1. Let \( \mathbf{b} = \langle 1, 1, 1 \rangle \) and \( \mathbf{a} = \langle 0, 1, 2 \rangle \).
   i. Express \( \mathbf{b} \) as \( \mathbf{b} = \mathbf{b}_1 + \mathbf{b}_2 \) where \( \mathbf{b}_1 \) is parallel to \( \mathbf{a} \) and \( \mathbf{b}_2 \) is orthogonal to \( \mathbf{a} \)
   ii. Sketch the appropriate triangle labeling all the vectors mentioned above.
   iii. Find the angle between \( \mathbf{b} \) and \( \mathbf{a} \)

2. Find the equation of a plane that contains the point \((1, 0, -1)\) and is parallel to the plane \(x + y + z = 14\).

3. Find the equation of a line that passes through the points \((-1, -2, 4)\) and \((4, 2, 1)\).

4. i. Find the equation of a plane through the points \((0, 0, 0), (1, 1, 1), (1, 2, 3)\).
   ii. Sketch the plane in the first octant.

4a.) do an arclength problem

5. For \( r(t) = (2 \cos(t), 2 \sin(t), t) \).
   a. Sketch the curve in \( \mathbb{R}^3 \) and plot the points \( t = 0, \pi/2, \pi, 2\pi \) and find and plot the tangent line at \( t = \pi/4 \)
   b. Find \( r'(t), r''(t), T, N, B \)
   c. Write \( r''(t) \) in terms of \( T, N \)

6. redo example 1 p 946
1. Express \( \mathbf{b} = \langle 2, 3, -1 \rangle \) as \( \mathbf{b} = \mathbf{b}_1 + \mathbf{b}_2 \) where \( \mathbf{b}_1 \) is parallel to \( \mathbf{a} \) and \( \mathbf{b}_2 \) is orthogonal to \( \mathbf{a} \) and \( \mathbf{a} = \langle 0, 4, 2 \rangle \).
2. Find the equation of a plane that contains the points \((2, 0, 1), (0, 6, -2) \) and \((-2, 3, 0)\)
3. Find the equation of a plane that contains the point \((1, 0, -1)\) and is parallel to the plane \(3x + 6y + 2z = 6\).
4. Find the parametric equations of a line that satisfies the condition that it passes through the point \((1, 0, 2)\) and is parallel to the line whose parametric equations \( x = t + 1, y = 3t, z = 4t + 1 \).
5. Find the parametric equations of a line that passes through the points \((1, 2, 3)\) and \((0, 1, 3)\).
6. Find the equation of a line that passes through the point \((1, 7, 0)\) and is parallel to the y-axis.

V. Sketch the following:

1. The surface \(x^2 + y^2 + z^2 - 4x - 4y = 0\) (hint: complete the square). Partial credit will be given for the sketch in each of the planes.

2. For \(r(t) = (t, \sqrt{2} \cos(t), \sqrt{2} \sin(t))\).
   a. Sketch the curve.
3. Sketch the surface \(x^2 + y^2 - 9 = 0\)

IV. Find the equation of the Plane which satisfy the following:

1. A plane through the points \((0, 0, 0), (1, 1, 1), (1, 2, 3)\).

2. A plane through the point \((0, 1, 2)\) and containing the line \(x = t, 2y = t, 3z = t\).

3. Find the point where the line \(x = t + 1, y = 2t, z = 3t\) and the plane \(x + y + z = 1\) intersect.

I. Answer the following:

1. Let \(L\) be the line in \(\mathbb{R}^3\) that passes through the points \(P = (-1, -2, 4)\) and \(Q = (4, 2, 1)\). At what point (if any) does \(L\) intersect the plane \(x + y + 2z = 11\)?
2. If \(L\) is the line through \(A = (3, 2, 1)\) and parallel to the vector \(v = \langle -2, 1, 3 \rangle\), what’s the equation of the plane that contains \(L\) and the point \(B = (-2, 3, 1)\).
3. Find the distance from the origin to the plane \(x + 2y + 2z = 6\).
4. Graph the solid in the first octant bounded by the plane \(x + 2y + z = 4\).