Interlude 1: Exercise 5

Explanation

This is a test of the ability to apply a definition to evaluate a situation. We have a number of vectors, and we will determine which of them are oriented perpendicularly to each other.

Hint

Recall the definition of orthogonality.

Answer

Two vectors are orthogonal is their dot product is exactly 0. So, we have a lot of dot products to calulate:

$$(1,\ 1,\ 1)\cdot(2,\ -1,\ 3) = (1)\,(2) + (1)\,(-1) + (1)\,(3) = 2 - 1 + 3 = 4$$

$$(1,\ 1,\ 1)\cdot(3,\ 1,\ 0) = (1)\,(3) + (1)\,(1) + (1)\,(0) = 3 + 1 + 0 = 4$$

$$(1,\ 1,\ 1)\cdot(-3,\ 0,\ 2) = (1)\,(-3) + (1)\,(0) + (1)\,(2) = -3 + 0 + 2 = 1$$

$$(2,\ -1,\ 3)\cdot(3,\ 1,\ 0) = (2)\,(3) + (-1)\,(1) + (3)\,(0) = 6 - 1 + 0 = 5$$

$$(2, -1, 3)\cdot(-3, 0, 2) = (2)(-3) + (-1)(0) + (3)(2) = -6 + 0 + 6 = 0$$

$$(3, 1, 0)\cdot(-3, 0, 2) = (3)(-3) + (1)(0) + (0)(2) = 9 + 0 + 0 = 9.$$

So the only orthogonal pair of vectors is $(2, -1, 3)$ and $(-3, 0, 2)$.