MA 123
Calculus I
Midterm II Practice Exam

Please Note: The midterm will **not** be restricted to the questions below. Although Midterm II is not directly cumulative, it will demand knowledge of concepts covered on the previous exam. Leave all answers in terms of any constants. Calculators and any other electronic devices are *not* permitted. The exam will be 75 minutes in duration.

1) Differentiate the following functions with respect to x

(a.) $f(x) = \dfrac{x^2 - 2\sqrt{x}}{x}$

(b.) $f(x) = e^{3x}\sqrt{x^2+1}$

(c.) $f(x) = e^x(\cos x + cx)$; Where c is some arbitrary constant

(d.) $f(x) = \sin(e^{\alpha x})$; Where α is some arbitrary constant

2) Use Logarithmic Differentiation to find the derivative of the following function

$$y = e^x\sqrt{x}(x^2+1)^{10}$$

3) Use Implicit Differentiation to find the equation of the tangent line to the following curve at the given point.

$$x^2 + 2xy - y^2 + x = 2 \qquad \text{at the point} \quad (1,2)$$

4) Let $f(x) = x^4 - 2x^2$.

(a.) Find the first and second derivatives of $f(x)$.

(b.) On which intervals is $f(x)$ increasing? decreasing ?

(c.) On which intervals is $f(x)$ concave upward ? concave downward ?

(d.) What are the inflection points of $f(x)$?

5) Water is leaking out of an inverted conical tank at a rate of 10,000 cm^3/min at the same time that water is being pumped into the tank at a constant rate. The tank has a height of 6 m and the diameter at the top is 4 m. If the water level is rising at a rate of 20 cm/min when the height of the water is 2 m, find the rate at which water is being pumped into the tank. (Hint: See Figure 3 on Page 264 for a better visualization)

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6) Let $f(x) = \dfrac{x^3}{x^2 - 4}$.

(a.) Find any/all local max and local min of $f(x)$.

(b.) Determine when $f(x)$ is increasing.

(c.) Determine when $f(x)$ is decreasing.

(d.) Find all asymptotes of $f(x)$.

(e.) Determine when $f(x)$ is concave upward.

(f.) Determine when $f(x)$ is concave downward.

(g.) Use your results from parts A through F to sketch the graph of $f(x)$ on the graph below.

Midterm II : Thurs, June 12th at 6 pm in MCS B33