Math 130

Sample Test #2

Continuity

[1] Determine where the function $y = \frac{1}{x-2}$ is continuous at (a) x=0 (b) x=1 (c) x=2. If the function is discontinuous at either of the points, what type of discontinuity is it?

[2] Sketch the graph: h(x) = $\begin{cases} 3 + x & if\ x \leq 1 \\ 3 - x & if\ 1 < x \end{cases}$ Is h(x) continuous at 1? Why or why not?

[3] If $f(x) = \{|x - 3|\ \ if\ x \neq 3$ and f(x) is continuous at $x = 3$, what must f(3) equal?

[4] If $f(x) = \begin{cases} \cos(x)\ \ if\ x < 0 \\ 0\ \ if\ x = 0 \\ 1 - x^2\ \ if\ x > 0 \end{cases}$

Where is x discontinuous and why?

At which points is f continuous from the right, from the left, or neither? Sketch the graph.

Infinite Limits

[5] Find the limit of the following problems

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

(b) $\lim_{x\to\infty} \frac{x^2+2x}{x^5+3x^2}$

(c) $\lim_{t\to\infty} \frac{6x^4+x^7+3}{4x^4+3x^2+2}$

Horizontal and Vertical Asymptotes

[6] Find the horizontal and vertical asymptotes for the following equations

(a) $y = \frac{1+2x^2}{x^2-1}$

(b) $y = \frac{-8x-4}{2x^2-7x-4}$

(c) $y = \frac{x^2-4}{x-2}$

Derivatives

[7] Find the derivative of $f(x) = \frac{1}{2x-1}$ using the definition of the derivative

[8] Using the definition of a derivative, find $f'(x)$ when $f(x) = 2x^2 + 3x$

[9] Differentiate the following:

(a) $f(x) = 4x^7 + 16x^2 - 2\sqrt{x} + \frac{5}{x}$

(b) $y = (2x^3 - 5x^4 + 4)^5$

(c) $y = \sqrt{3x^2 + 4x + 6}$

(d) $f(x) = (x^2 - 3x)(4x + 5)$

(e) $y = (x^2 + 1)^3(x^3 - 1)^2$

(f) $f(x) = \frac{x^2+1}{1-3x}$

(g) $f(x) = \frac{x^2-6x+9}{x-3}$

[10] Find the equation of the tangent line to the function $y = \frac{4x}{x+2}$ at the point (2, 4). Write your answer in the $y = mx + b$ form.

[11] Find the points on the curve y = $3x^3$ + $4.5x^2$ + 2x + 8 where the tangent is horizontal.

[12] Find the derivative of the following logarithmic functions:

(a) $f(x) = log_2(1 - 3x)$

(b) $f(x) = ln\frac{(2t+1)^3}{(3t-1)^4}$

(d) $f(x) = \frac{lnx}{x^2}$

(e) $f(x) = log_5(xe^x)$

(f) $f(x) = \ln(e^{-x} + xe^{-x})$

(g) $f(x) = x^2\ln(2x)$

(h) $f(x) = [\ln(1 + e^x)]^2$

[13] A particle moves according to a law of motion $s = 2t^2 - 5t + 2$, $t \geq 0$, where t is measured in seconds and s in feet.

(a) Find the velocity at time t = _____

(b) What is the velocity at time t = 1? _____

(c) What is the particle's acceleration at time t? _____

(d) What is the acceleration at 4 seconds? _____

(e) What is the speed at 1 second? _____

(f) When is the particle at rest? _____

(g) When is the particle moving in the positive direction? _____

[14] Suppose that the cost in dollars for a company to produce *x* pairs of a new line of jeans is $c(x) = 1500 + 2x + .01x^2 + .0003x^3$. Find:

(a) The marginal cost of the function _____

(b) Find $c'(53)$ _____. What does it predict? _____

(c) What will it cost to introduce the 53rd pair? _____

[15] Find an equation of the tangent line to the graph of each equation at the specified point.

(a) y $= sinx + sin^2x$ (0,0)

(b)y = $(1 + 2x)^{10}$ (0,1)

[16] Find f', f'', f'''

(a) $f(x) = x^5 - 3x^4 + x^2 + 2$

(b) $f(x) = \frac{1}{2}x^7 - \frac{4}{5}x^6 - 2x^3 + 1$

(c) $f(x) = \frac{3}{x^3}$

(d) $f(x) = \frac{6}{\sqrt{x}}$