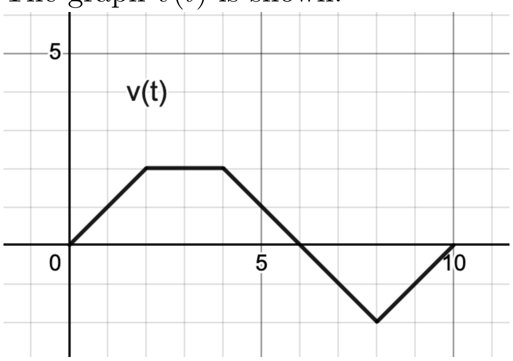
Name: ____________________

5.3 The Fundamental Theorem and Interpretations

Total Change Principle
Let F(t) be some quantity with a continuous rate of change F'(t). Then

1. The graph $v(t)$ is shown.



   (a) If $v(t)$ is measured in $\frac{km}{hr}$, and t is measured in hours, what are the units of $\int_0^{10} v\,(t)\,dt$ and what does it represent?

   (b) Find $\int_0^{10} v\,(t)\,dt$ and interpret the meaning.

   (c) Assuming $v\,(t)$measures the velocity of a car starting at position 0 at time 0, sketch a graph of the position of the car as a function of time.

   (d) Is there a way to find $\int_0^{10} v\,(t)\,dt$ using the position graph?

2. Pollution is removed from a lake at a rate of $f(t)$ kg/day on day t.

   (a) Explain the meaning of the statement $f(12) = 500$.

   (b) If $\displaystyle\int_5^{15} f\,(t)\,dt = 4000$, give the units of the 5, the 15, and the 4000.

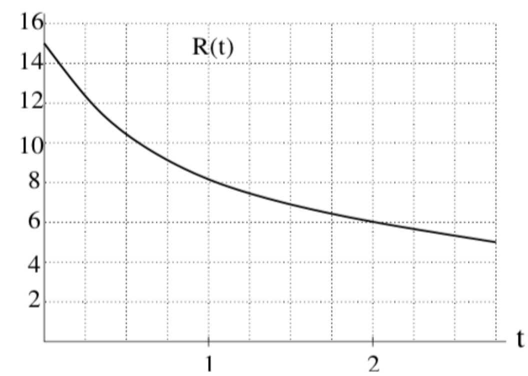
   (c) Give the meaning of $\displaystyle\int_5^{15} f\,(t)\,dt = 4000$.

3. Water is leaking out of a tank at a rate of R(t) gallons per hour, where t is measured in hours (see graph to the right).

(a) Write a definite integral that expresses the total amount of water that leaks out in the first two hours.

(b) On the graph to the right, shade the region whose area represents the total amount of water that leaks out in the first two hours.

(c) Give your best estimate of the amount of water that leaks out of the tank in the first two hours.



4. A can of soda is put into a refrigerator to cool. The rate at which the temperature of the soda is changing is given by

$$f(t) = -25e^{-2t}\text{degrees Fahrenheit per hour,}$$

where t represents the time (in hours) after the soda was placed in the refrigerator.

(a) How fast is the can of soda cooling after 1 hour has passed? Include the appropriate units with your answer.

(b) If the temperature of the can of soda is 60°F when it is placed in the refrigerator, estimate the temperature of the can of soda after 3 hours have passed.