1. Find the limit (either a number, $\infty$, or $-\infty$) or explain why it does not exist: \[\lim_{x \to 1^+} \frac{x^2}{1 - x^2}\]

2. Find the limit (either a number, $\infty$, or $-\infty$) or explain why it does not exist: \[\lim_{x \to \infty} \frac{6x^2 - x + 1}{2x^2 + 7x}\]

3. Is the function \(f(\theta) = \begin{cases} \sin \theta & \text{if } \theta \leq 0 \\ 1 - \cos \theta & \text{if } \theta > 0 \end{cases}\) continuous at \(x = 0\)? Explain why or why not.

4. Use the definition of the derivative to find \(f'(2)\) for \(f(x) = (x - 1)^2\).

5. Is the function \(f(x) = \frac{x + 1}{x^2 - 1}\) continuous at \(x = 1\)? Explain why or why not.

6. Is the function \(f(x) = |x - 2|\) differentiable at \(x = 2\)? Explain why or why not.

7. Find the slope of the tangent line to the curve \(y + y^3 = 2x^2 - 8\) at the point \((3, 2)\).

8. Find the second derivative of the function \(f(x) = \cos(x^2)\).

9. A particle moves along the curve \(x^2 + y^2 = 25\). When the particle reaches the point \((3, 4)\) its \(x\)-coordinate is increasing at a rate of 8 m/s. At what rate is the \(y\)-coordinate changing at this moment?

10. A cylinder with volume \(64\pi\) cm\(^3\), radius \(r\), and height \(h\) is being crushed so that \(\frac{dh}{dt} = -3\) cm/s (and its volume, given by \(V = \pi r^2 h\), remains constant). Find \(\frac{dr}{dt}\), the rate at which the radius is changing, when \(r = 8\) cm.

11. Find the derivative of the function \(g(x) = \int_1^3 t^2(1 - t)^2 \, dt\)

12. Use the Intermediate Value Theorem to show that the equation \(2 \left( x^3 + 17 \right)^{\frac{1}{2}} - 9 = 0\) has a solution between \(-1\) and \(2\).

13. Find the absolute maximum and absolute minimum values of \(f(x) = x - \sin(x)\) over the interval \([-\pi, \pi]\).

14. A right triangle has base length \(x\) and height \(y\) satisfying the equation \(2x + y = 12\). Find the dimensions \(x\) and \(y\) that maximize the area of the triangle.

15. Sketch the graph of \(f(x) = \frac{x^2 - 1}{x^2 + 1}\). Clearly indicate the location of all axis intercepts, asymptotes, and local extremes.

16. The velocity of a particle at time \(t\) is given by the function \(v(t) = 3 - 6t^2\) and after 1 second its position is \(p(1) = 5\). Find an equation for the position of the particle at time \(t\).

17. Find the average value of the function \(f(x) = (2 - x)^4\) over the interval \([0, 2]\).

18. Find the area above the curve \(y = 2x + x^2\) below the \(x\)-axis.

19. The velocity of an object at time \(t\) is \(v(t) = \frac{t}{2} - 1\). Find the total distance traveled from \(t = 0\) to \(t = 4\).

20. Evaluate the integral \(\int \frac{\cos x}{\sqrt{\sin x}} \, dx\).

21. Evaluate the integral \(\int_2^3 (10 - 5x)^4 \, dx\).