# Exercises
# Chapter One

**Q2) Create a vector x with the elements:**

A. 2, 4, 6, 8, ...
B. 10, 8, 6, 4, 2, 0, -2, -4
C. 1, 1/2, 1/3, 1/4, 1/5, ...
D. 0, 1/2, 2/3, 3/4, 4/5, ...

**rat, rats: Rational fraction approximation**
**Description**
**rat(X), with no output arguments, simply displays the continued fraction.**

**A. X =[2 : 2 : n]**

**B. X=[10 : -2 : -4]**

**C. i = 1:5, X = 1./i , rats(X)**

**D. i = 0:4, i = 1:5, X = i./j , rats(X)**

**Q3) Given a vector, t , of length n , write down the MATLAB expressions that will correctly compute the following:**

$\ln (2 + t + t^2)$
$e^t (1 + \cos(3t))$
$\cos^2(t) + \sin^2(t)$
$\tan^{-1}(1)$
$\cot (t)$
$\sec^2(t) + \cot(t) - 1$

**Test that your solution works for t = 1:0.2:2**

```
t=1:0.2:2;
y= log(2+t+t.^2)
```

**Q3) With x = 5 and y = 2, compute the following quantities:**

$u = x + y$

$v = xy$

$w = x/y$

$z = w^3$

$s = xy^2/(x - y)$

$p = 3x/2y$

$r = 3xy/2$

$t = x^5/(x^5 - 1)$

**Q3) With x = 10 and y = 3, compute the following quantities:**

$r = 8 \sin(y)$

$s = 5 \sin(2y)$

$z = \sin(x)$

$w = 2(\sin(x))/5$

$p = e^{x-1}$

$u = 2 + \cos(2\pi x)$

$m = \sqrt{x} + 4 + \sin(0.2\pi) + e^2$

**Q4) Create a variable *a* and set *a* = ¼ + 3, Create *b* and set *b* = cos(*a*).**

1. Type 'format long', and redisplay variable b. Does it look different?
2. Type 'format short', and redisplay variable b. Does it look different?
3. Calculate a * b. Calculate a + b. Calculate a/b.

**Q7) Create a MATLAB expression that calculates the logarithm base 10 of e raised to the power of 16.**

```
>> log10( exp(16))
```

**Q8) Create a MATLAB expression that calculates the square root of the sum of the sine of 24 degrees and the cosine of 56 degrees.**

```
>> sqrt( sin(24) + cos (56) )
```

**Q9) Create a MATLAB expression that calculates the tangent of 78 degrees and then raises this result to the power of 4.**

```
>> ( tan (78) ) ^ 4
```

**Q10) All the following instructions should be implemented in your script except of sub-question e, k, m and o, which you should run from the command line.**

A. Create a variable called ***current*** that has the value **3** (A);
B. Create a variable called ***resistance*** that has the value **2.4** (ohm);
C. Calculate the value of the variable ***voltage*** (according to ohm's law ***voltage = current * resistance***)
D. Display your result in the following format "The voltage is: <your result>".
E. Delete the variable ***resistance*** from the workspace using the function clear.
F. Now display all the variables in the workspace using the function who. How many variables are in the working space?
G. Load the saved variable ***resistance***. How many variables exist in the Workspace now?
H. Insert % to your script in the beginnings of the lines where you deleted the variable *resistance* from the work-space and the line where you saved the variable *resistance*. Save the script and re-run it. Why did you get an error?
I. Use clear in the command line. How many variables exist in the Workspace?
J. Copy & paste the following line into your command line:
K. current =10 ; resistance =13; What is the voltage now?

```
>> current = 3;
>> resistance = 2.4;
>> voltage = current * resistance ;
>> disp ‘ The voltage is: ‘, voltage
>> clear resistance
>> who
>> resistance = 2.4;
>> who
>> current =10 ;  resistance =13;
>> voltage = current * resistance
```

