

## Matrices and Loops

**Q / find the summation of the main diagonal of matrix A? use *for* loops.**

```
>> A=[4,8,12,6;5,7,9,11;2,3,5,4;3,10,1,2]
```

```
s=0;
```

```
for i=1:4
```

```
    for j=i
```

```
        s=s+A(i,j);
```

```
    end
```

```
end
```

```
disp(s)
```

```
18
```

**Q / find the summation of the elements of the matrix A under main diagonal of? use *for* loops.**

```
>> A=[5,8,12,1;4,7,9,11;2,3,5,4;3,10,1,2]
```

```
s=0;
```

```
for i=2:4
```

```
    for j=1:i-1
```

```
        s=s+A(i, j);
```

```
    end
```

```
end
```

```
disp(s)
```

```
44
```

**Q / Build a matrix A(3\*4) that starts with 4 and with increment of 2? use *for* loops.**

```
s=4;
for i=1:3;
    for j=1:4;
        A(i,j)=s;
        s=s+2;
    end
end
disp(A)
```

4	6	8	10
12	14	16	18
20	22	24	26

**Q / Find out the output of the following program?**

```
s=5;
for i=1:3;
    for j=1:4;
        A(i,j)=s;
        s=s+3;
        if A(i,j)>25
            A(i,j)=0;
        end
    end
end
end
```

```
disp(A)
```

**Q / Write a MATLAB code to find the summation of the elements of the first and fourth columns of matrix A?**

```
A=[5,4,6,8;10,12,17,13;2,5,9,6];  
s=0;  
for i=1:3  
    for j=[1 4]  
        s=s+A(i,j);  
    end  
end  
disp(s)
```

**Q / Write a program that multiply the elements of the second and third columns of the matrix A by 2?**

```
A=[5,4,6,8;10,12,17,13;2,5,9,6]
```

**Q / Write a program that duplicate the elements of the first and third rows of the matrix A?**

```
A=[5,4,6,8;10,12,17,13;2,5,9,6]
```

## Differentiation

The derivative of a function  $y = f(x)$  is written as  $(dy/dx)f(x)$  and is defined as the rate of change of the dependent variable  $y$  with respect to  $x$ . The derivative is the slope of the line tangent to the function at a given point.

MATLAB has a function *polyder*, which will find the derivative of a polynomial.

For example, for the polynomial  $x^3 + 2x^2 - 4x + 3$ , which would be represented by the vector `[1 2 -4 3]`, the derivative is found by:

```
>> p = [1 2 -4 3];  
>> diffp = polyder(p)  
diffp =  
3    4    -4
```

which shows that the derivative is the polynomial  $3x^2 + 4x - 4$ . The function *polyval* can then be used to find the derivative for certain values of  $x$ ;

for example for  $x = 1, 2$ , and  $3$ :

```
>> polyval(diffp, 1:3)  
ans =  
3    16    35
```

MATLAB has a built-in function, **diff**, which returns the differences between consecutive elements in a vector. For example,

```
>> diff([4 7 15 32])
```

```
ans =
```

```
3     8    17
```

**Q / find the first differentiation of the equation f(x)?**

$$f(x)=x^2\sin(x)+\cos(x)$$

```
>> syms x
```

```
>> f=x^2*sin(x)+cos(x);
```

```
>> d=diff(f,x)
```

$$d = x^2 \cos(x) - \sin(x) + 2x \sin(x)$$

**Q / find the first differentiation of the equation f(x)?**

$$f(x)=x^2\sin(x)+\tan(x)$$

```
>> syms x
```

```
>> f=x^2*sin(x)+tan(x);
```

```
>> d=diff(f,x)
```

$$d = x^2 \cos(x) + \tan(x)^2 + 2x \sin(x) + 1$$

**Q / find the second differentiation of the equation f(x)?**

```
>> syms x
```

```
>> f=x^2*sin(x)+tan(x);
```

```
>> d=diff(f,x,2)
```

```
d = 2*sin(x) - x^2*sin(x) + 4*x*cos(x) + 2*tan(x)*(tan(x)^2 + 1)
```

**Q / find the third differentiation of the equation f(x)?**

```
>> syms x
```

```
>> f=x^2*sin(x)+tan(x);
```

```
>> d=diff(f,x,3)
```

```
d = 6*cos(x) + 2*(tan(x)^2 + 1)^2 - x^2*cos(x) +  
4*tan(x)^2*(tan(x)^2 + 1) - 6*x*sin(x)
```

**Q / find the third differentiation of the equation f(x) at the point  $x=\pi$ ?**

```
>> syms x
```

```
>> f=x^2*sin(x)+tan(x);
```

```
>> d=diff(f,x,3)
```

```
d =
```

```
6*cos(x) + 2*(tan(x)^2 + 1)^2 - x^2*cos(x) +  
4*tan(x)^2*(tan(x)^2 + 1) - 6*x*sin(x)
```

```
>> subs(d,x,pi)
```

```
ans = pi^2 - 4
```

**Q / find  $\frac{\partial^2 f}{\partial x^2}$  of the equation f?**

$$f(x,y,z)=x^2y^3z^4$$

```
>> syms x y z
```

```
>> f=x^2*y^3*z^4;
```

```
>> d=diff(f,x,2)
```

```
d =
```

$$2*y^3*z^4$$

**Q / find  $\frac{\partial^2 f}{\partial y^2}$  of the above equation f?**

```
>> syms x y z
```

```
>> f=x^2*y^3*z^4;
```

```
>> L=diff(f,y,2)
```

```
L =
```

$$6*x^2*y*z^4$$

**Q / find  $\frac{\partial^2 f}{\partial y \partial x}$  of the above equation f?**

```
>> syms x y z
```

```
>> f=x^2*y^3*z^4;
```

```
>> k=diff(diff(f,y),x)
```

$$k = 6*x*y^2*z^4$$