1. (24 points, 6 points each part) Find the following limits. Give the limit as a real number or $\infty$ or $-\infty$ or does not exist, whichever is MOST appropriate.

(a) \( \lim_{h \to 0} \frac{h}{h^2 - 7h + 1} \)

(b) \( \lim_{x \to -4} \frac{x^2 + 2x - 8}{x^2 + 5x + 4} \)

(c) \( \lim_{x \to -1} \frac{5}{x + 1} \)

(d) \( \lim_{w \to -\infty} \frac{2w^2 - 3w + 4}{5w^2 + 7w - 1} \)
2. (14 points, 2 points each) Given the graph of $y = f(x)$ shown below, find:

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

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

(c) $\lim_{{x \to 1}} f(x) =$

(d) Is $f$ continuous at $x = 2$? 

(e) Is $f$ continuous at $x = 1$? 

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

(g) $\lim_{{x \to -\infty}} f(x) =$
3. (12 points total, 3 points each) Let \( f(x) = \begin{cases} \frac{16}{x^2} & \text{if } x \geq 2 \\ 3x - 2 & \text{if } x < 2 \end{cases} \)

(a) Find \( \lim_{x \to 2^-} f(x) = \) ________________

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

(c) Is \( f(x) \) continuous at \( x = 2 \)? Ans. ________________

(d) Find all points of discontinuity of \( f(x) \). Ans. ________________
4. (10 points) Solve the inequality \( \frac{x^2 - x - 6}{x^2 + 4x - 5} \geq 0 \)

5. Use differentiation rules to find the derivative, \( \frac{dy}{dx} \), of each of the following:

   (a) (5 points) \( y = 5x^2 - 9x \)

   (b) (5 points) \( y = \frac{13 - x^4}{3} \)
(c) (5 points) \( y = \frac{1}{x} \)

(d) (5 points) \( y = \frac{1}{\sqrt{x}} \)

6. (10 points) Use the definition of the derivative below to find \( f'(x) \).

If \( f(x) = x^2 + 4x - 8 \), then find \( \lim_{h \to 0} \frac{f(x + h) - f(x)}{h} \)

(over, please)
7. (10 points) The average cost per unit when $q$ units are produced is given by

$$\bar{c} = 0.00002q^2 - 0.01q + 6 + \frac{20,000}{q}.$$ 

Find the marginal cost function.