

2012 NonCalculator MC

AA

1. If $y = x \sin x$, then $\frac{dy}{dx} =$

- (A) $\sin x + \cos x$
- (B) $\sin x + x \cos x$
- (C) $\sin x - x \cos x$
- (D) $x(\sin x + \cos x)$
- (E) $x(\sin x - \cos x)$

2. Let f be the function given by $f(x) = 300x - x^3$. On which of the following intervals is the function f increasing?

- (A) $(-\infty, -10]$ and $[10, \infty)$
- (B) $[-10, 10]$
- (C) $[0, 10]$ only
- (D) $[0, 10\sqrt{3}]$ only
- (E) $[0, \infty)$

A A

3. $\int \sec x \tan x \, dx =$

(A) $\sec x + C$

(B) $\tan x + C$

(C) $\frac{\sec^2 x}{2} + C$

(D) $\frac{\tan^2 x}{2} + C$

(E) $\frac{\sec^2 x \tan^2 x}{2} + C$

4. If $f(x) = 7x - 3 + \ln x$, then $f'(1) =$

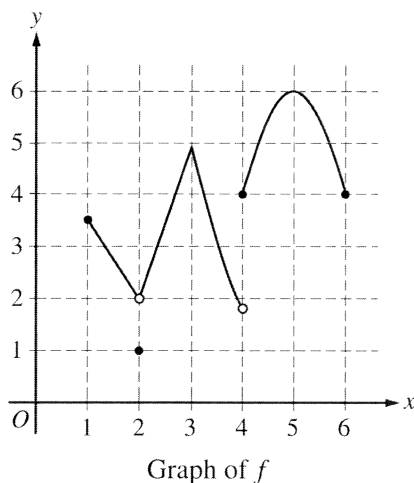
(A) 4

(B) 5

(C) 6

(D) 7

(E) 8



5. The graph of the function f is shown above. Which of the following statements is false?
- (A) $\lim_{x \rightarrow 2} f(x)$ exists.
 - (B) $\lim_{x \rightarrow 3} f(x)$ exists.
 - (C) $\lim_{x \rightarrow 4} f(x)$ exists.
 - (D) $\lim_{x \rightarrow 5} f(x)$ exists.
 - (E) The function f is continuous at $x = 3$.

6. A particle moves along the x -axis. The velocity of the particle at time t is $6t - t^2$. What is the total distance traveled by the particle from time $t = 0$ to $t = 3$?
- (A) 3 (B) 6 (C) 9 (D) 18 (E) 27



7. If $y = (x^3 - \cos x)^5$, then $y' =$

- (A) $5(x^3 - \cos x)^4$
- (B) $5(3x^2 + \sin x)^4$
- (C) $5(3x^2 + \sin x)$
- (D) $5(3x^2 + \sin x)^4 \cdot (6x + \cos x)$
- (E) $5(x^3 - \cos x)^4 \cdot (3x^2 + \sin x)$

t (hours)	4	7	12	15
$R(t)$ (liters/hour)	6.5	6.2	5.9	5.6

8. A tank contains 50 liters of oil at time $t = 4$ hours. Oil is being pumped into the tank at a rate $R(t)$, where $R(t)$ is measured in liters per hour, and t is measured in hours. Selected values of $R(t)$ are given in the table above. Using a right Riemann sum with three subintervals and data from the table, what is the approximation of the number of liters of oil that are in the tank at time $t = 15$ hours?
- (A) 64.9 (B) 68.2 (C) 114.9 (D) 116.6 (E) 118.2

A A

$$f(x) = \begin{cases} \frac{(2x+1)(x-2)}{x-2} & \text{for } x \neq 2 \\ k & \text{for } x = 2 \end{cases}$$

9. Let f be the function defined above. For what value of k is f continuous at $x = 2$?
(A) 0 (B) 1 (C) 2 (D) 3 (E) 5

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10. What is the area of the region in the first quadrant bounded by the graph of $y = e^{x/2}$ and the line $x = 2$?
(A) $2e - 2$ (B) $2e$ (C) $\frac{e}{2} - 1$ (D) $\frac{e-1}{2}$ (E) $e - 1$

A A

11. Let f be the function defined by $f(x) = \sqrt{|x - 2|}$ for all x . Which of the following statements is true?

- (A) f is continuous but not differentiable at $x = 2$.
- (B) f is differentiable at $x = 2$.
- (C) f is not continuous at $x = 2$.
- (D) $\lim_{x \rightarrow 2} f(x) \neq 0$
- (E) $x = 2$ is a vertical asymptote of the graph of f .

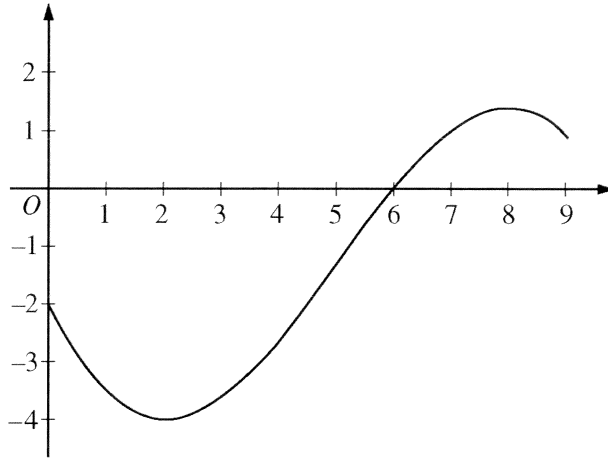
12. Using the substitution $u = \sqrt{x}$, $\int_1^4 \frac{e^{\sqrt{x}}}{\sqrt{x}} dx$ is equal to which of the following?

