Math 19 E
Spring 2019
Exam 2
March 20
Version A

Name: _____

This exam contains 7 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	40	
2	10	
3	10	
4	20	
5	10	
6	10	
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. (40 points) Calculate the derivatives of the following functions.

   (a) (8 points)
   $$h(x) = 7x^4 - 9x + 10$$

   (b) (8 points)
   $$h(x) = 10\ln(x^2 + 2x + 1)$$

   (c) (8 points)
   $$h(x) = \frac{1 - e^x}{1 + x^2}$$

(d) (8 points)
$$h(x) = (x+1)^4 \ln(x)$$

(e) (8 points)
$$h(x) = e^{x^2 + 12x}$$

2. (10 points) For the function $h(x) = e^{x^2+12x}$ from Problem 1(e), find the equation of the tangent line to $h(x)$ when $x = 0$.

3. (10 points)

(a) (5 points) Suppose $h(x) = \dfrac{f(x)}{g(x)}$ and suppose we know that $f(3) = 1$, $f'(3) = 3$,

   $g(3) = 4$, and $g'(3) = 3$. Calculate $h'(3)$.

(b) (5 points) Consider the function $T(x)$ defined as

$$T(x) = \ln\left(\frac{f(x)}{x^2 g(x)}\right).$$

   Find $T'(x)$. Hint: use properties of logarithms to simplify.

4. (20 points) For the implicit curve defined by the equation: $x^2 + y^2 = e^y$

    (a) (10 points) Use implicit differentiation to find $\dfrac{dy}{dx}$.

    (b) (5 points) Find the equation of the tangent line at the point $(1, 0)$.

    (c) (5 points) For what value(s) of x will the tangent line to the curve be horizontal.

5. (10 points) A 40-foot ladder is placed against a wall. If the top of the ladder is sliding down the wall at 4 feet per second, at what rate is the bottom of the ladder moving away from the wall when the bottom of the ladder is 20 feet away from the wall?

6. (10 points) Find the intervals on which $f(x)$ is increasing and the intervals on which $f(x)$ is decreasing.

$$f(x) = x^3 - 48x + 3$$

Hint: make a sign chart for the derivative of f.