(Solution)

Problem 1: Supervised learning uses the paired dataset (x,y) which has ground-truth; while the unsupervised learning uses only input x without ground-truths.
(I read the answers and give full scores if you correctly describe supervised learning and unsupervised learning. There was no person score deducted from this problem.)

Problem 2: $(x_1, x_5, x_6) \rightarrow c_1$, $(x_2, x_3, x_4) \rightarrow c_2$ , Samples are assigned to the nearest centroid.

Problem 3:

$$c_1 = \left(\frac{\cos(\frac{\pi}{3}) + \cos(\frac{5\pi}{3}) + \cos(\frac{6\pi}{3})}{3}, \frac{\sin(\frac{\pi}{3}) + \sin(\frac{5\pi}{3}) + \sin(\frac{6\pi}{3})}{3}\right) = \left(\frac{2}{3}, 0\right)$$

$$c_2 = \left(\frac{\cos(\frac{2\pi}{3}) + \cos(\frac{3\pi}{3}) + \cos(\frac{4\pi}{3})}{3}, \frac{\sin(\frac{2\pi}{3}) + \sin(\frac{3\pi}{3}) + \sin(\frac{4\pi}{3})}{3}\right) = \left(-\frac{2}{3}, 0\right)$$

Problem 4:

$$y_3 = sign\left(\begin{bmatrix} -1 \\ 1 \end{bmatrix} x_3 + 0\right) = sign\left(\begin{bmatrix} -1 \\ 1 \end{bmatrix} \begin{bmatrix} -1 \\ 0 \end{bmatrix} + 0\right) = sign(1) = +1$$

$$y_6 = sign\left(\begin{bmatrix} -1 \\ 1 \end{bmatrix} x_6 + 0\right) = sign\left(\begin{bmatrix} -1 \\ 1 \end{bmatrix} \begin{bmatrix} 1 \\ 0 \end{bmatrix} + 0\right) = sign(-1) = -1$$