Math 19 A&B **Name:** _____
Fall 2019
Final Exam
Version 1

This exam contains 8 pages and 8 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	15	
2	15	
3	15	
4	8	
5	15	
6	8	
7	8	
8	16	
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. (15 points) Evaluate the following indefinite integrals

   (a) (5 points)

$$\int (8x^4 - 2x^2 + 16)dx$$

   (b) (5 points)

$$\int \frac{4x^3}{\sqrt{x^4 - 1}}dx$$

   (c) (5 points)

$$\int (x^3 + 13x)^6(9x^2 + 39)dx$$

2. (15 points)

(a) (5 points) Given that

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

Find the particular antiderivative of

$$f(x) = \ln x$$

which passes through the point $(1, 6)$.

(b) (5 points) Estimate the area under $f(x) = 8x + 6$ on $[1, 10]$ using $n = 3$ right rectangles.

(c) (5 points) Compute the definite integral

$$\int_1^{10} (8x + 6)dx$$

3. (15 points) Evaluate the following limits. Make sure to briefly justify your answer. If a limit does not exist, determine if it is $+\infty$ or $-\infty$ (if neither, write DNE).

   (a) (5 points)

$$\lim_{x\to 6} \frac{1}{(x-6)^2}$$

   (b) (5 points)

$$\lim_{x\to \infty} \frac{e^x + 4x}{8x+1}$$

   (c) (5 points)

$$\lim_{x\to \infty} \frac{x^3 + 2x - 1}{9x^3 + 16x^2}$$

4. (8 points) Consider the function

$$f(x) = x^2 - 4x + 5.$$

Use the limit definition of the derivative to compute $f'(x)$. No credit will be given for using shortcuts on this problem.

(a) (2 points)

$$f(x+h) =$$

(b) (2 points)

$$f(x+h) - f(x) =$$

(c) (2 points)

$$\frac{f(x+h) - f(x)}{h} =$$

(d) (2 points)

$$f'(x) =$$

5. (15 points) Compute the following derivatives. You may use shortcuts.

(a) (5 points)

$$\frac{d}{dx}\left(6x^5 - 2\sqrt{x} + 4 + \ln x\right)$$

(b) (5 points)

$$\frac{d}{dx}\left(\frac{1-2x^4}{1-x^3}\right)$$

(c) (5 points)

$$\frac{d}{dx}\left(x^3 e^{-x^2}\right)$$

6. (8 points) Consider the function

$$f(x) = x^3(x-7)^4$$

(a) (4 points) Find the equation of the tangent line at $x = 3$.

(b) (4 points) Find where the tangent line is horizontal.

7. (8 points) Find y' for the implicit curve defined by the equation

$$\ln y - xy = x.$$

8. (16 points) For the function $f(x) = x^3 - 6x^2 - 15x + 12$

   (a) (5 points) Find the intervals where f is increasing/decreasing

   (b) (1 point) Find any local maxima or minima.

   (c) (5 points) Find the intervals where f is concave up/concave down

   (d) (1 point) Find any points of inflection.

   (e) (4 points) Find the absolute maximum and absolute minimum of f on $[-2, 4]$.