8. [14 points] A car speeds up at a constant rate from 10 to 70 mph over a period of half an hour, between $t = 0$ and $t = 1/2$. Its fuel efficiency, $E(v)$, measured in miles per gallon, depends on its speed, v, measured in miles per hour.

a. [4 points] Write an integral which gives the total distance traveled by the car during the half hour.

b. [5 points] Write an integral which gives the average fuel efficiency of the car during the half hour.

c. [5 points] For speeds v greater than 70 mph suppose the relationship between E and v is given by

$$E(v) = 2 + v^{-av}$$

for some constant a. Using this formula, write an expression for the definition of the derivative $E'(82)$. Do not evaluate your expression.