

# MTH 139-02

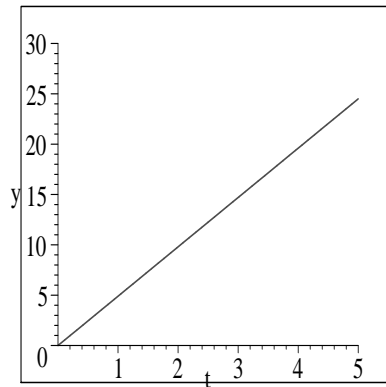
Exam 3

Tuesday, November 18, 2003

Name: \_\_\_\_\_

Remember to **show your work**. Unsupported solutions will receive no credit.

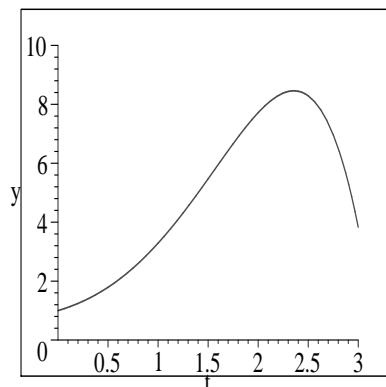
1. (5 points) The graph below shows the velocity (in meters per second) of a car driving from one end of a dead-end street (at  $t = 0$ ) to an intersection, which it reaches at  $t = 5$  seconds. Approximately how long is this piece of road?



$$y = v(t)$$

2. (5 points) Evaluate  $\sum_{i=2}^5 \frac{i+1}{i}$ .

3. (5 points) Approximate the area under the curve between  $t = 0.5$  and  $t = 2.5$  with 4 suitable rectangles. Give a numerical answer.



4. (5 points) State the Fundamental Theorem of Calculus.

5. (20 points) Determine each indefinite integral.

(a)  $\int e^{-0.5x} dx$

(b)  $\int \frac{1}{\sqrt{x^{11}}} dx$

(c)  $\int \left( x^4 - \frac{2}{x} - 9 \right) dx$

(d)  $\int x^{3/5} dx$

6. (5 points) Find the average value of  $f(x) = 4x^2$  on the interval  $[-2, 1]$ .

7. (20 points) Evaluate each definite integral using the Fundamental Theorem of Calculus. You may use your calculator to check your answer, but a numerical answer alone will receive **zero points**. You must support your answers with work.

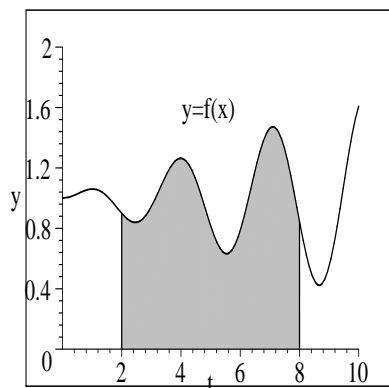
(a)  $\int_{-2}^2 x^5 dx$

(b)  $\int_4^9 \sqrt{x} dx$

(c)  $\int_1^e \frac{1}{x} dx$

(d)  $\int_0^{12} 350e^{0.005t} dt$

8. (10 points) Represent the shaded area below as a definite integral. Do not evaluate the integral. Also sketch a rectangle that illustrates the average value of  $f$  fairly accurately.



9. (5 points) If  $F(x) = \int_1^x \frac{t^3}{t^2 + 1} dt$ , what is  $F'(x)$ ?

10. (10 points) Find the area bounded by the graphs of  $f(x) = 4x^2$  and  $g(x) = x^3$ .

11. (10 points) True or False.

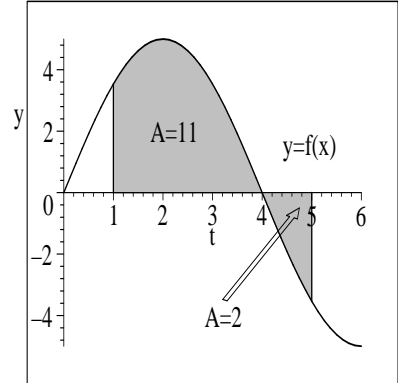
(a) \_\_\_\_\_ If  $\int_a^b f(x)dx = 4$  and  $\int_a^b g(x)dx = -1$ , then  $\int_a^b [f(x) - g(x)]dx = 5$ .

(b) \_\_\_\_\_  $\int_{-2}^2 x^{-2}dx = \frac{x^{-1}}{-1} \Big|_{-2}^2 = -\left(\frac{1}{2} - \left(\frac{1}{-2}\right)\right) = -1$ .

(c) \_\_\_\_\_ If  $f$  is the function graphed to the right and the areas are as shown, then  $\int_1^5 f(x)dx = 13$ .

(d) \_\_\_\_\_ A definite integral always equals the area between the graph of the integrand and the  $x$ -axis.

(e) \_\_\_\_\_ If  $D'$  has units of dollars per hour and  $x$  has units of hours, then  $\int_0^8 D'(x)dx$  has units of dollars.



12. (BONUS!! 5 points) If  $F(x) = \int_0^{x^2} \sqrt{e^{-t^2} + 1}dt$ , what is  $F'(x)$ ? (You'll need to think about this one!)