2

a) l2 norm of $x = 1^2+2^2+3^2$

$= 14$

l2 " " $y = 9^2+11^2+13^2$

$= 371$

b) $\vec{u_1} = \frac{1}{\sqrt{5}} (2,-1,0)^T$

$\frac{2}{\sqrt{5}} \cdot \frac{1}{\sqrt{30}} - \frac{1}{\sqrt{5}} \cdot \frac{2}{30}$

$\vec{u_2} = \frac{1}{\sqrt{30}} (1,2,-5)^T$

$\vec{u_3} = \frac{1}{\sqrt{24}} (2,4,2)^T$

$\vec{u_1} \cdot \vec{u_2} = 0$

$\vec{u_2} \cdot \vec{u_3} = 0$

$\vec{u_3} \cdot \vec{u_1} = 0$

orthogonal

$|\vec{u_1}| = 1$

$|\vec{u_2}| = 1$

$|\vec{u_3}| = 1$

orthonormal

(c) $x_0 = 4$ $x_1 = 9$ $x_2 = -6$

$f(x_0) = -0.757$ $f(x_1) = 0.412$ $f(x_2) = 0.279$

$P_1(x) = a_0 + a_1 x$

$-0.757 = a_0 + 4a_1$

$0.412 = a_0 + 9a_1$

$0.279 = a_0 - 6a_1$

$$\begin{bmatrix} 1 & 4 \\ 1 & 9 \\ 1 & -6 \end{bmatrix} \begin{bmatrix} a_0 \\ a_1 \end{bmatrix} = \begin{bmatrix} -0.757 \\ 0.412 \\ 0.279 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 1 & 1 \\ 4 & 9 & -6 \end{bmatrix} \begin{bmatrix} 1 & 4 \\ 1 & 9 \\ 1 & -6 \end{bmatrix} \begin{bmatrix} a_0 \\ a_1 \end{bmatrix} = \begin{bmatrix} 1 & 1 & 1 \\ 4 & 9 & -6 \end{bmatrix} \begin{bmatrix} -0.757 \\ 0.412 \\ 0.279 \end{bmatrix}$$

$$\begin{bmatrix} 3 & 8 \\ 8 & 142 \end{bmatrix} \begin{bmatrix} a_0 \\ a_1 \end{bmatrix} = \begin{bmatrix} -0.066 \\ -1.751 \end{bmatrix}$$

$$\begin{bmatrix} a_0 \\ a_1 \end{bmatrix} = \begin{bmatrix} 0.0128 \\ -0.013 \end{bmatrix}$$

$P_1(x) = 0.013 - 0.013x$