15. (a) Find symmetric equations for the line that passes through the point $(1, -5, 6)$ and is parallel to the vector $\langle -1, 2, -3 \rangle$.

(b) Find the points in which the required line in part (a) intersects the coordinate planes.

a) $r(t) = \langle 1, -5, 6 \rangle + t\langle -1, 2, -3 \rangle$

$x = 1 - t$
$y = -5 + 2t$
$z = 6 - 3t$

$\frac{x-1}{-1} = \frac{y+5}{2} = \frac{z-6}{-3}$

on xy-plane $z = 0$

$t = 2 \rightarrow x = -1, \; y = -1 \quad (-1, -1, 0)$

on xz plane, $y = 0 \rightarrow t = \frac{5}{2} \rightarrow \left(-\frac{3}{2}, 0, -\frac{3}{2}\right)$

67–68 Use the formula in Exercise 43 in Section 12.4 to find the distance from the point to the given line.

67. $(4, 1, -2)$; $x = 1 + t$, $y = 3 - 2t$, $z = 4 - 3t$

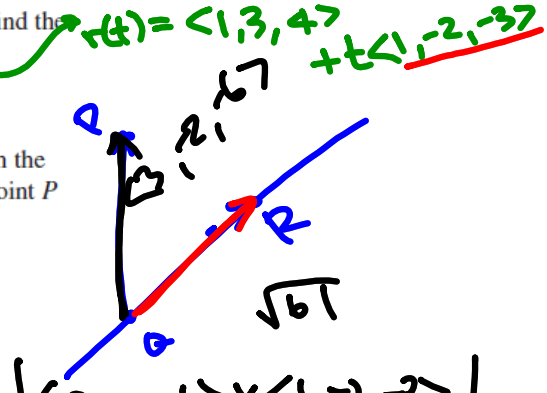
$r(t) = \langle 1, 3, 4 \rangle + t\langle 1, -2, -3 \rangle$

43. (a) Let P be a point not on the line L that passes through the points Q and R. Show that the distance d from the point P to the line L is

$$d = \frac{|\mathbf{a} \times \mathbf{b}|}{|\mathbf{a}|}$$

where $\mathbf{a} = \overrightarrow{QR}$ and $\mathbf{b} = \overrightarrow{QP}$.

(b) Use the formula in part (a) to find the distance from the point $P(1, 1, 1)$ to the line through $Q(0, 6, 8)$ and $R(-1, 4, 7)$.



$\sqrt{61}$

$\frac{|\langle 3, -2, -6 \rangle \times \langle 1, -2, -3 \rangle|}{\sqrt{14}}$

$\begin{vmatrix} i & j & k \\ 3 & -2 & -6 \\ 1 & -2 & -3 \end{vmatrix} = \langle -6, 3, -4 \rangle$

$\frac{\sqrt{61}}{\sqrt{14}}$

$$V = |a \cdot (b \times c)|$$

A(0,0,0)
B(2,1,5)
C(-1,-1,0)
D(0,1,7)

B, C, & D are neigh. vertices from A.
Find V of P.D.

$\overrightarrow{AB} = b$

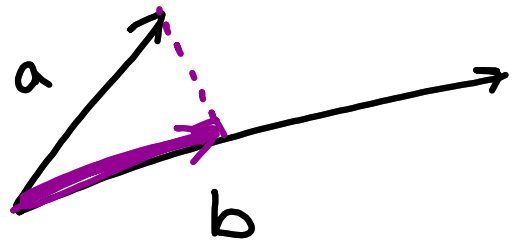
$V = |b \cdot (c \times d)|$

$c \times d = \langle -7, 7, -1 \rangle$

$b \cdot (c \times d) = -14 + 7 - 5$
$= -12$

$V = 12$

$\text{Proj}_b a$



$a \cdot b = 0 \longrightarrow a \perp b$

$a \times b = 0 \longrightarrow a = kb$

$r(t) = \langle 1,2,3 \rangle + t\langle 0,2,-1 \rangle$

$s(t) = \langle 0,1,-2 \rangle + t\langle 1,2,3 \rangle$

(r) (s)

$1 = x = k$

$2t+2 = y = 2k+1$

$3 - t = z = 3k-2$

$k = 1$

$t = \frac{1}{2}$

skew