Math 112, Spring 2017, Midterm II

May 16, 2017

Name_____

TA/Section_____

Instructions.

- There are 4 questions. The exam is out of 40 points.

- You are allowed to use one page of notes written only on one side of the sheet in your own handwriting. It has to be the original and not a photocopy. **Hand in your notes with your exam paper.**

- You may only use a TI 30X IIS calculator.

- **Show your work**. If I cannot read or follow your work, I cannot grade it. You may not get full credit for a right answer if your answer is not justified by your work. Please ⬛ BOX ⬛ your final answer.

Copying from someone elses paper, using notes (unless expressly allowed by the teacher), altering an exam for re-grading, getting an advance copy of the examination, or hiring a surrogate test-taker are all flagrant violations of University policy.

Source: Student Academic Responsibility, University of Washington

Question	points
1	
2	
3	
4	
Total	

1. Evaluate the following.

(a) (2 points) $\dfrac{d}{dx} \ln \left(3x^2 + 3x + 5\right) =$

(b) (3 points) $\displaystyle\int \left(5x^3 - \sqrt{x} + e^{2x} - 8\right)\, dx =$

(c) (3 points) $\displaystyle\int_1^2 \dfrac{x^2 + 1}{x^2}\, dx =$

2. You produce and sell Petsetas. The marginal cost of producing Petsetas is given by the function

$$\mathrm{MC}(x) = 0.001x^3 + 0.12x^2 - 4x + 80$$

where the quantity x is in hundreds of Petcetas and the marginal cost MC is in dollars per Petseta. The marginal revenue, again in dollars per Petseta is given by

$$\mathrm{MR}(x) = 0.001x^3 - 0.12x^2 + 3.072x + 200.$$

You can see their graphs on the right. Your answers below should follow from calculations. You can use the graph for ideas and compare approximate values you see from graphs to your actual answers below.

Marginal Revenue and Marginal Cost

dollars per Petsetas

hundreds of Petsetas
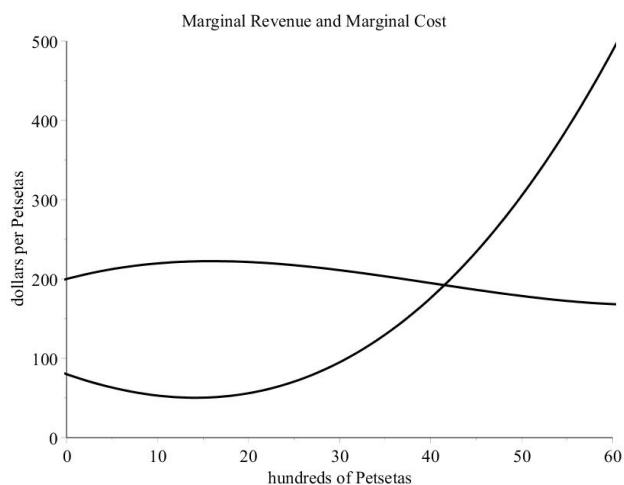
(a) (3 points) Find the quantity where the graph of marginal revenue has an inflection point.

(b) (3 points) Find the minimum value of marginal cost. Include units with your answer.

(c) (2 points) Set up an integral for the change in total cost when the quantity increases from 1000 Petsetas to 4500 Petsetas. Do not evaluate this integral.
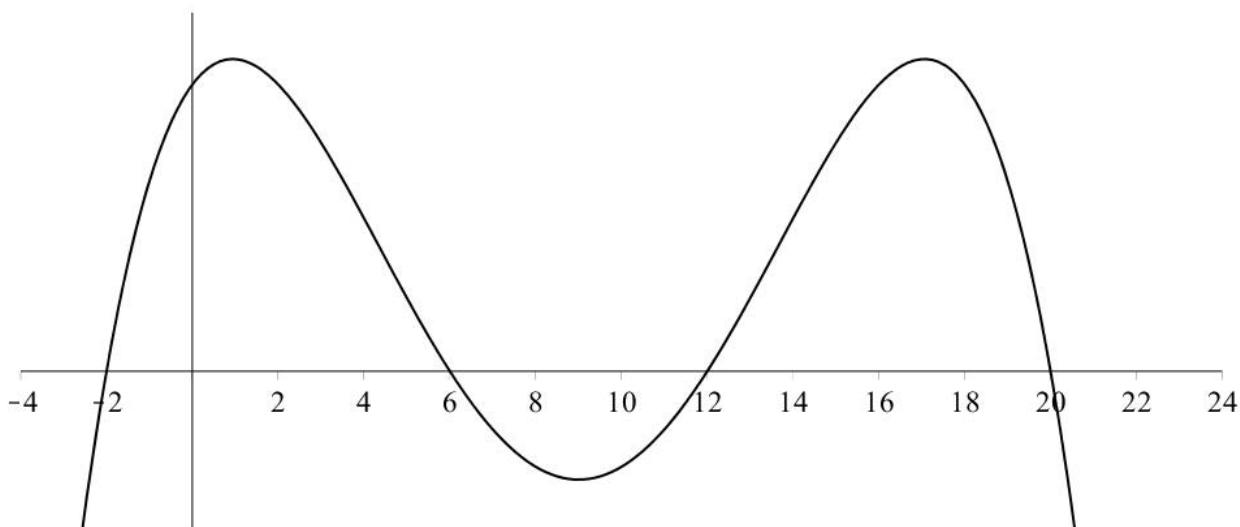
3

Here are the functions again:

$$\mathrm{MC}(x) = 0.001x^3 + 0.12x^2 - 4x + 80 \qquad\qquad \mathrm{MR}(x) = 0.001x^3 - 0.12x^2 + 3.072x + 200.$$

(d) (7 points) If the fixed costs are $30,000$, what is the maximum profit? Round to the nearest dollar and include units with your answer.

3. (8 points) The following is the graph of $y = f'(x)$, the **derivative of the function** $f(x)$. Circle the correct answer for each question. No explanation required.

(a) At $x = 3$, the value of f'' is   POSITIVE   NEGATIVE   CAN'T TELL

(b) On the interval $(0, 1)$ the graph of $f(x)$ is   CONCAVE UP   CONCAVE DOWN   CAN'T TELL

(c) The value $f(0)$ is   POSITIVE   NEGATIVE   CAN'T TELL

(d) On the interval $(7, 11)$ $f(x)$ is   INCREASING   DECREASING   CAN'T TELL

(e) The integral $\displaystyle\int_{10}^{16} f'(x)\, dx$ is   POSITIVE   NEGATIVE   ZERO

(f) The integral $\displaystyle\int_{14}^{16} f''(x)\, dx$ is   POSITIVE   NEGATIVE   ZERO

(g) The difference $f(9) - f(2)$ is   POSITIVE   NEGATIVE   ZERO

(h) At $x = 12$, the function $f(x)$ has a   MAXIMUM   MINIMUM   NEITHER

4. (a) (4 points) Find the critical point of the function $f(x) = e^{-0.5x^2}$ and use the second derivative to determine if it is a relative minimum or relative maximum.

(b) (5 points) If $f'(x) = 5e^{3x} - \frac{1}{1+4x}$ and $f(0) = 2$, what is $f(x)$?