**Student Name: ________________________________________**

**Student ID Number: ___________Time of the Lecture: ________**

1. ***Do not open*** *this exam until you are told to begin.*
2. ***No*** *Questions are allowed during the examination.*
3. *This exam has **6** plus one bonus questions.*
4. *Do not separate the pages of the exam.*
5. *Scientific calculator are allowed but cannot be shared. Graphing Calculators are not allowed.*
6. *Turn off all cell phones and remove all headphones.*
7. *Take off your cap.*
8. *No communication of any kind.*

Student signature: ________________________________________

**Good Luck**

**Problem One** **10 Points**

Find the derivatives of the following functions (***do not simplify***):

1. $f(x) = 2^x x^2 + \ln(x^2) + 2$

2. $f(\theta) = \sqrt{1 - \tan(\theta^2 - 1)}$

**Problem Two** **10 Points**

1. $\int_0^1 x^2\sqrt{4 - x}\, dx$

2. $\int_0^{\frac{\pi}{2}} \sin(2x) - \sqrt{e}\ \, dx$

**Problem Three** **12 Points**

**a.** Use the second derivative test to find all local max and local min for the function

$$f(x) = x^3 - 2x^2 + x + 2$$

**b.** Find the absolute Max and absolute Min of $f$ on the interval $[-2, 2]$

**Problem Four** **8 Points**

Use Riemann sum to find

$$\int_{-4}^{0} x - 2\,dx$$

use an infinite number of rectangles and the right endpoints rectangles.

You may use the following formulas:

$\sum_{i=1}^{n} i = \frac{n(n+1)}{2}$, $\sum_{i=1}^{n} i^2 = \frac{n(n+1)(2n+1)}{6}$ $\sum_{i=1}^{n} i^3 = \frac{n^2(n+1)^2}{4}$

**Problem Five** **10 Points**

Given $f(x) = \frac{x}{(x+1)^2}$ and $f'(x) = \frac{1-x}{(x+1)^3}$ $f''(x) = \frac{2(x-2)}{(x+1)^4}$

Find

**a.** The domain of $f$

**b.** $x$ –and $y$ –intercepts

**c.** The vertical and horizontal asymptotes

**d.** The Interval(s) on which $f(x)$ is increasing and decreasing

**e.** The local max/min of $f(x)$, if any values (if any);

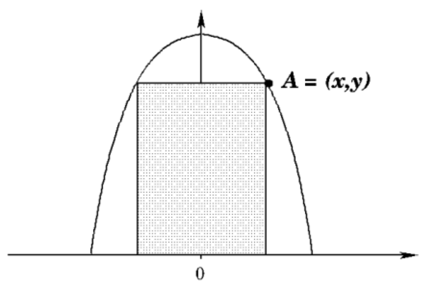
**f.** Intervals on which $f(x)$ is concave upward and downward

**g.** Any inflection points

**h.** Sketch the graph of $f$ (**label clearly** all intercepts, critical points and inflection points)

**Problem Six** **10 Points**

A rectangle is placed inside the region bounded by the parabola $y = 9 - x^2$ and the $x$ –axis (see figure).




**a.** Suppose the corner $A$ has coordinates $(x, y)$. Express the area of the rectangle in terms of $x$ and $y$.

**b.** Find the dimensions of the rectangle which has the maximum area.

**Bonus** **2 Points**

Write the following limit as a definite integral

$$\lim_{n\to\infty}\sum_{i=1}^{n}\left(2\left(\frac{i}{n}\right)^2+\frac{i}{n}\right)\left(\frac{1}{n}\right)$$