Projection onto Planes Telephone

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1 Goals

The goals of this activity are:

1. To give students practice working with projections.
2. To give students practice with cooperating with students outside their group.

2 Materials

For this activity you will not need any materials.

3 Instructions

This activity will take approximately 40 minutes.

1. Form two pairs of groups of students, and explain the goals of the activity.
2. The class a whole receives a fixed vector v.
3. Give each of the four groups an equation of a plane, making sure a group cannot tell what equation another group got.
4. In the first step of the activity, ask each group to find an orthogonal basis for the subspace corresponding to the plane. Each group then gives the orthogonal basis to the other group in their group-pair.
5. In the second step, when a group receives an orthogonal basis, they compute the projection of the vector v onto the subspace spanned by the orthogonal basis. They then return the projection they just computed to the other group in their group-pair.
6. In the final step, each group verifies that the projection they received actually lies on their plane.

4 Tips

1. You can choose $v = (2, 1, 1)$, and let the 4 planes be $2x + y + z = 0, x - y - z = 0, x + z = 0$, and $3x + y = 0$. The projections of v onto these 4 planes are $(0, 0, 0), (2, 1, 1), (1/2, 1, -1/2)$, and $(-1/10, 3/10, 1)$