Name: $\qquad$
Student ID: $\qquad$
Instructor: Asaduzzaman Mohammad
Time: 60 minutes

- Write your name and student ID number in the space provided above
- There are 10 problems on 9 pages (including cover page).
- No books or notes allowed. No calculators allowed.
- For all problems (unless otherwise mentioned), you MUST show sufficient work to justify your answers. Partial credits will be awarded for all the right steps. Place your SIMPLIFIED final answers in the box provided.
- The exam is self-explanatory! Please do not ask the instructor to interpret any question(s)
- Cheating of any form will NOT be tolerated!!
- Remember to check your answers before turning in the exam!
- Finally, do NOT panic - believe in yourself and be confident!! ©


1. [8 points] What is the area of the triangle with vertices $(\mathbf{1 , 0 , 1}),(1,1,1)$, and $(\mathbf{0}, 2,0)$ [No partial credits for this problem]
A) $\frac{1}{2}$
B) $\frac{1}{\sqrt{2}}$
C) 1
D) $\sqrt{2}$
E) None of the above
2. [8 points] Find the limit $\lim _{(x, y) \rightarrow(0,0)} \frac{x y}{\sqrt{x^{2}+y^{2}}}$

## [No partial credits for this problem]

A) -1
B) 0
C) $1 / 2$
D) 1
E) The limit does not exist
3. [8 points] Use linear approximation of the function $f(x, y)=x y-\sqrt{x+y}$ at $(1,3)$ to approximate $f(0.9,3.1)$. [No partial credits for this problem]
A) 1.1
B) 0.98
C) 0.93
D) 0.8
E) 0.78

4. [8 points] Let $\vec{u}=\langle 3,2,1\rangle$ and $\vec{v}=\langle-1,0,1\rangle$. If $\vec{w}=\langle a, b, c\rangle$ is perpendicular to $\vec{u} \times \vec{v}$, then which of the following hold?
A) $b=3 a+c$
B) $a=2 b-c$
C) $a=2 c+b$
D) $b=-2 a-c$
E) $a+b+c=0$
5. [10 points] Determine whether the lines $L_{1}$ and $L_{2}$ are parallel, skew, or intersecting. If they intersect, find the point of intersection.
$L_{1}: \frac{x}{1}=\frac{y-1}{-1}=\frac{z-2}{3}$
$L_{2}: \frac{x-2}{2}=\frac{y-3}{-2}=\frac{z}{7}$
6. [14 points] Classify and neatly sketch the surface $\frac{x^{2}}{4}+y^{2}-\frac{z^{2}}{4}-1=0$

7. [12 points] Reparametrize the curve $\vec{r}(t)=\langle\cos (2 t), \sin (2 t), 1\rangle$ with respect to the arc length $(s)$ measured from the point where $t=0$ in the direction of increasing $t$.
8. [10 points] Use implicit differentiation to find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$

$$
x^{2}-y^{2}+z^{2}-2 z=4
$$

$$
\begin{aligned}
& \frac{\partial z}{\partial x}=\square \\
& \frac{\partial z}{\partial y}=\square
\end{aligned}
$$

9. [10 points] If $\tan ^{-1}\left(x^{2} y\right)=e^{x y}$, then evaluate $\frac{d y}{d x}$.
10. [12 points] Find the curvature of $\vec{r}(t)=\left\langle\sqrt{2} t, e^{t}, e^{-t}\right\rangle$
