6. If f is continuous for $a \le x \le b$, then at any point $x = c$, where $a < c < b$, which of the following must be true

(A) $f(c) = \dfrac{f(b) - f(a)}{b - a}$

(B) $f(a) = f(b)$

(C) $f(c) = 0$

(D) $\int_a^b f(x)\,dx = f(c)$

(E) $\lim_{x \to c} f(x) = f(c)$

4.4

8. Which of the following integrals correctly gives the area of the region consisting of all points above the x-axis and below the curve $y = 8 + 2x - x^2$?

(A) $\int_{-2}^{4} \left(x^2 - 2x - 8\right) dx$

(B) $\int_{-4}^{2} \left(8 + 2x - x^2\right) dx$

(C) $\int_{-2}^{4} \left(8 + 2x - x^2\right) dx$

(D) $\int_{-4}^{2} \left(x^2 - 2x - 8\right) dx$

(E) $\int_{2}^{4} \left(8 + 2x - x^2\right) dx$

4.4

C

32. If $\int_{30}^{100} f(x)dx = A$ and $\int_{50}^{100} f(x)dx = B$, then $\int_{30}^{50} f(x)dx =$

(A) $A + B$ (B) $A - B$ (C) 0 (D) $B - A$ (E) 20

4.4

C

40. Use differentials to approximate the change in the volume of a sphere when the radius is increased from 10 to 10.02 cm.

(A) 4213.973 (B) 1261.669 (C) 1256.637 (D) 25.233 (E) 25.133

5.7

C

2. A particle moves along the x-axis so that its acceleration at any time $t > 0$ is given by $a(t) = 12t - 18$. At time $t = 1$, the velocity of the particle is $v(1) = 0$ and the position is $x(1) = 9$.

(a) Write an expression for the velocity of the particle $v(t)$.

(b) At what values of t does the particle change direction?

(c) Write an expression for the position $x(t)$ of the particle.

(d) Find the total distance traveled by the particle from $t = \frac{3}{2}$ to $t = 6$.

4.4

C

36. The average value of the function $f(x) = \ln^2 x$ on the interval $[2, 4]$ is

(A) -1.204 (B) 1.204 (C) 2.159 (D) 2.408 (E) 8.636

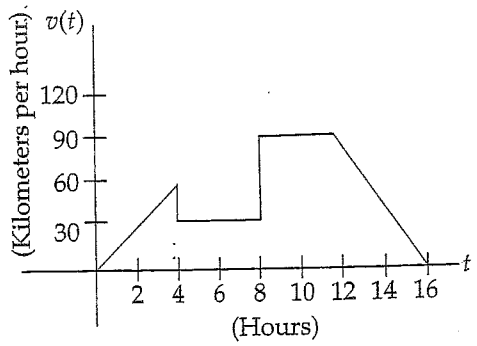
4.4 or 5.2

18. The average value of the function $f(x) = (x-1)^2$ on the interval from $x = 1$ to $x = 5$ is

(A) $-\frac{16}{3}$ (B) $\frac{16}{3}$ (C) $\frac{64}{3}$ (D) $\frac{66}{3}$ (E) $\frac{256}{3}$

4.4

10.



4.4

A car's velocity is shown on the graph above. Which of the following gives the total distance traveled from $t = 0$ to $t = 16$ (in kilometers)?

(A) 360 (B) 390 (C) 780 (D) 1000 (E) 1360

2.20r
5.8

26. If $f(x)=\cos^3(x+1)$ then $f'(\pi)=$

(A) $-3\cos^2(\pi+1)\sin(\pi+1)$

(B) $3\cos^2(\pi+1)$

(C) $3\cos^2(\pi+1)\sin(\pi+1)$

(D) $3\pi\cos^2(\pi+1)$

(E) 0

5.8

28. If $f(x)=\sec(4x)$, then $f'\left(\frac{\pi}{16}\right)$ is

(A) $4\sqrt{2}$ (B) $\sqrt{2}$ (C) 0 (D) $\frac{1}{\sqrt{2}}$ (E) $\frac{4}{\sqrt{2}}$

5.8

7. If $f(x) = \sec x + \csc x$, then $f'(x) =$

(A) 0

(B) $\sec^2 x + \csc^2 x$

(C) $\csc x - \sec x$

(D) $\sec x \tan x + \csc x \cot x$

(E) $\sec x \tan x - \csc x \cot x$

5.8

85. If the graph of $f(x) = x^3 - x - 3 + \cos x$ changes concavity at $(a,\ f(a))$, then $a =$

2.20r
5.8

(A) -0.438

(B) -0.164

(C) 0.164

(D) 0.438

(E) 1.571

8. $\int_0^x \sin t \cos^2 t \, dt =$

5.9

(A) $-\cos^3 x$

(B) $-\frac{\cos^3 x}{3}$

(C) $\frac{\cos^3 x}{3}$

(D) $\cos^3 x$

(E) $\frac{1-\cos^3 x}{3}$

10. If $f(x) = \cos^2 x$, then $f''(\pi) =$

2.2 or 5.8

(A) -2 (B) 0 (C) 1 (D) 2 (E) 2π

9. $\int \cos(3x)\, dx =$

5.9

(A) $\frac{1}{2}\cos^2(3x) + C$

(B) $-3\sin(3x) + C$

(C) $\cos\left(\frac{3}{2}x^2\right) + C$

(D) $-\frac{1}{3}\sin(3x) + C$

(E) $\frac{1}{3}\sin(3x) + C$

14. A particle moves along the graph of $y = x + \sin x$. As it passes the point $(2\pi, 2\pi)$, the particle's y-coordinate is increasing at the rate of 2 units per second. How fast is the x-coordinate of the particle changing at this point (in units per second)?

2.6 or 5.8

(A) 0

(B) $\frac{1}{\pi}$

(C) $\frac{1}{2}$

(D) 1

(E) 2

4. If $f(x) = \sec(2x)$, then $f'(x) =$ 5.8

(A) $\tan^2(2x)$

(B) $2\tan^2(2x)$

(C) $\tan(2x)\sec(2x)$

(D) $2\tan(2x)\sec(2x)$

(E) $-2\sin(2x)\sec^2(2x)$

C

43. Let $f(x) = \int \cot x\, dx;\ 0 < x < \pi$. If $f\left(\frac{\pi}{6}\right) = 1$, then $f(1) =$

(A) −1.861 (B) −0.480 (C) 0.134 (D) 0.524 (E) 1.521

11. $\frac{d}{dx}\tan^2(4x) =$ 5.8

(A) $8\tan(4x)$
(B) $4\sec^4(4x)$
(C) $8\tan(4x)\sec^2(4x)$
(D) $4\tan(4x)\sec^2(4x)$
(E) $8\sec^4(4x)$

2.2 or 5.8

C

90. Consider the functions f and g given by $f(x) = \frac{1}{x}$ and $g(x) = \cos x$. At what value of x do the graphs of f and g have perpendicular tangent lines?

(A) −1.300

(B) −0.877

(C) 0

(D) 0.767

(E) 0.769

27. Which of the following are antiderivatives of the function $\sin(2x)$? 5.9

I. $3 - \cos^2 x$

II. $\sin^2 x$

III. $-\frac{1}{2}\cos(2x)$

(A) None

(B) I and II only

(C) I and III only

(D) II and III only

(E) I, II and III