MATLAB Basics – Exercise 1

Compute the following expressions

1. **Arithmetic operations**

$$\frac{2^5}{2^5-1} \qquad \left(1-\frac{1}{2^5}^{-1}\right) \qquad \frac{\sqrt{5}-1}{(\sqrt{5}+1)^2}$$

(Answers: 1.0323, 1.0323, 0.1180)

2. **Exponentials and logarithms**

$$e^3 \qquad \ln(e^3) \qquad \log_{10}(e^3) \qquad \log_{10}(10^5)$$

(Answers: 20.0855, 3, 1.3029, 5)

3. **Trigonometric operations**

$$\sin\left(\frac{\pi}{6}\right) \qquad \cos(\pi) \qquad \tan\left(\frac{\pi}{2}\right) \qquad \sin^2\left(\frac{\pi}{6}\right)+\cos^2\left(\frac{\pi}{6}\right)$$

(Answers: 0.5, -1, 1.6331E16, 1)

MATLAB Basics – Exercise 2

- The following matrix is defined

$$M = \begin{bmatrix} 6 & 9 & 12 & 15 & 18 & 21 \\ 4 & 4 & 4 & 4 & 4 & 4 \\ 2 & 1 & 0 & -1 & -2 & -3 \\ -6 & -4 & -2 & 0 & 2 & 4 \end{bmatrix}$$

- Evaluate the following expressions without using MATLAB, then check your results with MATLAB

```
1. A = M([1,3], [2,4])
2. B = M(:, [1,4:6])
3. C = M([2,3], :)
```

MATLAB Basics – Exercise 3

1. Plot the following functions (choose your own appropriate range for x):
   a) y = 1/x, with a blue dashed line
   b) y = sin(x) cos(x), with a red dotted line
   c) y = $2x^2$-3x+1, with red cross markers

   Turn the grid on in all your plots, and remember to labelaxes and use a title
2. Given the following function

$$s = \arccos(\phi) + \sqrt{b^2 - (a\sin(\phi) - c)^2}$$

   plot s as a function of angle ϕ when a = 1, b = 1.5, c = 0.3 and 0 °< ϕ < 360°

MATLAB Basics – Exercise 4

1. Plot the following 3D curves using the **`plot3`** function

   a)

$$x = \sin\left(\frac{t}{2c}\right)\cos(t)$$
$$y = \sin\left(\frac{t}{2c}\right)\sin(t)$$
$$z = \cos\left(\frac{t}{2c}\right)$$

   where c = 5 and $0 < t < 10\pi$

   b) Sine wave on a sphere

$$x = \cos(t)\sqrt{b^2 - c^2\cos^2(at)}$$
$$y = \sin(t)\sqrt{b^2 - c^2\cos^2(at)}$$
$$z = c \cdot \cos(at)$$

   where a = 10, b = 1, c = 0.3, and $0 < t < 2\pi$

2. Plot the following 3D curves using the **`surf`** function

   a) Sine surface

$$x = \sin(u)$$
$$y = \sin(v)$$
$$z = sin(u + v)$$

   where $0 < u < 2\pi$ and $0 < v < 2\pi$

   b) Elliptic torus

$$x = [1 - r_1\cos(v)]\cos(u)$$
$$y = [1 - r_1\cos(v)]\sin(u)$$
$$z = r_2 \cdot \left[\sin(v) + \frac{tu}{\pi}\right]$$

   where $r_1 = r_2 = 0.5$, t = 1.5, $0 < u < 10\pi$ and $0 < v < 10\pi$