

9. [12 points] Joey decides to participate in a medical study that tests the effects of a new drug against fatigue on people by measuring their energy levels on a scale from 0 to 100 before and after taking the drug. The scientists conducting the study created new units of energy called energons to measure the energy level of the participants. The experiment goes as follows:

- Starting with initial energy equal to 100 energons, participants do a certain exercise for 1 hour.
- Then participants immediately take the drug and do the same exercise for one more hour.

Let $E = J(t)$ be Joey's energy level, in energons, t minutes after the beginning of the experiment.

Joey's energy level decreases at a constant rate of 0.8 energons/min during the first hour, and it decreases at a constant rate of 0.3 energons/min during the second hour.

a. [2 points] Evaluate $J(62)$.

Solution: $J(62) = 100 - 0.8 \cdot 60 - 2 \cdot 30 = 100 - 48 - 0.6 = 51.4$ energons.

b. [5 points] Write a piecewise-defined formula for the function $J(t)$ for $0 \leq t \leq 120$.

Solution:

$$J(t) = \begin{cases} 100 - 0.8t & , 0 \leq t < 60 \\ 52 - 0.3(t - 60) & , 60 \leq t \leq 120 \end{cases}$$

c. [5 points] Find a piecewise-defined formula for the function $t = J^{-1}(E)$.

Solution:

$$J^{-1}(E) = \begin{cases} \frac{70 - E}{0.3} & , 34 \leq E \leq 52 \\ \frac{100 - E}{0.8} & , 52 < E \leq 100 \end{cases}$$