

NAME: _____

TQS 124

CALCULUS & ANALYTIC GEOMETRY
EXAM # 2

Autumn 2007

Read through the entire test before beginning. The question sheet should have 6 (plus one bonus) questions. You are to write your answers on the blank white paper provided. Please

- write on only one side of a piece of paper;
- put your name on each piece of paper;
- clearly label each solution;
- keep your solutions in numbered order.

You may use your calculator and ask me questions if you find a problem unclear. Please be sure to show your work. *Unsupported answers will be counted as minimally correct.*

If you have time and the inclination, please consider filling out the *Reality Check*. I am asking you to reflect on how well you think you did on the exam. The student(s) who guess(es) closest to their actual score will be given a 2 point bonus. (If you know your score exactly, the bonus increases to 3 pts.)

Good luck and remember—you know quite a lot. Rely on your instincts and common sense. If something doesn't seem right, ASK! If you have no idea how to get started on a problem, ASK! If you are stuck, ASK! The worst thing that can happen is I look at you and say "You should know that."

Problem	Grade	Reality Check
1	/40	
2	/24	
3	/8	
4	/8	
5	/8	
6	/12	
*	/5	
Total	/100	

1. For each of the following problems, formulate the requested information. Circle your final answer (/40)
— You need **not** simplify your work.

(a) Let $y = \sin(t) + t^4$. Find $\frac{dy}{dt}$.

(b) Let $z = \frac{1}{\cos(x)}$. Find $z'(\pi/4)$.

(c) Let $G(r) = r \cdot e^r$. Find $G'(r)$.

(d) Let $y = \cos(\ln(t))$. Find $\frac{dy}{dt}$.

(e) Let $y = \frac{\sin x}{x^2 \cos^2 x}$. Find y' .

2. For differentiable functions f and g , you are given the following information: (/24)

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
0	1	0.7	-1	10
1	2	1.4	0	6
2	4	2.8	3	.5
3	8	5.5	0	-3

(a) If $h(x) = g(x)/f(x)$, find $h'(2)$.

(b) If $j(x) = g(f(x))$, find $j'(1)$.

(c) If f^{-1} is the inverse function of f (i.e. $f \circ f^{-1}(x) = x$), find $\left. \frac{df^{-1}}{dx} \right|_{x=8}$.

3. Find $\frac{dy}{dt}$ if (/8)

$$1 + t = \sin(ty^2).$$

4. Find the linearization of $y = xe^{-x}$ at the point $(-1, -e)$. (/8)

5. A baseball diamond is a square with side 90 ft. A batter hits the ball and runs toward first base with a speed of 24 ft/s. At what rate is his distance from third base increasing when he is halfway to first base? (/8)

6. **Essay Question.** You may answer the question posed for full credit (12 pts) or propose your own essay question and answer for partial credit (9 pts max). If you choose the second option, be sure to clearly state your *well-posed* question. You are to write a paragraph presenting your answer and reasons why it is correct. You may wish to illustrate your discussion with graphs or other diagrams. (/12)

Fully discuss the relevance of the following quote from French mathematician Joseph Fourier in the context of the material from Chapter 3.

Mathematics compares the most diverse phenomena and discovers the secret analogies that unite them.

- *. **Bonus Question.** Explain (and I do mean *really* explain) one mathematical topic that you studied to prepare for this examination but feel you did not get the opportunity to adequately show your knowledge. (/5)