

- 1) $\lim_{h \rightarrow 0} \frac{(3+h)^{-1} - 3^{-1}}{h} =$
- a) 0 b) $-\frac{1}{3}$ c) $-\frac{1}{9}$ d) 3 e) none of these
- 2) The value of x for which the function $f(x) = x^3 - 9x^2 - 120x + 30$ has a local minimum is
- a) -10 b) -4 c) 4 d) 10 e) none of these
- 3) The slope of the tangent line to the curve $y = \ln(\ln x)$ at $(e, 0)$ is
- a) e b) $\frac{1}{e}$ c) 0 d) 1 e) none of these
- 4) If $f(x) = \int_1^{x^2+1} \frac{1}{u+1} du$, then $f'(3) =$
- a) $3/11$ b) $6/11$ c) $9/4$ d) $3/2$ e) none of these
- 5) If $f(x) = 5^{10,001}$, then $f'(x)$ is
- a) 0 b) $10,001(5^{100,000})$ c) $5^{10,001} \cdot \ln 5$ d) $\ln 5$
- e) none of these
- 6) $\lim_{x \rightarrow \pi} (\cot x + \csc x) =$
- a) -1 b) 0 c) 1 d) does not exist e) none of these

7) The function $f(x) =$ the greatest integer less than or equal to x . The value of $\lim_{x \rightarrow -\frac{\pi}{2}} f(x)$ is

- a) -3 b) -2 c) -1 d) 0 e) none of these

8) The value of c that satisfies the hypothesis of Rolle's Theorem for the function $f(x) = \sqrt{x} - \sqrt[4]{x}$ on the interval $[0, 1]$ is

- a) $1/16$ b) $1/8$ c) $1/4$ d) $1/2$ e) none of these

9) The domain of the derivative of $F(x) = \frac{4 - 3x}{2 + x}$ is

- a) $(-\infty, \infty)$ b) $(-\infty, 0) \cup (0, \infty)$ c) $(-\infty, 2) \cup (2, \infty)$
d) $(-\infty, -2) \cup (-2, \infty)$ e) none of these

10) $\int_{-2}^2 \{ -|x-1| + 2 \} dx =$

- a) 3 b) 5 c) 8 d) 12 e) none of these

11) If $f(x) = xk^{-x}$ where k is a positive constant, then $f'(1)$ is

- a) 0 b) 1 c) k d) $\frac{1}{k}$ e) none of these

12) If $x^3 + y^3 = 1$, then an expression for y'' is

- a) $-\frac{2x}{y^5}$ b) $\frac{x^3 + y^3}{y^6}$ c) $-\frac{3x}{y^4}$ d) $\frac{x^3 - y^3}{y^6}$ e) none of these

13) A ball is thrown upward with a speed of 48 ft/sec from the edge of a cliff 432 ft above the ground. The time in seconds at which the ball hits the ground is

- a) 1 b) 2 c) 3 d) 5 e) none of these

14) The area bounded by the curves $x = 1 - y^4$ and $x = y - y^3$ is

- a) $\frac{6}{5}$ b) $\frac{7}{5}$ c) $\frac{8}{5}$ d) $\frac{9}{5}$ e) none of these

15) The equation of the tangent line to the graph of $x^{\frac{2}{3}} + y^{\frac{2}{3}} = 4$ at the point $(-3\sqrt{3}, 1)$ is

- a) $x - 3y = 0$ b) $x - \sqrt{3}y = -4\sqrt{3}$ c) $3x - y = 0$
d) $3x - y = 0$ e) none of these

16) The acceleration due to gravity on Planet X is 8 m/s^2 . A rock is thrown straight up and returns to the planet's surface 20 seconds later. Assuming the only force acting on the rock is the planet's gravity, the rock reached a maximum height of

- a) 240 m b) 320 m c) 400 m d) 480 m e) none of these

17) $\int_0^{\frac{\pi}{3}} \frac{\sin \theta}{\cos^2 \theta} d\theta =$

- a) 1 b) $\frac{\pi}{3}$ c) $-\frac{3}{\pi}$ d) $\frac{3}{\pi}$ e) none of these

18) $\int_1^e \frac{\ln(ex)}{x} dx =$

- a) $\frac{1}{2}$ b) $\frac{e}{2}$ c) $\frac{3}{2}$ d) $\frac{3e}{2}$ e) none of these

