

**Quiz 12**  
November 20, 2002

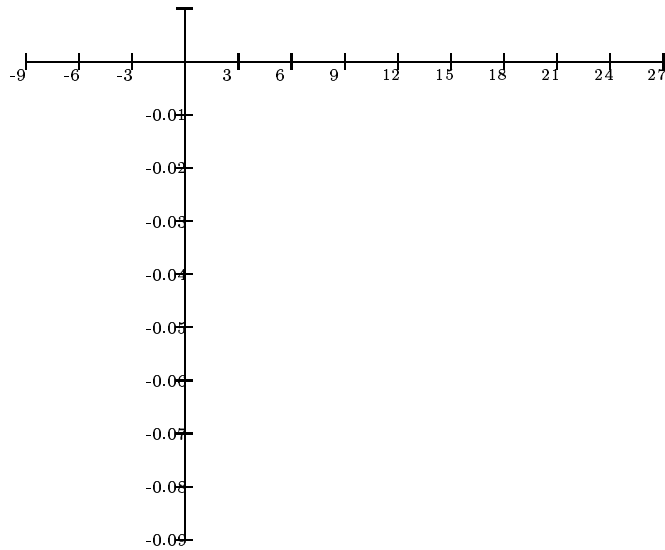
Name \_\_\_\_\_

Using data from the 1998 *Statistical Abstract*, we model the rate of change of the percentage of the U.S. population living in New England from 1970 through 1997 as

$$P(t) = -0.000197t^2 + 0.0043t - 0.0484$$

percentage points per year where  $t$  is the number of years since 1970.

1. Sketch a graph of  $P$  from  $t = 0$  to  $t = 27$  on the following axis.



2. What does the fact that the graph of  $P$  lies below the  $t$ -axis from  $t = 0$  to  $t = 27$  tell you about the percentage of the population living in New England?
3. Use five midpoint rectangles to estimate the area of the region between the graph of  $P$  and the  $t$ -axis from  $t = 10$  to  $t = 20$ . Interpret your answer.
4. Do you have some estimate (an **estimate** not an exact answer) for  $\int_{10}^{20} P(t) dt$ ? If so what is it?