8. [12 points] Let $P(d)$ be a function giving the total electricity that a solar array has generated, in kWH, between the start of the year and the end of the dth day of the year. Each of the following centences (a)–(d) expresses a mathematical equality in practical terms. For each, give a **single** mathematical equality involving P (and, as needed, its inverse and derivatives) that corresponds to the sentence.

a. [3 points] The end of the day on which the array had generated 3500 kWH of electricity was the end of the 4th of January.

Solution: $P^{-1}(3500) = 4$. ($P(4) = 3500$ is equivalent, though the statement suggests that 3500 kWH is the independent variable, and so that the equation involving the inverse is the better for this statement.)

b. [3 points] At the end of January 4th, the array was generating electricity at a rate of 1000 kWH per day.

Solution: $P'(4) = 1000$.

c. [3 points] When the array had generated 5000 kWH of electricity, it would take approximately half a day to generate an additional 1000 kWH of electricity.

Solution: $(P^{-1})'(5000) = \frac{1}{2000}$. (Or, alternately, $P'(P^{-1}(5000)) = 2000$.)

d. [3 points] At the end of January 30th, it would take approximately one day to generate an additional 2500 kWH of electricity.

Solution: $P'(30) = 2500$. (Or, $P'(31) = 2500$.)