Math 2415
Homework on 12.5

Recall the following defintions:

(i) A **vector parametrization** of the line through the endpoint of the vector $\mathbf{a}$ in the direction of the vector $\mathbf{b}$ is given by $\mathbf{r}(t) = \mathbf{a} + t\mathbf{b}$, where $t \in \mathbf{R}$.

(ii) A **scalar parametrization** of the line in (i) is

$$x = a_1 + tb_1$$
$$y = a_2 + tb_2$$
$$z = a_3 + tb_3$$

where $\mathbf{a} = (a_1, a_2, a_3)$ and $\mathbf{b} = (b_1, b_2, b_3)$.

For each problem start by drawing a schematic diagram that illustrates the geometrical relationships between the various points, lines, and vectorsin the problem. Use your diagram to help you set up equations that will help you solve the problem.

1. Which of the following points are on the line $(x, y, z) = \mathbf{r}(t) = (1+3t, 4-5t, 2t)$. Why?

   (a) $(-2, 9, -2)$

   (b) $(2, 7, 4)$

2. Find a vector parametrization for the line through the point $(4, -3, 5)$ containing the vector $(6, 2, -1)$.

3. Find a vector parametrization for the line passing through the points $(1, 2, 3)$ and $(9, 8, 7)$.

4. Determine whether the line $(x, y, z) = \mathbf{r}(t) = (1 - t, 4 - 5t, 2t + 5)$

   (a) intersects the xy-plane.

   (b) intersects with the z-axis

5. Find a parametrization for a line whose intersection with the y-axis is one point.