Carefully justify every answer.

Exercise 1 (2.11 p.283)

Perform Gram-Schmidt on the following basis for $\mathbb{R}^2$, and check that the resulting vectors are orthogonal:

$$\langle \begin{pmatrix} 1 \\ 1 \end{pmatrix}, \begin{pmatrix} -1 \\ 2 \end{pmatrix} \rangle.$$

....

Exercise 2 (3.12 p.292)

Find the projection of the following vector in the subspace:

$$\begin{pmatrix} 1 \\ 2 \\ 0 \end{pmatrix}, \quad S = \left[\left\{ \begin{pmatrix} 0 \\ 2 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 \\ -1 \\ 1 \end{pmatrix} \right\} \right].$$

....

Exercise 3 (1.1 p.329)

Find the determinant of each of these matrices:

$$\begin{pmatrix} 3 & 1 \\ -1 & 1 \end{pmatrix}, \quad \begin{pmatrix} 2 & 0 & 1 \\ 3 & 1 & 1 \\ -1 & 0 & 1 \end{pmatrix}, \quad \begin{pmatrix} 4 & 0 & 1 \\ 0 & 0 & 1 \\ 1 & 3 & -1 \end{pmatrix}.$$

....

Exercise 4 (1.3 p.329)

Verify that the determinant of an upper-triangular 3×3 matrix is the product down the diagonal:

$$\det \begin{pmatrix} a & b & c \\ 0 & e & f \\ 0 & 0 & i \end{pmatrix} = aei.$$

....