a. Explain why the definite integral from $t = 0$ to $t = 9$ represents the distance Rhoda rode in the first 9 seconds.

b. Use the trapezoidal rule to estimate the integral in part a. Try 9, 45, 90, and 450 trapezoids. Record all the decimal places your program gives you.

c. What number (an integer in this case) do you think is the exact value of the integral? Explain why this number is a limit. Why are the approximate answers by trapezoids all smaller than this number?

d. Figure out how many trapezoids are needed so that the approximation of the integral is within 0.01 unit of the limit. Explain how you go about getting the answer.

14. *Work Problem:* The work done as you drag a box across the floor is equal to the product of the force you exert on the box and the distance the box moves. Suppose that the force varies with distance, and is given by

$$F(x) = 10 - 3\sqrt{x}$$

where $F(x)$ is the force, in pounds, and x is the distance, in feet, the box is from its starting point. Figure 2-5j shows the graph of F.

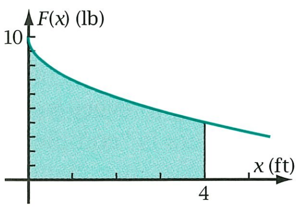

Figure 2-5j

a. Explain why a definite integral is used to calculate the amount of work done.

b. Use the trapezoidal rule with $n = 10$ and $n = 100$ increments to estimate the value of the integral from $x = 0$ to $x = 4$. What are the units of work in this problem?

c. The exact amount of work is the limit of the trapezoidal sums as n approaches infinity. In this case the answer is an integer. What do you suppose the integer is?

d. What is the minimum number, D, such that the trapezoidal sums are closer than 0.01 unit to the limit in part c whenever $n > D$?

15. *Searchlight Problem:* A searchlight shines on a wall as shown in Figure 2-5k. The perpendicular distance from the light to the wall is 100 ft. Write an equation for the length, L, of the beam of light as a function of the angle, x, in radians, between the perpendicular and the beam. How close to $\pi/2$ must the angle be for the length of the beam to be at least 1000 ft, assuming that the wall is long enough?

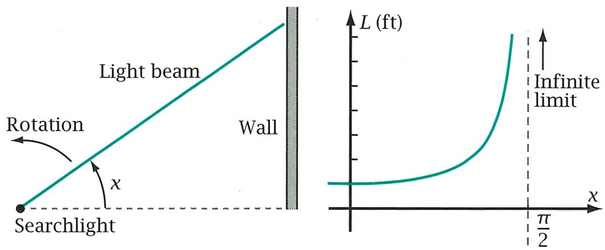

Figure 2-5k

16. *Zero Times Infinity Problem:* You have learned that 0/0 is called an indeterminate form. You can't determine what it equals just by looking at it. Similarly, $0 \cdot \infty$ is an indeterminate form. In this problem you will see three possibilities for the limit of a function whose form goes to $0 \cdot \infty$. Let f, g, and h be functions defined as follows.

$$f(x) = 5x(x-2) \cdot \frac{1}{x-2}$$

$$g(x) = 5x(x-2) \cdot \frac{1}{(x-2)^2}$$

$$h(x) = 5x(x-2)^2 \cdot \frac{1}{x-2}$$

a. Show that each of the three functions takes the form $0 \cdot \infty$ as x approaches 2.

b. Find the limit of each function as x approaches 2.

c. Describe three things that the indeterminate form $0 \cdot \infty$ could approach.