Name ____ March 10, 2017

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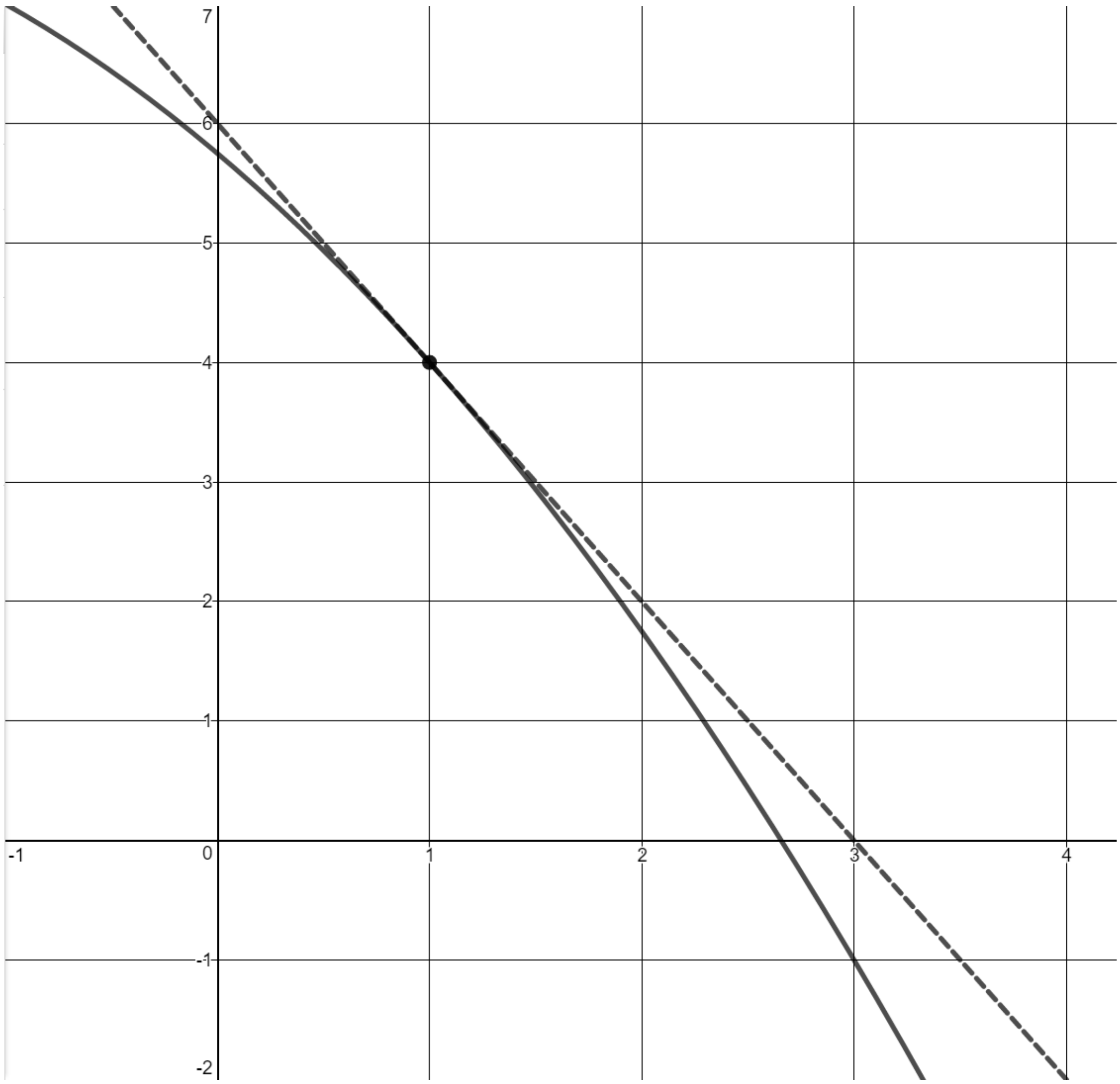
Instructions: ***This is page 1 of your exam.*** *There are further instructions on the back.*

1. I used Desmos to draw the graph of $f(x)$ and a tangent line to f.



(a) Linearly approximate $f(.97)$. (Make it clear what a and h are.) [10 pts]

(b) Using the Newton-Raphson method with $c_0 = 1$, find c_1. [5 pts]

(c) Draw, directly on the graph above, the line that would allow you to find c_2. (The slope doesn't have to be perfect. c_2 is actually quite close.) [5 pts]

Further instructions: No calculators (duh). You'll always be graded on the work you show. Do problem k on page k and write ***your name*** *and* ***your discussion leader's name*** *on each page. Problem values are marked. I strongly recommend not working in order, but I'm not the one taking the exam. The time for the test is 50 minutes; you can hand it in and leave whenever, but it is never a sign of weakness to use all the time that you have.*

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2. (a) Take the derivatives of the following functions. Please do not simplify.
   i. $a(x) = 2^x - e^2$ [4 pts]
   ii. $b(x) = \sin^3(4x)$ [4 pts]

   (b) Let $c(x) = f(g(x))$ and $d(x) = e^{f(x)}$, where

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
1	5	11	2	7
2	3	8	4	5
7	-2	-1	-3	-4

   Find $c'(1)$ and $d'(1)$. [8 pts]

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3. Define a curve implicitly by the equation

$$\sin(x - y) = \sin(xy).$$

   (a) Verify that $(\pi, 0)$ is on the curve. [4 pts]
   (b) Find the equation of the tangent line to the curve at the point $(\pi, 0)$. (Note that I did *not* ask you to solve for dy/dx in general.) [12 pts]

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4. Prove that $h(t) = \sin(t)\cos(t)$ is a solution to the differential equation $h'' = -kh$ for some positive number k. What is k? [16 pts]

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5. Using the facts that $e^{-0} = 1$ and $y = e^{-x}$ satisfies the differential equation $y' = -y$, use two-step Euler's method to approximate e^{-1}. (Note: e^{-1} is between 0 and 1.) [16 pts]

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6. A 5-foot ladder slides away from a wall at 2 feet per second. How fast is the top of the ladder sliding down the wall when the bottom of the ladder is 4 feet from the wall? [16 pts]