Section 1 Part A (no calculator):

1. The $\lim\limits_{x \to -\infty} \dfrac{2x-1}{1+2x}$ is?
   a. -1
   b. 0
   c. 1
   d. 2
   e. nonexistent

2. $\displaystyle\int_{\pi/2}^{x} \cos t \, dt$
   a. $\cos x$
   b. $-\sin x$
   c. $\sin x - 1$
   d. $\sin x + 1$
   e. $-\sin x + 1$

3. The radius of a sphere is increasing at a constant of $2\,cm/sec$ 2 cm/sec. At the instant when the volume of the sphere is increasing at $32\pi\,cm^3/sec,$, the surface area of the sphere is?
   a. 8π
   b. $\dfrac{32\pi}{3}$
   c. 16π
   d. 64π
   e. $\dfrac{256\pi}{3}$

4. Given the equation $A = \dfrac{\sqrt{3}}{4}(5s-1)^2$ what is the instantaneous rate of change of A with respect to s at $s=1$?
   a. $2\sqrt{3}+5$
   b. $2\sqrt{3}$
   c. $\dfrac{5}{2}\sqrt{3}$
   d. $4\sqrt{3}$
   e. $10\sqrt{3}$

5. What is the $\lim\limits_{x \to \ln 2} g(x)$, if
   $g(x) = \begin{cases} e^x & \text{if } x > \ln 2 \\ 4 - e^x & \text{if } x \le \ln 2 \end{cases}$?
   a. -2
   b. $\ln 2$
   c. e^2
   d. 2
   e. nonexistent

6. If $g(x) = -2|x+3|$, what is the $\lim\limits_{x \to -3^-} g(x)$?
   a. -6
   b. -2
   c. 2
   d. 6
   e. nonexistent

7. What is $\lim\limits_{\Delta x \to 0} \dfrac{\sin\left(\dfrac{\pi}{3}+\Delta x\right) - \sin\left(\dfrac{\pi}{3}\right)}{\Delta x}$?
   a. $-\dfrac{1}{2}$
   b. 0
   c. $\dfrac{1}{2}$
   d. $\dfrac{\sqrt{3}}{2}$
   e. nonexistent

8. The graph of f' is shown in Figure 1T-1. A possible graph of f is (see Figure 1T-2):

Figure 1T-1

(A)

(B)

(C)

(D)
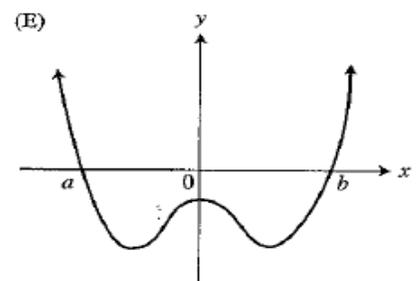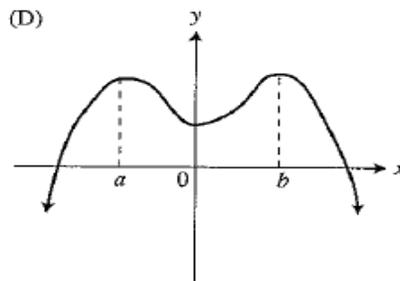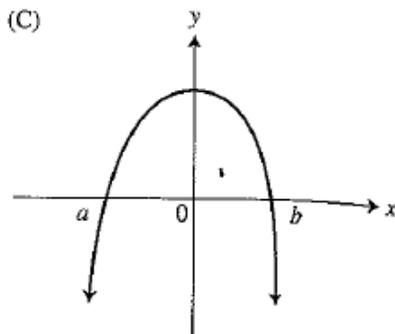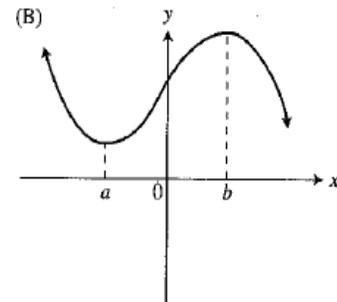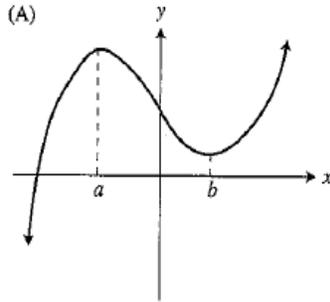
(E)
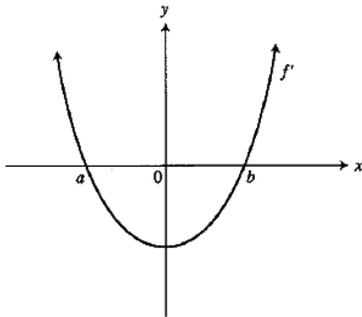
Figure 1T-2

