**Activity 8.4.4 Transforming Vectors with Matrices**

In the last activity, we multiplied matrices by vectors to solve equations using the inverse of a matrix. We know that when a matrix multiplies a vector, the result is vector because when we multiply an *m* × *n* matrix by an *n* × 1 vector the result is a *m* × 1 vector.

If *m* and *n* are equal then we are multiplying a square *m* × *m* matrix by an *m* × 1 vector and this gives a vector of the same dimension. So in that case, we transform one vector to another by multiplying by a matrix.

1. The simplest example is multiplying a vector by the identity matrix. What happens?
2. Another simple example is
3. In this case, what happens to vector ?
4. Find the inverse of
5. What happens when we multiply
6. So multiplying a vector by a matrix gives another vector. What do you think happens when we multiply the result by the inverse of the original matrix?
7. Lets check this out with matrix .

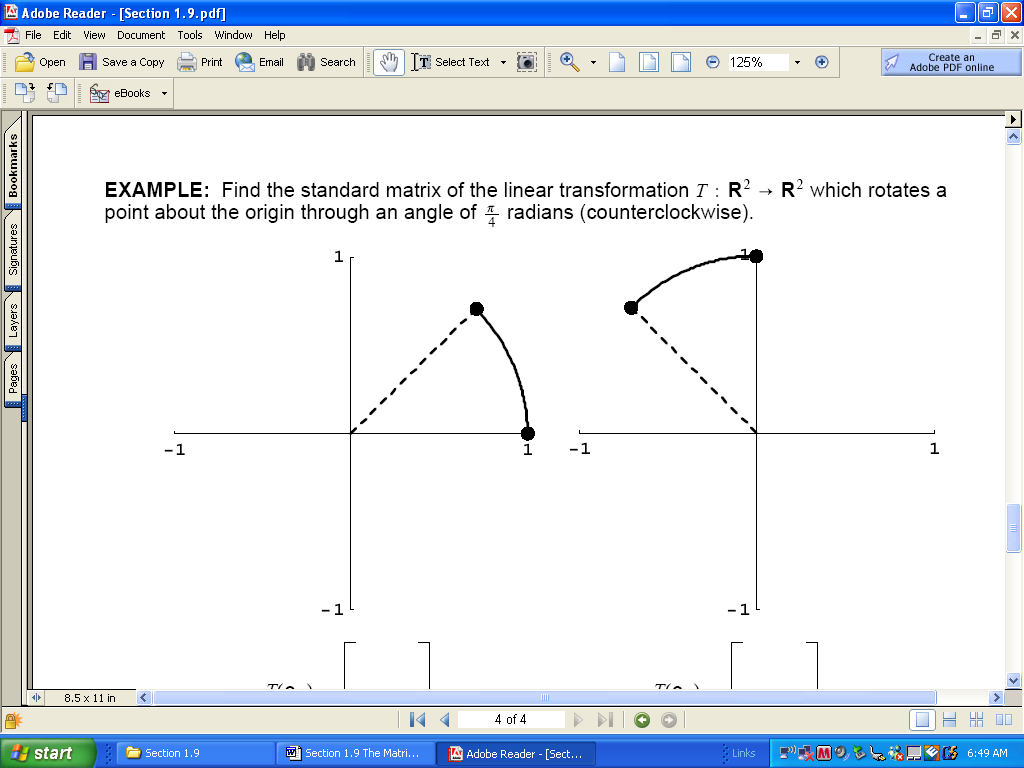
What does this do to the original vector?

1. Find the inverse of matrix
2. Check that multiplying by this inverse results in undoing the effect of multiplying vector by Start with
3. Try this matrix:

What does this matrix do to the vector it multiplies?

Start with the vectors and and plot the location of the resultant vectors.

See if you can find a pattern and predict what multiplying by does to the original vector.



We have seen that multiplying a vector by a matrix transforms the vector to a new vector by rotation or stretching/compressing or a combination of these depending on the entries in the matrix. We will soon extend this to vectors in three-space.