3. (a) In the graphs we see that a lot of eigen values are small and some are very large. This proves the point that the modes of variation are not 282 but for less. Below is a table showing estimates of significant modes of variation for numbers 0 through 9.

Number	Max Eigenvalue	Number of significant modes of Variation (Eigen value $> 10^5$)
0	5.67×10^5	39
1	5.12×10^5	17
2	3.97×10^5	50
3	3.64×10^5	45
4	3.17×10^5	40
5	5.18×10^5	47
6	4.85×10^5	39
7	3.92×10^5	33
8	3.66×10^5	49
9	4.03×10^5	37

The significant modes of vibrations are far less than $784 (28^2)$ since most of the people write similarly and hence most of the pixels end up having values close enough in all the imges. But some eigenvalues are very high which shows that there are sufficient differences as well

(b) We see that the three figures vary enough for the distinctions to be observed.

The $\mu - \text{Sqrt}(\lambda) * v$ and $\mu + \text{sqrt}(\lambda) * v$ are clearly very different for most of the numbers. This is because the principal mode of variation is able to capture most of the variation in the group of images. So not all people write in the same fashion. For e.g. for the number 1, this shows us that people write in different orientations.