* Task 1
* Question 1.

1. We could see, The activities like Walking, walking\_upstairs,walking\_downstairs have more fluctuating waveforms.
2. And for others class of activites(sitting, standing,laying)show stable/flatter waveforms
3. As we can see on above output, there are differences between the given activities. But Some dynamic activities may look similar (walking upstairs vs. downstairs).
4. There are some neural network models those can be work on above activites

Question 2

Static activities(sitting, standing, laying):There are means the involve very little movement, so the acceleration magnitude a should be relatively low and stable. We simply say, the variance in magnitude is very low

Dynamic activities(walking, walking upstairs , walking downstairs) : it involves very high waveform movement so the accesleration magnitude a should be high and instable. Here variance in magnitude is very high.

If the acceleration magnitude a shows a clear difference in variability or mean value between these two groups, a simple **threshold-based rule** could work quite well

A=sqrt(accx2​+accy2​+accz2​)

1. **Linear acceleration magnitude can easily separate static from dynamic activities**, likely without needing a full machine learning model.
2. This is because static activities show low variance in acceleration magnitude while dynamic activities have higher variance due to movement.
3. **Machine learning models become essential when classifying within these groups** (e.g., sitting vs standing, or walking vs walking upstairs).

Question 3.

Subtask 4.

* **PCA on Total Acceleration Magnitude**
* It is working on formula A=sqrt(accx2​+accy2​+accz2​)
* It is Simple and raw data-based
* **PCA on TSFEL-extracted features:**
* It is working on Statistical and temporal features extracted from raw accelerometer data (or acceleration magnitude) using TSFEL.
* It provides us feature set to capture time and frequency info
* **PCA on provided dataset features:**
* Features already precomputed and provided by the UCI HAR dataset

**Raw total acceleration PCA is useful as a quick baseline but limited** due to reduced information content.

**TSFEL is flexible and can be customized**, which is valuable in exploratory analysis or new datasets.

Hence For **better class discrimination and feature understanding**, PCA on TSFEL features is more powerful.

Question 4.

We have calculated the correlation matrix for TSFEL and features provided in dataset. Now we found that there are some features those are very correlated (>9.0) are

tBodyAcc-mean()-X

tBodyAcc-mean()-y

tBodyAcc-mean()-Z

Redundant features don’t add new information beacuase:

* Lead to overfitting.
* Increase training time.
* Obscure model interpretability.