1) What is the output when the following commands are implemented?

```
A=[1:3;2:2:6;3:-1:1]
A=A'
A(:,3)=[]
A=[A(:,1) [4 5 7]' A(:,2)]
A=sum(diag(A))
```

2) The MATLAB humps function defines a curve $0 \leq x \leq 2$,

$$f(x) = \frac{1}{(x-0.3)^2 + 0.01} + \frac{1}{(x-0.9)^2 + 0.04} - 6$$

Use MATLAB to generate a plot of $f(x)$ versus x with $x = [0:1/256:2]$;

3) Use the linspace function to create vectors identical to the following created with colon notation:
(a) $t = 4:6:35$
(b) $x = -4:2$

4) Use colon notation to create vectors identical to the following created with the linspace function:
(a) $v = \text{linspace}(-2,1.5,8)$
(b) $r = \text{linspace}(8,4.5,8)$

5) The standard normal probability density function is a bell-shaped curve that can be represented as

$$f(z) = \frac{1}{\sqrt{2\pi}} e^{z^2/2}$$

Use MATLAB to generate a plot of this function from $z = -5$ to 5. Label the ordinate as frequency and the abscissa as z.

6) It is general practice in engineering and science that equations be plotted as lines and discrete data as symbols. Here are some data for concentration (c) versus time (t) for the photodegradation of aqueous bromine:

t, min	10 20 30 40 50 60
c, ppm	3.4 2.6 1.6 1.3 1.0 0.5

These data can be described by the following function:

$$c = 4.84e^{-0.034t}$$

Use MATLAB to create a plot displaying both the data (using diamond-shaped, filled-red symbols) and the function (using a green, dashed line). Plot the function for t = 0 to 70 min.

7) Here are some wind tunnel data for force (F) versus velocity (v):

v, m/s	10 20 30 40 50 60 70 80
F, N	25 70 380 550 610 1220 830 1450

These data can be described by the following function:

$$F = 0.2741v^{1.9842}$$

Use MATLAB to create a plot displaying both the data (using circular magenta symbols) and the function (using a black dash-dotted line). Plot the function for v = 0 to 100 m/s and label the plot's axes.

8) The Maclaurin series expansion for the cosine is

$$\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \frac{x^8}{8!} - \cdots$$

Use MATLAB to create a plot of the sine (solid line) along with a plot of the series expansion (black dashed line) up to and including the term $\frac{x^8}{8!}$. Use the built-in function factorial in computing the series expansion. Make the range of the abscissa from $x = 0$ to $\frac{3\pi}{2}$.

9) The sine function can be evaluated by the following infinite series:

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \frac{x^9}{9!} - \cdots$$

Create an M-file to implement this formula so that it computes and displays the values of sin x as each term in the series is added. In other words, compute and display in sequence the values for

$$\sin x = x$$

$$\sin x = x - \frac{x^3}{3!}$$

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!}$$

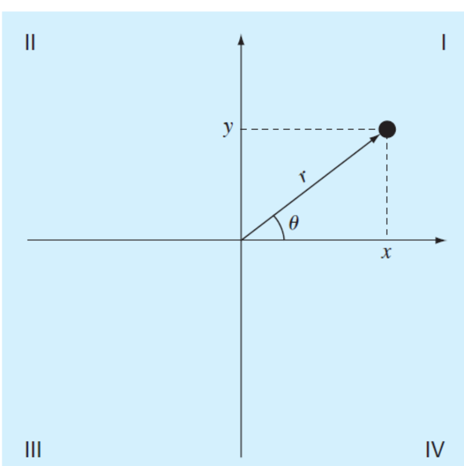
up to the order term of your choosing. For each of the preceding, compute and display the percent relative error as

$$\%error = \frac{true - series\ approximation}{true} \times 100\%$$

As a test case, employ the program to compute $sin(0.9)$ for up to and including eight terms, that is, up to the term $\frac{x^{15}}{15!}$.

10) Two distances are required to specify the location of a point relative to an origin in two-dimensional space.

- The horizontal and vertical distances (x, y) in Cartesian coordinates.
- The radius and angle (r, θ) in polar coordinates.



It is relatively straightforward to compute Cartesian coordinates (x, y) on the basis of polar coordinates (r, θ). The reverse process is not so simple. The radius can be computed by the following formula:

$$r = \sqrt{x^2 + y^2}$$

If the coordinates lie within the first and fourth coordinates (i.e., $x > 0$), then a simple formula can be used to compute θ:

$$\theta = \tan^{-1}\left(\frac{y}{x}\right)$$

The difficulty arises for the other cases. The following table summarizes the possibilities:

$\boldsymbol{x}$	$\boldsymbol{y}$	$\boldsymbol{\theta}$
< 0	> 0	$\tan^{-1}(y/x) + \pi$
< 0	< 0	$\tan^{-1}(y/x) - \pi$
< 0	$= 0$	π
$= 0$	> 0	$\pi/2$
$= 0$	< 0	$-\pi/2$
$= 0$	$= 0$	0

Write a well-structured a .mlx-file using $if \ldots elseif$ structures to calculate r and θ as a function of x and y.

Express the final results for θ in degrees. Test your program by evaluating the following cases:

$\boldsymbol{x}$	$\boldsymbol{y}$	$\boldsymbol{r}$	$\boldsymbol{\theta}$
2	0		
2	1		
0	3		
-3	1		
-2	0		
-1	-2		
0	0		
0	-2		
2	2		

11) Develop a .mlx-file to determine polar coordinates as described in (Q 10). However, rather than designing the function to evaluate a single case, pass vectors of x and y. Have the function display the results as a table with columns for x, y, r, and θ. Test the program for the cases outlined in (Q 10).