

Math 31 - Fall 2003

Review Problems

Name: _____

Instructions:

1. Read carefully and answer **all** questions. Show all work on the exam in the space provided (you may use the backs of pages if necessary).
2. Where appropriate, place your final answer in the boxes provided.
3. Unless otherwise specified, **give exact answers**. For example, write $\sqrt{2}$ not 1.414, write π instead of 3.1415, write $\frac{1}{3}$ instead of 0.3333.
4. Check your answers carefully.
5. Remember to sign the Honor Pledge.

I have neither given nor received any unauthorized help on this exam
and I have conducted myself within the guidelines of the University
Honor Code.

Pledge: _____

(5) 1. Give the appropriate ϵ, δ definition of $\lim_{x \rightarrow c} f(x) = L$.

(8) 2. Define $f(x) = \frac{x^2 - 25}{6x - 30}$ to make the function continuous at $x = 5$.

$f(5) =$

(10) 3. Use the **limit definition of the derivative** to calculate $f'(x)$ for $f(x) = 2x^2 + 3x - 1$

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4. Find each of the following limits (if it exists). If the limit does not exist, explain why.

(5) (a) $\lim_{x \rightarrow 0} \frac{\sqrt{x+3} - \sqrt{3}}{x}$

(5) (b) $\lim_{x \rightarrow 0} \frac{|x|}{x}$

(5) (c) $\lim_{x \rightarrow 0} \frac{\sin 2x}{5x}$

(10) 5. Find the equation of the tangent line to the graph of $\frac{x^4}{x^2+1}$ at the point where $x = 1$.

Please go on to the next page...

- (10) 6. Find the **coordinates** on the curve $y = (x-2)^2$ at which the tangent line is perpendicular to the line $y = 2x + 3$.

7. Calculate $f'(x) = \frac{dy}{dx}$ for each of the following functions. **Do Not Simplify!**

(5) (a) $f(x) = 2x^3 - \frac{3}{x^2} + \pi$

(5) (b) $f(x) = (3x^4 + 14x^3 - x^2 - 1)(4x^3 - 5)$

(5) (c) $f(x) = \frac{4x^3 + x}{x^2 - 3}$

8. For each of the following, draw a graph of a function $f(x)$ which is described.

(3) (a) $\lim_{x \rightarrow 0} f(x)$ does not exist, and $f(0) = 1$

(3) (b) $\lim_{x \rightarrow 0} f(x)$ exists, but $f(x)$ is not continuous at 0.

(3) (c) $\lim_{x \rightarrow 0} f(x) = 1$, but $f(x)$ is not differentiable at 0

(3) (d) $f'(0) = 0$

9. Find the following limits (if it exists). If it does not exist, state why.

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

(5) (b) $\lim_{t \rightarrow 4} \frac{t^2 - 5t - 6}{t - 4}$

(5) (c) $\lim_{x \rightarrow 3^-} \frac{x + 5}{\sin(|x - 3|)}$