# Exercises
# Chapter Two

**Q1) What is drawn by the following code?**

```
>> t = 0:0.01:6*pi;
>> y = cos(t);
>> plot(t,y)
```

**What is the difference compared to**

```
>> plot(y)
```

**Q2) Enter a vector**

**x = [0:0.1:20]; then create the vectors,**
**y = sin(x);**
**z = sin(x/2);**
**w = y + x;**
**r = y-x;**
**and**

Plot y vs. x
Plot z vs. x
Plot w vs. x
Plot r vs. x

**Q3) Plot the expression (determined in modeling the growth of the US population)**

$$P(t) = 197273000/ (1 + e^{-0.0313(t - 1913.25)})$$

**Where t is the date, in years AD, using t = 1790 to 2000. What Population is predicted in the year 2020?**

```
>> t = 1790 : 2000 ;
>> a= 1 + exp(-0.0313*(t - 1913.25));
>> p = 197273000. / a;
>> plot (p,t)
```

```
>> a= 1 + exp(-0.0313*(2020 - 1913.25));;
>> p = 197273000/ a
```

**Q4) Create the vector x = randn (35,1) and then evaluate the following function using only logical indexing:**

$y(x) = |\sin(x)|$

$z(x) = |\cos(x)|$

**You can check your answer by plotting y vs. x and z vs. x with symbols.**

```
>> x= randn(35,1);
>> y = abs ( sin(x));
>> z= abs( cos (x));
>> plot(y,x,'r',z,x,'b')
```

**Q5) Evaluate the function $y = \tan(x)$ for x = 3 to x = 5 in step of 0.01 and make its plot.**

```
>> X = 3: 0.01 : 5;
>> Y= tan (X);
>> plot(Y,X)
```

**Q6) Let be the function $y = \sin(x^2)$; x=from 0 to $2\pi$**

A. plot y vs. x
B. try making the step smaller ($\pi/100$),
C. add some labels (xlabel, ylabel),
D. and a title (title),
E. and a legend (legend),
F. finally add a grid (grid on).

```
>> X = 0 : 2*pi;
>> Y = sin (X.^2);
>> plot(Y,X)

>> X = 0 : pi/100:2*pi;
>> Y = sin (X.^2);
>> plot(Y,X), xlabel (' x = 0 : 2 pi ') , ylabel (' Sine of x '), title (' Plot of the Sine function '), legend ( ' sin(x^2) '  )
```

**Q7) Plot a graph y & z vs. x, with x from -5 to 10 with a step of 0.2**

$y = \tan^{-1}(x)$

$z = \tan(x)$

```
>> X = -5 : 0.2 : 10;
>> Y = atan(X);
>> Z = tan (X);
>> plot ( y,x,'r',z,x,'b')
```

**Q8) Obtain a hard copy of the plot of the functions *Y = 2x , Z = 3x* for *x* = -1, …, 1 on the same axis. Label the *x* and *y* axes and creates a legend indicating which graph is which.**

```
X = -1 : 0.1 : 1;
Y = 2* X;
Z = 3 * X;
plot(Y,X,'r',Z,X,'b'), xlabel (' x ') , ylabel (' y and z'), legend ( ' 2X ', '3X' )
```

**Q9) For the same x in Q8, Make some log and semi log plots of y = $x^2$, and $z = x^3$. The commands to use are semilogx and loglog. To create a vector of $x^3$, type y = x.^3**

```
X = -1 : 0.1 : 1;
Y = X.^2;
Z = X.^3;
plotyy(Y,X,Z,X,'semilogy','loglog')
```

# Exercises
# Chapter Three

**Q1) Create the vector x = randn(35,1) and then evaluate the following function using only logical indexing:**

**y(x)= 2 if x < 6**
**y(x)= x - 4 if 6 <= x < 20**
**y(x)= 36 - x if 20 <= x <= 35**

```
X= randn(35,1);
if   (X < 6)
    Y = 2
elseif   (6 <= X)   &  (X < 20)
     Y = X – 4
else     (20 <= X)  &  (X <= 35)
     Y = 36 – X
end
```

