* 1. Chart, scatter chart

     Description automatically generated

Chart, scatter chart

Description automatically generated

Graphical user interface, text, application

Description automatically generated

* 1. Chart

     Description automatically generatedY

Chart, scatter chart

Description automatically generated

Chart, scatter chart

Description automatically generated

* 1. Graphical user interface, text, application

     Description automatically generated

Chart

Description automatically generated

* 1. **Results for data set Y\_good\_3D:**

Chart, scatter chart

Description automatically generated

Text

Description automatically generatedCovariance Matrix:



Eigenvalues:

Graphical user interface, text, application

Description automatically generated

Eigenvectors:

Text

Description automatically generatedA dimension reduction is appropriate because there are two large eigenvalues that account for a majority of the data out of three total eigenvalues, so we can reduce the dimension.

* 1. **Results for data set Y\_bad\_3D:**

Chart, scatter chart

Description automatically generated

Text

Description automatically generatedCovariance Matrix:



Eigenvalues:

Graphical user interface, text

Description automatically generated

Eigenvectors:

Text

Description automatically generatedA dimension reduction is appropriate in this case because one of the eigenvalues is significantly larger than the other two and accounts for a majority percentage of the data, so it is appropriate to reduce the data set by one or two dimensions.

* 1. **Results for data set Y\_good\_5D**

Text

Description automatically generatedCovariance Matrix:

Eigenvalues:

Text

Description automatically generatedEigenvectors:

A dimension reduction is also appropriate in this case because three of the five eigenvalues are significantly larger than the other two and account for a majority percentage of the data. Therefore, it would be appropriate to reduce the data set by one or two dimensions

Text

Description automatically generated

* 1. **Results for data set Y\_bad\_5D**

Text

Description automatically generatedCovariance Matrix:



Eigenvalues:

Text

Description automatically generatedEigenvectors:

Text

Description automatically generatedOne of the eigenvalues is significantly larger than the other four eigenvalues and accounts for a majority percentage of the data, so it would be appropriate to reduce this data set by anywhere from 1 to 4 dimensions.

Shape

Description automatically generated4.)

Projecting the data onto the first principal component might be a mistake because we have to use the mean-centered x and y values, which would not be representative of the data set as a whole due to its spiral-like geometry and whacky combination of negative and positive values in this spiral pattern.

However, it might be reasonable, nonetheless to describe this dataset as being “approximately one-dimensional” because we can project this data set onto a line through the origin based on the absolute values of the distance of the points from the origin, which would make for a good projection, thus allowing us to visualize the dataset as one-dimensional.