MATH 121 **October 30, 2020**
Midterm 3 - Practice Problems **Joanna Bieri**

Name: _____

	Score
1	/0
2	/0
3	/0
4	/0
5	/0
6	/0
Total	/0

Problem 1 (0 points)
Things you should be able to do for this exam:
OLD STUFF - that you still need to do to finish problems

1. Take the derivative or find a limit for a given function.
2. Recognize the derivative as a rate of change.
3. Describe what a function and its derivative mean.
4. Take the derivative of an implicit function.

NEW STUFF - that you definitely need to demonstrate and be able to explain

1. Find all critical points for a given function and classify them as local or global maxima or minima using both first and second derivative tests.
2. Find inflection points using the second derivative.
3. Explain why the first and second derivative tests work and what an inflection point is.
4. Find the best possible bounds for a function.
5. Given a function with parameters in it find the constants given information about critical points.
6. Calculate maxima and minima for story problems. For example, max area given perimiter, max volume given surface area, max area of a triangle or rectangle with one vertex on a curve, max or min of a given function along with interpretation of what the answer means, finding maximum profit.
7. Calculating rates and related rates for different story problems. For example, relating rate of increase in radius to increase in volume or answering questions about the rates of a given function.

Problem 2 (0 points)

1. A ball is thrown up into the air so that it's position in meters at time t seconds is given by $f(t) = 80t - 16t^2$. Answer the following questions about the ball:

(a) What do $f(1) = 64$ and $f'(1) = 48$ mean?

(b) What is velocity of the ball at time $t = 2$?

(c) At what time does the ball reach it's maximum height?

2. A spherical balloon is inflated so that its radius is increasing at a constant rate of 1 cm/s. At what rate is its volume increasing when the raduis is $5cm$. NOTE: Volume of a sphere $\frac{4}{3}\pi r^2$.

Problem 3 (0 points)

1. Using the following information, draw a sketch of the functions:

(a) $f(x)$ has a local minimum at $x = -2$ and global minimum at $x = 1$ and local maximum at $x = -1$. It crosses the x-axis at $x = -3$ and $x = 2$ and has inflection points at $x = 1.5$ and $x = 0$.

(b) $f'(x)$ changes from positive to negative at $x = -1$, changes from negative to positive at $x = 0$ and is undefined at $x = 1$. It also has an inflection point at $x = 0.5$.

2. Find the values of a and b so that the function $y = axe^{-bx}$ has a local maximum at the point $(2, 10)$.

3. For a positive constant, a, find the critical points of the function $f(x) = xe^{-ax}$. For what value of a does the function have a critical point at $x = 2$? Is this critical point a max or a min?

Problem 4 (0 points)

1. The total cost C(q) of producing q goods is given by $C(q) = 0.5q^2 + 2q + 10$. The company who produces this product can sell each one for 42 dollars. If Profit = Revenue - Cost, then what quantity of goods should they produce to maximize profit?

2. A closed cylinder with radius r has a surface area of $8cm^2$. What is the maximum volume for this cylinder? NOTE Volume $= \pi r^2 h$ and Surface Area $= 2\pi rh + 2\pi r^2$.

Problem 5 (0 points)

1. If you have 100 feet of fencing and you want to enclose a rectangular area against a long, straight, wall, what is the largest area that you can enclose?

2. A square has one side along the x-axis, one side on the y-axis, and one vertex on the function $f(x) = 1 - 3x^2$. What is the maximum area for this square?

Problem 6 (0 points)

CHALLENGE PROBLEM:

You run a small furniture business. You sign a deal with a customer to deliver up to 400 chairs, the exact number to be determined by the customer later. The price will be \$90 per chair up to 300 chairs and will be reduced by \$0.25 per chair (on the whole order) for every additional chair over 300 ordered. What are the largest and smallest revenues your company can make under this deal?