Set A

1. $\int \sin 3\theta \; d\theta =$

A) $3\cos 3\theta + C$

B) $-3\cos 3\theta + C$

C) $-\cos 3\theta + C$

D) $\frac{1}{3}\cos 3\theta + C$

E) $-\frac{1}{3}\cos 3\theta + C$

4. $\int_0^1 \frac{x}{x^2+1}\, dx =$

A) $\frac{\pi}{4}$

B) $\ln\sqrt{2}$

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

D) $\frac{3}{2}$

E) $\ln 2$

9. If $f(x) = \int_2^{2x} \frac{1}{\sqrt{t^3+1}}\, dt$, then $f'(1) =$

A) 0

B) $\frac{1}{3}$

C) $\frac{2}{3}$

D) $\sqrt{2}$

E) undefined

6. $\int_0^5 \frac{dx}{\sqrt{3x+1}} =$

A) $\frac{1}{2}$

B) $\frac{2}{3}$

C) 1

D) 2

E) 6

Set B

7. There is a point between $P(1,0)$ and $Q(e,1)$ on the graph of $y = \ln x$ such that the tangent to the graph at that point is parallel to the line through points P and Q. The x-coordinate of this point is

A) $e - 1$

B) e

C) -1

D) $\frac{1}{e-1}$

E) $\frac{1}{e+1}$

5. The average value of $g(x) = (x-3)^2$ in the interval $[1,3]$ is

A) 2

B) $\frac{2}{3}$

C) $\frac{4}{3}$

D) $\frac{8}{3}$

E) None of these

10. If $\int_a^b f(x)\, dx = 3$ and $\int_a^b g(x)\, dx = -2$, then which of the following must be true?

I. $f(x) > g(x)$ for all $a \le x \le b$

II. $\int_a^b [f(x) + g(x)]\, dx = 1$

III. $\int_a^b [f(x)g(x)]\, dx = -6$

A) I only

B) II only

C) III only

D) II and III only

E) I, II, and III

Set C

11. The graph of f is shown below. Approximate $\int_{-3}^{3} f(x)\,dx$ using the trapezoid rule with 3 equal subdivisions.

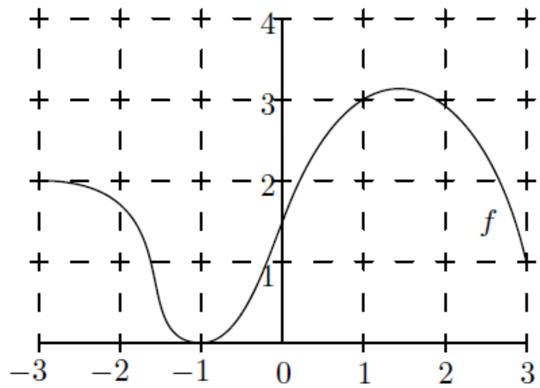
A) $\frac{9}{4}$

B) $\frac{9}{2}$

C) 9

D) 18

E) 36



12. If $\int_0^k \frac{\sec^2 x}{1+\tan x}\,dx = \ln 2$, then the value of k is

A) $\pi/6$.

B) $\pi/4$.

C) $\pi/3$.

D) $\pi/2$.

E) π.

13. The graph of the function f on the interval $[-4, 4]$ is shown below. $\int_{-4}^{4} |f(x)|\,dx =$

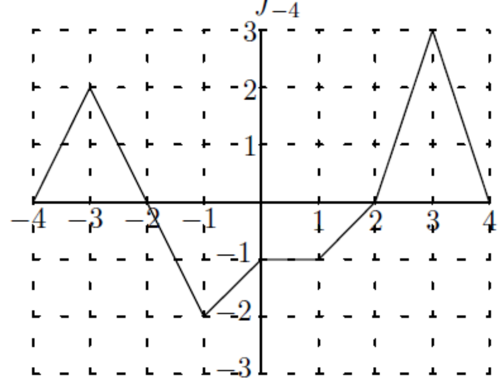
A) 1

B) 2

C) 5

D) 8

E) 9



Set D

14. The acceleration of a particle moving along the x-axis at time $t > 0$ is given by $a(t) = \frac{1}{t^2}$. When $t = 1$ second, the particle is at $x = 2$ and has velocity -1 unit per second. If $x(t)$ is the particle's position, then the position when $t = e$ seconds is

A) $x = -2$.

B) $x = -1$.

C) $x = 0$.

D) $x = 1$.

E) $x = 2$.

