

Math 19 E
Spring 2019
Exam 3
April 18
Version B

Name: _____

This exam contains 6 pages and 6 questions. Total of points is 100. For full credit you must show your work. Partial credit may be given for incorrect solutions if sufficient work is shown. Messy/unorganized answers may be penalized, even if correct.

Grade Table (for teacher use only)

Question	Points	Score
1	20	
2	20	
3	18	
4	20	
5	10	
6	12	
Total:	100	

HONORS PLEDGE (sign after exam is completed): I have neither given nor received aid on this exam, nor have I observed a violation of the UVM Code of Academic Integrity.

Signature: _____

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1. (20 points) For the function $f(x) = x^3 - 12x^2 + 45x$
- (a) (6 points) Calculate the first derivative of f .

 - (b) (6 points) Find the partition numbers of f' .

 - (c) (6 points) Find the intervals where f is increasing/decreasing.

 - (d) (2 points) Find any local extrema. Make sure to specify whether each is a maximum or a minimum.

2. (20 points) For the function $f(x) = x^3 - 12x^2 + 45x$ from the previous page

(a) (6 points) Calculate the second derivative of f .

(b) (6 points) Find the partition numbers of f'' .

(c) (6 points) Find the intervals where f is concave up/down.

(d) (2 points) Find any points of inflection.

3. (18 points) For the function $f(x) = x^3 - 9x^2 + 15x$

(a) (6 points) Calculate the first derivative of f .

(b) (6 points) Find the critical numbers of f .

(c) (6 points) Find the absolute maximum and minimum on the interval $[0, 4]$.

4. (20 points) Evaluate the following limits. Use L'Hopital's rule if it applies – do NOT factor.

(a) (10 points)

$$\lim_{x \rightarrow 7} \frac{x - 7}{x^2 + 6x - 91}$$

(b) (10 points)

$$\lim_{x \rightarrow 0} \frac{e^{2x} - 1 - 2x}{x^2}$$

5. (10 points) Evaluate the integral

$$\int (x^4 + 9x^2 + \sqrt{x} - 3)dx$$

6. (12 points) Since 1950, U.S. consumption of renewable energy has been growing at a rate (in quadrillion Btu per year) given by

$$f'(t) = 0.002t + 0.03$$

where t is years after 1950.

- (a) (8 points) Find $f(t)$ by taking the integral $\int f'(t)dt$.

- (b) (4 points) In 2016, U.S. consumption of renewable energy was 9.97 quadrillion Btu – that is, **$f(66) = 9.97$** . Solve for C and use $f(t)$ to predict the U.S. consumption of renewable energy in 2030 ($t = 80$).