Chapter 12

1. Find the cosine of the angle between the vectors $\mathbf{u}$ and $\mathbf{v}$. (12.3)

   (a) $\mathbf{u} = \langle 4, -3, 0 \rangle$
   $\mathbf{v} = \langle 2, 6, -3 \rangle$

   (b) $\mathbf{u} = \langle 1, 2, 2 \rangle$
   $\mathbf{v} = \langle 0, 0, -3 \rangle$

   (c) $\mathbf{u} = \langle 1, 4, 2 \rangle$
   $\mathbf{v} = \langle 4, 1, -2 \rangle$

   (d) $\mathbf{u} = \langle -4, -4, -6 \rangle$
   $\mathbf{v} = \langle 2, 2, 3 \rangle$

   (e) $\mathbf{u} = \langle 0, 5, -11 \rangle$
   $\mathbf{v} = \langle 2, 0, 0 \rangle$

   (f) $\mathbf{u} = \langle 3, 2, 1 \rangle$
   $\mathbf{v} = \langle 6, 4, 2 \rangle$

2. Find the projection of $\mathbf{u}$ onto $\mathbf{v}$. (12.3)

   (a) $\mathbf{u} = \langle 4, -3, 0 \rangle$
   $\mathbf{v} = \langle 2, 6, -3 \rangle$

   (b) $\mathbf{u} = \langle 1, 2, 2 \rangle$
   $\mathbf{v} = \langle 0, 0, -3 \rangle$

   (c) $\mathbf{u} = \langle 1, 4, 2 \rangle$
   $\mathbf{v} = \langle 4, 1, -2 \rangle$

   (d) $\mathbf{u} = \langle -4, -4, -6 \rangle$
   $\mathbf{v} = \langle 2, 2, 3 \rangle$

   (e) $\mathbf{u} = \langle 0, 5, -11 \rangle$
   $\mathbf{v} = \langle 2, 0, 0 \rangle$

   (f) $\mathbf{u} = \langle 3, 2, 1 \rangle$
   $\mathbf{v} = \langle 6, 4, 2 \rangle$

3. Use the cross product to find a vector normal to both $\mathbf{u}$ and $\mathbf{v}$. (12.4)

   (a) $\mathbf{u} = \langle 4, -3, 0\rangle$
   $\mathbf{v} = \langle 2, 6, -3\rangle$

   (b) $\mathbf{u} = \langle 1, 2, 2\rangle$
   $\mathbf{v} = \langle 0, 0, -3\rangle$

   (c) $\mathbf{u} = \langle 1, 4, 2\rangle$
   $\mathbf{v} = \langle 4, 1, -2\rangle$

   (d) $\mathbf{u} = \langle -4, -4, -6\rangle$
   $\mathbf{v} = \langle 2, 2, 3\rangle$

   (e) $\mathbf{u} = \langle 0, 5, -11\rangle$
   $\mathbf{v} = \langle 2, 0, 0\rangle$

   (f) $\mathbf{u} = \langle 3, 2, 1\rangle$
   $\mathbf{v} = \langle 6, 4, 2\rangle$

4. Give a vector equation and parametric equations for the line. (12.5)

   (a) The line passing through $(1, 3, -2)$ and parallel to $\langle 3, 0, 1\rangle$.

   (b) The line passing through $(-2, 0, 4)$ and $(1, 3, 3)$.

   (c) The line parallel to $\mathbf{r}(t) = \langle t, 2 - t, 2 + t\rangle$ and passing through $(2, 4, 5)$.

   (d) The line with equation $x = -3z + 1$ in the xz plane.

   (e) The line normal to the plane with equation $x + y + 2z = 4$ and passing through $(1, 1, 1)$.

5. Give the distance from the point to the line: (12.5)

   (a) $(4, 5, 3)$ to $\mathbf{r}(t) = \langle 1 + t, 2 + 2t, 2t\rangle$

   (b) $(-1, -2, 2)$ to $\mathbf{r}(t) = \langle -1 + 3t, -4, 2 + 4t\rangle$

   (c) $(3, 0)$ to $\mathbf{r}(t) = \langle 4 - 4t, 7 - 3t\rangle$

   (d) $(2, 6)$ to $\mathbf{r}(t) = \langle -3 + 3t, 1 + t\rangle$

6. Give an equation for the plane. (12.5)

   (a) The plane passing through $(1, 3, -2)$ and normal to $\langle 3, 0, 1\rangle$.
   (b) The plane passing through $(1, -2, 0)$ and parallel to $2x - y + 3z = 3$.
   (c) The plane passing through $(1, 1, 1)$ and normal to the line with equation $\mathbf{r}(t) = \langle 4 - 3t, t, 2 + 2t\rangle$.
   (d) The plane passing through $(-2, 0, 4)$, $(1, 3, 3)$, and $(0, 0, 2)$.

7. Give the distance from the point to the plane: (12.5)

   (a) $(5, 1, 1)$ to $x - 2y + 2z = 2$
   (b) $(4, -1, 3)$ to $3x + 4z = 4$
   (c) $(0, 1, 1)$ to $-2x - 3y - 6z = 5$
   (d) $(-1, 5, 2)$ to $x + y + z = 3$

8. Sketch the curve given by the equation in the appropriate coordinate plane, and then sketch the cylinder in xyz space given by the equation. (12.6)

   (a) $y = x^2$
   (b) $x = z^3$
   (c) $y = \sin z$
   (d) $z = e^x$
   (e) $z = \ln y$
   (f) $xy = 1$

9. Sketch the three coordinate plane cross-sections for the quadric surface given by the equation, sketch the surface itself, and give the name of the surface. (12.6)

   (a) $x^2 - y = -z^2$
   (b) $y^2 + z^2 = 4 - 4x^2$
   (c) $z^2 - 9y^2 = x^2$
   (d) $y^2 - z^2 = 4 - 4x^2$
   (e) $4x^2 - y^2 - 4z^2 = 16$
   (f) $z = y^2 - 4x^2$