- 19) The graph of $A(x) = x\sqrt{x+3}$ is concave up on the interval
- a) $(0, \infty)$ b) $(3, \infty)$ c) $(-3, \infty)$ d) $(0, 3)$ e) none of these
- 20) The radius r (in cm) of a sphere after t minutes is given by $r = t^2 + 2t + 1$.
The rate at which the surface area (in cm^2/min) of the sphere is changing when the radius is 4 cm is
- a) 128π b) 144π c) 256π d) 432π e) none of these
- 21) Complete *The Fundamental Theorem of Calculus*. If f is continuous on $[a, b]$, then $\int_a^b f(x)dx = F(b) - F(a)$ where _____.
- a) $F = f'$ b) $F' = f$ c) $F = f$ d) $F'' = f$ e) none of these
- 22) Compute $\int_4^9 \frac{(\sqrt{u}-2)^{19}}{\sqrt{u}} du$
- a) $1/10$ b) $1/5$ c) $3/10$ d) $2/5$ e) none of these
- 23) The average value of $f(x) = \sqrt{x}$ on $[4, 9]$ is
- a) 5 b) $1/10$ c) $-1/60$ d) 10 e) none of these
- 24) $\lim_{h \rightarrow 0} \frac{e^{h+2} - e^2}{h} =$
- a) 0 b) 1 c) e d) e^2 e) none of these
- 25) The maximum velocity attained by a particle whose displacement is given by $s(t) = 2t^3 - 12t^2 + 16t + 2$ on $[0, 5]$ is
- a) 16 b) 0 c) 12 d) 46 e) none of these

- 26) The approximate value of $\int_0^4 2^x dx$ obtained from the Trapezoid Rule with $n = 2$ is
- a) 22 b) 23 c) 24 d) 25 e) none of these
- 27) If $f(x) = |x - 4|$, then $\lim_{x \rightarrow 4^+} f'(x)$ is
- a) 0 b) 1 c) -1 d) 2 e) none of these
- 28) The equation of the line normal to the graph of $x^2 - 2xy + 2y^2 = 5$ at the point $(1, -1)$ is
- a) $2x - 3y = 5$ b) $2x + 3y = -1$ c) $3x - 2y = 5$ d) $3x + 2y = 1$
- e) none of these
- 29) A kite 100 feet above the ground moves horizontally at a speed of 8 ft/sec. The rate at which the angle between the string and the horizontal is decreasing when 200 ft of string have been let out is
- a) 5 rad/sec b) 25 rad/sec c) $\frac{1}{50}$ rad/sec d) $-\frac{1}{50}$ rad/sec
- e) none of these
- 30) $\lim_{x \rightarrow 0} \frac{\sqrt{x^2 - 9}}{2x - 6} =$
- a) 0 b) $\frac{1}{2}$ c) $\frac{1}{3}$ d) 3 e) none of these
- 31) The graph of $y = \frac{x^2 - 1}{2x + 4}$ has vertical asymptote(s) at
- a) $x = 1, x = -1$ b) $x = 2$ c) $x = -\frac{1}{2}$ d) $x = -2$
- e) none of these

- 32) If $f(x) = \int_{\ln 2}^x e^{2t} dt$ for all positive x , then $f'(x) =$
- a) e^{2x} b) xe^{2x} c) $e^{2x} - 4$ d) $xe^{2x} - 4$ e) none of these
- 33) The number of horizontal tangents on the graph of $y = x^4 - 2x^2 + 2$ is
- a) 3 b) 4 c) 5 d) 6 e) none of these
- 34) A spherical tank has a radius of 10 feet. Using differentials, the estimated volume (in cubic inches) of paint needed to cover the surface of the tank with paint 1/100 inch thick is
- a) 144π b) 288π c) 432π d) 576π e) none of these
- 35) The points on the hyperbola $y^2 - x^2 = 4$ that are closest to the point $(2, 0)$ are
- a) $(1, 2)$ b) $(1, \pm 5)$ c) $(1, \pm\sqrt{5})$ d) $(0, 0)$ e) none of these
- 36) $\int_e^{e^4} \frac{1}{x\sqrt{\ln x}} dx =$
- a) $2(e^2 - \sqrt{e})$ b) 0 c) 1 d) 2 e) none of these
- 37) If $g(x) = \begin{cases} -x^3 & \text{if } x < -1 \\ (x+2)^2 & \text{if } x > -1 \end{cases}$, then $\lim_{x \rightarrow -1^+} g(x) =$
- a) 0 b) 1 c) 2 d) 5 e) none of these
- 38) The area of the region bounded by the curves $y = (e-1)x + 1$ and $y = e^x$ is
- a) $\frac{e-1}{2}$ b) $\frac{2e-1}{2}$ c) $\frac{3e-2}{2}$ d) $\frac{3-e}{2}$ e) none of these

- 39) The positive value c , for x that satisfies the conclusion of the Mean Value Theorem for Derivatives for $f(x) = 3x^2 - 5x + 1$ on the interval $[2, 5]$ is
- a) 1 b) $13/6$ c) $11/6$ d) $23/6$ e) none of these
- 40) A drinking cup is made in the shape of a right circular cylinder. For a fixed volume, we wish to make to total material used, the circular bottom (*no lid*) and the cylindrical side, as small as possible. Under this condition, the ratio of the height to the diameter is
- a) $1/2$ b) $2/3$ c) $3/2$ d) 2 e) none of these

