

Find the answer to each given problem in exact simplified form. You have 8 minutes to complete this test.

- _____ 1) Calculate the derivative of $2020x^{2019}$ at $x = 1$.
- _____ 2) $\frac{1}{2020} \sum_{i=1}^{2020} \frac{i}{2020} - \lim_{n \rightarrow \infty} \frac{1}{n} \sum_{i=1}^n \frac{i}{n} =$
- _____ 3) Find the average value of $f(x) = x^2$ on the interval $[1, 4]$.
- _____ 4) $\lim_{x \rightarrow 1} \frac{e^x - e}{x - 1} =$
- _____ 5) Estimate the area under the curve $y = x + 1$ from $x = 1$ to $x = 4$ using a Right Riemann sum with 3 equal subintervals.
- _____ 6) Find the maximum possible number of inflection points for a quintic function.
- _____ 7) Evaluate $\lim_{x \rightarrow \infty} \left(1 + \frac{1}{x}\right)^{\sin x}$.
- _____ 8) Compute the sum of the abscissas of the relative extrema of $f(x) = x^3 - 4x^2 + 2x + 6$.
- _____ 9) $\int_2^3 x^x (\ln x + 1) dx =$
- _____ 10) Find the volume generated when the curve $y = x$ from $x = 0$ to $x = 2$ is rotated about the x -axis.
- _____ 11) Find k if $\int_0^\infty e^{-kx} dx = 4$.
- _____ 12) What is the maximum volume of a sphere inscribed in a cube of volume 64?
- _____ 13) Find the maximum value of $\cos x + \cos 2x + \cos 3x$ across all real x .
- _____ 14) $\frac{d}{dy} (8x + 3x^2 + \sin 2x) =$
- _____ 15) Evaluate the 2020th derivative of $\cos x$ at $x = 0$.
- _____ 16) Evaluate the 2020th derivative of $x \cos x$ at $x = 0$.
- _____ 17) Evaluate the 2020th derivative of $x^2 \cos x$ at $x = 0$.
- _____ 18) $\int_0^3 \sqrt{1 - \frac{x^2}{9}} dx =$
- _____ 19) What is the largest real number k for which $\sum_{i=1}^\infty \frac{x^2 + x + 1}{x^k}$ diverges?
- _____ 20) If the Maclaurin series for $f(x)$ is $3 + 2x + x^2 + \dots$, find the derivative of $(f(x))^2$ at $x = 0$.
- _____ 21) $\lim_{x \rightarrow 0} \frac{1 - \cos x}{\sin^2 x} =$
- _____ 22) Find the area enclosed by $y = -2(x - 5)(x - 8)$ and $y = 0$.
- _____ 23) Evaluate MU if $M = 124$ and $U = 126$.
- _____ 24) Find the integrating factor for the equation $y' - \frac{3}{x}y = e^x \sin x$.
- _____ 25) How many relative extrema does $\sin x$ have on $[0, 4\pi]$?
- _____ 26) Find the centroid of the region bound by $9x^2 + 4y^2 + 36x - 20y + 45 = 0$.
- _____ 27) Use Newton's method to find x_1 for the function $f(x) = x^2 - 3$ if $x_0 = 2$.
- _____ 28) $\int_0^{\ln 3} \frac{e^{2x}}{e^{2x} + 1} dx =$
- _____ 29) If $f(x)$ is an even function and $f'(2) = 3$ then evaluate $f'(-2)$.
- _____ 30) $\frac{d}{dx} \left[\int_2^{2x} \cos^2 t dt \right] \Big|_{x=\pi/12} =$
- _____ 31) What is the area enclosed by the polar curve $r = 4 \cos \theta$?
- _____ 32) $\lim_{x \rightarrow 0} \frac{\sin x (1 - \cos x)}{x^\alpha}$ converges to a positive real number for what value of α ?
- _____ 33) $\sum_{n=0}^\infty \frac{(-1)^n}{2^n} =$
- _____ 34) $\sum_{n=1}^\infty \frac{(-1)^n}{n \cdot 2^n} =$
- _____ 35) A sequence satisfies the recurrence relation $a_n = 5a_{n-1} - 6a_{n-2}$, $a_0 = 2$, $a_1 = 5$. Evaluate $\lim_{n \rightarrow \infty} \sqrt[n]{a_n}$.
- _____ 36) $y = (x - 2)^{1/3} + 3$ has a vertical tangent at what point?
- _____ 37) $\frac{d}{dx} (e^x \cos x) \Big|_{x=\pi/2} =$
- _____ 38) $\int_0^{\pi/6} (\sin^{-1} x + \cos^{-1} x) dx =$
- _____ 39) Determine $y''(2)$ if $x \frac{dy}{dx} = x + 1$.
- _____ 40) Find $\int_{34}^{35} 2x dx$.