Scrap paper - Tear this page off and don't turn it in

Formulas:

$$\frac{\mathrm{d}}{\mathrm{dx}} \sin x = \cos x$$
$$\frac{\mathrm{d}}{\mathrm{dx}} \cos x = -\sin x$$
$$\frac{\mathrm{d}}{\mathrm{dx}} \tan x = \sec^2 x$$
$$\frac{\mathrm{d}}{\mathrm{dx}} \cot x = -\csc^2 x$$
$$\frac{\mathrm{d}}{\mathrm{dx}} \sec x = \sec x \tan x$$
$$\frac{\mathrm{d}}{\mathrm{dx}} \csc x = -\csc x \cot x$$
$$\frac{\mathrm{d}}{\mathrm{dx}} \log_a x = \frac{1}{x \ln a}$$
$$\frac{\mathrm{d}}{\mathrm{dx}} a^x = a^x \ln a$$
$$\frac{\mathrm{d}}{\mathrm{dx}} \arcsin x = \frac{1}{\sqrt{1-x^2}}$$
$$\frac{\mathrm{d}}{\mathrm{dx}} \arccos x = -\frac{1}{\sqrt{1-x^2}}$$
$$\frac{\mathrm{d}}{\mathrm{dx}} \arctan x = \frac{1}{1+x^2}$$

Scrap paper

Name: _____ uNID: _____

Math 1310 Final exam

Show all of your work. Read all the questions carefully! You have until 10:00am to complete this exam. This exam is questions and 100 points total. Good luck!

1. Find the domains of the following functions:
   (a) (2 points) $f(x) = \ln(\sqrt{x+1})$
   (b) (2 points) $f(x) = \arcsin(x)$
   (c) (2 points) $f(x) = \arctan\left(\dfrac{1}{x}\right)$

2. (5 points) Consider the parametric curve given by
$$x(t) = 1 + \sqrt{t}, \quad y(t) = \frac{t+1}{t+2}.$$
   Find a cartesian equation for the curve by elminating the parameter t.

3. Compute the following limits:
   (a) (3 points) $\lim\limits_{x\to 3^-} \dfrac{x^2}{x-3}$
   (b) (3 points) $\lim\limits_{x\to 3^+} \dfrac{x^2}{x-3}$

4. Consider the function $f(x)$ that is defined on the interval $(0, \infty)$
$$f(x) = \ln(x) - \frac{x^2}{4}$$
   (a) (3 points) Find the x-value(s), if any, where $f(x)$ has zero slope.
   (b) (4 points) Find the interval(s) where $f(x)$ is increasing and decreasing.
   (c) (4 points) Find the point(s) of inflection, if any, for $f(x)$, and the intervals where $f(x)$ is concave up and concave down
   (d) (3 points) Based on the results from above, sketch a graph of $f(x)$, indicating the intervals and points in (a)-(c), correctly represent increasing and decreasing regions, and concavity.

5. Differentiate the following functions:
   (a) (3 points) $f(x) = x^3 + x - \dfrac{2}{x^2}$
   (b) (3 points) $f(x) = x^2 e^x$
   (c) (3 points) $f(x) = \tan^2 x$
   (d) (3 points) $f(x) = \sin(\sin(\sin(x))$

6. (a) (4 points) Solve for $\dfrac{dy}{dx}$, given

$$y^3 = \cos(x+y)$$

(b) (4 points) Now solve for $\dfrac{dy}{dx}$ given

$$xy^2 = x + y + 1$$

(c) (2 points) Using your answer for part b, find an equation for the line tangent to the curve $xy^2 = x + y + 1$ at the point $(1, 2)$.

7. (6 points) Suppose the function $f(t)$ represents the velocity of an object for t in the range $[0, \sqrt{\pi}]$.

$$f(t) = t\sin(t^2)$$

Find the distance traveled by the object from time $t = 0$ to time $t = \sqrt{\pi}$.

8. Compute the following integrals

(a) (4 points) $\displaystyle\int_{-1}^{0} (2x - e^x)\,dx$

(b) (4 points) $\displaystyle\int_{1}^{2} \frac{v^3 + 3v^6}{v^5}\,dv$

(c) (4 points) $\displaystyle\int \frac{x^3}{\sqrt{x^4+2}}\,dx$

(d) (4 points) $\displaystyle\int x^2 \sin x\,dx$

(e) (4 points) $\displaystyle\int_{0}^{\pi/2} \cos x \sin(\sin x)\,dx$

(f) (4 points) $\displaystyle\int_{0}^{\pi/2} \sin^2 x\,dx$

9. Compute the following integrals

(a) (3 points) $\displaystyle\int_{1}^{\infty} \frac{1}{x^2}\,dx$

(b) (3 points) $\displaystyle\int_{0}^{1} x^{-2/3}\,dx$

10. (5 points) Compute the derivative of $f(x) = x^x$

11. (5 points) Compute the integral: $\displaystyle\int_{-\infty}^{0} xe^x\,dx$

12. (1 point) Will you fill out an evaluation for this course?

A. Yes B. No

Extra credit

13. (6 points (bonus)) Compute the integral:

$$\int \frac{x^2 + x + 1}{(x^2 + 2)(x - 1)}\, dx$$

14. (4 points (bonus)) Compute the derivative of $x^{\sin x}$

Page	Points	Score
3	43	
4	57	
Total:	100	