Your Name

Your Signature

Student ID #

Quiz Section

- Don't open the exam until everyone has a copy and the start of the test is announced. Once the exam starts, check that you have 5 pages of problems, in addition to this cover page.
- This exam is closed book. You may use one $8\frac{1}{2} \times 11$ sheet of notes. Do not share notes. Graphing/integrating/differentiating calculators are NOT allowed.
- Please silence and put away your cell phone and all other electronics.
- **Unless otherwise instructed, you must show your work.** Answers with incomplete or incorrect work may receive little or no credit, even if the answer happens to be correct.
- Leave your answers in exact form (unless otherwise instructed.)
- There are different versions of this exam. Cheating is a serious offense and will be dealt with in accordance with the university's rules for academic misconduct.
- **Please place a box around YOUR FINAL ANSWER to each question.**
- If you need more room, use the backs of the pages and indicate to the reader that you have done so.
- Raise your hand if you have a question. Good luck!

Problem	Total Points	Score
1	8	
2	12	
3	10	
4	12	
5	8	
Total	50	

1. [**8 points**] Answer the following questions. You need not show work or explain your answers.

(a) [**4 points**] In this problem, $\mathbf{u}$, $\mathbf{v}$, and $\mathbf{w}$ are vectors, and a, b and c are scalars. For each expression below, decide if it is a vector (**V**), a scalar (**S**), or nonsense (**N**).

	Circle one:		
$(\mathbf{u} \cdot \mathbf{v})\mathbf{w}$	**V**	**S**	**N**
$\dfrac{\lvert\mathbf{v}\rvert}{\mathbf{v}}$	**V**	**S**	**N**
$\text{comp}_{\mathbf{w}}(\mathbf{v} + b\mathbf{u})$	**V**	**S**	**N**
$a\mathbf{u} \times (b\mathbf{v} \cdot c\mathbf{w})$	**V**	**S**	**N**

(b) [**3 points**] In this problem, $\mathbf{u}$, $\mathbf{v}$, and $\mathbf{w}$ are **non-zero** vectors in 3-space, and no two of them are parallel or perpendicular to each other. For each statement below, decide if it is always true (**T**), always false (**F**), or only sometimes true (**S**).

	Circle one:		
$\text{comp}_{\mathbf{w}}(\mathbf{v} + \mathbf{u})$ is a positive scalar	**T**	**F**	**S**
$\text{proj}_{\mathbf{w}}(\mathbf{v} + \mathbf{u})$ is parallel to $\mathbf{w}$	**T**	**F**	**S**
$\mathbf{u} \cdot (\mathbf{w} \times (-\mathbf{w}))$ is zero	**T**	**F**	**S**

(c) [**1 points**] Give an example of a **nonzero** vector $\mathbf{v}$ such that $\text{proj}_{\mathbf{k}}\mathbf{v} = \mathbf{0}$

2. [**12 points**] Let α denote the plane $2x + y - 2z = 2$. Let A, B, C denote the points where the plane α intersects the x-axis, the y-axis, and the z-axis, respectively.

(a) [**3 points**] Find the coordinates of the points A, B, and C.

(b) [**3 points**] Find a vector equation for the line through A which is parallel to the line BC.

(c) [**6 points**] Find the distance from the origin $O(0, 0, 0)$ to the plane α specified above. Show work.

3. [**10 points**] Let C denote the polar curve

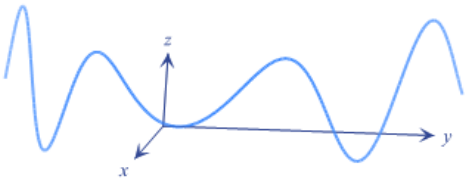
$$r = 4\sin(\theta).$$

(a) [**4 points**] Sketch the graph of C in xy-coordinates.

(b) [**6 points**] Find the equation $y = mx + b$ of the tangent line to the curve C at $\theta = \dfrac{\pi}{6}$. Show work.

4. [**12 points**] A portion of the path followed by a rollercoaster can be parameterized by the vector function:

$$\mathbf{r}(t) = \langle -20t^2, 30t + 6, 10\sin(t^2) \rangle$$



(a) [**3 points**] Compute $\mathbf{r}'(t)$ and $\mathbf{r}'(0)$

(b) [**3 points**] Find parametric equations for the tangent line to this path at $t = 0$.

(c) [**6 points**] Find the curvature of the rollercoaster's path at $t = 0$. Show work.

5. [**8 points**] Circle the correct answers (no explanation needed).

Consider the surface $z^2 = 3x^2 + 2y^2$.

(a) Describe the traces (cross-sections) of this surface parallel to the given plane.

(i) Traces parallel to the yz-plane (when x is fixed) are:

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(ii) Traces parallel to the xz-plane (when y is fixed) are:

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(iii) traces parallel to the xy-plane (when z is fixed) are:

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(b) Circle the name of the surface given by $z^2 = 3x^2 + 2y^2$:

CONE, SPHERE, ELLIPSOID
Parabolic CYLINDER, Hyperbolic CYLINDER, Elliptical CYLINDER,
HYPERBOLOID, Elliptic PARABOLOID, Hyperbolic PARABOLOID,
NONE of the above