9. If $f(x)$ is an antiderivative of xe^{-x^2} and $f(0)=1$, then $f(1)=$?

a. $\dfrac{1}{e}$

b. $\dfrac{1}{2e}-\dfrac{3}{2}$

c. $\dfrac{1}{2e}-\dfrac{1}{2}$

d. $-\dfrac{1}{2e}+\dfrac{3}{2}$

e. $-\dfrac{1}{2e}+\dfrac{1}{2}$

10. If $g(x)=3\tan^2(2x)$, then $g'\left(\dfrac{\pi}{8}\right)$ is?

a. 6

c. 12

e. 24

b. $6\sqrt{2}$

d. $12\sqrt{2}$

Figure 1T-3

I. $f'(0)=0$

II. f has an absolute maximum value on $[a,b]$

III. $f''<0$ on $(0,b)$

a. III only   b. I and II only

c. II and III only   d. I and III only
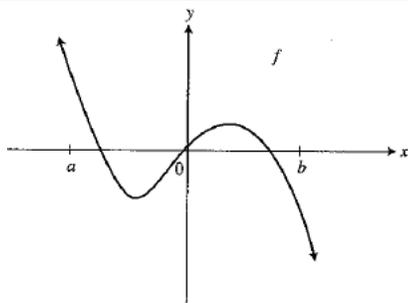
e. I, II, and III

11. The graph of the function f is shown in Figure 1T-3. Which of the following statements is/are true?

12. $\int \dfrac{1+x}{\sqrt{x}}\,dx =$

a. $2\sqrt{x} + \dfrac{x^2}{2} + c$

b. $\dfrac{\sqrt{x}}{2} + \dfrac{3}{2}x^{3/2} + c$

c. $2\sqrt{x} + \dfrac{2}{3}x^{3/2} + c$
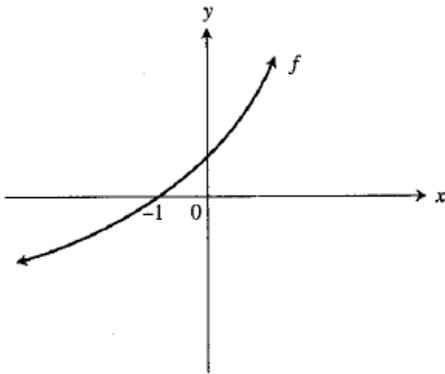
d. $\sqrt{x} + \dfrac{2}{3}x^{3/2} + c$

e. 0

Figure 1T-4

13. The graph of f is shown in Figure IT-4 and f is twice differentiable. Which of the following has the smallest value?

I. $f(-1)$

II. $f'(-1)$

III. $f''(-1)$

a. I   b. II
c. III   d. I and II
e. II and III

14. If $\dfrac{dy}{dx} = 3e^{2x}$, and at $x = 0$, $y = \dfrac{5}{2}$, a solution to the differential equation is

a. $3e^{2x} - \dfrac{1}{2}$

b. $3e^{2x} + \dfrac{1}{2}$

c. $\dfrac{3}{2}e^{2x} + 1$

d. $\dfrac{3}{2}e^{2x} + 2$

e. $\dfrac{3}{2}e^{2x} + 5$

15. The graph of the velocity function of a moving particle is shown in Figure 1T-5. What is the total displacement of the particle during $0 \le t \le 20$?
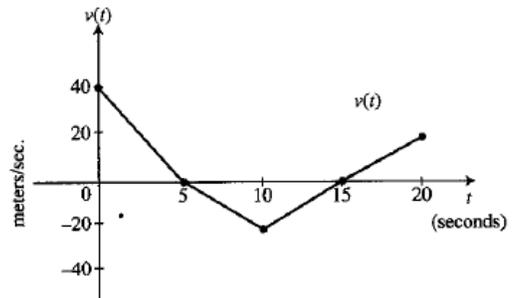

Figure 1T-5

a. $20m$
b. $50m$
c. $100m$
d. $250m$
e. $500m$

16. The position function of a moving particle is $s(t) = \dfrac{t^3}{6} - \dfrac{t^2}{2} + t - 3$ for

$0 \le t \le 4$. What is the maximum velocity of the particle on the interval $0 \le t \le 4$?

    a. $\dfrac{1}{2}$ c. $\dfrac{14}{16}$ e. 5

    b. 1

             d. 4

17. If $\displaystyle\int_{-k}^{k} |2x|\,dx = 18$ and $k > 0$, the value(s) are?

    a. -3 b. $-3\sqrt{2}$ c. 3 e. 9

                                           d. $3\sqrt{2}$

18. A function f is continuous on $[-1, 1]$ and some of the values of f are shown below:

x	-1	0	1
$f(x)$	2	b	-2

If $f(x) = 0$ has only one solution, r, and $r < 0$, then a possible value of b is

    a. 3 c. 1 e. -1

    b. 2 d. 0

19. $\displaystyle\int_{0}^{\ln 2} e^{2x}\,dx =$

    a. $\dfrac{3}{2}$ c. 4 d. $e^2 - \dfrac{1}{2}$ e. $2e^2 - 1$

    b. 3

20. The area of the region enclosed by the graph of $y = \sqrt{9 - x^2}$ and the x-axis is

    a. 36 b. $\dfrac{9\pi}{2}$ c. 9π e. 36π

                                           d. 18π

21. If a function f is continuous for all values of x, and $a > 0$ and $b > 0$, which of the following integrals always have the same value?

