Estimating Area and Definite Integrals NAME____

1. Water into being pumped out of a tank. The rate at which of the water has been pumped out is given by $R(t)$, where R is measured in ounces/minutes, and t is measures in minutes.

t	0	20	60	80	90	100	120
$R(t)$	1.2	2.8	4.0	4.7	5.1	5.2	4.8

   a. Estimate $\int_0^{120} R(t)\,dt$ using a left Riemann Sum with six subintervals.

   b. Estimate $\int_0^{120} R(t)\,dt$ using a right Riemann Sum with six subintervals.

   c. Estimate $\int_0^{120} R(t)\,dt$ using a trapezoidal approximation with six subintervals.

   d. Describe each of the following in the context of the problem:

      i. $R(70)$

      ii. $R'(70)$

      iii. $\int_0^{120} R(t)\,dt$

      iv. $\frac{1}{120}\int_0^{120} R(t)\,dt$

2. Estimate $\int_0^{4} 4 - x^2\,dx$ using

   a. Left Riemann Sum with 4 subintervals

   b. Right Riemann Sum with 4 subintervals

   c. Midpoint Riemann Sum with 4 subintervals

   d. Trapezoidal Approximation with 4 subintervals

3. Graph each integrand and use the areas to evaluate each integral.

a. $\int_{-2}^{4} \frac{x}{2} + 3\, dx$

b. $\int_{0}^{4} -2x + 4\, dx$

c. $\int_{-3}^{3} \sqrt{9 - x^2}\, dx$

d. $\int_{-2}^{1} |x|\, dx$

4. Suppose that f and g are continuous functions and that $\int_1^2 f(x)\, dx = -4$, $\int_1^5 f(x)\, dx = 6$, $\int_1^5 g(x)\, dx = 8$.

a. $\int_2^2 g(x)\, dx =$

b. $\int_5^1 g(x)\, dx =$

c. $\int_1^2 f(x)\, dx =$

d. $\int_2^5 f(x)\, dx =$

e. $\int_1^5 [f(x) - g(x)]dx =$

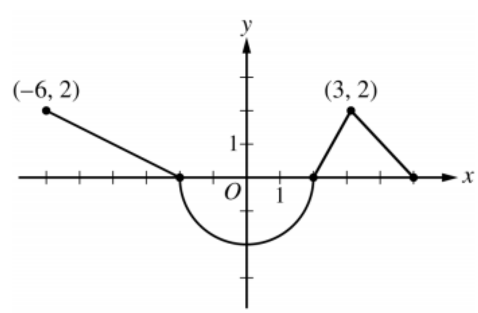
f. $\int_1^5 [4f(x) - g(x)]\, dx =$

5. Suppose that f is continuous and that $\int_0^3 f(t)\, dt = 3$ and $\int_0^4 f(t)\, dt = 7$.

d. $\int_3^4 f(t)\, dt =$

b. $\int_4^3 f(t)\, dt =$

6. The graph of $f'(t)$ is given to the right. It consists of a semicircle and three line segments.
The function f is defined as $f(x) = \int_0^x f'(t)\, dt$.
Evaluate the following:



a. $f(2) =$

b. $f(3) =$

c. $f(5) =$

d. $f(-2) =$

e. $f(-6) =$