1. What transformations can be applied to the graph of $f(x) = \frac{1}{x}$ to get the graph of $g(x) = \frac{x-2}{x-3}$?
   A. Translation to the right by 3 units and up by 1 unit.
   B. Translation to the right by 3 units and down by 1 unit.
   C. Reflection across the y-axis and translation to the right by 3 units.
   D. Reflection across the x-axis, then translation to the left by 3 units.
   E. NOTA

2. Which of the following is equivalent to the expression $\frac{\sin x \sin 2x}{2\cos x} + \frac{\cos x \sin 2x \csc x}{2}$, where defined?
   A. $\sin x \tan x + \cos x$ B. $\sin^2 x + \sin x \cos x$
   C. $\sin x + \cos x$ D. 1 E. NOTA

3. What is the point of intersection of the two asymptotes of the function $y = \frac{5x^2-3x-\pi}{x-1}$?
   A. $(-1, -13)$ B. $(1, 3)$ C. $(1, 5)$ D. $(1, 7)$ E. NOTA

4. Which of the following lines are NOT tangent to the unit circle?
   I. $y = -2x + \sqrt{3}$ II. $y = -2x + \sqrt{5}$ III. $y = -2x + \sqrt{7}$
   A. II B. I, III C. II, III D. I, II, III E. NOTA

5. Let $\mathcal{R}$ be the region bound by the following graphs:
   $$y = \sqrt{-x^2 + 4x + 12}, x = -2, x = 6, y = 6$$
   Find the volume of the solid created when $\mathcal{R}$ is revolved about the x-axis.
   A. $\frac{256\pi}{3}$ B. $\frac{608\pi}{3}$ C. 256π D. 288π E. NOTA

6. Let (a, b) be the point on the line $y = 2x + 1$ that is equidistant from the points $(0, 2)$ and $(2, 0)$. What is $a + b$?
   A. -2 B. 0 C. 2 D. 4 E. NOTA

7. With left and right Riemann sums of 2 equal subintervals, the value of $\int_1^3 (x^2+1)\,dx$ can be bounded. Which of the following is that bounding interval?

A. $(5, 13)$ B. $(5, 15)$ C. $(7, 13)$ D. $(7, 15)$ E. NOTA

8. Which of the following functions satisfy the condition that $\lim_{x\to 2} f(x) = 8$ but $f(2)$ is undefined?

A. $f(x) = \sqrt{x-2} + 8$ B. $f(x) = 8\ln(x-2)$

C. $f(x) = \frac{8}{\sqrt{x-2}}$ D. $f(x) = \frac{8x-16}{x-2}$ E. NOTA

9. Given a polynomial function $f(x)$ with degree $n > 0$ and leading coefficient a. Which of the following conditions guarantees that $\lim_{x\to\infty} f(x) = \infty$ and $\lim_{x\to-\infty} f(x) = -\infty$

A. $a < 0$ and n is even B. $a < 0$ and n is odd

C. $a > 0$ and n is even D. $a > 0$ and n is odd E. NOTA

10. Find the ordered pair (a, b) such that $f(x)$ is everywhere continuous.

$$f(x) = \begin{cases} \dfrac{x^2-4}{x+2} & x < -2 \\ ax + b & -2 \le x \le 2 \\ \dfrac{x^2-4}{x-2} & x > 2 \end{cases}$$

A. $(1, 0)$ B. $(1, 4)$ C. $(2, 0)$ D. $(2, 4)$ E. NOTA

11. For $f(x)$ from question 10, find $\lim_{x\to-2} f'(x)$.

A. -4 B. 1 C. 2 D. DNE E. NOTA

12. If $a = \lim_{x\to 0} \frac{\sin x}{x}$ and $b = \lim_{x\to 0} \frac{1-\cos x}{x}$, what is $a^2 + b^2$?

A. -1 B. 0 C. 1 D. 4 E. NOTA

13. If $\frac{d}{dt}(h\cos 2x) = -2h\sin 2x\frac{dx}{dt} \neq 0$, which of the following is true about x and h?

A. h and x are both constants with respect to t
B. h is a constant with respect to t and x is a non-constant function of t
C. x is a constant with respect to t and h is a non-constant function of t
D. h and x are both non-constant functions of t
E. NOTA

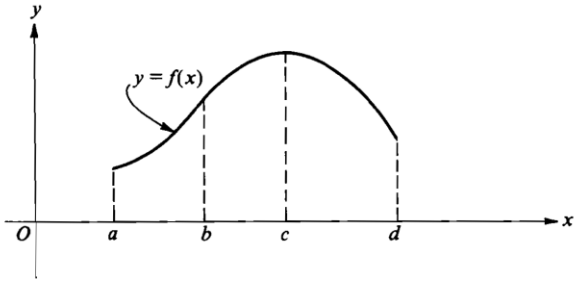
14. Find $\frac{d}{dx}(2\sin(5-x^2)\cos(5-x^2))$

A. $-8x\cos(10-2x^2)$ B. $-4x\cos(10-2x^2)$
C. $4x\cos(10-2x^2)$ D. $8x\cos(10-2x^2)$ E. NOTA

15. If $f(x) = \lim_{h\to 0}\frac{\tan(5x+5h)-\tan 5x}{h}$ and $g(x) = \lim_{h\to 0}\frac{\sec(5x+5h)-\sec 5x}{h}$, find $\frac{f(x)}{g(x)}$.

