1. State the domain of $f(x) = \frac{\sqrt{x+1}}{x-3}$. Express your answer in interval notation. (4 points)

2. Consider the graph of $y = -x^2$. Using shifting techniques, graph $y = -(x - 3)^2 + 2$. (4 points)
3. For the function \( f(x) \) below,
\[
f(x) = \begin{cases} 
-\frac{1}{2}x - 4, & \text{if } x \leq -1 \\
-2, & \text{if } x > -1
\end{cases}
\]

(a) Draw the graph of \( f(x) \). (4 points)

Now evaluate the following limits. (1 point each unless noted otherwise)

(b) \( \lim_{x \to -1^-} f(x) = \) 

(c) \( \lim_{x \to -1^+} f(x) = \) 

(d) \( \lim_{x \to -1} f(x) = \) 

(e) \( \lim_{x \to 2^-} f(x) = \) 

(f) \( \lim_{x \to 2^+} f(x) = \) 

(g) \( \lim_{x \to 2} f(x) = \) 

(h) \( \lim_{x \to 0} f(x) = \) 

(i) \( \lim_{x \to \infty} f(x) = \) 

(j) Is \( f(x) \) continuous at \( x = -1 \)? 
Mathematically explain your answer. (2 points)

(k) Is \( f(x) \) continuous at \( x = 2 \)? 
Mathematically explain your answer. (2 points)
4. Evaluate the following limits. (3 points each)

(a) \( \lim_{x \to 3} \frac{x^2 - 9}{x - 3} \).

(b) \( \lim_{x \to 4} \frac{\sqrt{4-x} - 3}{x} \).

(c) \( \lim_{x \to 0} \frac{|x|}{x} \).

(d) \( \lim_{x \to \infty} \frac{3x^2 - 16x + 5}{4x^2 - 1} \).
5. \( f(x) = \frac{5}{2x} - 3. \)

(a) Find the derivative of \( f(x) \) by using the definition of the derivative. No credit will be given if the definition is not used. (5 points)
6. Find the first and second derivatives of each of the following functions clearly labeling both. (8 points total)

(a) \( g(x) = 5\sqrt{x} - 9x^3 - \pi \)

(b) \( h(x) = \frac{-x^8 + x^3 + 4}{x^3} \)

7. Find the derivative of each of the following functions using any rules that you wish. Do not simplify your answer. (4 points each)

(a) \( m(x) = 6\sqrt{x} (2x + 1) \)

(b) \( n(x) = \frac{x^3 - 1}{x - 1} \)

(c) \( p(x) = \sqrt[3]{9x - 1} \)
8. Find the equation of the tangent line to the curve \( k(x) = 2\sqrt[3]{x^4} + 7 \) when \( x = 8 \). (7 points)
9. After \( t \) hours a car is a distance \( s(t) = 60t + \frac{100}{t+3} \) miles from its starting point. (12 points)

(a) Find the velocity at 2 hours.

(b) Find the acceleration at 2 hours.
10. A company can produce miniature robots where the cost function is \( c(x) = x^3 - 3x + 34 \).

(a) Find the **marginal cost** function. (2 points)

(b) Find the **average cost** function. (2 points)

(c) Find the **marginal average cost** function. (2 points)

(d) Evaluate the **marginal cost** function when the company has produced 10 miniature robots. (2 points)

(e) Interpret your answer from part d. (4 points)