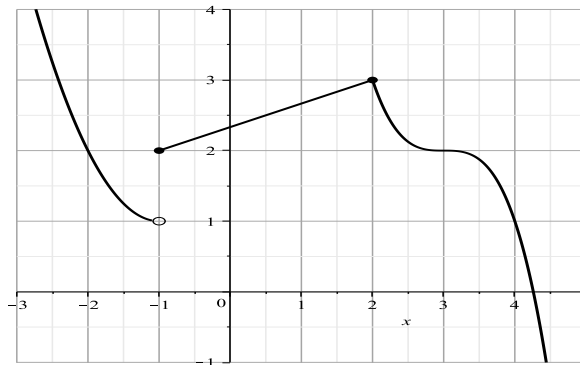


Fall 2023 - Math 1496 - Sample Test 1

1. From the following graph determine the following limits.



(i) $\lim_{x \rightarrow -1^-} f(x)$ (ii) $\lim_{x \rightarrow -1^+} f(x)$ (iii) $\lim_{x \rightarrow -1} f(x)$

(iv) $\lim_{x \rightarrow 2^-} f(x)$ (v) $\lim_{x \rightarrow 2^+} f(x)$ (vi) $\lim_{x \rightarrow 2} f(x)$

2. Calculate $\lim_{x \rightarrow 1} \frac{x^3 - x^2}{x - 1}$ using the techniques of graphically, numerically and analytically.

3. Calculate the following limits analytically.

(i) $\lim_{x \rightarrow -1} \frac{x^2 + 3x + 2}{x^2 - 1}$ (ii) $\lim_{x \rightarrow 4} \frac{x - 4}{\sqrt{x} - 2}$, (iii) $\lim_{x \rightarrow 0} \frac{\sin 4x}{\sin 2x}$, (iv) $\lim_{x \rightarrow \infty} \frac{3x^2 + 4}{x^2 + 2x + 1}$

4. Calculate the first derivative (either $f'(x)$ or y') of the following. Do not simplify your answer. Evaluate at c if a point is given.

(i) $y = \frac{4e^x}{x^2 + 1}$, (iii) $y = x^2 \tan x$,

(iii) $y = (2x + 1)(x^2 + 3x + 2)$ at $x = -1$, (iv) $y = \frac{e^x}{x^2 + 1}$ at $x = 0$,

5.(i) State the definition of the derivative.

(ii) If $f(x) = 3x^2 - 5x + 2$ then find $f'(x)$ from the definition.

6. Find the equation of the tangent to $y = x^4 - 2x^3 + 3x^2$ at $x = 1$.

7. If

$$f(x) = \begin{cases} x + 1 & x \leq 0 \\ x^2 + 1 & x > 0 \end{cases}$$

is $f(x)$ continuous and differentiable at $x = 0$?