

- Find equations of the spheres with center $(2, 3, 6)$ that touch
 - the xy -plane;
 - the yz -plane;
 - the xz -plane.
- Find the acute angle between the two vectors $\mathbf{a} = \langle 4, 0, 2 \rangle$ and $\mathbf{b} = \langle 2, -1, 0 \rangle$.
 - Find the acute angle between the following lines.

$$2x - y = 3 \quad 3x + y = 7$$

- Find the scalar and vector projections of $\mathbf{b} = \mathbf{i} + 2\mathbf{j} + 3\mathbf{k}$ onto $\mathbf{a} = 3\mathbf{i} + 6\mathbf{j} - 2\mathbf{k}$, i.e. $\text{comp}_{\mathbf{a}} \mathbf{b}$ and $\text{proj}_{\mathbf{a}} \mathbf{b}$.
- Find two unit vectors orthogonal to both $\mathbf{u} = \langle 3, 2, 1 \rangle$ and $\mathbf{v} = \langle 1, 1, 0 \rangle$.
- Find the volume of the parallelepiped (“parallelo-box”) determined by the vectors $\mathbf{a} = \langle 1, 2, 3 \rangle$, $\mathbf{b} = \langle 1, 1, 2 \rangle$, $\mathbf{c} = \langle 2, 1, 4 \rangle$.
- Use the scalar triple product to determine whether the points $A(1, 3, 2)$, $B(3, -1, 6)$, $C(5, 2, 0)$, and $D(3, 6, -4)$ lie in the same plane.
- Find a vector equation and parametric equations for the line through the point $(3, -4, 6)$ and
 - perpendicular to the plane $x + 3y - z = 11$.
 - parallel to the vector $\mathbf{v} = \langle 1, 3, -1 \rangle$.
 - Briefly explain why the same answer works for both parts (a) and (b).
- Find a vector equation and parametric equations for the line *segment* from $(7, 3, -1)$ to $(-2, 4, 5)$.
- Find parametric equations for the line through the point $(0, 1, 2)$ that is parallel to the plane $x + y + z = 2$ and perpendicular to the line

$$x = 1 + t, \quad y = 1 - t, \quad z = 2t.$$

- Find parametric equations for the tangent line to the curve $\mathbf{r}(t) = \langle t^3 + 3t, t^2 + 1, 3t + 4 \rangle$ at the point $(4, 2, 7)$.
- Sketch the domain of the following function.
 - $f(x, y) = \frac{\sqrt{y - x^2}}{1 - x^2}$
- Show that the following limit does not exist.

$$\lim_{(x,y,z) \rightarrow (0,0,0)} \frac{xy + yz^2 + xz^2}{x^2 + y^2 + z^4}$$

- Show that the following limit does exist, and find the limit.

$$\lim_{(x,y) \rightarrow (0,0)} \frac{x^2 + y^2}{\sqrt{x^2 + y^2 + 1} - 1}$$