**Q2) Create a 10 elements of random numbers (use randn). Move through the elements, and calculate the sum of any value that is less than 0.2 to 0.**

```
Sum = 0;
for  i = 1 : 10
     X= randn(1)
          if (X >= 0) &  (X < 0.2)
                    Sum = Sum + X
          end
end
  Sum
```

**Q3) Write a script which calculates the sum of 20 elements. Use a for loop.**

```
Sum = 0;
for i = 1 : 20
      Sum = Sum + i;
end
Sum
```

**Q4) Write a script which finds F= N*3 if N < 1000 and F=$N^2$ if N ≥ 1000.**

```
N = 500;
if  (N < 1000)
    F = N * 3
elseif  ( N >= 1000)
    F = N ^2
end
```

**Q5) Write a script which finds the sum of the first 40 numbers of F**

$$\sum_{n=1}^{40} F$$

```
F = 0;
for n = 1 : 40
      F = F + n;
end
F
```

**Q6) Write a script computing the sum of integers ranging from 1 to 100.**

```
Sum = 0;
for i = 1 : 100
    x = randn(1);
   Sum = Sum + int8(x);
end
Sum
```

**Q7) Create a row vector with 19 values distributed between 100 and 100000. Print out the total sum as a power of 10 times.**

```
N=(100000-100)/19;
Sum = 0;
 for i = 100 : N : 100000
Sum = Sum + i;
end
Sum^10
```

**Q8) The area of a circle is given by $A1 = \pi r^2$ where r is the radius. Also the area of rectangle is given by A2 = X*Y . If $0 \leq x$ calculate A1. If $y \leq 1$. Calculate A2. Where r= 5.**

```
r = 5;
x=1;
y=2;
if  ( 0 <= x)
    A1 = pi * r^2
elseif ( y <= 1)
    A2 = x * y
end
```

**Q9) Write a script to inter the user age and then classifies the age according to the following scheme:**
**Error < 0< = Baby < 1 <= Child < 13 <= Teenager < 18 <= Adult < 60 <= Senior < 120 <= Error**

```
If    ( 0 <= age) & ( age < 1)
      disp ( ' Baby ')
elseif   ( 1 <= age) & ( age < 13)
       disp ( ' Child ')
elseif   ( 13 <= age) & ( age < 18)
       disp ( ' Teenager ')
elseif   ( 18 <= age) & ( age < 60)
       disp ( ' Adult ')
elseif   ( 60 <= age) & ( age < 120)
       disp ( ' Senior ')
else
       disp ( ' Error ')
end
```

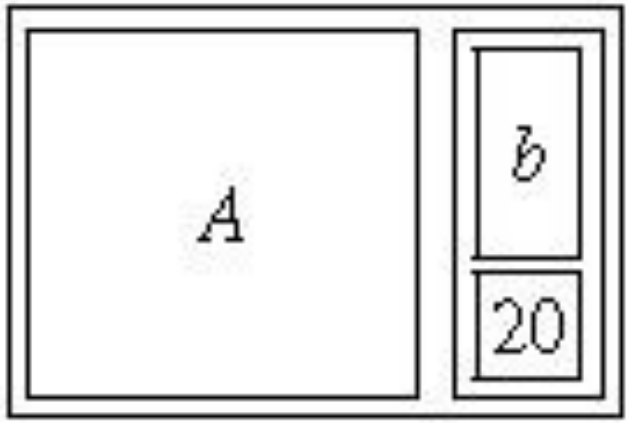
**Q10) Write a script that calculates the mean for a series of numbers, if the number between 2 and 12.**

```
sum = 0;
for i= 2 : 12
   sum = sum + i;
end
mean = sum / 10
```

