

# Written Homework 8

MATH 2200-98 ILSB Calculus 1

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## Instructions

1. When using the test for increasing/decreasing or concavity are required to organize your work in a table similar to those seen in the lesson notes and worksheet solutions. **If I have to search for your work you will receive no credit for the problem.** You are welcome to send me a picture or scan of your work *before* the assignment is due if you wish to receive feedback on how you are writing up your solutions.
2. **A word of warning:** You are required to justify your results for this assignment using *calculus*. Justification using graphs, tables of function values, or simple algebra alone will receive NO credit.
3. You are advised and encouraged to verify your results by graphing each function and verifying that your calculations and conclusions are correct. There is no reason not to get full credit on this homework! You do NOT need to include these graphs with your solutions. Desmos is an excellent online option for graphing. A link to this site is available in WyoCoures under Technology Resources.

## Assignment Problems

1. Find the intervals for which the function  $p(x) = x^2 - 2 \ln(x)$  is increasing and decreasing.

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2. Use the first derivative test to determine the maximum and minimum value(s) of the function  $f(x) = (x^2 - 4)^{2/3}$ .

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3. Use the second derivative test to determine the maximum and minimum value(s) of the function  $h(x) = e^x(x - 7)$ .

4. Find the intervals of concavity for the function  $h(x) = 2 + 2x^2 - x^4$ .

5. Find the points of inflection for the function  $q(x) = \ln(x^4 + 27)$ .

6. Coughing forces the trachea (windpipe) to contract, which affects the velocity  $v$  of the air passing through the trachea. The velocity of the air during coughing is

$$v(r) = k(R - r)r^2, \quad 0 \leq r < R$$

where  $k$  is a constant,  $R$  is the normal radius of the trachea, and  $r$  is the radius during coughing. What radius will produce the maximum air velocity?

7. A sales analyst determines that the revenue from sales of fruit smoothies is given by

$$R(x) = -60x^2 + 300x$$

where  $x$  is the price in dollars charged per smoothie for  $0 \leq x \leq 5$ . Determine the absolute maximum value of the revenue function and the price that maximizes this revenue.

8. Find the maximum and minimum values of  $k(x) = \sin(x) + \cos(x)$  on  $0 \leq x \leq 2\pi$



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9.  $g(x) = \frac{x^2}{x-1}$ . Note that this question is worth 20 points.

(a) State the first and second derivative of the function. (You do not need to show your work.)

(b) Find the critical points.

(c) Find the interval(s) of increase and/or decrease. Report your results by completing the table below. Note that there may be more columns than necessary.

Interval				
Test value				
Value of $g'(x)$				
Sign of $g'(x)$				
Behavior				

9. (Continued)

- (d) Find the interval(s) where the function is concave up and/or concave down. Report your results by completing the table below. Note that there may be more columns than necessary.

Interval				
Test value				
Value of $g''(x)$				
Sign of $g''(x)$				
Behavior				

- (e) Determine the point(s) of inflection (if any).

- (f) Use an appropriate *derivative test* to determine any maximum or minimum values. This means you must clearly indicate which test you are applying by name.