2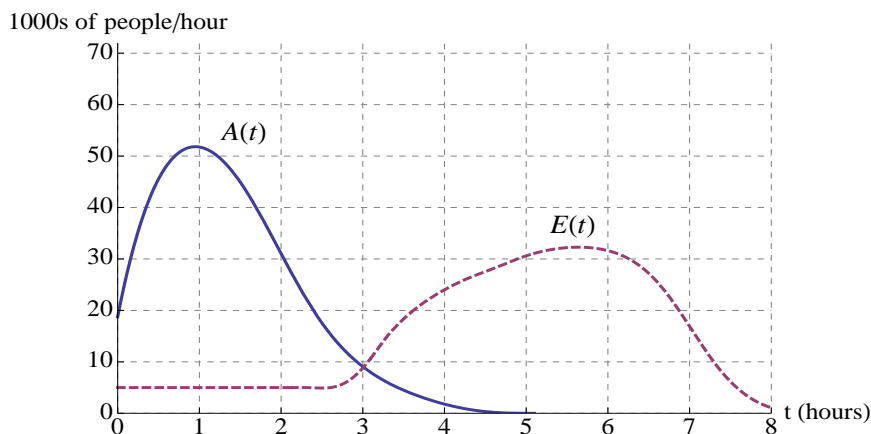. [12 points] The following is a graph showing the rates at which visitors arrive at and exit from the Big House during a football game:

1000s of people/hour

The solid line $A(t)$ shows the arrival rate and the dashed line $E(t)$ shows the exit rate, in thousands of people per hour. Time t is measured in hours after 10 a.m. At 10 am, there are already 10,500 people inside the stadium.

a. [5 points] Let $P(t)$, the number of people, in thousands, in the stadium at time t. Give an expression for $P(t)$.

Solution:
$$P(t) = 10.5 + \int_0^t A(x) - E(x)dx.$$

b. [3 points] Give a practical interpretation of the statement $\int_1^4 A(t)dt = 67$. Include units.

Solution: 67,000 people arrived at the Big House between 11 a.m. and 2 p.m.

c. [2 points] At what time(s) of the day are there the most people in the stadium?

Solution: $t = 3$ (or 1 p.m).

d. [2 points] To comply with safety regulations, the game organizers must determine an upper bound (overestimate) of the number of people in the stadium at the beginning of the game. Circle the estimation rule(s) they could use. The game begins at noon.

left   right   trap   **MID**