Math 141 **Exam 2** **11/14/2014**

Name: _____

Answer the questions on the exam and not on a separate sheet of paper. No work is necessary for the True/False questions or the multiple choice. For all other questions, please circle your answers and show your work for full credit. There are 8 questions for a total of 100 points.

True or False: Please circle either true or false. No work is necessary.

_____ 1. (5 points) If $f(x) = \sin^{-1}(x^2 - 1)$, then $f'(x) = \dfrac{2x}{\sqrt{2x^2 - x^4}}$.

A. True B. False

_____ 2. (5 points) The derivative of $y = x^{\sqrt{x}}$ is $y' = x^{\sqrt{x}} \log x$.

A. True B. False

_____ 3. (5 points) Suppose that $f(x)$ is differentiable at $x = 2$ and satisfies $f(2) = 1$ and $f'(2) = 2$. Then the linearization of $f(x)$ at $a = 2$ is $L(x) = 5 - 2x$.

A. True B. False

_____ 4. (5 points) Write your own true statement.

A. True B. False

Multiple Choice: Please circle your answer. No work is necessary.

_____ 5. (5 points) Find $\dfrac{dy}{dx}$ if $\sin(x + y) = y^2 \cos x$.

A. $\cos(x + y) - 2y \sin x$

B. $\dfrac{y^2 \sin x + \cos(x + y)}{2y \cos x - \cos(x + y)}$

C. $\cos(x + y) - 2y \cos x - y^2 \sin x$

D. $\dfrac{\sin x + \cos(x + y)}{\cos x - \cos(x + y)}$

E. $\dfrac{2y \sin(x + y)}{\cos y - \cos x}$

Short Answer.

6. For the following parts (a)-(g), let $f(x) = \dfrac{2x}{x^2+4}$. When possible place your answers in interval notation.

   (a) (5 points) Find the critical points of $f(x)$.

   (b) (5 points) Determine the intervals of increasing and decreasing of $f(x)$.

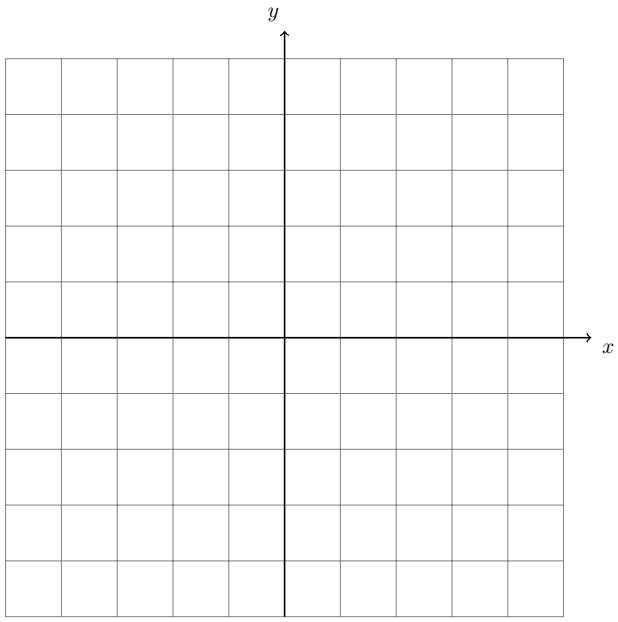
   (c) (5 points) Determine the relative extrema of $f(x)$.

   (d) (5 points) Find the absolute maximum and minimum of $f(x)$ on the interval $[-0.5, 3]$.

(e) (5 points) Determine the inflection points of $f(x)$.

(f) (5 points) Determine the intervals of concavity of $f(x)$.

(g) (5 points) Graph the function $f(x)$ on the interval $[-0.5, 3]$.



7. (20 points) Find the tangent to the folium of Descartes $x^3 + y^3 = 6xy$ at the point $(3, 3)$. Make sure and use complete sentences (and words) to justify your answer.

8. (20 points) An airplane is flying with a steady altitude of 6 miles on a flight path that will take it directly over a radar tracking station. The distance (defined by the line of sight) between the tracking station and the plane is decreasing at a rate of 400 miles per hour when the plane is 10 miles from the station (distance is still line of sight). At this point in time, what is the speed of the plane?