Exercise 1
Calculate the coordinates of \( \mathbf{v} = (-3, 2, -1) \) relative to the orthogonal basis
\[
\{(2, 0, 0), (0, 2, -3), (0, -3, -2)\}
\]

(i) with respect to the standard dot product;
(ii) with respect to the inner product
\[
\langle \mathbf{u}, \mathbf{v} \rangle = u_1 v_1 + 4u_2 v_2 + 4u_3 v_3
\]
(check that the given basis is still orthogonal with respect to this inner product).

Exercise 2
Find the orthogonal projection of the vector \( \mathbf{v} \) onto the plane spanned by the orthogonal basis \( \{\mathbf{u}_1, \mathbf{u}_2\} \) (with respect to the standard dot product), where
\[
\mathbf{u}_1 = (1, 2, 0), \quad \mathbf{u}_2 = (-2, 1, -2),
\]
and
(i) \( \mathbf{v} = (1, 0, 1) \);
(ii) \( \mathbf{v} = (1, 1, 1) \).

Exercise 3
Use the Gram-Schmidt process to transform the given basis into orthogonal one:
(i) \( \mathbf{u}_1 = (-1, 0), \mathbf{u}_2 = (1, -3) \);
(ii) \( \mathbf{u}_1 = (1, 0, -1), \mathbf{u}_2 = (1, 0, 0), \mathbf{u}_3 = (2, 1, 0) \).