# MATH 202 Midterm 1
# Supplementary Questions

October 3, 2024

**Question 1.** Find the combination of inequalities to describe the following solid in 3D: the solid ball of radius 4 centered at $(0, 0, 0)$ with the part below the plane $z = 2$ (excluding the plane) removed.

**Question 2.** Let $\vec{u} = \vec{i} + 2\vec{j} + \vec{k}$ and $\vec{v} = \vec{k}$ be vectors in 3D. Find the length of $\vec{u} + \vec{v}$.

**Question 3.** Let $L : \vec{r}(t)$ be the line satisfying the following two conditions: (1) It is perpendicular to both $\vec{u} = \langle 1, 1, 1\rangle$ and $\vec{v} = \langle 1, 2, 1\rangle$, and (2) it passes through $(2, -1, -1)$. Find $\vec{r}(t)$.

**Question 4.** Find the domain and the range of the function

$$z = f(x, y) = \sqrt{x + y - 2}.$$

**Question 5.** Find $\lim\limits_{(x,y)\to(0,0)} \dfrac{3x^3}{2x^2 + 2y^2}$.

**Question 6.** Let $x = st$, $y = s^2t$, and $w = f(x, y)$ be such that $\partial w/\partial x = \mathrm{e}^y$ and $\partial w/\partial y = x\mathrm{e}^y$. Find $\partial w/\partial s$ and $\partial w/\partial t$.

**Question 7.** Find parametric equations for the line in 3D that is perpendicular to the graph of the equation $x^2 + 2y^2 + 3z^2 = 6$ at the point $(1, 1, 1)$.

# Answers

**Question 1.** $x^2 + y^2 + z^2 \leq 4^2$ and $z \geq 2$. □

**Question 2.** 3. □

**Question 3.** $\vec{r}(t) = \langle 2, -1, -1\rangle + t\langle -1, 0, 1\rangle$, $-\infty < t < \infty$. □

**Question 4.** The range is $z \geq 0$. The domain is $x + y \geq 2$. □

**Question 5.** 0. □

**Question 6.** $\partial w/\partial s = te^{s^2t} + 2s^2t^2e^{s^2t}$, $\partial w/\partial t = se^{s^2t} + s^3te^{s^2t}$. □

**Question 7.** $x = 1 + 2t$, $y = 1 + 4t$, $z = 1 + 6t$, $-\infty < t < \infty$. □