4. [11 points] A city is replacing carbon-based energy production with solar power, saving large amounts of carbon that would otherwise have been burned in energy production. As a consultant for the city, you have created the following functions, which are both differentiable and invertible, to model these quantities.

- $E(t)$ is the solar capacity, in megawatts (MW), of the city t years after January 1, 2000.
- $C(s)$ is the amount of carbon, in tons, the city would save each day with a solar capacity of s MW.

a. [2 points] Using a complete sentence, give a practical interpretation of the equation

$$C^{-1}(15) = 3.$$

Solution: In order to save 15 tons of carbon each day, the city needs a solar capacity of 3 MW.

b. [3 points] Write a single equation involving E, C, and/or their inverses that represents the following statement.

At the start of 2008, the city saved twice as much carbon each day as it did at the start of 2001.

Answer: $C(E(8)) = 2C(E(1))$

c. [3 points] Write a single equation involving exactly one of the derivative functions E', C', $(E^{-1})'$ or $(C^{-1})'$ that represents the following statement.

If the city increased its solar capacity from 4.8 to 4.9 MW, it would save about 0.6 additional tons of carbon each day.

Answer: $C'(4.8) = 6$ **or** $C'(4.9) = 6$

d. [3 points] Using the fact that

$$(E^{-1})'(8) = \frac{2}{3},$$

answer the following question from the city, making sure you **include units** in your answer.

If we have a solar capacity of 8 MW at the start of 2025, approximately how much time do you expect it to take to increase our solar capacity an additional 0.5 MW?

Answer: $\frac{1}{3}$ **of a year, or** 4 **months**