Some extra practice problems for Exam 3, Fall 2022, Math 10250

This is not the length of a full exam. It is just a few extra problems that we had left over in making the "real" practice exam.

1. Let $f(x) = 2x^3 + 3x^2 - 12x$. Which numbers below are the location(s) of the absolute maximum on the interval $[0, 2]$?

   (a) $x = 2$

   (b) $x = 1$

   (c) $x = 1$ and $x = 2$

   (d) $x = 0$ and $x = 1$

   (e) $x = 0$ and $x = 2$

2. The owner of a restaurant in Duncan Student Center wants to sell Extra-Fancy Chicken Sandwiches. After some testing the demand function was determined to be

$$p = \frac{81}{x + 2}$$

   where p is the price in dollars of each sandwich and x is the number of sandwiches sold. The profit function was determined to be

$$P(x) = \frac{81x}{x + 2} - 2x$$

   where $P(x)$ is measured in dollars. What price should the owner charge to maximize profits? [Hint: the question is asking for the price, not the number sold.]

   (a) 10
   (b) 27
   (c) 3
   (d) 9
   (e) The higher the price he sets the more profit is gained.

3. Let $y^2 = xe^{-x}$. Use implicit differentiation to express $\dfrac{dy}{dx}$ as a function of x and y.

(a) $\dfrac{e^{-x} + xe^{-x}}{2y}$

(b) $\dfrac{e^{-x} - xe^{-x}}{2y}$

(c) $x + xe^{-x}$

(d) $2y(x + xe^{-x})$

(e) $2y(x - xe^{-x})$

4. Find the antiderivative: $\displaystyle\int \frac{1}{x} dx$

(a) $\dfrac{1}{x^2} + C$

(b) $\ln(x)$

(c) $-\dfrac{1}{x^2} + C$

(d) 1

(e) $\ln|x| + C$

5. Consider the function

$$f(x) = e^x x^3 (x^2 + 1).$$

(a) Use properties of the natural logarithm to write an expression for $\ln(f(x))$. **Simplify your answer as much as possible.**

(b) Compute $\dfrac{d}{dx} \ln(f(x))$ using the expression in part (a).

(c) Use part (b) to compute $\dfrac{d}{dx} f(x)$.

6. Aaron invests some sum of money in an account with a 6% annual interest rate. For both of the following problems, what we're looking for is the formula, not the actual numerical answer.

    (a) Find the effective rate (also known as APR) if the interest is compounded continuously.

    (b) Find the effective rate (also known as APR) if the interest is compounded monthly.