1. 
   a. Find an equation of the sphere passing through the origin with center (1, 2, 3).

   b. Find the distance from (-5, -12, -18) to:
      
      the yz plane:

      The x-axis:

2. 
   a. Find the algebraic vector represented by the line segment with initial point (2, -3, 4) and terminal point (-2, 1, 1).

   b. Find a unit vector in the same direction as the negative z-axis.

   c. Find a unit vector in the same direction as \( \mathbf{v} = \langle -4, 5 \rangle \)
3. 
   a. Find an exact expression (not an approximation) for the angle between the 
      vectors \( \mathbf{v} = \langle 1, 2, 3 \rangle \) and \( \mathbf{w} = \langle 4, 0, 1 \rangle \)

   b. Sketch and clearly label the vectors \( \mathbf{a} = \langle 12, 4 \rangle \), \( \mathbf{b} = \langle 3, 7 \rangle \) and \( \text{proj}_a \mathbf{b} \)

4. 
   a. Determine whether the vectors \( \langle a, b, c \rangle \) and \( \langle b, 0, -c \rangle \) are parallel, 
      orthogonal, or neither.

   b. Find all values of \( x \) such that \( \langle 3, 2, x \rangle \) and \( \langle 2x, 4, x \rangle \) are orthogonal.

5. Find a vector orthogonal to the plane that contains the points \((1, 0, 0)\), \((0, 2, 0)\), 
   and \((0, 0, 3)\).
6.  
   a. Given \( \mathbf{a} = \langle 3, 2, -5 \rangle \) and \( \mathbf{b} = \langle 1, -2, -3 \rangle \), compute \( \mathbf{b} \times \mathbf{a} \).

   b. Is the expression \( (\mathbf{a} \cdot \mathbf{b}) \times \mathbf{c} \) meaningful?  (Circle one below and provide explanation)
   
   YES What physical thing(s) does it represent?

   NO Explain why the expression is meaningless.

7.  
   a. Find parametric equations for the line that passes through the points (1, 3, 2) and (-4, 3, 0).

   b. Find an equation of the plane passing through the point (2, -4, 6) and perpendicular to the vector \( \langle 8, -3, 4 \rangle \).

8. Find the distance from the point (2, 8, 5) to the plane \( x - 2y - 2z = 1 \).
9. Find equations for, and name, the traces of the surface \(-x^2 + 4y^2 - z^2 = 1\) in the planes indicated below:

a. \(x = 2\)

b. \(y = k\) (list restrictions on \(k\), if any)

c. \(z = 0\)

10. 
   a. Write the equation \(x^2 + y^2 + z^2 + 2z = 4\) in the spherical coordinate system.

b. Identify and describe the surface \(r = 4\sin \theta\)