

2. [15 points] There were 3 trillion trees in the world in the year 2000.

- Since the year 2000, a group of environmentalists have recorded the number of trees lost in the world due to natural causes or due to human activities. Let $C(t)$ be the rate at which the number of trees decreases due to any of these causes, t years after the year 2000, in trillions of trees per year.
- At the same time, some governments and other organizations plant new trees to increase the number of trees in the world. The group is also measuring the rate $P(t)$ at which the trees are being planted, t years after the year 2000, in trillions of trees per year.

Throughout this question, you may assume that the functions $C(t)$ and $P(t)$ describe the only changes to the number of trees in the world.

a. [7 points] In parts (i) and (ii) below, give a mathematical expression that may involve $C(t)$, $P(t)$, their derivatives, and/or definite integrals.

- (i) Find an expression for the total number of trees in the world (in trillions) in the year 2005.

Answer: _____

- (ii) Find an expression for the average rate at which the trees were being planted (in trillions of trees per year) between the years 2002 and 2009.

Answer: _____

- b. [3 points] Write a practical interpretation of the statement $\int_{13}^{17} C(t)dt = 0.05$. Your answer must be a complete sentence.

The question has been reproduced here for your convenience.

There were 3 trillion trees in the world in the year 2000.

- Since the year 2000, a group of environmentalists have recorded the number of trees lost in the world due to natural causes or due to human activities. Let $C(t)$ be the rate at which the number of trees decreases due to any of these causes, t years after the year 2000, in trillions of trees per year.
- At the same time, some governments and other organizations plant new trees to restore the forests. The group is also measuring the rate $P(t)$ at which the trees are being planted, t years after the year 2000, in trillions of trees per year.

Throughout this question, you may assume that the functions $C(t)$ and $P(t)$ describe the only changes to the number of trees in the world.

c. [5 points] Additionally, you know that

- $C(t) = P(t)$ in 2001 and 2009,
- between 2000 and 2010, the number of trees in the world was the largest in 2006.

The graph of $P(t)$ is given below for $0 \leq t \leq 10$. In the same axis, **sketch a possible graph** of $C(t)$ that is consistent with the above information. Note that there may be many correct answers.

