

Midterm #1, 9/24
Math 156 (Calculus I), Fall 2024

Each problem is worth 10 points, for a total of 50 points. You have 50 minutes to do the exam. Remember to *show your work* on all problems! Where possible, simplify answers.

1. Let $f(x) = \cos(2x) - 1$.
 - (a) Graph $y = f(x)$. Be sure to include some value labels on your x - and y -axes.
 - (b) Let $g(x)$ be the function whose graph is obtained from the graph of $f(x)$ by translating to the right by $\frac{\pi}{4}$ and stretching vertically by a factor of 3. Write the formula for $g(x)$. (The formula you write should not have f in it.)
2. Let $g(x) = e^{5x} + 2$.
 - (a) Describe all the horizontal and/or vertical asymptotes of the graph $y = g(x)$ of this function. Explain your answer by saying what these asymptotes mean in terms of limits.
 - (b) Let $f(x) = \ln(x - 2)$. Write the formula for the composition $(f \circ g)(x)$. Make sure your formula is written in the most simplified form possible.
3. Let $f(x) = \frac{x^2 - 2x}{x^2 - 4}$. Compute the following limits, or if they do not exist explain why:
 - (a) $\lim_{x \rightarrow 2} f(x)$
 - (b) $\lim_{x \rightarrow 0} f(x)$
 - (c) $\lim_{x \rightarrow -2} f(x)$
4. Compute the following limits, or if they do not exist explain why:
 - (a) $\lim_{x \rightarrow 0} e^{\sin(x)}$
 - (b) $\lim_{x \rightarrow \infty} \frac{x^2 - 3x + 2}{2x^2 + 2x - 7}$
 - (c) $\lim_{x \rightarrow \infty} \frac{x^2 + 2x - 8}{7x + 9}$
5. What is the slope of the line tangent to the curve $y = -x^2 + 1$ at the point $(x, y) = (0, 1)$? Explain your answer, for instance by sketching a graph or by discussing a limit.