MTH 126
Exam 3
Spring 2025

Formulas are on the last page, which you may pull off.

Calculators are allowed. You may use a scientific calculator or a graphing calculator (e.g., TI-84) but not one with CAS (e.g., no TI-89, no TI-Nspire CAS). You may not use a phone app.

Show work to support each answer, to be eligible for full credit. Be neat and organized. Clearly indicate your answers.

100 points possible. 8 problems at 12 points each, plus 4 free points.

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1. Find the derivative of the function. Don't simplify your answer.

$$g(x) = (x^8 + 10)^{-5}$$

2. Find the derivative of the function. Don't simplify your answer.

$$y = \sqrt{3x^2 + 5x + 1}$$

3. Find the third derivative of $y = \dfrac{2}{x^3}$

4. Suppose the revenue (in dollars) from the sale of a product is given by

$$R(x) = 30x + 0.9x^2 - 0.003x^3$$

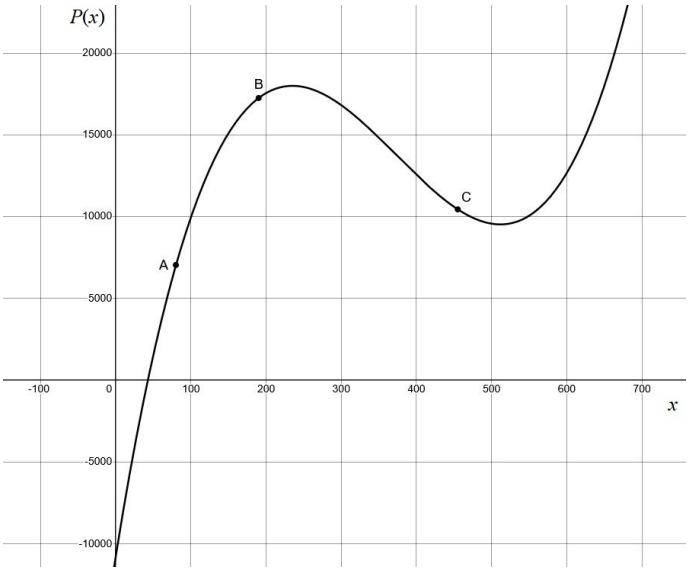
where x is the number of units sold.

(a) Find R'

(b) Find R''

(c) How fast is the marginal revenue $\overline{MR}$ changing when $x = 30$?

5. The graph of a company's profit function is shown. Use the graph to answer the following questions about points A, B, and C.



(a) Rank from smallest to largest the amounts of profit received at these 3 points.

(b) Explain your answer to (a). (Select the best answer.)

(i) The profit is represented by the slope at each point.

(ii) The profit is represented by the $P(x)$ coordinates.

(iii) The profit is represented by the x coordinates.

(c) Is there a loss at any of these 3 points? If so, which?

(d) Rank from smallest to largest the marginal profit at these 3 points.

(e) Explain your answer to (d). (Select the best answer.)

(i) The marginal profit is represented by the slope at each point.

(ii) The marginal profit is represented by the $P(x)$ coordinates.

(iii) The marginal profit is represented by the x coordinates.

(f) Is marginal revenue negative at any of these 3 points? If so, which?

6. Consider the following.

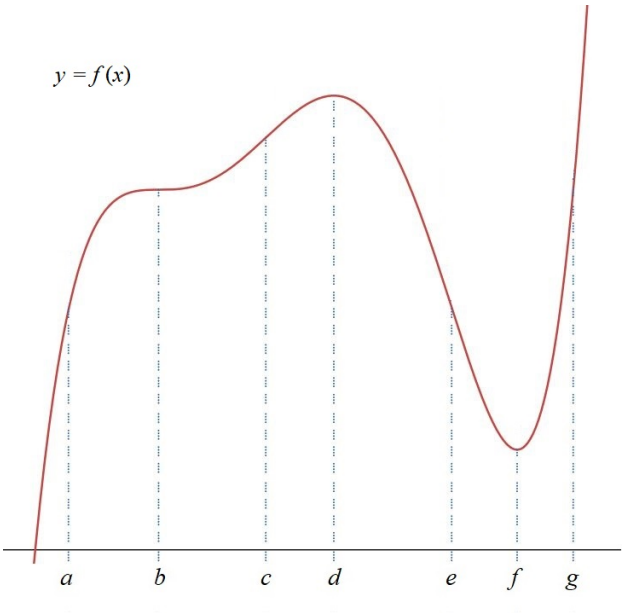
$$f(x) = \tfrac{1}{3}x^3 - 4x^2 + 7x$$

(a) Find $f'(x)$

(b) Find the critical values of f (just find the x-values).

(c) Make a sign diagram and determine the relative maxima and minima for f (just find the x-values).

7. Use the indicated x-values on the graph of this function to answer the following questions about the graphed function.



(a) Find the intervals where $f''(x) > 0$

(b) Find the intervals where $f''(x) < 0$

(c) Find the x-coordinates of three points of inflection.

8. Suppose the total cost function for a product is

$$C(x) = 90 + 0.4x^2 \text{ dollars.}$$

(a) How many units x should be produced to result in a minimum **average** cost per unit? Use calculus methods.

(b) Find the minimum average cost per unit.