Python for Scientific Data Analysis

Homework - Week 4 (continuing from Week 3)

7. Eigendecomposition (in class)

- construct a 3x3 matrix with elements

  ```
  [40, 42.5, 45, 47.5, 50, 52.5, 55, 57.5, 60 ]
  ```

  using the `np.linspace` and `reshape` functions.

  - perform eigendecomposition on this matrix.
  - what is the rank of the original matrix? Why is the answer not 3?

8. Eigendecomposition (graduate students only)

- construct a 3x3 matrix with elements

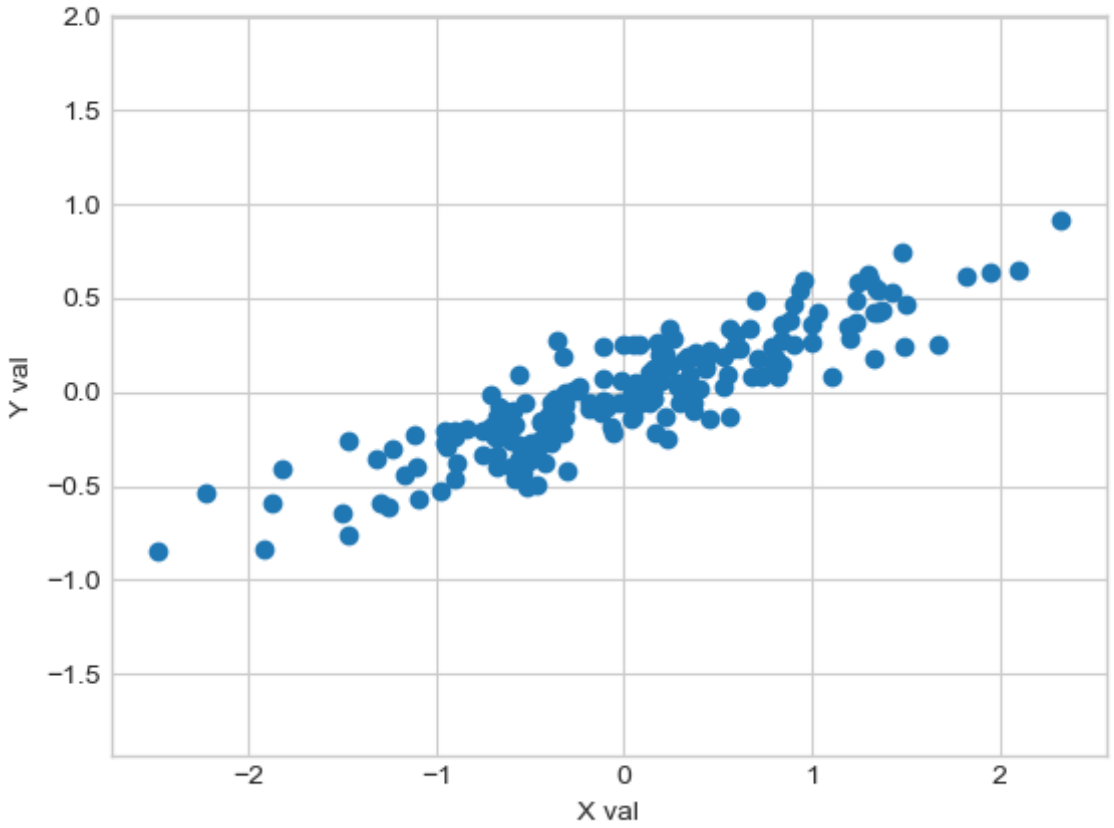
```
[16, 18.0625, 20.25,22.5625, 25, 27.5625, 30.25, 33.0625, 36]
```

using the `np.linspace` and `reshape` functions (hint: 4^2=16, 5^2=25, and 6^2=36).

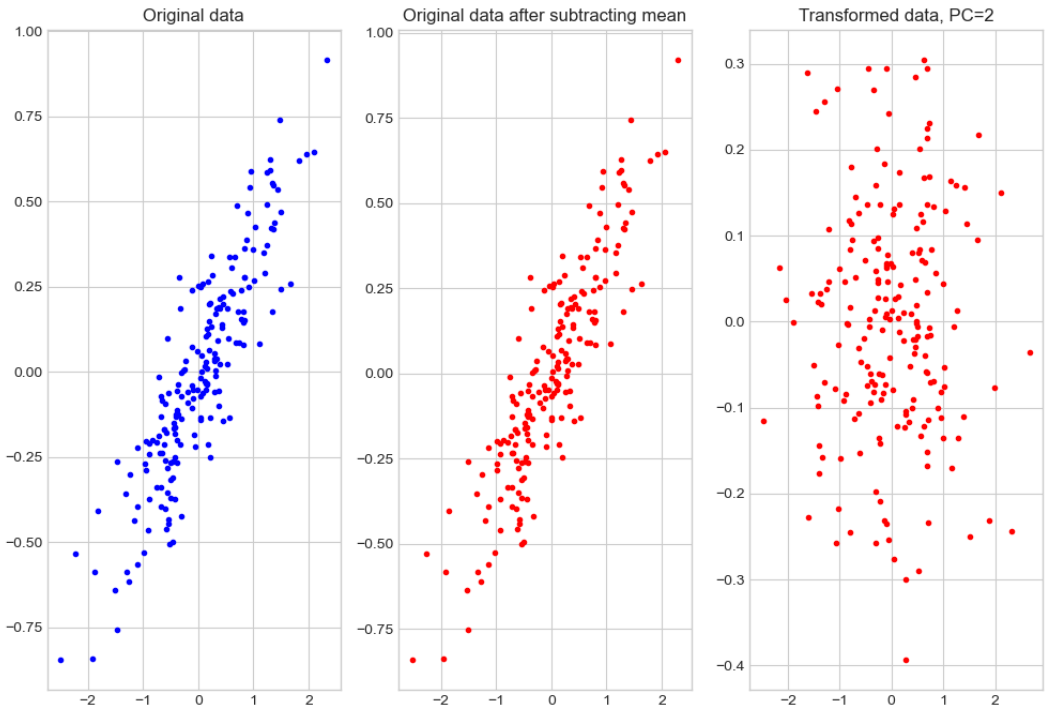
- confirm the formulas $\mathbf{A} = \mathbf{V}\Lambda\mathbf{V}^{-1}$ and $\Lambda = \mathbf{V}^{-1}\mathbf{A}\mathbf{V}$ using this matrix as $\mathbf{A}$.

9. PCA (in class?)

- Take the data shown in our first plot of the PCA lecture notes:
  `rng = np.random.RandomState(1) X = np.dot(rng.rand(2, 2), rng.randn(2, 200)).T`



Perform PCA on these data to produce the following plot:



- Do the same analysis but now use only 1 principal component.

Use the source code in `pcademo3.py` for plotting and guidance.