SysID Lab 1: (Re)introduction to Matlab

You will develop a function with the exact signature:
`[index, v, y, yhat] = intro(index)`

For this particular lab, the index is irrelevant, but we'll keep it in so that you get used to the mechanism and function signatures that we'll use in subsequent labs.

Exercise 1: Some basic vector manipulations

- Create a vector containing the natural numbers from 1 to 30 in reverse, descending order.
- Replace the elements having odd indices with their sine.
- Sort the elements having even indices in ascending order (by replacing their current values with their sorted values).

Return the resulting vector after all these operations in output `v` of your Matlab function.

For this part, try to avoid using loops (for, while, etc.). Each bullet point is doable in a single Matlab line of code.

Exercise 2: Function approximation

- Generates a vector of values x between 0 and 4, equidistantly spaced with a distance of 0.25.
- Computes a vector of corresponding y values, where:
  $$y = f(x) = 2\exp(-x^2) + 2\sin(0.67x + 0.1)$$
- Computes a vector of corresponding $\hat{y}$ values, where $\hat{y}$ are approximations computed with the polynomial $g(x)$:

  $$\hat{y} = g(x) = 2.2159 + 1.2430x - 2.6002x^2 + 1.7223x^3 - 0.4683x^4 + 0.0437x^5$$
  (this polynomial was fitted beforehand to the function by the teacher).
- Plots the true values y as well as their approximations $\hat{y}$, as a function of x.
- Computes an error vector with the formula $e = y - \hat{y}$ and plots it on another figure.
- Computes the mean squared error of the approximation:
  $$\frac{1}{N}\sum_{i=1}^{N}(y_i - \hat{y}_i)^2$$
  and displays its value in the title of the error figure.

Return the resulting row vectors of exact and approximate function values in outputs `y` and `yhat` of your Matlab function, respectively.

If everything works correctly, you should obtain graphs similar to those below.