Homework #6 Solutions

2. The line through $(0,0,0)$ and $(4,3,-1)$

$\vec{v} = \langle 4, 3, -1 \rangle$

a.) Parametric equation

$$\boxed{\begin{aligned} x(t) &= 4t \\ y(t) &= 3t \\ z(t) &= -t \end{aligned}}$$

Other answers:

- $x(t) = \pm 4t + 4$

  $y(t) = \pm 3t + 3$

  $z(t) = \mp t - 1$

- $x(t) = -4t$

  $y(t) = -3t$

  $z(t) = t$

b.) Symmetric Equation

$$\boxed{\frac{x}{4} = \frac{y}{3} = \frac{z}{-1}}$$

Other answers:

- $\dfrac{x-4}{\pm 4} = \dfrac{y-3}{\pm 3} = \dfrac{z+1}{\mp 1}$

- $\dfrac{x}{-4} = \dfrac{y}{-3} = \dfrac{z}{1}$

c.) Vector equation

$\vec{r}(t) = \langle 4t, 3t, -t \rangle$

other answers work similarly.

3. Find the line through the pt $(2,1,0)$ and $\perp$ to both $\vec{i}+\vec{j}$ and $\vec{j}+\vec{k}$.

$$\vec{v} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 1 & 1 & 0 \\ 0 & 1 & 1 \end{vmatrix} = (1)\vec{i} - (1)\vec{j} + (1)\vec{k}$$

$$= \langle 1, -1, 1 \rangle$$

parametric equation

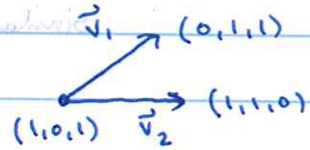
(a)
$$\boxed{\begin{aligned} x(t) &= t + 2 \\ y(t) &= -t + 1 \\ z(t) &= t + 0 \end{aligned}}$$

(b)
$$\boxed{\frac{x-2}{1} = \frac{y-1}{-1} = \frac{z}{1}}$$

or
$$\boxed{x - 2 = -y + 1 = z}$$
after simplification

(c)
$$\boxed{\vec{r}(t) = \langle t+2, -t+1, t \rangle}$$

4. Write the equation for the plane containing the points $(0,1,1)$, $(1,0,1)$, and $(1,1,0)$.



(not an accurate picture)

$$\vec{v}_1 = \langle -1, 1, 0 \rangle$$

$$\vec{v}_2 = \langle 0, 1, -1 \rangle$$

$$\vec{n} = \vec{v}_1 \times \vec{v}_2 = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ -1 & 1 & 0 \\ 0 & 1 & -1 \end{vmatrix} = (-1)\vec{i} - (1)\vec{j} + (-1)\vec{k}$$

$$= \langle -1, -1, -1 \rangle$$

plane :

$$-1(x-0) - (y-1) - (z-1) = 0$$

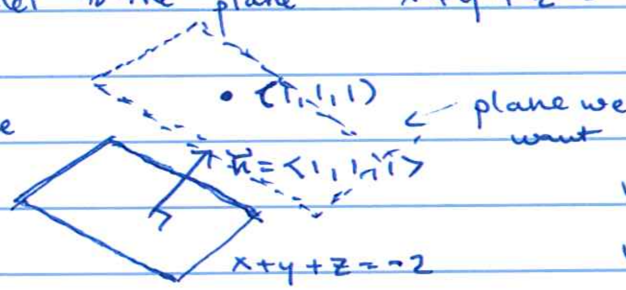
$$-x - y + 1 - z + 1 = 0$$

$$\Rightarrow \boxed{x + y + z = 2}$$

Regardless of what point you use, this will be your answer.

5. Write the equation of the plane through the point $(1,1,1)$ parallel to the plane $x + y + z = -2$.

Picture



we will use the same vector $\langle 1,1,1 \rangle$ but use the new point $(1,1,1)$

So we get $1(x-1) + 1(y-1) + 1(z-1) = 0$

$$\Rightarrow \boxed{x + y + z = 3}$$