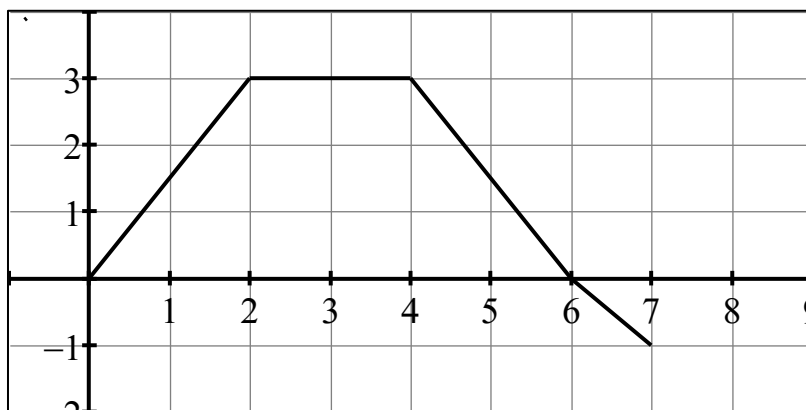


**Multiple Choice****(No Calculator)**

For #1 – 2, use the given graph and information.



A bug begins to crawl up a vertical wire at time  $t = 0$ . The velocity  $v$  of the bug at time  $t$ ,  $0 \leq t \leq 8$ , is given by the function whose graph is shown above.

1. At what value of  $t$  does the bug change direction?

- A) 2      B) 4      C) 6      D) 7      E) 8

2. What is the total distance the bug traveled from  $t = 0$  to  $t = 8$ ?

- A) 14      B) 13      C) 11      D) 8      E) 6

3. The area of the region enclosed by the graph of  $y = x^2 + 1$  and the line  $y = 5$  is

- A)  $\frac{14}{3}$       B)  $\frac{16}{3}$       C)  $\frac{28}{3}$       D)  $\frac{32}{3}$       E)  $8\pi$

**(Calculator OK)**

4. What is the area of the region in the first quadrant enclosed by the graphs of  $y = \cos x$ ,  $y = x$ , and the  $y$ -axis?

- A) 0.127      B) 0.385      C) 0.400      D) 0.600      E) 0.947

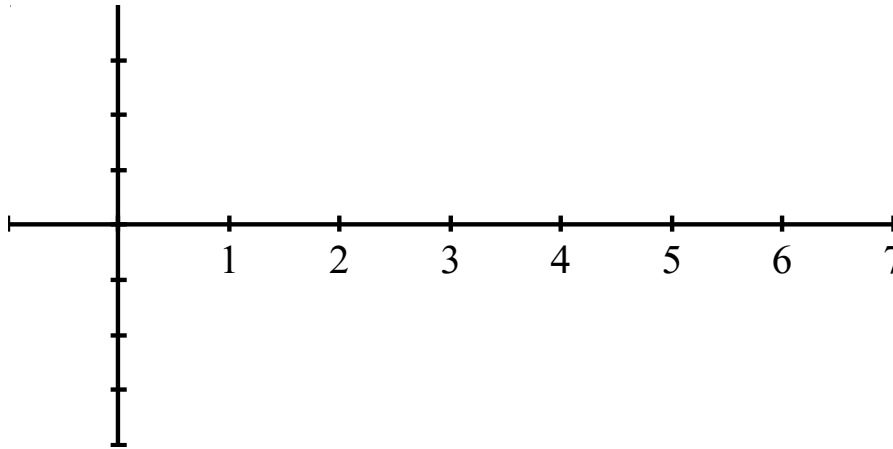
5. At time  $t \geq 0$ , the acceleration of a particle moving on the  $x$ -axis is  $a(t) = t + \sin t$ . At  $t = 0$ , the velocity of the particle is  $-2$ . For what value of  $t$  will the velocity of the particle be zero?

- A) 1.02      B) 1.48      C) 1.85      D) 2.81      E) 3.14

**Free Response**  
**(Calculator OK)**

1. Let  $f$  be the function given by  $f(x) = \sqrt{x-3}$ .

a) On the axes provided below, sketch the graph of  $f$  and shade the region  $R$  enclosed by the graph of  $f$ , the x-axis, and the vertical line  $x = 6$ .



b) Find the area of the region  $R$  described in part a).

c) Rather than using the line  $x = 6$  as in part a), consider the line  $x = w$ , where  $w$  can be any number greater than 3. Let  $A(w)$  be the area of the region enclosed by the graph of  $f$ , the x-axis, and the vertical line  $x = w$ . Write an integral expression for  $A(w)$ .

d) Let  $A(w)$  be described in part c). Find the rate of change of  $A$  with respect to  $w$  when  $w = 6$ .

