1. **(15%)** Find the unit vector **n** that is perpendicular to the plane determined by the three points (1, 3, 5), (3, -1, 2), and (4, 0, 1).

2. **(20%)** Evaluate the determinants of the following matrix (a) $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$. (b) $\begin{bmatrix} 2 & 2 & 1 \\ 1 & 1 & 1 \\ 3 & 4 & 2 \end{bmatrix}$.

3. **(15%)** Find the distance of a point (1, 2, -1) from the line determined by the two points (2, -2, -1) and (4, -3, 1).

4. **(15%)** To win a lottery, one must pick 6 different numbers from 1 to 49. The order in which the numbers are chosen does not matter. If we buy only one ticket, what are our chances of winning the jackpot?

5. **(20%)** Consider an ordinary differential equation $\frac{dy}{dx} + y = 1$. (a) Find the general form for the solution $y(x)$. (b) Find the solution for $y(0) = 6$.

6. **(15%)** Find positive values of (x, y, z) whose sum is 20 such that the function xyz^2 is a maximum.

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