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1a. $\vec{AP} = (P_x, P_y, P_z - 1)$ $\vec{PB} = (-1-P_x, 1-P_y, 5-P_z)$

$-2\vec{AP} = (-2P_x, -2P_y, -2P_z + 2)$ $3\vec{PB} = (-3-3P_x, 3-3P_y, 15-3P_z)$

$-2P_x = -3-3P_x$
$P_x = -3$

$-2P_y = 3-3P_y$
$P_y = 3$

$-2P_z + 2 = 15 - 3P_z$
$P_z = 13$

$\boxed{P = (-3, 3, 13)}$

$* \Rightarrow (-6)^2 = 6^2$

b.
$D_{\vec{PC}} = \sqrt{(13-(-1))^2 + (3-1)^2 + (-3-3)^2} = \sqrt{14^2 + 2^2 + 6^2}$ *

$= \boxed{\sqrt{236}}$

2a. Orthogonal vector to P is $\langle -2, -4, 6\rangle$, which is equivalent to vector $\langle -1, -2, 3\rangle$ $-1 = a$, $-2a = 2a$, $3 = 3$.

$\boxed{\text{Only } -1 \text{ satisfies the 3 equations.}}$

b. $\vec{n} \cdot L = 0$ $\langle -2, -4, 6\rangle \cdot \langle a, 2a, 3\rangle = 0$
$-2a - 8a + 18 = 0$
$-10a = -18$
$\boxed{a = 1.8}$

c. when $a = 1$, $L = \langle 1, 2, 3\rangle t$ $x = t$ $y = 2t$ $z = 3t$

$P \Rightarrow -2(t) - 4(2t) + 6(3t) = 1$
$-2t - 8t + 18t = 1$
$8t = 1$
$\boxed{t = \frac{1}{8}}$

Homework #1

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$$\boxed{L\left(\tfrac{1}{8}\right) = \left(\tfrac{1}{8}, \tfrac{1}{4}, \tfrac{3}{8}\right)}$$

3. $\vec{n}_p = \langle 2, 1, -1 \rangle$ $\quad L_n = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} + \begin{pmatrix} 2 \\ 1 \\ -1 \end{pmatrix} t = \begin{pmatrix} 1+2t \\ 1+t \\ 1-t \end{pmatrix}$

$2x + y - z = 0 \qquad x = 1+2t \qquad y = 1+t \qquad z = 1-t$

$$2(1+2t) + (1+t) - (1-t) = 0$$
$$2 + 4t + 1 + t - 1 + t = 0$$
$$6t - 2 = 0$$
$$6t = 2$$
$$t = \tfrac{1}{3}$$

$x\left(\tfrac{1}{3}\right) = 1 + \tfrac{2}{3} \qquad y\left(\tfrac{1}{3}\right) = 1 + \tfrac{1}{3} \qquad z = 1 - \tfrac{1}{3}$

$Q = \left(\tfrac{5}{3}, \tfrac{4}{3}, \tfrac{2}{3}\right)$

$$D_{\vec{QP}} = \sqrt{\left(\tfrac{5}{3}-1\right)^2 + \left(\tfrac{4}{3}-1\right)^2 + \left(\tfrac{2}{3}-1\right)^2} = \sqrt{\left(\tfrac{2}{3}\right)^2 + \left(\tfrac{1}{3}\right)^2 + \left(-\tfrac{1}{3}\right)^2} = \sqrt{\tfrac{4}{9} + \tfrac{1}{9} + \tfrac{1}{9}} = \sqrt{\tfrac{6}{9}}$$
$$= \sqrt{\tfrac{2}{3}}$$

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4a.

$$L = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} + \begin{pmatrix} -2t \\ -t \\ -4t \end{pmatrix}$$

When $t=0$ $L=(1,2,3)$
When $t=1$ $L=(-1,1,-1)$

b. $-2(x-1) - (y-1) - 4(z-1) = 0$

$-2x + 2 - y + 1 - 4z + 4 = 0$

$\boxed{-2x - y - 4z + 7 = 0}$ → scalar equation

Parametric equation:

- $c + as + br$, where c is a point on the plane and a and b are two parallel vectors.

$$c = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$$

a, b → plug in x and y values in scalar equation to find z values for different points

When x and $y = (0,0)$ → $-4z = -7$ $z = \frac{7}{4}$
When x and $y = (-1,-1)$ → $3 + 7 - 4z = 0$ → $4z = 10$ → $z = \frac{10}{4} = \frac{5}{2}$

We get points $a_0 = (0, 0, \frac{7}{4})$ and $b_0 = (-1, -1, \frac{5}{2})$

$a = \overrightarrow{a_0c} = \langle 1, 1, 1-\frac{7}{4} \rangle = \langle 1, 1, -\frac{3}{4} \rangle$

$b = \overrightarrow{b_0c} = \langle 2, 2, -\frac{3}{2} \rangle$

$$\boxed{P: \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} + \begin{pmatrix} 1 \\ 1 \\ -\frac{3}{4} \end{pmatrix} s + \begin{pmatrix} 2 \\ 2 \\ -\frac{3}{2} \end{pmatrix} r}$$