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

---

2. $\int 3^{x^2} x \; dx =$

A) $\dfrac{3^{x^2+1}}{x^2+1} + C$

B) $\dfrac{3^{x^2}}{\ln 9} + C$

C) $3^{x^2} \ln 3 + C$

D) $3^{x^3/3} + C$

E) None of these

---

3. Let $f(x)$ be defined as below. Evaluate $\displaystyle\int_0^6 f(x)\; dx$.

$$f(x) = \begin{cases} x & 0 < x \le 2 \\ 1 & 2 < x \le 4 \\ \frac{1}{2}x & 4 < x \le 6 \end{cases}$$

A) 5

B) 6

C) 7

D) 8

E) 9

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

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

B) $\ln\sqrt{2}$

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

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

E) $\ln 2$

---

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

---

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

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

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

C) 1

D) 2

E) 6

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) $\dfrac{1}{e-1}$

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

---

8. Which of the following statements are true?

I. If the graph of a function is always concave up, then the left-hand Riemann sums with the same subdivisions over the same interval are always less than the right-hand Riemann sum.

II. If the function f is continuous on the interval $[a, b]$ and $\int_a^b f(x)\,dx = 0$, then f must have at least one zero between a and b.

III. If $f'(x) > 0$ for all x in an interval, then the function f is concave up in that interval.

A) I only

B) II only

C) III only

D) II and III only

E) None are true.

---

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

A) 0

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

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

D) $\sqrt{2}$

E) undefined

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

---

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

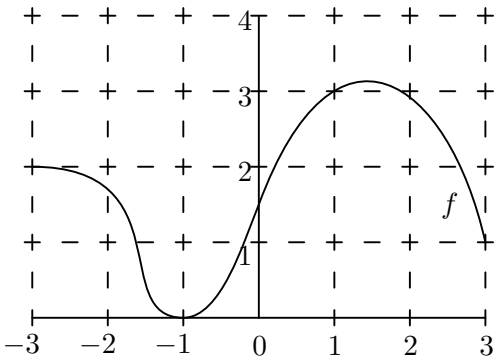
A) $\frac{9}{4}$

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

C) 9

D) 18

E) 36



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

A) $\pi/6$.

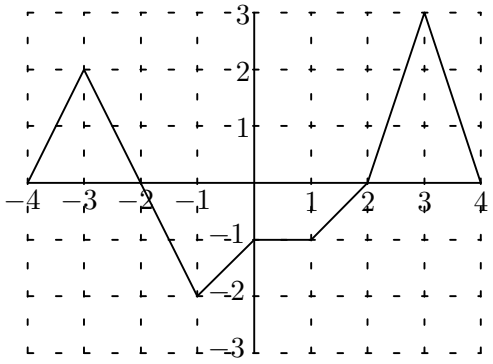
B) $\pi/4$.

C) $\pi/3$.

D) $\pi/2$.

E) π.

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



A) 1

B) 2

C) 5

D) 8

E) 9

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14. The acceleration of a particle moving along the x-axis at time $t > 0$ is given by $a(t) = \dfrac{1}{t^2}$. 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) $x = 2$.

---

15. The area enclosed by the two curves $y = x^2 - 4$ and $y = x - 4$ is given by

A) $\displaystyle\int_0^1 (x - x^2)\, dx$

B) $\displaystyle\int_0^1 (x^2 - x)\, dx$

C) $\displaystyle\int_0^2 (x - x^2)\, dx$

D) $\displaystyle\int_0^2 (x^2 - x)\, dx$

E) $\displaystyle\int_0^4 (x^2 - x)\, dx$