7a. (0.5pts)

$S_1: 3x - y + z - 4 = 0$

$S_2: x + 2z = -1$

If the planes are perpendicular, their normal vectors are perpendicular:

$\vec{n}_1 = (3,-1,1)$ $\quad$ $\vec{n}_1 \cdot \vec{n}_2 = 3 + 2 = 5 \neq 0$

$\vec{n}_2 = (1,0,2)$

$\Rightarrow$ $\boxed{S_1 \text{ and } S_2 \text{ are } \underline{\text{not}} \text{ perpendicular}}$

8b. (0.5pts)

line: $\begin{cases} x = 2 + t \\ y = 1 - t \\ z = 5 + 3t \end{cases}$

plane: $6x + 6y - 7 = 0$.

If the line and plane are perpendicular, the direction vector of the line and the normal vector of the plane must be parallel.

direction vector $\vec{v} = (1,-1,3)$

normal vector $\vec{n} = (6,6,0)$

$\Rightarrow$ not scalar multiples of each other

$\Rightarrow$ $\boxed{\text{line and plane are } \underline{\text{not}} \text{ perpendicular}}$

9ab. (0.5 × 2 = 1pt)

(a) $P(3,-1,2)$

$\vec{n} = (2,1,3)$

The line that passes through P and is parallel to $\vec{n}$ is: $\boxed{x = 3 + 2t \quad y = -1 + t \quad z = 2 + 3t}$

(b) $P(-2,3,-3)$

$\vec{n} = (6,-6,-2)$

$\Rightarrow$ $\boxed{x = -2 + 6t \quad y = 3 - 6t \quad z = -3 - 2t}$

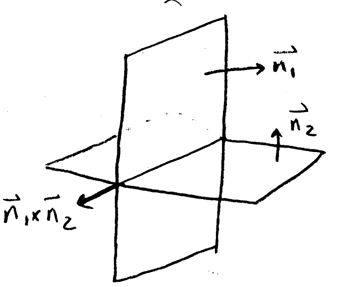
10a. (0.5pts) Find the line between $(5,-2,4)$ and $(7,2,-4)$.

The direction vector of the line is $(2,4,-8)$. So one parameterization of the line is $\boxed{x = 5 + 2t \quad y = -2 + 4t \quad z = 4 - 8t}$

11a. (1pt)

$S_1: 7x - 2y + 3z = -2$

$S_2: -3x + y + 2z = -5$



The line of intersection of S_1 and S_2 is parallel to the vector perpendicular to the normal vectors of S_1, S_2.

So $\vec{n}_1 = (7,-2,3)$ $\quad \Rightarrow \quad \vec{n}_1 \times \vec{n}_2 = (-7,-23,1)$.

$\vec{n}_2 = (-3,1,2)$

(cont'd)