SHEET (4)

1- Using the Zeros, Eye, and Ones built-in matrices in MATLAB and the, create the 4
arrays (D,E,F,G), where
  a) D should be M × N filled with ones,
  b) E should be M × M filled with three's,
  c) F should be N × N with five's on the diagonal, and
  d) G should be N× M filled with 0's.
(Note: M varies between 3 and 6 and N varies between 4 and 7. It is recommended to use
nested for loops)

2- Write a program in a M-File that finds the smallest even integer that is divisible by 13 and
by 16 whose square root is greater than 120. Use a loop in the program. The loop should start
from 1 and stop when the number is found. The program prints the message "The required
number is:" and then prints the number.

3- Rewrite the following statements to use only one if statement.
     if x<y if z<10 w=x*y*z end end

4- Consider the array A.

$$A = \begin{bmatrix} 3 & 5 & -4 \\ -8 & -1 & 33 \\ -17 & 6 & -9 \end{bmatrix}$$

Write a program that computes the array B by computing the natural logarithm of all the
elements of A whose value is no less than 1, and adding
20 to each element that is equal to or greater than 1. Do this in two ways:
     a. By using a for loop with conditional statements.

     b. By using a logical array as a mask.

5- Create using a while loop a script to determine how many terms in the series 2^K, k = 1, 2, 3,
.. , are required for the sum of the terms to exceed 2000. What is the sum for this number of
terms?

6- Compute Use a loop in MATLAB to determine how long it will take to accumulate
$1,000,000 in a bank account if you deposit $10,000 initially and $10,000 at the end of each year;
the account pays 6 percent annual interest.

SHEET (4)

7- Given Cam is a mechanical device that transforms rotary motion into linear motion. The shape of the disc is designed to produce a specified displacement profile. A displacement profile is a plot of the displacement of the follower as a function of the angle of rotation of the cam. The motion of a certain cam is given by the following equations:

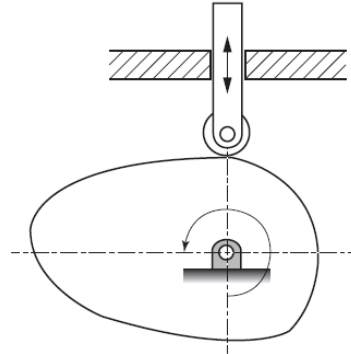$$y = 6[2\theta - 0.5\sin\theta]/\pi \quad \text{for} \quad 0 \le \theta \le \pi/2$$

$$y = 6 \quad \text{for} \quad \pi/2 \le \theta \le 2\pi/3$$

$$y = 6 - 3\left[1 - 0.5\cos\left(3\left(\theta - 2\frac{\pi}{3}\right)\right)\right] \quad \text{for} \quad 2\pi/3 \le \theta \le 4\pi/3$$

$$y = 3 \quad \text{for} \quad 4\pi/3 \le \theta \le 3\pi/2$$

$$y = 3 - 1.5\left(\frac{\theta - 3(\pi/2)}{\pi/4}\right)^2 \quad \text{for} \quad 3\pi/2 \le \theta \le 7\pi/4$$

$$y = 0.75 - 0.75\left(1 - \frac{t - 7(\pi/4)}{\pi/4}\right)^2 \quad \text{for} \quad 7\pi/4 \le \theta \le 2\pi$$

8- Create The height and speed of a projectile (such as a thrown ball) launched with a speed of at an angle A to the horizontal are given by

$$h(t) = v_0 t \sin A - 0.5gt^2$$

$$v(t) = \sqrt{v_0^2 - 2v_0 gt \sin A + g^2 t^2}$$

where g is the acceleration due to gravity. The projectile will strike the ground when $h(t)=0$, which gives the time to hit $thit=2(v_0/g)\sin A$. Suppose that $A = 30°$, $v_0= 40$ m/s, and g $=9.8$ m/s². Use the MATLAB relational and logical operators to find the times when The height is no less than 15 m.

9- Write a function that accepts temperature in degrees Fahrenheit (°F) and computes the corresponding value in degrees Celsius (°C). The relation between the two is T (°C) $=59(T$ (°F)-32), Test your function at 32, 50 and 100.

10- An object thrown vertically with a speed $v0$ reaches a height h at time t, where $h=v_0 t - 12gt^2$, Write and test a function that computes the time t required to reach a specified height h, for a given value of v_0. The function's inputs should be h, v_0, and g. Test your function for the case where $h = 100$ m, $v_0 = 50$ m/s, and $g = 9.81$ m/s². Interpret both answers.