I. $\int_0^a f(x)dx$

II. $\int_b^{a+b} f(x-b)dx$

III. $\int_b^{a+b} f(x+b)dx$

   a. I and II only
   b. I and III only
   c. II and III only
   d. I, II, and III
   e. None

22. What is the average value of the function $y = 2\sin(2x)$ on the interval $\left[0, \dfrac{\pi}{6}\right]$?

   a. $-\dfrac{3}{\pi}$

   b. $\dfrac{1}{2}$

   c. $\dfrac{3}{\pi}$

   d. $\dfrac{3}{2\pi}$

   e. 6π

23. Given the equation $y = 3\sin^2\left(\dfrac{x}{2}\right)$, what is an equation of the tangent line to the graph at $x = \pi$?

   a. $y = 3$
   b. $y = \pi$
   c. $y = \pi + 3$
   d. $y = x - \pi + 3$
   e. $y = 3(x - 1$

24. The position function of a moving particle on the x-axis is given as $s(t) = t^3 + t^2 - 8t$ for $0 \le t \le 10$. For what values of t is the particle moving to the right?

   a. $t < -2$
   b. $t > 0$
   c. $t < \dfrac{4}{3}$
   d. $0 < t < \dfrac{4}{3}$
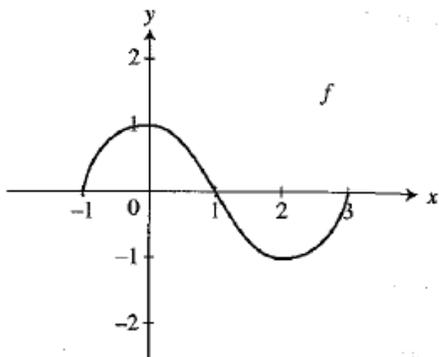   e. $t > \dfrac{4}{3}$

25. See Figure 1T-6.

Figure 1T-6

The graph of f consist of two semicircles, for $-1 \le x \le 3$ as shown in Figure 1T-6. What is the value of $\int_{-1}^{3} f(x)dx$?

a. 0
b. π
c. 2π
d. 4π
e. 8π

26. If $\int_{1}^{x} t(t^3 + 1)^{3/2} dt$, then $f'(2)$ is

a. $2^{3/2}$

b. $54 - 2^{3/2}$

c. 54

d. $135 - \dfrac{13\sqrt{2}}{2}$

e. 135

27. If $\int_{-k}^{k} f(x)dx = 2\int_{-k}^{0} f(x)dx$ for all positive values of k , then which of the following could be the graph of f ? (See Figure 1T-7.)
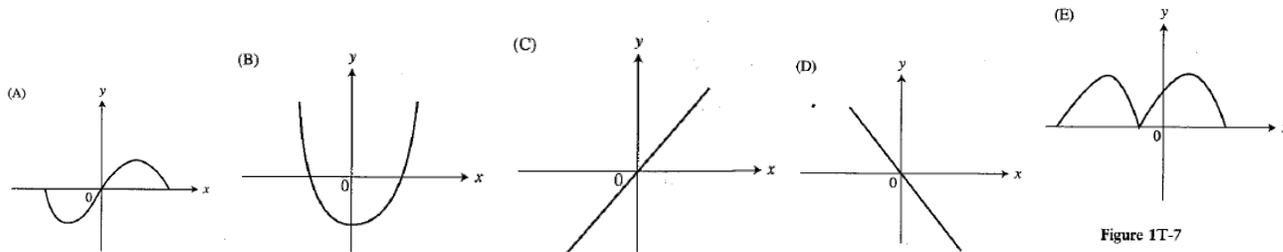

Figure 1T-7

28. If $h'(x) = k(x)$ and k is a continuous function for all values of x , then $\int_{-1}^{1} k(5x)dx$ is

a. $h(5) - h(-5)$
b. $5h(5) + 5h(-5)$
c. $5h(5) - 5h(-5)$

d. $\dfrac{1}{5}h(5) + \dfrac{1}{5}h(-5)$

e. $\dfrac{1}{5}h(5) - \dfrac{1}{5}h(-5)$