

1. (10 points)

(a) State the definition of the derivative of a function.

(b) State the definition of the limit of a function.

2. (15 points; p134 #9)

(a) Find the derivative of the function  $f(x) = x^3 - 5x + 1$ , *using the limit definition of the derivative.*

(b) Find the equation of the tangent line to the curve  $y = x^3 - 5x + 1$  at  $x = 1$ .

(c) Find the equation of the tangent line to the curve  $y = x^3 - 5x + 1$  at  $x = 0$ .

3. (25 points; p125 #8, #10, #13; p92 #16, #21) Compute the following limits:

(a)  $\lim_{x \rightarrow -1} \frac{x^2 - x - 2}{x^2 + 3x + 2} =$

(b)  $\lim_{x \rightarrow -6^+} \frac{x}{x + 6} =$

(c)  $\lim_{x \rightarrow 8^-} \frac{|x - 8|}{x - 8} =$

(d)  $\lim_{x \rightarrow 1} \frac{x^3 - 1}{x^2 - 1} =$

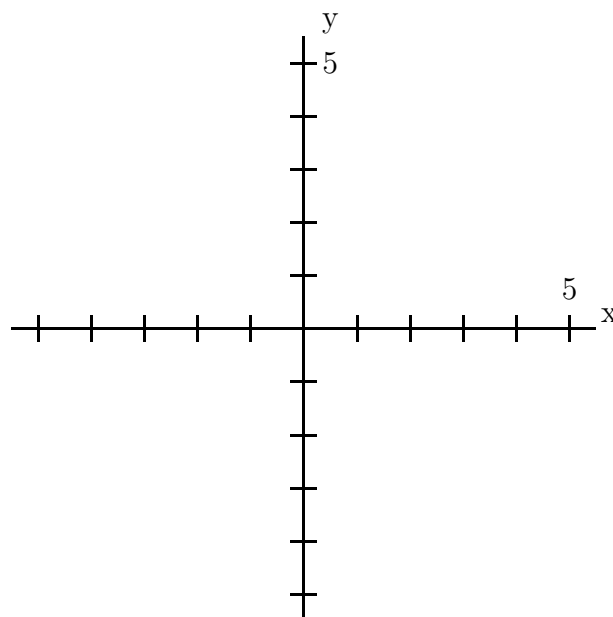
(e)  $\lim_{t \rightarrow 0} \frac{\sqrt{2-t} - \sqrt{2}}{t} =$

4. (8 pts; p48 #38) Given  $f(x) = \frac{1}{x-1}$  and  $g(x) = \frac{x-1}{x+1}$ , find and simplify the formulas for  $f(g(x))$  and  $g(f(x))$ .

5. (10 pts; p113 #34) For the function  $f(x)$  given below, check whether or not  $f(x)$  is continuous at  $x = -1$  and at  $x = 1$ . Explain your answer by computing the value of the function, the limit from the left, and the limit from the right.

$$f(x) = \begin{cases} 2x + 1 & \text{if } x \leq -1 \\ 3x & \text{if } -1 < x < 1 \\ 2x - 1 & \text{if } 1 \leq x \end{cases}$$

6. (7 pts; p47 #18) On the axes below, graph the function  $y = 2 + \frac{1}{x+1}$ .



7. (9 points) The derivative of the function  $f(x) = x^4 - 4x^3 + 4x^2 + 1$  is  $f'(x) = 4x^3 - 12x^2 + 8x$ . Use this formula to find the points on the curve  $y = x^4 - 4x^3 + 4x^2 + 1$  at which the tangent line to the curve is a horizontal line.

8. (6 points; p114 #43) Use the Intermediate Value Theorem to prove that the polynomial  $x^3 - 3x + 1$  has a root. Find an interval that contains this root.

8. (10 points; p145 #24) Use the limit definition of the derivative to find  $f'(x)$ , for the function  $f(x) = \frac{1}{x^2}$ .

page 1	/ 25
page 2	/ 25
page 3	/ 25
page 4	/ 25
Total	/100
Grade	