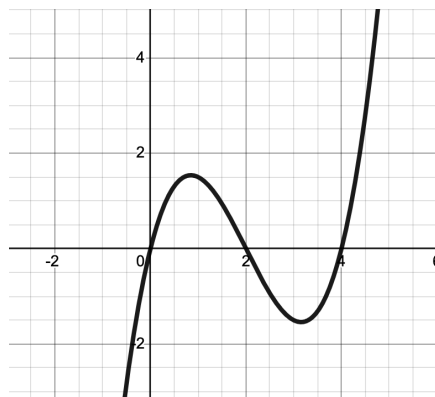


Problem Set 2 (Total Points: 185), Due July 13th

Review Questions

Problem (1). (40 points) Consider the following function $f(x)$ given by the graph



- (a) Sketch a graph of $y = -2f(x+2)$.
- (b) Sketch a graph of $y = f(x) + \sin(x)$.

Feel free to use Desmos or a graphing calculator on this problem.

Problem (2). (10 points) If $f(x)$ is an odd function what is $f(0)$?

Problem (Bonus). (30 points) If $f(x)$ and $g(x)$ are functions classify when $f(x)g(x)$ is an even or odd function based on if $f(x)$ and $g(x)$ are even or odd. It might be useful to remember that x^n is an even function when n is even and x^n is odd when n is odd. Express your answer as a table.

Questions on Limits

Compute the following limits. (5 points each)

- (3) $\lim_{x \rightarrow 0} \frac{x^2}{x}$.
- (4) $\lim_{x \rightarrow 0} \frac{x}{x^3}$.
- (5) $\lim_{x \rightarrow -\infty} 2^x + 1$

$$(6) \lim_{x \rightarrow \infty} \frac{2x^2 + 3x - 1}{4x^2 + 9}$$

$$(7) \lim_{x \rightarrow 3^+} 2 \operatorname{sgn}(3 - x)$$

$$(8) \lim_{x \rightarrow 3^-} 2 \operatorname{sgn}(3 - x)$$

(9) Express your answer in terms of the variables a and b you may assume

$$a \neq b: \lim_{x \rightarrow a} \frac{(x - a)(x - b)^2}{(a - x)(x - b)}$$

$$(10) \lim_{x \rightarrow 0} \frac{e^x - 1}{x}$$

$$(11) \lim_{x \rightarrow \infty} \frac{x^2}{e^x}$$

Problem (12). (15 points) Which of the following functions are continuous.

(a) $a(x) = \operatorname{sgn}(x) + \operatorname{sgn}(-x)$

(b) $b(x) = \frac{x^2 - 5x + 6}{x^2 + 3x - 10}$

(c) $c(x) = \frac{x^2 + 2x + 1}{x^2 + x + 4}$

Questions on Derivatives

Problem (13). (10 points) State the limit definition of the derivative.

Problem (14). (20 points) Match the following quantities in the following way. The first group is the function $f(t)$ and the second group is the function $f'(t)$. All quantities should be considered functions of time. **Group 1:**

(a) Distance (Displacement)

(b) Velocity

(c) Price

(d) Concentration of a reactant

(e) Heat Rate

(f) Population

- (g) Energy (or Work)
- (h) Momentum (or Impulse)
- (i) Internet Traffic

Group 2:

- (i) Inflation
- (ii) Velocity
- (iii) Rate of Data Transfer
- (iv) Force
- (v) Acceleration
- (vi) Power
- (vii) Growth Rate
- (viii) Rate of Reaction
- (ix) Heart Rate Variability

Problem (15). (45 points) Compute the following derivatives using the limit definition of the derivative.

1. $f'(-3)$ where $f(x) = 3x + 1$
2. $f'(2)$ where $f(x) = x^2 + 3x$.
3. $f'(a)$ where $f(x) = x^3$. (for any value of a .)

Problem (Bonus). (20 points) Compute $f'(0)$ where $f(x) = \cos(x)$ using the limit definition of the derivative.