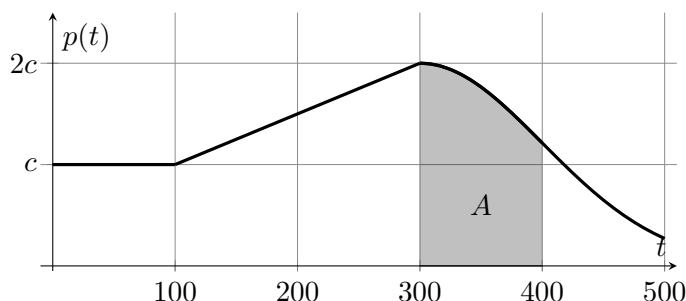


1. [9 points] Sunita is a horticulturist, who has been cultivating tomato plants. Let $p(t)$ be the probability density function (pdf) for the lifespan t of a tomato plant in her facility, measured in days.

A **partial** graph of $p(t)$ is shown below. Note that $p(t)$ is piecewise linear on the interval $[0, 300]$ and that $p(t) = 0$ for all $t < 0$. The value of the shaded area between $p(t)$ and the t -axis on $[300, 400]$ is given by the positive number A .



- a. [2 points] Suppose that $p(800) = 0.0002$. Complete the following sentence:

“The probability that a tomato plant has a lifespan between 775 and 825 days is ...”

Solution: ...approximately $(0.0002)(50) = 0.01 = 1\%$.

- b. [2 points] The median lifespan of a tomato plant is 300 days. Find the value of c .

Solution: Since the median for the pdf $p(t)$ is 300, we must have $\int_0^{300} p(t) dt = 0.5$. Computing the area under the graph of $p(t)$ from 0 to 300, we obtain that $400c = 0.5$. Therefore, $c = \frac{1}{800}$.

Answer: $c = \frac{1}{800}$

- c. [2 points] Additionally, suppose that there is a 80% chance that a tomato plant in the facility has a lifespan of 400 days or fewer. Find the value of A .

Solution: From part **b**, we know that there is a 50% chance that a tomato in the facility has a lifespan of 300 days or fewer. Combining this with the information given in this part, we find that there is a 30% chance that a tomato plant in the facility has a lifespan between 300 and 400 days. Therefore, we must have $A = 0.3$.

Answer: $A = 0.3$

- d. [3 points] Let $S(t)$ be the function which gives the probability that a tomato plant has a lifespan of t or **more** days in Sunita's facility. Which of the following statements **must** be true, given the assumptions from parts **b**. and **c**.?

i. $S(350) < 0.5$

iv. $\lim_{t \rightarrow \infty} S(t) = 1$

ii. $S(350) < 0.2$

v. $S(600) \leq S(700)$

iii. $\lim_{t \rightarrow \infty} S(t) = 0$

vi. $S(600) \geq S(700)$

vii. NONE OF THESE