MATH 251 – MIDTERM 1

Name	
Student ID	
Section	501
Signature	

Instructions: Welcome to your Midterm! You have 50 minutes to take this exam, for a total of 50 points. No books, notes, calculators, or cellphones are allowed. Remember that you are not only graded on your final answer, but also on your work. **Please put your answers in the boxes provided, if possible** If you need to continue your work on the back of the page, please check the box "Work on back," or else your work will be discarded.

Academic Honesty Statement: With the signature above, I certify that the exam was taken by the person named and without any form of assistance and acknowledge that any form of cheating (no matter how small) results in an automatic F in the course, and will be further subject to disciplinary consequences, pursuant to the Aggie Honor Code.

Date: Friday, September 24, 2021.

1. *(10 points)* Find the **vector** equation of the tangent line to the following curve at $(5, 2, 8)$

$$\mathbf{r}(t) = \left\langle 1 + 2t, t^3 - 3t, 2t^2 \right\rangle$$

Answer	

☐ Work on back

2. *(10 points)* For the following surface, find the:

   (1) Name of the surface
   (2) Center of the surface
   (3) Direction the surface is facing in (x, y, z direction)
   (4) A *very* rough sketch of the surface, just to get an idea of the general shape in the correct direction

$$x^2 - y^2 + z^2 = 2x + 8y - 6z - 32$$

Name:	
Center:	
Direction:	
Sketch:	

☐ Work on back

3. *(10 points)* Find the arclength of the following curve from $t = 0$ to $t = \pi$

$$\mathbf{r}(t) = \left\langle 5\cos(2t), 2 - \left(\sqrt{3}\right) t, 5\sin(2t) \right\rangle$$

Arclength:	

☐ Work on back

4. *(10 points)* Find the equation of the plane containing the point $(0, -6, 1)$ and the line parametrized by $\mathbf{r}(t) = \langle 2t - 4, t - 3, t \rangle$.

   Note: Write your final answer in the form $x = ay + bz + c$ for some a, b, and c.

Equation:	

☐ Work on back

5. *(10 = 6 + 4 points)* A particle has velocity vector $\mathbf{v}(t) = \left\langle 4t, \sin(t), 2e^{-2t} \right\rangle$ and initial position $\mathbf{r}(0) = \langle 2, 3, 0 \rangle$.

   (a) Find the position vector $\mathbf{r}(t)$

   (b) Suppose further that the particle has mass $m = 3$. Find the force $\mathbf{F}(0)$ acting on the particle when $t = 0$

$\mathbf{r}(t) =$

$\mathbf{F}(0) =$

☐ Work on back