Homework # 2, Section # 1.3

2. Write the equation of the line passing through P with normal vector $\mathbf{n}$ in (a) normal form and (b) general form.

$$P = (1, 2), \quad \mathbf{n} = \begin{bmatrix} 5 \\ -3 \end{bmatrix}$$

4. Write the equation of the line passing through P with directional vector $\mathbf{d}$ in (a) normal form and (b) parametric form.

$$P = (-4, 4), \quad \mathbf{d} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

7. Write the equation of the plane passing through P with normal vector $\mathbf{n}$ in (a) normal form and (b) general form.

$$P = (0, 1, 0), \quad \mathbf{n} = \begin{bmatrix} 3 \\ 2 \\ 1 \end{bmatrix}$$

18. The line $\mathbf{l}$ passes through the point $P = (1, -1, 1)$ and has direction vector

$$\mathbf{d} = \begin{bmatrix} 2 \\ 3 \\ -1 \end{bmatrix}.$$

For each of the following planes $\mathcal{P}$, determine whether $\mathbf{l}$ and $\mathcal{P}$ parallel, perpendicular or neither: **(a)** $2x + 3y - z = 1$ **(d)** $4x + 6y - 2z = 0$

27. Find the distance from the point Q to the line $\mathbf{l}$

$$Q = (2, 2), \quad \mathbf{l} \text{ with equation } \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -1 \\ 2 \end{bmatrix} + t \begin{bmatrix} 1 \\ -1 \end{bmatrix}.$$

36. Find the distance between the parallel lines.

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix} + s \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} \text{ and } \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix} + t \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}.$$

41. Prove that, in $\mathcal{R}^2$, the distance between parallel lines with equations $\mathbf{n} \cdot \mathbf{x} = c_1$ and $\mathbf{n} \cdot \mathbf{x} = c_2$ is given by

$$\frac{|c_1 - c_2|}{||\mathbf{n}||}.$$

43. Find the acute angle between the planes with the given equations: $x + y + z = 0$ and $2x + y - 2z = 0$.

48a. Use the method of Exercise 43 to find the projection of

$$\mathbf{v} = \begin{bmatrix} 1 \\ 0 \\ -2 \end{bmatrix}$$

onto the plane with the following equation: $x + y + z = 0$.