1. a. Find an equation of the sphere that passes through the point (6, 2, -3) and has center (-1, 2, 1).

b. Draw *and appropriately label* a picture that shows how we can use the Distance Formula to determine that three points lie on the same line.

2. Find two unit vectors that are orthogonal to both \( \mathbf{j} + 2\mathbf{k} \) and \( \mathbf{i} - 2\mathbf{j} + 3\mathbf{k} \)

3. Given the two vectors \( \mathbf{v} \) and \( \mathbf{w} \) pictured below, *sketch and label* \( \text{proj}_w \mathbf{v} \).

4. a. Find the scalar projection of \( \mathbf{a} = \langle 2, 3 \rangle \) onto \( \mathbf{b} = \langle 4, -2 \rangle \).

b. Draw a picture to illustrate the formula \( D = |\text{comp}_n \mathbf{b}| \) for finding the distance from a point \( P \) to a plane where point \( P \) is not on the plane and \( \mathbf{n} \) is the normal vector of the plane.
5. Find the line of intersection between the planes $3x - 2y + z = 1$ and 
$2x + y - 3z = 3$

6. Find an equation of the plane that contains the line $x = 3 + 2t$, $y = t$, $z = 8 - t$ and is 
parallel to the plane $2x + 4y + 8z = 17$

7. Find parametric equations of the tangent line to $\mathbf{r}(t) = \langle 2\cos t, \ 2\sin t, \ 4\cos 2t \rangle$

at $(\sqrt{3}, 1, 2)$.

8. Given the surface $x^2 = 2y^2 + 3z^2$:

a. Write the equation of the trace and identify the trace in the following planes:

$x = 2$:

Equation:____________________ Name:__________________

$y = k, y \neq 0$:

Equation:____________________ Name:__________________

$z = 1$:

Equation:____________________ Name:__________________

b. Sketch and identify the surface.
9. Two particles travel along the space curves $r_1(t) = \langle t, t^2, t^3 \rangle$ and $r_2(t) = \langle 1+2t, 1+6t, 1+14t \rangle$

a. Determine whether the paths of the particles intersect.

b. Determine whether the particles collide.

10. Given $r(t) = \langle e^t, e^{-t} \rangle$

a. Compute $r'(t)$

b. Make a sketch of this curve by “un-parameterizing” the curve, e.g., writing the curve as $y = f(x)$. ALSO sketch the position vector $r(t)$ and the tangent vector $r'(t)$ for $t = 0$