**(Calculator OK)**

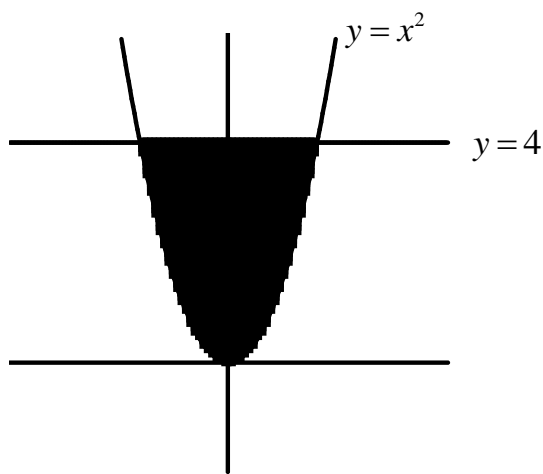
2. Let  $R$  be the region bounded by the  $x$ -axis, the graph of  $y = \sqrt{x}$ , and the line  $x = 4$ .

a) Find the area of region  $R$ .

b) Find the value of  $h$  such that the vertical line  $x = h$  divides the region  $R$  into two regions of equal area.

**(Calculator OK)**

3.

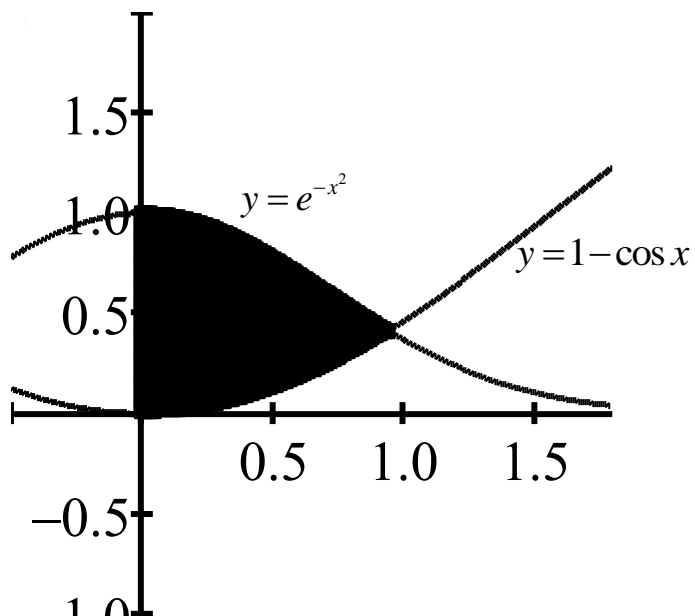


The shaded region,  $R$ , is bounded by the graph of  $y = x^2$  and the line  $y = 4$ , as shown in the figure above.

a) Find the area of  $R$

(Calculator OK)

4.



Let  $R$  be the shaded region in the first quadrant enclosed by the graphs of  $y = e^{-x^2}$ ,  $y = 1 - \cos x$ , and the  $y$ -axis, as shown in the figure above.

a) Find the area of the region  $R$ .

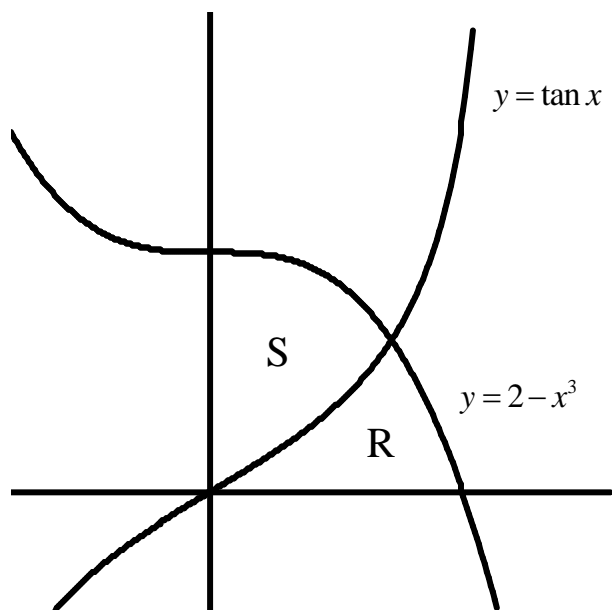
(Calculator OK)

5. Let  $f$  and  $g$  be the functions given by  $f(x) = e^x$  and  $g(x) = \ln x$ .

a) Find the area of the region enclosed by the graphs of  $f$  and  $g$  between  $x = \frac{1}{2}$  and  $x = 1$ .

(Calculator OK)

6.



Let  $R$  and  $S$  be the regions in the first quadrant shown in the figure above. The region  $R$  is bounded by the x-axis and the graphs of  $y = 2 - x^3$  and  $y = \tan x$ . The region  $S$  is bounded by the y-axis and the graphs of  $y = 2 - x^3$  and  $y = \tan x$ .

a) Find the area of  $R$ .

b) Find the area of  $S$ .