Final Exam Math 1190 sec. 51

Fall 2016

Name: ____

Your signature (required) confirms that you agree to practice academic honesty.

Signature: ____

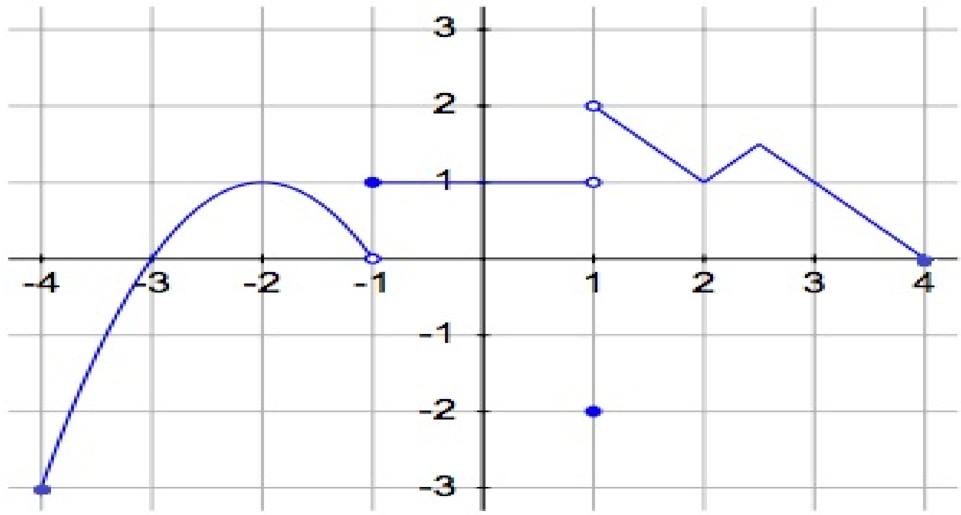
Problem	Points
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

INSTRUCTIONS: There are 10 problems; the point values are listed with the problems.

There are no notes, or books allowed and **no calculator is allowed. Illicit use of a calculator, smart phone, tablet, device that runs apps, or hand written notes will result in a grade of zero on this exam as well as a formal allegation of academic misconduct.**

To receive full credit, answers must be clear, complete, justified, and written using proper notation.

(1) (10 points) Use the graph of $y = f(x)$ shown to answer the following questions.



Evaluate, or state "DNE". (Explanations are **not** required.)

(a) $\lim_{x \to 1^-} f(x) =$

(b) $f(1) =$

(c) $f'(2) =$

(d) $\lim_{h \to 0} \frac{f(-2+h) - f(-2)}{h} =$

(e) $\lim_{x \to -1^+} f(x) =$

(f) $\lim_{x \to 3} f(x) =$

(g) Determine at least one interval over which $f''(x)$ is negative.

(h) Find the absolute maximum **value** of f on $[-4, 4]$ or state that there is not one.

(i) Find the absolute minimum **value** of f on $[-4, 4]$ or state that there is not one.

(j) State at least three x-values on the interval $(-4, 4)$ at which $f'(x)$ does not exists.

(2) (10 points) Find the absolute maximum and absolute minimum values of the function on the indicated interval. **You must show all of your work to receive full credit.**

$$f(x) = x^4 - 4x, \quad [-1, 2]$$

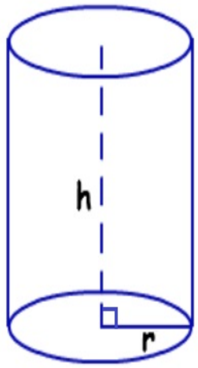
(3) (12 points) Evaluate each limit using any applicable technique. **You must show your work to receive credit.**

(a) $\displaystyle\lim_{x\to 4} \frac{\sqrt{x}-2}{x-4}$

(b) $\displaystyle\lim_{x\to -\infty} xe^{x}$

(c) $\displaystyle\lim_{x\to \infty} x^{1/x}$

(4) (6 points) A manufacturer needs to construct an open topped cylinderical metal can to be fitted with a plastic lid. The bottom and lateral surface is to be made out of 27π square inches of metal. Determine the radius and height of the can that will maximize its volume. **You must show your work to receive full credit. Provide your final answer in the space provided.**



The optimal dimensions are

Radius $r =$ ____________ inches

Height $h =$ ____________ inches

The following may or may not be useful:

The volume of a cylinder is $\pi r^2 h$.
The surface area of a sphere is $4\pi r^2$.
The can will be used to package onion dip.
The volume of a sphere is $\frac{4\pi}{3} r^3$.
Onion dip pairs well with potato chips.

(5) (10 points) Find the derivative of each function. **Do not leave compound fractions (fractions within fractions) in your answers.**

(a) $f(x) = xe^{2x}$

(b) $f(x) = \dfrac{\sec x}{\tan x + 1}$

(c) $g(t) = \sin^{-1}(t^3)$

(d) $y = \dfrac{\ln x}{x}$

(e) $h(x) = 4^x + \log_6(x)$

(6) (10 points) Find the equation of the line tangent to the graph of the curve $xy^3 + y - 4x^2 = 6$ at the point $(1, 2)$. Express your answer in the form $y = mx + b$.

(7) (10 points) Find all of the critical values of the function $f(x) = (x + 2)^2(x - 3)^3$.

(8) (12 points) Evaluate each definite integral.

(a) $\displaystyle\int_{\pi/4}^{\pi/2} \sin\theta \, d\theta$

(b) $\displaystyle\int_1^2 x(2-3x)\, dx$

(c) $\displaystyle\int_1^4 \frac{\sqrt{x}+1}{x}\, dx$

(9) (10 points) Consider the function $f(x) = \begin{cases} Ax^2 + 1, & x \leq -1 \\ 2 + 3x, & x > -1 \end{cases}$ where A is constant.

(a) Evaluate $\displaystyle\lim_{x \to -1^-} f(x)$

(b) Evaluate $\displaystyle\lim_{x \to -1^+} f(x)$

(c) Find all values of A such that f is continuous at -1.

(10) (10 points) A student paces the hall in a straight line outside of his calculus class so that his velocity is $v(t) = 3\cos t + 4\sin t$ feet per second.

(a) If he starts at the door of the classroom (the door is the origin), find a function $s(t)$ representing his position relative to the door (i.e. the origin) for all $t > 0$.

(b) Find the acceleration of the student at $t = \pi$ seconds. Include units in your answer.