Math 19 E **Name:** ______________________
Spring 2019
Final Exam
May 6
Version B

This exam contains 7 pages and 7 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	20	
4	12	
5	8	
6	8	
7	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: ____

1. (20 points) Evaluate the following indefinite integrals

   (a) (8 points)

$$\int (6x^8 - 5x^4 + 3)dx$$

   (b) (6 points)

$$\int (8x^3 + 2)e^{x^4+x}dx$$

   (c) (6 points)

$$\int \frac{6x-1}{3x^2-x}dx$$

2. (20 points)

(a) (6 points) Given that

$$\frac{d}{dx}\left(x\ln(x) - x\right) = \ln(x).$$

Find the particular antiderivative of

$$\ln(x)$$

which passes through the point $(1, 0)$.

(b) (6 points) Given that

$$\int_0^9 f(x)dx = 5; \qquad \int_0^7 g(x)dx = 2; \qquad \int_7^9 g(x)dx = 6$$

Compute $\int_0^9 (2f(x) + g(x)dx$.

(c) (8 points) Compute the definite integral

$$\int_6^8 (7x+3)dx$$

3. (20 points) When evaluating limits make sure to justify your answer. Write DNE if a limit does not exist.

   (a) (6 points) Evaluate

$$\lim_{x \to 8} \frac{x-7}{x-8}$$

   (b) (6 points) Evaluate

$$\lim_{x \to 0} \frac{x^2}{e^{3x} - 3x - 1}$$

   (c) (8 points) Find all horizontal and vertical asymptotes of

$$f(x) = \frac{x^2 - 4}{5(x^2 - 6x + 8)}$$

4. (12 points) Compute the following derivatives

   (a) (6 points)

$$\frac{d}{dx}\left(x^5 + \ln(1+x^5)\right)$$

   (b) (6 points)

$$\frac{d}{dx}\left(e^x(x^2+2x+1)^8\right)$$

5. (8 points) Find the equation of the tangent line to the function

$$f(x) = x^3 + x + 1$$

   at the point $(0, 1)$.

6. (8 points) Find y' given that

$$xy - y^3 - e^x = 0$$

7. (12 points) For the function $f(x) = x^3 - 9x^2 + 15x$

(a) (8 points) Find the intervals where f is increasing/decreasing

(b) (4 points) Find any local maxima or minima.

Bonus (3 pts) The 3rd-degree Taylor polynomial approximation for $f(x)$ at $x = 1$ is defined to be

$$p(x) = f(1) + f'(1)x + \frac{1}{2}f''(1)x^2 + \frac{1}{6}f'''(1)x^3$$

where $f'(1)$, $f''(1)$, and $f'''(1)$ are the 1st, 2nd, and 3rd derivatives of f evaluated at $x = 1$.

Compute the 3rd-degree Taylor polynomial at $x = 1$ for $f(x) = \ln(x)$.