

Second Midterm Exam

Name _____

Student ID _____

Discussion Section (Time and GSI) _____

You may use one sheet of notes. No other notes, books or calculators allowed. There are 8 questions, on front and back. Write answers on the exam and turn in only this paper. Show enough work so that we can see how you arrived at your answers.

1. Find the equation of the tangent line to the hyperbola $x^2 + 2xy - y^2 + x = 9$ at the point $(2, 1)$.

2. Differentiate the function $(\ln x)^{\cos x}$.

3. The surface area of a melting spherical ball of ice decreases at a rate of $1 \text{ cm}^2/\text{min}$. How fast is the volume decreasing when the radius of the ball is 10 cm ? For your information, the surface area and volume of a sphere of radius r are given by $A = 4\pi r^2$ and $V = 4\pi r^3/3$.

4. Use a linear approximation or differentials to estimate the value of $\sqrt[4]{1.2}$

5. Use the Mean Value Theorem to determine whether the estimate for $\sqrt[4]{1.2}$ obtained by linear approximation is greater or less than the actual value.

6. Find the minimum and maximum values, and any local minima and maxima in the interior of the interval, of the function $f(x) = x^2 + x - 2|x|$ on $[-2, 2]$.

7. Find the limit

$$\lim_{x \rightarrow 1} \left(\frac{1}{\ln x} - \frac{1}{x-1} \right)$$

8. Find the area of the largest rectangle in the first quadrant with one side on the x -axis, one side on the y -axis, and the opposite vertex on the parabola $y = 27 - x^2$.