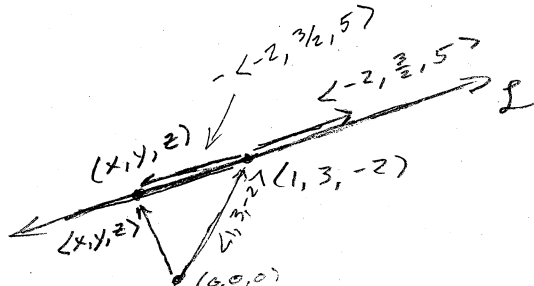


Solutions

1. Determine a vector equation for the line through the point  $(1, 3, -2)$  and parallel to the vector  $\langle -2, 3/2, 5 \rangle$ .

$$\langle x, y, z \rangle = \langle 1, 3, -2 \rangle + t \cdot \langle -2, \frac{3}{2}, 5 \rangle$$



2. What is the general form for a vector equation of a line?

$$\langle x, y, z \rangle = \langle x_1, y_1, z_1 \rangle + t \langle v_1, v_2, v_3 \rangle, \quad t \text{ is our input variable}$$

$$\underline{r} = \underline{p} + t \underline{d}$$

where  $\underline{r}$  is our variable vector,  
 $\underline{p}$  is a point as a vector,  
 and  $\underline{d}$  is the direction vector

3. Find symmetric equations and parametric equations for the line through the point  $(1, 3, -2)$  and parallel to the vector  $\langle -2, 3/2, 5 \rangle$ .

vector:

$$\langle x, y, z \rangle = \langle 1, 3, -2 \rangle + t \cdot \langle -2, \frac{3}{2}, 5 \rangle$$

parametric:

$$x = 1 - 2t$$

$$y = 3 + \frac{3}{2}t$$

$$z = -2 + 5t$$

$$t = \frac{x-1}{-2} = \frac{y-3}{3/2} = \frac{z+2}{5}$$

symmetric

4. Is the line through  $(4, 1, -1)$  and  $(2, 5, 3)$  perpendicular to the line through  $(-3, 2, 0)$  and  $(5, 1, 4)$ ?

$$\underline{L}_1: \underline{d}_1 = \langle -2, 4, 4 \rangle$$

$$\underline{L}_2: \underline{d}_2 = \langle 8, 1, 4 \rangle$$

$$\underline{d}_1 \cdot \underline{d}_2 = -16 + 4 + 16 = 4$$

No, the dot-product isn't zero.

5. Determine whether the lines  $L_1$  and  $L_2$  are parallel, skew, or intersecting. If they intersect, find the point of intersection.

$$L_1: x - 1 = \frac{y + 2}{3} = \frac{z - 4}{-1} = t$$

$$L_2: \frac{x}{2} = y - 3 = \frac{z + 3}{4} = s$$

$$x = 1 + t \quad y = -2 + 3t \quad z = 4 - t$$

$$x = 2s \quad y = 3 + s \quad z = -3 + 4s$$

$$\underline{d}_1 = \langle 1, 3, -1 \rangle$$

$$\underline{d}_2 = \langle 2, 1, 4 \rangle$$

Not parallel

$$1 + t = 2s \quad -2 + 3t = 3 + s \quad 4 - t = -3 + 4s$$

$$t = 2s - 1 \quad -2 + 3(2s - 1) = 3 + s$$

$$-5 + 6s = 3 + s$$

$$5s = 8$$

$$s = 8/5$$

$$t = 2 \cdot \frac{8}{5} - 1$$

$$= 11/5$$

$$4 - \frac{11}{5} \stackrel{?}{=} -3 + 4 \cdot \frac{8}{5}$$

$$\frac{9}{5} \stackrel{?}{=} -\frac{15}{5} + \frac{32}{5}$$

$$\frac{9}{5} \neq \frac{17}{5}$$

Skew