

Functions worksheet

This worksheet will use sine waves.

We will work in radians.

The basic formula for a sine wave is $s(t) = A \sin(2 \cdot \pi \cdot f \cdot t + \phi)$

A = amplitude (peak)

f = frequency (Hz or $1/(2\pi)$ of radians)

t = independent variable (time or x)

ϕ = phase (radians)

Task 1 create a sine Wave function

Task1 a wave function

Create a function called MySinFun

make s your output

make A, f, t, and phi inputs

Task1 b call function

1. Create a standard MATLAB script called sine_WorkSheet1.m
2. Start with "clc" "clear" and "close all"
3. Create variable x from 0 to 6π with 1000 points
4. Call function MySinFun outputting to y1 where the inputs are:

A = 2

f = $1/(2\pi)$

t = x

phi = 0

5. plot y1 against x

Task 2 feval

Task 2a

Create a new pointless function called phaseUp

This function will call MySinFun and increase the phase by $\pi/3$

You will need to use “feval” (this is the point of the function understanding feval)

The input into feval for the function name must be a character or string array!

Output to y2

Task 2b

1. In the main script call phaseUp function outputting to y2
2. Make a new figure Plot y1 and y2 against x

Task 3 feval again

Task 3a

Create a new pointless function called freqUp

This function will call MySinFun and increase the frequency by 2 times

You will need to use “feval” (this is the point of the function understanding feval)

The input into feval for the function name must be a character or string array!

Output to y3

Task 3b

1. In the main script call freqUp function outputting to y3
2. Plot y1, y2 and y3 against x

Task 4 differentiation

Task 4a

Create a function Called MyDiff

This function will call MySinFun and differentiate it with respect to x, h should be an input to the function.

You can use “feval” (this will mean you will need to enter all of MySinFun inputs)

The input into feval for the function name must be a character or string array!

Output to dy_dx

Task 4b numerical diff variable

1. In the main script call MyDiff function outputting to dy_dx using 1e-4 for h

Task 4C True Analytical differentiation

The input to this is $s(t) = A \sin(2 \cdot \pi \cdot f \cdot t + \phi)$

Differentiate chain rule=

$$\frac{ds}{dt} = A \cdot \cos(2 \cdot \pi \cdot f \cdot t + \phi) \cdot \frac{d}{dt}(2 \cdot \pi \cdot f \cdot t + \phi)$$

$$\frac{d}{dt}(2 \cdot \pi \cdot f \cdot t + \phi) = 2\pi f$$

$$\frac{ds}{dt} = A \cdot (2 \cdot \pi \cdot f) \cdot \cos(2 \cdot \pi \cdot f \cdot t + \phi)$$

Where $A = 2$, $f = 1/2 \cdot \pi$, $\phi = 0$

1. Create a variable called dy_dt_true and using the equation above
2. Plot dy_dt_true and dy_dx together

Task 4D

Calculate the error $dy_dx - dy_dx_true$

Plot the error

You should have 5 figures by the end of this worksheet