A. $-\cot 5x$ B. $\csc 5x$ C. $\sec 5x$ D. $\tan 5x$ E. NOTA

16. For which intervals in the graph of $y = f(x)$ below is $\frac{dy}{dx} > 0$ and $\frac{d^2y}{dx^2} < 0$?
Note: There's a point of inflection at $x = b$ and relative maximum at $x = c$.



A. (a,b) B. (a,c) C. (b,c) D. (b,d) E. NOTA

17. Let $f(x)$ be a polynomial function with degree at least 3. If $a < b$ and $f(a) = f(b) = 2$, which of the following must be true for at least one value of c on the interval (a,b)?

I. $f(c) = 0$ II. $f'(c) = 0$ III. $f''(c) = 0$

A. II only B. III only C. II, III D. I, II, III E. NOTA

18. Find the minimum value of $f(x) = x^3 - 3x^2 + 12$ on $[-2, 4]$.

A. -8 B. -2 C. 2 D. 8 E. NOTA

19. Find $\int_1^9 |x - 3| dx$.

A. $-\frac{27}{2}$ B. $\frac{27}{2}$ C. 20 D. 40 E. NOTA

20. Given that $\int_{-5}^{-2} f(x)dx = 6$, $\int_{-2}^{3} f(x)dx = 3$, $\int_{-1}^{-4} f(x)dx = -3$, and $\int_{3}^{-1} f(x)dx = -1$. Compute the value of $\int_{-4}^{-2} f(x)dx$.

A. -7 B. -5 C. -1 D. 5 E. NOTA

21. Find $\int \frac{x}{\sqrt{3x^2+5}} dx$

A. $\frac{1}{6}\sqrt{3x^2 + 5} + C$ B. $\frac{1}{3}\sqrt{3x^2 + 5} + C$

C. $\frac{1}{2}\sqrt{3x^2 + 5} + C$ D. $\sqrt{3x^2 + 5} + C$ E. NOTA

22. Find $\int \frac{-1}{\sqrt{e^{-2t}-1}} dt$.

A. $\arcsin(e^{-t}) + C$ B. $\text{arcsec}(e^{-t}) + C$

C. $\sqrt{e^{-2t} - 1} + C$ D. $\frac{\sqrt{e^{-2t}-1}}{e^{-2t}} + C$ E. NOTA

23. $f(x)$ is odd and $g(x)$ is even, and both functions have domain over all real numbers. Which of the following is/are guaranteed to be true?

I. $\int_{-2}^{2} f(x)g(x)dx = 0$ II. $\int_1^{-1} g(x)dx = 2\int_0^1 g(x)dx$

A. I only B. II only C. Both D. Neither E. NOTA

24. If $\int_0^k (2kx - x^2)\, dx = 18$ then what is k?

A. 1 B. 2 C. 3 D. 4 E. NOTA

25. $f(x)$ is odd and $g(x)$ is even, and both functions have domain over all real numbers. Which of the following is/are guaranteed to be true?

I. $\int_{-2}^{2}\big(f(x)+\ g(x)\big)\,dx = 2\int_{0}^{2} g(x)dx$

II. $\int_{-3}^{3} f\left(g\big(f(x)\big)\right)dx = 2\int_{3}^{0} f\left(-g\big(f(x)\big)\right)dx$

A. I only B. II only C. Both D. Neither E. NOTA

26. What is the average value of $f(x) = 3x - x^2$ for the part of the graph that resides in the first quadrant?

A. 0.5 B. 1 C. 1.5 D. 2 E. NOTA

27. Compute $\int_{-3}^{1}(x^3 + \sin(x) + \ x^2 + 5x)\,dx + \int_{1}^{3}(x^3 + \sin(x) + \ x^2)\,dx$

A. -4 B. -3 C. -2 D. -1 E. NOTA

28. If $f(x) = \int_{x^2}^{3} \sin(t^2)\,dt$, find $f'(x)$.

A. 0 B. $\sin(x^4)$ C. $2x\sin(x^2)$ D. $2x\sin(x^4)$ E. NOTA

29. The velocity of a particle is described by $v(t) = e^{\operatorname{arcsec}(t)}$ for $t > 0$. Find the acceleration of the particle at $t = 2$.

A. $\frac{\sqrt{3}e^{\frac{\pi}{6}}}{6}$ B. $\frac{\sqrt{3}e^{\frac{\pi}{3}}}{6}$ C. $\frac{\sqrt{3}e^{\frac{\pi}{6}}}{3}$ D. $\frac{\sqrt{3}e^{\frac{\pi}{3}}}{3}$ E. NOTA

30. Find $\frac{d}{dx}(x^{\sin(x)})$.

A. $\cos x \cdot x^{\sin x - 1}$ B. $\sin x \cos x \cdot x^{\sin x - 1}$

C. $\frac{\sin x}{x} + \ln x \cos x$ D. $\frac{x}{\sin x + x \ln x \cos x}$ E. NOTA