MTH 126
Exam 3, Form A
Fall 2023

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. 9 problems at 11 points each, plus 1 free point.

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

$$h(x) = \frac{9x^2 + 2x + 8}{6 + 7x}$$

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

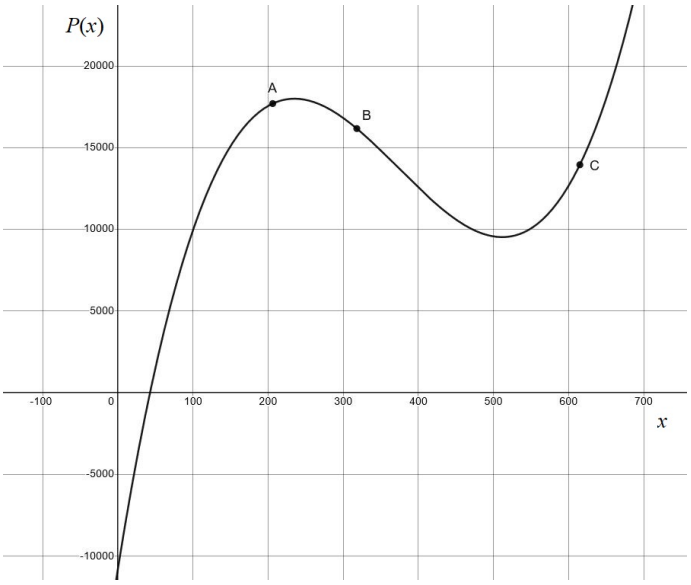
$$f(x) = \frac{7}{3}(x^7 - 4x^6 + 5)^{12}$$

3. Find the derivative of the function. **Simplify** your answer.

$$y = \frac{9}{5}x^{10}(5x^9 - 2)^5$$

4. Find the third derivative of $y = \dfrac{2}{x^6}$

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.

$$f(x) = 3x^5 - 125x^3 + 4000$$

(a) Find the critical values of f (for the part, just find the x-values).

(b) Make a sign diagram and determine the relative maxima and minima for f.

relative maximum $(x, y) =$

relative minimum $(x, y) =$

7. Consider the function

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

Find $f'(x)$

Find $f''(x)$

Find the x-values of the *possible* points of inflection of f.

Determine the intervals on which the function f is concave up.

Determine the intervals on which the function f is concave down.

Find the points of inflection of f.

$(x, y) =$

$(x, y) =$

8. Suppose the total cost function for a product is

$$C(x) = 245 + 0.2x^2 \text{ dollars.}$$

(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.

9. Find the derivative of each function. Don't simplify.

(a) $h(x) = 3\ln(9x + 4)$

(b) $k(x) = 4e^{10x^3}$

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Exam 3, Form B
Fall 2023

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

100 points possible. 9 problems at 11 points each, plus 1 free point.

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

$$h(x) = \frac{8x^2 + 5x + 7}{3 + 4x}$$

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

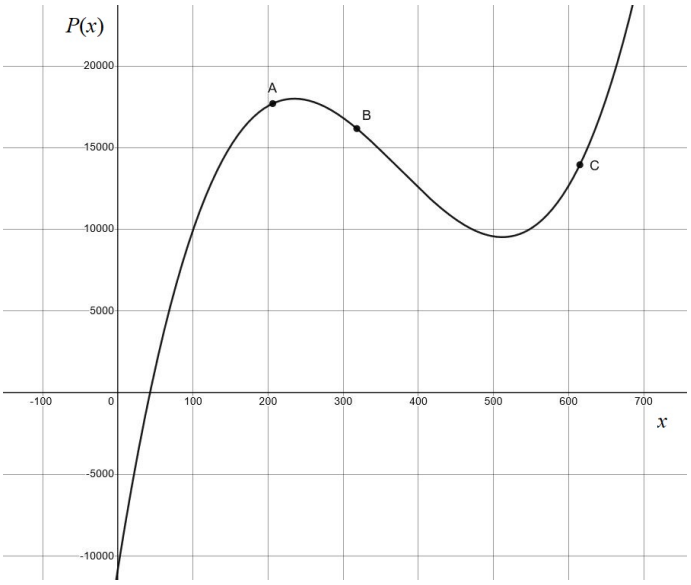
$$f(x) = \frac{8}{3}(x^7 - 3x^6 + 9)^{12}$$

3. Find the derivative of the function. **Simplify** your answer.

$$y = \frac{9}{5}x^{10}(5x^9 - 2)^5$$

4. Find the third derivative of $y = \dfrac{2}{x^7}$

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.

$$f(x) = 3x^5 - 125x^3 + 6000$$

(a) Find the critical values of f (for the part, just find the x-values).

(b) Make a sign diagram and determine the relative maxima and minima for f.

relative maximum $(x, y) =$

relative minimum $(x, y) =$

7. Consider the function

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

Find $f'(x)$

Find $f''(x)$

Find the x-values of the *possible* points of inflection of f.

Determine the intervals on which the function f is concave up.

Determine the intervals on which the function f is concave down.

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$(x, y) =$

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8. Suppose the total cost function for a product is

$$C(x) = 405 + 0.2x^2 \text{ dollars.}$$

(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.

9. Find the derivative of each function. Don't simplify.

(a) $h(x) = 5\ln(4x + 9)$

(b) $k(x) = 8e^{10x^3}$