MT-A315 Introduction to Linear Algebra Worksheet 4.2

Group: ______________ Present: ____

1. Compute the projection b_0 of the vector $v = [-2, 3, 1]^t$ onto the vector $u = [1, -3, 1]^t$. Also compute the complement b_1 of v with respect to u. The inner product is the usual dot product.

   $b_0 = \frac{v \cdot u}{u \cdot u} u =$

   $b_1 =$

2. We want to figure out a formula for the projection of a general vector $x = [x_1, x_2, x_3]^t$ onto the plane with equation $2x - y + 4z = 0$.

   First step: Find a basis $\{A_1, A_2\}$ for the null space of the system (of one equation in three unknowns) $2x - y + 4z = 0$ (that is, a basis for the plane).

   Second step: apply the Gram-Schmidt process to find an orthogonal basis $\{Q_1, Q_2\}$ for the plane.

   Find the projection of $x = [x_1, x_2, x_3]^t$ onto the plane using your orthogonal basis and the Fourier Theorem.

   Use your formula to find the projection of $[7, 5, -3]^t$ onto the plane $2x - y + 4z = 0$.