

Math 213 – Spring 2026
Feb. 11, 2026 Exam 1

1. **(8 points)** Find the center and radius of the sphere given by:
 $x^2 + y^2 + z^2 - 4x + 6y - 2z - 11 = 0$.
2. **(21=3,4,5,5,4 points)** Let $\mathbf{u} = \langle 2, -1, 3 \rangle$, and $\mathbf{v} = \langle 1, 4, -2 \rangle$.
 - a. Compute $\mathbf{u} \cdot \mathbf{v}$.
 - b. Find the cosine of the angle between $\mathbf{u}$ and $\mathbf{v}$.
 - c. Compute $\mathbf{u} \times \mathbf{v}$.
 - d. Find the projection of $\mathbf{u}$ onto $\mathbf{v}$.
 - e. Find the area of the parallelogram whose sides are made up of $\mathbf{u}$ and $\mathbf{v}$.
3. Consider the line given by: $\mathbf{r}(t) = \langle 1, 2, 3 \rangle + t\langle 2, -1, 1 \rangle$ and the plane given by
 $3x - y + 2z = 10$
 - a. **(6 pts)** Determine whether the line intersects the plane and if so, find that intersection.
 - b. **(9 points)** Find the distance from the point $P(4, -1, 2)$ to the plane.
4. **(12 points)** Find the distance between the skew lines
 $\mathbf{L1}: \mathbf{r}(t) = \langle 1, 0, 2 \rangle + t\langle 1, 1, -1 \rangle$ and $\mathbf{L2}: \mathbf{r}(s) = \langle 2, 1, 0 \rangle + s\langle -1, 2, 2 \rangle$.
5. **(8 points)** Find the cosine of the angle between the planes
 $x + y - z = 10$ and $-x + 2y + 2z = 7$
6. **(8 points)** Classify and sketch the surface $\frac{x^2}{4} + \frac{y^2}{9} - z^2 = 1$.
7. **(16=6,5,6 points)** Consider the curve: $\mathbf{r}(t) = \langle t^2, \sin t, e^t \rangle$
 - a. Compute $\mathbf{r}'(t)$
 - b. Find the equation of the tangent line to the curve at $t = 0$.
 - c. Compute $\int_0^1 \mathbf{r}(t) dt$.
8. **(12 points)** Consider the 200 lb weight suspended by the 2 wires as shown in the figure below. First find $\cos \alpha$, $\sin \alpha$, $\cos \beta$ and $\sin \beta$. (Note the triangle is a right triangle). Write the relevant equations to find and then solve for $|\mathbf{F}_1|$ and $|\mathbf{F}_2|$.

