Math 241 Exam 1 Review

Find the limits in exercise 1-4.
1. \( \lim_{x \to -3} \frac{x^2 + 4x + 3}{x + 3} \)
2. \( \lim_{x \to -1} \frac{x^2 + 3x + 2}{x^2 - x - 2} \)
3. \( \lim_{x \to 2} \frac{4x - x^2}{2 - \sqrt{x}} \)
4. \( \lim_{x \to 2} \frac{x + 2}{\sqrt{x^2 + 5} - 3} \)
5. Prove \( \lim_{x \to 3} (3x - 7) = 2 \)
6. Prove \( \lim_{x \to 4} \left( \frac{x}{4} + 2 \right) = 3 \)

Find the limits in exercise 10-15.
10. \( \lim_{x \to 0} \frac{4x}{\sin 3x} \)
11. \( \lim_{x \to 0} \frac{\sin x}{\sin 2x} \)
12. \( \lim_{x \to \infty} \frac{2x + 3}{5x + 7} \)
13. \( \lim_{x \to \infty} \frac{9x^4 + x}{x^5 + 4x^3 - 23} \)

14. \( \lim_{x \to -5} \frac{3x}{2x + 10} \)
15. \( \lim_{x \to 2} \frac{x}{x^2 - 4} \)
   a. as \( x \to 2^+ \)
   b. as \( x \to 2^- \)
   c. as \( x \to -2^+ \)
   d. as \( x \to -2^- \)

16. Find all asymptotes for the following functions.
   a. \( y = \frac{1}{x - 1} \)
   b. \( y = \frac{x + 2}{x^2 - 1} \)
   c. \( y = \frac{2x + 4}{x^2 - 7x + 10} \)
   d. \( y = \frac{x^5 + 2x + 1}{x^2 - 3x + 2} \)

17. Exercise 15, section 2.6, p.94

18. For what value of \( a \) is the function continuous at every \( x \)?
   \[ f(n) = \begin{cases} 
   x, & \text{if } x < -2 \\
   ax^2, & \text{if } x \geq -2 
   \end{cases} \]

19. Find the equation for the line tangent to the graph at the given point. (using the definition of derivative at a point)
   a. \( f(x) = x^2 + 2 \) at \( (3, 11) \)
   b. \( f(x) = 3\sqrt{x} \) at \( (4, 6) \)
   c. \( f(x) = \frac{1}{x^2} \) at \( (3, 1) \)

For finding derivatives questions, try Chapter 3 Practice Exercise question 1-40, p.181-182.