- (A) $2 \int_1^{16} e^u du$ (B) $2 \int_1^4 e^u du$ (C) $2 \int_1^2 e^u du$ (D) $\frac{1}{2} \int_1^2 e^u du$ (E) $\int_1^4 e^u du$

A A

13. The function f is defined by $f(x) = \begin{cases} 2 & \text{for } x < 3 \\ x - 1 & \text{for } x \geq 3. \end{cases}$ What is the value of $\int_1^5 f(x) dx$?
- (A) 2 (B) 6 (C) 8 (D) 10 (E) 12

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14. If $f(x) = \sqrt{x^2 - 4}$ and $g(x) = 3x - 2$, then the derivative of $f(g(x))$ at $x = 3$ is
- (A) $\frac{7}{\sqrt{5}}$ (B) $\frac{14}{\sqrt{5}}$ (C) $\frac{18}{\sqrt{5}}$ (D) $\frac{15}{\sqrt{21}}$ (E) $\frac{30}{\sqrt{21}}$



Graph of f

15. The graph of a differentiable function f is shown above. If $h(x) = \int_0^x f(t) dt$, which of the following is true?

- (A) $h(6) < h'(6) < h''(6)$
- (B) $h(6) < h''(6) < h'(6)$
- (C) $h'(6) < h(6) < h''(6)$
- (D) $h''(6) < h(6) < h'(6)$
- (E) $h''(6) < h'(6) < h(6)$

A A

16. A particle moves along the x -axis with its position at time t given by $x(t) = (t - a)(t - b)$, where a and b are constants and $a \neq b$. For which of the following values of t is the particle at rest?

(A) $t = ab$

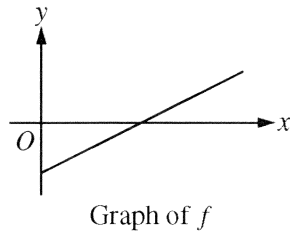
(B) $t = \frac{a + b}{2}$

(C) $t = a + b$

(D) $t = 2(a + b)$

(E) $t = a$ and $t = b$

A A



17. The figure above shows the graph of f . If $f(x) = \int_2^x g(t) dt$, which of the following could be the graph of $y = g(x)$?

- (A)
- (B)
- (C)
- (D)
- (E)

A A

18. $\lim_{h \rightarrow 0} \frac{\ln(4+h) - \ln(4)}{h}$ is

- (A) 0 (B) $\frac{1}{4}$ (C) 1 (D) e (E) nonexistent

19. The function f is defined by $f(x) = \frac{x}{x+2}$. What points (x,y) on the graph of f have the property that the line tangent to f at (x,y) has slope $\frac{1}{2}$?

- (A) $(0,0)$ only
(B) $\left(\frac{1}{2}, \frac{1}{5}\right)$ only
(C) $(0,0)$ and $(-4,2)$
(D) $(0,0)$ and $\left(4, \frac{2}{3}\right)$
(E) There are no such points.

A A

20. Let $f(x) = (2x + 1)^3$ and let g be the inverse function of f . Given that $f(0) = 1$, what is the value of $g'(1)$?
- (A) $-\frac{2}{27}$ (B) $\frac{1}{54}$ (C) $\frac{1}{27}$ (D) $\frac{1}{6}$ (E) 6

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21. The line $y = 5$ is a horizontal asymptote to the graph of which of the following functions?

- (A) $y = \frac{\sin(5x)}{x}$ (B) $y = 5x$ (C) $y = \frac{1}{x - 5}$ (D) $y = \frac{5x}{1 - x}$ (E) $y = \frac{20x^2 - x}{1 + 4x^2}$

A A

22. Let f be the function defined by $f(x) = \frac{\ln x}{x}$. What is the absolute maximum value of f ?

- (A) 1
- (B) $\frac{1}{e}$
- (C) 0
- (D) $-e$
- (E) f does not have an absolute maximum value.

23. If $P(t)$ is the size of a population at time t , which of the following differential equations describes linear growth in the size of the population?

- (A) $\frac{dP}{dt} = 200$
- (B) $\frac{dP}{dt} = 200t$
- (C) $\frac{dP}{dt} = 100t^2$
- (D) $\frac{dP}{dt} = 200P$
- (E) $\frac{dP}{dt} = 100P^2$

A A

24. Let g be the function given by $g(x) = x^2 e^{kx}$, where k is a constant. For what value of k does g have a critical point at $x = \frac{2}{3}$?

- (A) -3 (B) $-\frac{3}{2}$ (C) $-\frac{1}{3}$ (D) 0 (E) There is no such k .

A A

25. Which of the following is the solution to the differential equation $\frac{dy}{dx} = 2 \sin x$ with the initial condition $y(\pi) = 1$?
- (A) $y = 2 \cos x + 3$
 - (B) $y = 2 \cos x - 1$
 - (C) $y = -2 \cos x + 3$
 - (D) $y = -2 \cos x + 1$
 - (E) $y = -2 \cos x - 1$

A A

26. Let g be a function with first derivative given by $g'(x) = \int_0^x e^{-t^2} dt$. Which of the following must be true on the interval $0 < x < 2$?

- (A) g is increasing, and the graph of g is concave up.
- (B) g is increasing, and the graph of g is concave down.
- (C) g is decreasing, and the graph of g is concave up.
- (D) g is decreasing, and the graph of g is concave down.
- (E) g is decreasing, and the graph of g has a point of inflection on $0 < x < 2$.

