5. [7 points] Lovise is a character in a video game. As part of the game she lifts a crate straight up from the ground to a height of 60 m. Gravity in this video game world is not constant! At a height of h meters above the ground, the acceleration due to gravity is $7e^{-h}$ meters per second per second. The crate has a mass of 5 kg.

   Recall: Weight is the force exerted by gravity and is equal to mass times acceleration due to gravity.

   a. [3 points] Write an expression that approximates the amount of work done by Lovise in the video game to lift the crate from a height of h meters above the ground to $h + \Delta h$ meters above the ground. (Assume here that Δh is positive but very small.)
   Your expression should not involve any integrals.

$$\text{Mass} = 5kg$$
$$\text{acceleration} = 7e^{-h} \ m/s^2$$
$$\text{weight} = (5kg)(7e^{-h} \ m/s^2) = 35e^{-h} \ N$$
$$\text{distance to lift} = \Delta h \ m$$
$$\text{Work} = (\text{weight})(\text{distance}) = 35e^{-h}\Delta h \ \text{Joules}$$

   Answer: Work $\approx$ _____ $35e^{-h}\Delta h$ joules _____

   b. [4 points] Write and evaluate an integral that gives the total work done by the character Lovise in lifting the crate to a height of 60m above the ground.
   (You may do this by hand or by using your calculator. Give an exact answer or round your answer to two decimal places.)

$$\int_0^{60} 35e^{-h} \, dh = -35e^{-h}\Big|_0^{60} = -35e^{-60} + 35e^{-0}$$

   Answer: Integral Expression: _____ $\int_0^{60} 35e^{-h}\,dh$ _____

   Numerical Final Answer (with units): _____ $35(1-e^{-60})$ joules _____