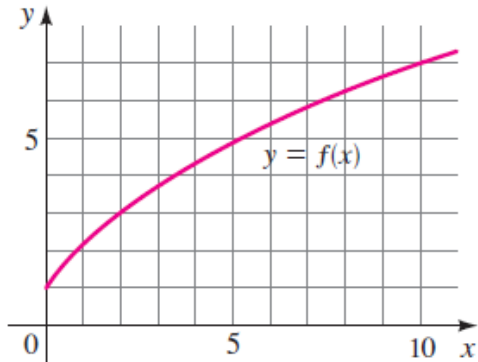


### Lesson 14.5: The Area Problem; The Integral

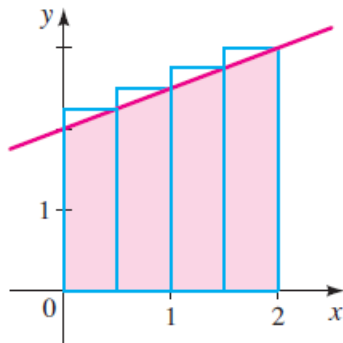
For credit, please show all work and answer on separate paper.

1. a) By reading values from the given graph of  $f$ , use five rectangles to find a lower estimate and an upper estimate for the area under the given graph of  $f$  from  $x = 0$  to  $x = 10$ . In each case, sketch the rectangles that you use.
- b) Find new estimates using ten rectangles in each case.

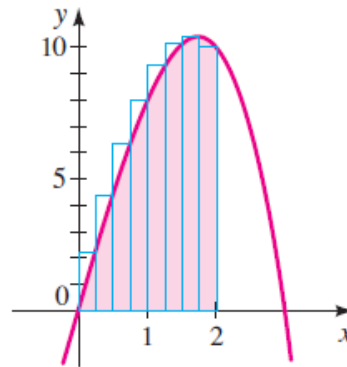


**#2-4 Approximate the area of the shaded region under the graph of the given function by using the indicated rectangles. (The rectangles have equal length.)**

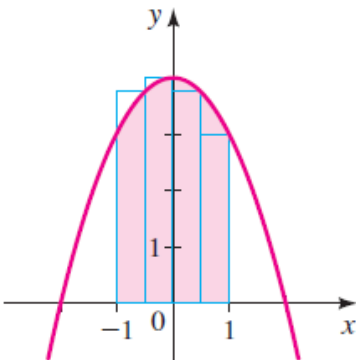
2.  $f(x) = \frac{1}{2}x + 2$



4.  $f(x) = 9x - x^3$



3.  $f(x) = 4 - x^2$



5. Use the definition of area as a limit to find the area of the region that lies under the curve.  
 $y = 3x, 0 \leq x \leq 5$

**#6-8 Find the area of the region that lies under the graph of  $f$  over the given interval.**

6.  $f(x) = 3x^2, 0 \leq x \leq 2$

7.  $f(x) = x + x^2, 0 \leq x \leq 1$

8.  $f(x) = 20 - 2x^2, 2 \leq x \leq 3$