1108. $\int_{-2}^{3} |x+1| \, dx =$

A) $\frac{5}{2}$ B) $\frac{17}{2}$ C) $\frac{9}{2}$ D) $\frac{11}{2}$ E) $\frac{13}{2}$

1107. $\int_{\pi/6}^{\pi/2} \cot x \, dx =$

A) $\ln \frac{1}{2}$ B) $\ln 2$ C) $\frac{1}{2}$ D) $\ln(\sqrt{3} - 1)$ E) None of these

1112. $\int_{-1}^{0} e^{-x} \, dx =$

A) $1 - e$ B) $\frac{1-e}{e}$ C) $e - 1$ D) $1 - \frac{1}{e}$ E) $e + 1$

Set E

1113. $\int_0^1 \frac{x}{x^2+1}\,dx =$

A) $\frac{\pi}{4}$ B) $\ln\sqrt{2}$ C) $\frac{1}{2}(\ln 2 - 1)$ D) $\frac{3}{2}$ E) $\ln 2$

1114. The acceleration of a particle moving along a straight line is given by $a = 6t$. If, when $t = 0$ its velocity $v = 1$ and its distance $s = 3$, then at any time t the position function is given by

A) $s = t^3 + 3t + 1$

B) $s = t^3 + 3$

C) $s = t^3 + t + 3$

D) $s = \frac{1}{3}t^3 + t + 3$

E) $s = \frac{1}{3}t^3 + \frac{1}{2}t^2 + 3$

1116. $\int_0^{\pi/2} \cos^2 x \sin x\,dx =$

A) -1 B) $-\frac{1}{3}$ C) 0 D) $\frac{1}{3}$ E) 1

1117. $\int_0^1 (3x^2 - 2x + 3)\,dx =$

A) 0 B) 5 C) 3 D) 8 E) None of these

Set F

1098 (1991BC). A particle moves on the x-axis so that its velocity at any time $t \geq 0$ is given by $v(t) = 12t^2 - 36t + 15$.

a) Find the position $x(t)$ of the particle at any time $t \geq 0$.

b) Find all values of t for which the particle is at rest.

c) Find the maximum velocity of the particle for $0 \leq t \leq 2$.

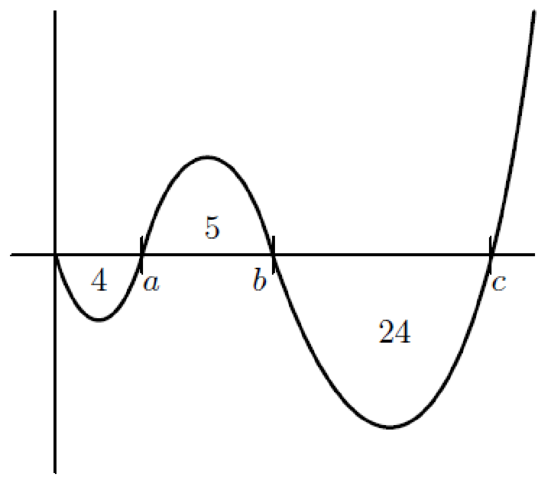
1099. A particle moves along the x-axis. Its initial position at $t = 0$ sec is $x(0) = 15$. The graph below shows the particle's velocity $v(t)$. The numbers are areas of the enclosed figures.

a) What is the particle's displacement between $t = 0$ and $t = c$?

b) What is the total distance traveled by the particle in the same time period?

c) Give the positions of the particle at times a, b, and c.

d) Approximately where does the particle achieve its greatest positive acceleration on the interval $[0, b]$?



Set G

Calculator Active:

1095 (1999AB, Calculator). A particle moves along the y-axis with velocity given by $v(t) = t\sin(t^2)$ for $t \geq 0$.

a) In which direction (up or down) is the particle moving at time $t = 1.5$? Why?

b) Find the acceleration of the particle at time $t = 1.5$. Is the velocity of the particle increasing at $t = 1.5$?

c) Given that $y(t)$ is the position of the particle at time t and that $y(0) = 3$, find $y(2)$.

d) Find the total distance traveled by the particle from $t = 0$ and $t = 2$.

1097 (1994AB, Calculator). Let $F(x) = \int_0^x \sin(t^2)\, dt$ for $0 \leq x \leq 3$.

a) Use the trapezoidal rule with four equal subdivisions of the closed interval $[0, 1]$ to approximate $F(1)$.

b) On what interval is F increasing?

c) If the average rate of change of F on the closed interval $[1, 3]$ is k, find $\int_1^3 \sin(t^2)\, dt$ in terms of k.