# Exercises
# Chapter Four

**Q2) Construct a larger matrix from the sub-matrices A and b:**
**The brackets are used here to group a number of sub-matrices into a new matrix. (Create the matrix as you like)**

```
A = [ 1 2 3; 4 5 6; 7 8 9];
B = [ 10 ; 11 ; 20];
C = [ A  B ]
```



**Q4) Let the variable A be a row matrix (2, 4, 0, -1, 3), and B be a column matrix whose five elements are 2, 5, 8, 3, -5, in that order. Calculate the quantity A * (B+1).**

```
A = [ 2 4 0 -1 3];
B = [ 2; 5; 8; 3; -5];
A * ( B + 1)
```

**Q5) Set up the vector, v = (0,1,2,...,50), and calculate the length of this vector $|v|$, as given by the formula: $|v| = \sqrt{v \,.\, v}$**

```
v = 0 : 50;
x= sqrt( v.^2 )
```

**Q6) Given the array A = [ 2 4 1 ; 6 7 2 ; 3 5 9], provide the commands needed to**

**a) assign the first row of A to a vector called x**

**b) assign the last 2 rows of A to an array called y**

**c) compute the sum over the columns of A**

**d) compute the sum over the rows of A**

```
A = [ 2 4 1; 6 7 2; 3 5 9];
X = [ A(1,:)]
Y = [ A(2,:); A(3,:)]
sum(A)
sum(A,2)
```

Q8) With $A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 9 & 10 & 11 & 12 \end{bmatrix}$ , perform the following operations:

(a) Extract the 3rd column of matrix A and store it in vector B.

(b) Extract the 1st and 3rd columns of matrix A and store them in matrix C.

(c) Add the 1st and 3rd rows of matrix A together and store the result in vector D

(d) Change the value in the 2nd row and 3rd column of A to -7 (instead of +7) and call the result AA (do not destroy/change the original A matrix).

(e) Create a matrix that contains rows 1 and 3 from A, the second row of AA, and the result of step (c). The resultant 4x4 matrix should be

```
A=[1 2 3 4; 5 6 7 8; 9 10 11 12];
B = [ A(3,:)]
C=[ A(1,:); A(3,:)]
D=[ A(1,:) + A(3,:)]
AA = A ; AA(2,3)= -7
BB = [ A(1,:);  A(3,:);  AA(2,:); D]
```

**Q9) Find a short MatLab expression to build the matrix:**

```
A =   1   2   3   4   5   6    7
      9   7   5   3   1  -1   -3
      4   8  16  32  64 128  256
```

```
A = [ 1:7 ; 9:-2:-3 ; 2.^(2:8)]
```

**Q10) Create 3 matrixes (Red, Green and Blue) with the same dimensions, containing values between 0 and 1.**

```
Red = eye(3)
Green = ones(3,3)
Blue = [ 0 1 1; 1 0 1; zeros(1,3)]
```

**Q14) Give a MATLAB expression that uses only a single matrix multiplication with B to obtain**

**(a) the sum of columns 5 and 7 of B**

**(b) the last row of B**

**(c) a version of B with rows 2 and 3 swapped**

```
B = randn(4,7);
sum(B(:,5)) , sum(B(:,7))
B(4,:)
B([3 2],:) = B([2 3],:)
```

If you want to swap columns 3 and 1 :

A(:,[1 3]) = A(:,[3 1])

If you want to swap rows 2 and 4:

A([4 2],:) = A([2 4],:)

**Q15) Using the colon operator, create a row vector that contains all of the even numbers between 2 and 27. The first element should be 2 and the numbers should be in ascending order.**

**X= [ 2 : 2 : 27]**

**Q16)**

**1. Create a row vector v with values (1, 2, 3, 5, 11, 7, 13).**

**2. Change the value of the 5th and the 6th element of the v to 7 and 11 respectively. Try doing this with only one command as well.**

**V = [ 1 2 3 5 11 7 13]**

**V(1,5)=7 , V(1,6)=11**