Let $v(h)$ be the rocket’s velocity (in m/s) when it is at a height of $h$ meters above the ground.

**c.** [2 points] Suppose $\Delta h$ is small. Write an expression (not involving integrals) in terms of $v$ and $h$ that approximates the time (in seconds) it takes for the rocket to ascend from a height of $h$ meters above the ground to a height of $h + \Delta h$ meters above the ground.

**d.** [2 points] Write, but do not evaluate, an integral that gives the total time (in seconds) it takes for the rocket to ascend from a height of 100 meters above the ground to a height of 2500 meters above the ground.