

1. In each case, find the projection \mathbf{p} of \mathbf{b} onto the line through \mathbf{a} . Then find the projection matrix P .

$$(a) \mathbf{a} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}, \mathbf{b} = \begin{bmatrix} 1 \\ 2 \\ 2 \end{bmatrix}$$

$$(b) \mathbf{a} = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}, \mathbf{b} = \begin{bmatrix} 2 \\ -1 \\ 0 \end{bmatrix}$$

$$(c) \mathbf{a} = \begin{bmatrix} 1 \\ 2 \\ 0 \\ 1 \end{bmatrix}, \mathbf{b} = \begin{bmatrix} 1 \\ 0 \\ 1 \\ 0 \end{bmatrix}$$

2. Problem set §3.2, exercises 9, 14, 17, 19
-

3. In each case, find the projection \mathbf{p} of \mathbf{b} onto the column space of A . Then find the projection matrix P , and check that $P\mathbf{b} = \mathbf{p}$.

$$(a) A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \\ 0 & 0 \end{bmatrix}, \mathbf{b} = \begin{bmatrix} 2 \\ 3 \\ 4 \end{bmatrix}$$

$$(b) A = \begin{bmatrix} 1 & 1 \\ 1 & 1 \\ 0 & 1 \end{bmatrix}, \mathbf{b} = \begin{bmatrix} 4 \\ 0 \\ 6 \end{bmatrix}$$

4. Use the method of least squares to find the equation of the line that best fits the given data points.

$$(a) \begin{bmatrix} 0 \\ 9 \end{bmatrix}, \begin{bmatrix} 1 \\ 4 \end{bmatrix}, \begin{bmatrix} 2 \\ 1 \end{bmatrix}.$$

$$(b) \begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 8 \end{bmatrix}, \begin{bmatrix} 3 \\ 8 \end{bmatrix}, \begin{bmatrix} 4 \\ 20 \end{bmatrix}.$$

5. Problem set §3.3, exercises 1, 3, 6, 11, and 13