

## Sample Exam #1

Math 150–Hughes

The use of a graphing calculator is not permitted on the test. You may use a scientific calculator. Show your work!

[30] 1. Find each limit. If the limit does not exist, explain why not.

a)  $\lim_{t \rightarrow -1} \frac{\frac{1}{t} + 1}{t + 1}$

b)  $\lim_{x \rightarrow 2^+} \frac{x^2 + x - 2}{x^2 - 4}$

c)  $\lim_{x \rightarrow 0} \frac{\sin^2 3x}{x^2}$

d)  $\lim_{x \rightarrow \infty} \frac{2x^2 - 7}{11x - 3x^2}$

e)  $\lim_{x \rightarrow \infty} (\sqrt{x^2 + 2x} - x)$

[8] 2. Suppose  $f(x) = \begin{cases} \frac{x^2 - 4}{x^2 - 2x}, & x \neq 0, 2 \\ 2, & x = 0 \\ 3, & x = 2 \end{cases}$ .

a) Find  $\lim_{x \rightarrow 2} f(x)$ .

b) Locate the discontinuities of  $f$ .

[8] 3. Find an equation of the line tangent to  $y = \frac{3}{x} + 1$  at the point  $(1, 4)$ .

[6] 4. The limit  $\lim_{h \rightarrow 0} \frac{\cos(\pi + h) + 1}{h}$  represents the derivative of some function  $f$  at some number  $a$ . State such an  $f$  and  $a$ .

[30] 5. Use differentiation rules to find the derivative of each function.

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

b)  $g(x) = \tan 3x - 2 \sec 3x$

c)  $p(x) = x^3 \cos x$

d)  $q(x) = \frac{3x^2 + x}{x + 4}$

e)  $h(x) = \sqrt{4x^2 + 3x}$

[8] 6. Use the (limit) definition of the derivative to find the derivative of  $f(x) = \sqrt{x}$ .

[10] 7. A ball is thrown upward from the top of a building. Suppose that its height in feet after  $t$  seconds is given by  $y = 32 + 64t - 16t^2$ .

a) Find the average velocity over the time period beginning when  $t = 0$  and ending when  $t = 1$ .

b) Find the instantaneous velocity when  $t = 1$ .