2. [12 points] Joe and Paula are at the same national park, hiking through the forest. They arrive at the bottom of a cliff and challenge each other to bring their hiking gear to the top of the cliff, which is 25 meters above the bottom. Each of them has a different idea of how to accomplish this.
You may assume that the acceleration due to gravity is $g = 9.8$ m/s^2.

a. [6 points] Joe plans to climb to the top of the cliff while carrying his water bottle. Before Joe starts climbing, the combined mass of Joe and his water bottle is 64 kilograms. However, a rock punctures the bottle as soon as Joe starts climbing, so water leaks out at a constant rate of 0.03 kilograms per second. Joe climbs the cliff at a constant rate of 0.25 meters per second.

(i) Let $M(h)$ be the combined mass of Joe and his water bottle, in kilograms (kg), when Joe is h meters above the ground. Write an expression for $M(h)$.

Answer: $M(h) =$ _____

(ii) Write an integral representing the total amount of work, in Joules (J), that it takes for Joe to move himself and the water bottle to the top of the cliff. Your answer should not involve the letter M. **Do not evaluate your integral.**

Answer: _____

b. [6 points] Paula ties a rope to her 3-kilogram backpack, walks to the top of the cliff, and then uses the rope to pull her backpack to the top. The rope has a mass of 0.1 kilograms per meter. Write an integral representing the total amount of work, in Joules (J), that it takes for Paula to pull her backpack and the attached rope to the top of the cliff.
Do not evaluate your integral.

Answer: _____