Homework 2: Sections 1.3, 2.2, and 2.3

Show ALL work on your own paper to get full credit. This assignment is due at the beginning of class on Friday, February 4.

A portion of the following problems will be graded for content. The remaining problems will be spot-checked for completion and work shown.

1. (1.3) Eliminate the parameter to find a Cartesian equation of the curve. Sketch the curve and describe how it is traced out as the parameter value increases.
\[ x = -2 - t, \quad y = -1 - t^2, \quad -2 \leq t < 1 \]

2. (1.3) Find a Cartesian equation and sketch the curve defined by the vector function \( \mathbf{r}(t) = <2 \cos t + 1, -2 \sin t - 1> \). How is the curve traced out as \( t \) increases?

3. (1.3) Find parametric equations for the line that passes through the point \((-3, 4)\) and is parallel to the line \( y = \frac{2}{3}x + 2 \).

4. (1.3) A line is parametrically defined by \( x = 7 + 9t, \quad y = 2 - 4t \). (a) What is the slope of this line? (b) Find a vector perpendicular to this line.

5. (2.2) Problem #4 from Section 2.2 in your textbook. (You do not need to redraw the graph.)

6. (2.2) Problem #8 from Section 2.2 in your textbook.

7. (2.2) Find all vertical asymptotes of the function \( f(x) = \frac{(x^2 + 4x + 3)(x - 2)}{(x^2 - 3x + 2)(x + 3)^2} \)

8. (2.2) Calculate the following limits (if they exist).
   
   (a) \( \lim_{x \to 2^-} \frac{x(x - 3)^2}{(x - 4)(x - 2)} \)
   
   (b) \( \lim_{x \to 2^+} \frac{x(x - 3)^2}{(x - 4)(x - 2)} \)
   
   (c) \( \lim_{x \to -4} \frac{(x + 6)(x - 5)^5}{(x + 4)^2} \)

9. (2.3) Calculate \( \lim_{x \to -7} \frac{\frac{1}{x} - \frac{1}{7}}{5 - x} \).

10. (2.3) Finish the following problem from the 2.3 lecture notes:
    
    Calculate \( \lim_{t \to -3} \mathbf{r}(t) \), where \( \mathbf{r}(t) = \left\langle \frac{2}{t - 3} - \frac{12}{t^2 - 9}, \frac{t - 3}{\sqrt{t^2 + 7} - 4} \right\rangle \)

11. (2.3) Calculate \( \lim_{x \to -7^-} \frac{x^2 + 6x - 7}{|x + 7|} \) and \( \lim_{x \to -7^+} \frac{x^2 + 6x - 7}{|x + 7|} \).

12. (2.3) Show that \( \lim_{x \to 0} x^4 \cos \left( \frac{2}{x} \right) = 0 \) by using the Squeeze Theorem.

Bonus: Find numbers \( a \) and \( b \) such that \( \lim_{x \to 0} \frac{\sqrt{ax + b} - 2}{x} = 1 \). (Show how you get your answers.)