1. Find \( \lim_{x \to 0} \frac{3x^4 + 6x}{x^2 + 5x} \) (a) by factoring the numerator and denominator and (b) by using l’Hopital’s Rule.

Answer: \( \frac{6}{5} \)

2. Find \( \lim_{x \to \infty} \frac{4x^2 + 2x}{5x^2 + 3} \) (a) by dividing the numerator and denominator by \( x^2 \) and (b) by l’Hopital’s rule.

Answer: \( \frac{4}{5} \)

3. What is \( \lim_{x \to 0} \frac{1 - e^{2x}}{\sin(4x)} \)?

Answer: \( \frac{1}{2} \)

4. Find \( \lim_{x \to 0} \frac{e^{6x} - 1}{\tan(3x)} \).

Answer: 2

5. Find \( \lim_{x \to 0} \frac{x}{e^x} \).

Answer: The given formula is not indeterminate. 0

6. Find \( \lim_{x \to \infty} \frac{\ln x}{x} \).

Answer: 0

7. What is \( \lim_{x \to \infty} \frac{x}{\ln x} \)?

Answer: \( \infty \)

8. \( \lim_{x \to \infty} \frac{e^x + 5}{e^{-x} + 10} \)

Answer: \( \infty \)

9. Sketch the graph of \( y = 3 + 2x - e^x \) using the first- and second-derivative tests.

Answer: \( y \) is increasing for \( x < \ln(2) \), is decreasing for \( x > \ln(2) \), and has a global maximum at \( x = \ln(2) \approx 0.69 \). The graph is concave down for all \( x \). Plot \( y(-3) = 3 - e^{-3} \approx -3.05 \), \( y(0) = 2 \), \( y(\ln(2)) \approx 2.36 \), and \( y(2) = 7 - e^2 \approx -0.40 \). Figure A9.

Figure A9
10. Sketch the graph of \( y = 3 - e^{-x^2/2} \). Use the First- and Second-Derivative Tests.

**Answer:** \( y = 3 - e^{-x^2/2} \) is defined and continuous for all \( x \) and is even. • \( y \to 3 \) as \( x \to \pm \infty \) • \( y \) is decreasing for \( x < 0 \), is increasing for \( x > 0 \) and has a global minimum at \( x = 0 \). • The graph is concave down for \( x < -1 \), concave up for \(-1 < x < 1\), and concave down for \( x > 1 \). • The graph has inflection points at \( x = \pm 1 \). • Figure A10

![Graph of y = 3 - e^{-x^2/2}](image)

**Figure A10**

11. Find the maximum and minimum of \( y = x^5 e^{-x} \) for \( 1 \leq x \leq 10 \).

**Answer:** [Maximum] = \( y(5) = 5^5 e^{-5} \) • [Minimum] = \( y(1) = e^{-1} \)

12. What are the maximum and minimum of \( y = (\ln x)/\sqrt{x} \) for \( 1 \leq x \leq 20 \)?

**Answer:** [Minimum] = \( y(1) = 0 \) • [Maximum] \( y(e^2) = 2e^{-1} \)