Math 165: 1015 Exam 1

Name:_____

Section:_____

1. Find the average rate of change of the function

$$f(x) = x^3 - 2x^2 + 4x - 3$$

over the interval $[0, 2]$. (5pt)

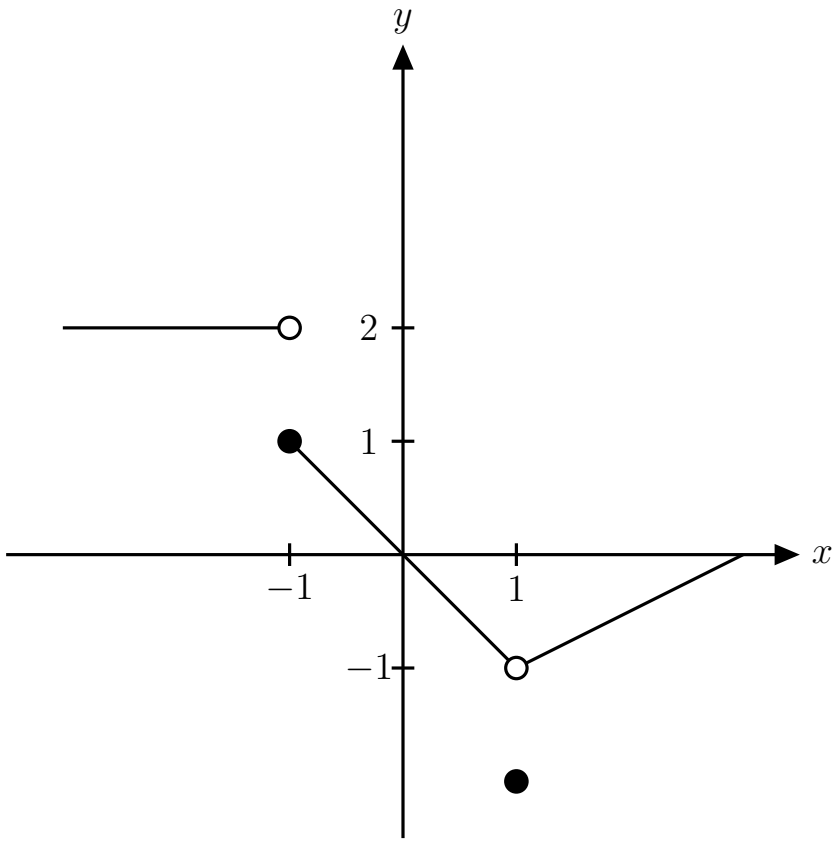
2. Find the following limits: (15pt)

(a) $\lim_{x \to 5} \dfrac{x^2 - 25}{x^2 - 6x + 5} =$

(b) $\lim_{x \to 2} \dfrac{\sqrt{x+2} - x}{x - 2} =$

(c) $\lim_{x \to 0} \dfrac{\sin(2x)}{5x} =$

3. The graph of a function $y = f(x)$ is shown below. (10pt)



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

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

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

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

(e) Does the limit $\lim_{x \to -1} f(x)$ exist?

4. Consider the following function:

$$f(x) = \frac{4x^2 + 11x - 20}{3x^2 + 6x + 3}$$

(a) Evaluate $\lim_{x \to +\infty} f(x)$ and $\lim_{x \to -\infty} f(x)$. (4pt)

(b) Find all horizontal asymptote(s). (2pt)

(c) Evaluate $\lim_{x \to -1} f(x)$. (2pt)

(d) Find all vertical asymptote(s). (2pt)

5. (a) Suppose $f(x)$ is a function. Write down the limit definition of the derivative $f'(x)$. (2pt)
[Hint: The formula should have x, h, f, and the lim sign involved.]

(b) Let $f(x) = 3x^2 - 6$. **Use the limit definition** to find $f'(x)$. (3pt)
[No point will be given for the answer without using the limit definition.]

(c) Write down the formula of a line that has slope m and passes through the point (a, b). (2pt)

(d) Let $f(x) = 3x^2 - 6$. Find the tangent line of $f(x)$ at $x = 2$. (3pt)
[Hint: The tangent line is a line that passes through the point $(2, f(2))$ and has slope $f'(2)$.]