There are 10 problems. Each problem is worth 10 points. SHOW your work. CIRCLE your answer. NO CALCULATORS!

1. Find the equation of the plane which contains \((0, 0, 0)\), \((1, 1, 1)\), and \((2, 3, 4)\). Be sure to check your answer.

2. Find the equations of the line which contains \((1, 2, 4)\) and \((7, 8, 9)\). Be sure to check your answer.

3. What is the distance from \((1, 1)\) to \(3x + 2y = 1\)?

4. Let \(\mathbf{u} = 2\mathbf{i} + 3\mathbf{j}\) and \(\mathbf{v} = \mathbf{i} + 2\mathbf{j} + 3\mathbf{k}\). Find vectors \(\mathbf{c}\) and \(\mathbf{d}\) so that \(\mathbf{c} + \mathbf{d} = \mathbf{u}\), \(\mathbf{c}\) is parallel to \(\mathbf{v}\), and \(\mathbf{d}\) is perpendicular to \(\mathbf{v}\). Be sure to check your answer.

5. Write \(z = x^2 - y^2\) in spherical coordinates.

6. Draw three level sets for \(f(x, y) = \sqrt{100 - x^2 - y^2}\).

7. Find \(\lim_{x \to 0} \frac{\cos x - 1}{x^2}\).

8. Find \(\lim_{(x,y) \to (0,0)} \frac{xy}{x^2 + y^2}\). (If the limit does not exist, be sure to explain why it does not exist.)

9. Find \(\lim_{(x,y) \to (0,0)} \frac{xy}{x^2 + y^2 + 2}\). (If the limit does not exist, be sure to explain why it does not exist.)

10. Find the intersection of \(\frac{x+2}{3} = \frac{y-3}{4} = z + 1\) and \(x - 2y + 3z + 7 = 0\). Be sure to check your answer.