

Your Name

Your Signature

Student ID #

Quiz Section

--	--

Professor's Name (check one)

Ebru Bekyel

☐

Charles Camacho

☐

Jonah Ostroff

☐

TA's Name

- CHECK that your exam contains 8 problems on 6 double-sided pages, including this cover sheet. There is one blank page at the front and two blank pages at the back reserved for scratch work or extra space.
- This exam is closed book. You may use one $8\frac{1}{2}'' \times 11''$ sheet of notes and a TI-30X IIS calculator. Do not share notes or calculators.
- Unless otherwise specified, you should give your answers in exact form. (For example, $\frac{\pi}{4}$ and $\sqrt{2}$ are in exact form and are preferable to their decimal approximations.)
- In order to receive full credit, you must show all of your work.
- **Write your answers in the provided blanks.**
- If you need more room, use the back of the first page or either side of the last page **and indicate that you have done so.**
- **Do not write within 1 centimeter of the edge of the page.**
- Raise your hand if you have a question.

Problem	Total Points	Score
1	12	
2	12	
3	12	
4	12	
5	12	

Problem	Total Points	Score
6	12	
7	14	
8	14	
Total	100	

You may use this page for scratch-work.

All work on this page will be ignored unless you write & circle “see first page” below a problem.

1. Parts (a) and (b) are not related.

- (a) (6 points) Find parametric equations for the line through the point $(0, 3, 2)$ that is parallel to the plane $x + y + z = 1$ and perpendicular to the line $x = t, y = 3 - t, z = 2 + 2t$.

Parametric equations: _____

- (b) (1.5 points each) Consider the quadric surface $x^2 + 2z^2 = y^2$. For each of the following planes, identify the trace of the quadric surface in that plane.

Circle one answer for each part. You do not have to show any work.

i. $x = 1$:	point	line	pair of lines	circle
	ellipse	parabola	hyperbola	does not exist
ii. $y = 1$:	point	line	pair of lines	circle
	ellipse	parabola	hyperbola	does not exist
iii. $z = 0$:	point	line	pair of lines	circle
	ellipse	parabola	hyperbola	does not exist
iv. $y = 0$:	point	line	pair of lines	circle
	ellipse	parabola	hyperbola	does not exist

2. (12 points) Find the equation of the tangent plane to the surface S at the point $P(4, -1, 5)$ given that the two curves

$$\mathbf{r}_1(t) = \langle 2t^2 + 3t + 5, 4t + 3, 4 - t^3 \rangle$$

and

$$\mathbf{r}_2(s) = \left\langle s^2, \frac{2}{s} - s, 2s + 1 \right\rangle$$

are on the surface S and they intersect at the point $P(4, -1, 5)$.

Give your answer in standard form: $Ax + By + Cz = D$.

Tangent plane (in standard form): _____

3. (12 points) Find the linear approximation for

$$g(x, y, z) = 4\sqrt{x^2 + y^2} + 5\sqrt{4y^2 + z^2}$$

at the point $(3, 4, 6)$ and use it to approximate the value $g(2.97, 4.01, 6.04)$. Round your answer to three digits after the decimal.

$$L(x, y, z) = \underline{\hspace{10cm}}$$

$$g(2.97, 4.01, 6.04) \approx \underline{\hspace{10cm}}$$

4. (12 points) Find and classify all critical points for the function

$$f(x, y) = -\frac{1}{4}x^4 + \frac{2}{3}x^3 + 4xy - y^2.$$

Points **and** classification: _____

5. (12 points) Evaluate the integral by converting to polar coordinates:

$$\int_0^{3/2} \int_{(\sqrt{3})x}^{\sqrt{9-x^2}} 2xy \, dy \, dx$$

Answer: _____

6. (12 points) Find the y -coordinate $\bar{y}$ of the center of mass of the lamina with density function $\rho(x, y) = x$ that occupies the region D **in the first quadrant** bounded by the curves $y = x+2$ and $y = x^2$.

$\bar{y} =$ _____

7. For this problem, let $f(x) = (2x - 1)^{5/2}$.

(a) (5 points) Find the second Taylor polynomial, $T_2(x)$, for the function f based at $b = 1$.

$$T_2(x) = \underline{\hspace{10cm}}$$

(b) (4 points) Use $T_2(x)$ to approximate the value of $1.04^{5/2}$.

$$1.04^{5/2} \approx \underline{\hspace{10cm}}$$

(c) (5 points) Use Taylor's inequality to find an upper bound for the error in your approximation in part (b).

Upper bound: $\underline{\hspace{10cm}}$

8. For this problem, let $f(x) = \frac{x^4}{1+3x^6} + x \sin(2x^3)$

(a) (6 points) Give the Taylor series for f based at $b = 0$ using one sigma sign.

Taylor series: _____

(b) (3 points) Find the largest open interval on which this Taylor series converges.

Interval: _____

(c) (5 points) Find $f^{(1000)}(0)$ (i.e. the 1000th derivative of f at 0).

$f^{(1000)}(0) =$ _____

You may use this page for scratch-work.

All work on this page will be ignored unless you write & circle “see last page” below a problem.

You may use this page for scratch-work.

All work on this page will be ignored unless you write & circle “see last page” below a problem.