

There are 100 points on this exam. Show **ALL** work. Justify your steps using **COMPLETE** sentences. GOOD LUCK!

1. (7 points) Find the domain of the function

$$f(x) = \frac{x}{x^2 - 5x + 6} + \sqrt{3x + 6}.$$

2. (13 points) Sketch the graph of the function

$$f(x) = |2x + 1| + |x - 1|.$$

At which points is $f(x)$ differentiable?

3. (10 points) Find the equation of the line that passes through the point $(1, 0)$ and is parallel to the line $y = 2x + 1$. Also, find the equation of the line that passes through the points $(1, 2)$ and $(2, 1)$.

4. (10 points) Graph the function $f(x) = x^2 - 4x + 3$. What is the range of the function $g(x) = (x^2 - 4x + 3)^2$?

5. (15 points) Compute the following limits:

$$\lim_{x \rightarrow 2} \left(\sqrt{x+2} + \frac{x^2+x}{x-1} \right), \quad \lim_{x \rightarrow 4} \frac{x^2-16}{x-4}, \quad \lim_{x \rightarrow 1} \frac{1}{|x-1|}.$$

6. (5 points) Determine the points of continuity of the function

$$f(x) = \frac{\sqrt{x}}{2x - 1}.$$

7. (10 points) Determine whether the following function is continuous at $x = 0$ and at $x = 1$

$$f(x) = \begin{cases} x + 1 & \text{if } x \geq 0 \\ x & \text{if } -1 \leq x < 0 \\ -1 & \text{if } x < -1. \end{cases}$$

8. (10 points) Let $f(x) = 1/x^2$. Compute the difference quotient $(f(x+h) - f(x))/h$ and use this to compute the limit $\lim_{h \rightarrow 0} (f(x+h) - f(x))/h$.

9. (10 points) Find the derivative of the functions

$$f(x) = (2x + 1)(x - 1), \quad g(x) = \sqrt{x} + \frac{1}{x}.$$

10. (10 points) Let $f(x) = x^3 - 2x + 1$. Find an equation of the tangent line to the graph of $f(x)$ at the point $(0, 1)$. Also, find at which points on the graph the tangent line is horizontal.