

## Key to MATLAB Exercise 6 – Polynomial

1.

1)  
 $\gg a=[1\ 0\ 0\ 0\ 3\ -4]$   
 $a =$

1	0	0	0	3	-4
---	---	---	---	---	----

2)  
 $\gg a2=[1\ 0\ 0\ 0]$   
 $a2 =$

1	0	0	0
---	---	---	---

3)  
 $\gg r=[0\ 1\ -3]; \text{poly}(r)$   
 $ans =$

1	2	-3	0
---	---	----	---

4)  
 $\gg a=[1\ -2; -3\ -4]; \text{poly}(a)$   
 $ans =$

1	3	-10
---	---	-----

2.

1)  
 $\gg a=[1\ 2\ 3]; \text{poly}(a)$   
 $ans =$

1	-6	11	-6
---	----	----	----

2)  
 $\gg \text{syms } x; f=(x-1)*(x-2)*(x-3)$   
 $f =$

$$(x-1)*(x-2)*(x-3)$$

3)  
 $\gg \text{pretty}(f)$

$$(x - 1) (x - 2) (x - 3)$$

4)  
 $\gg \text{horner}(f)$   
 $ans =$

$$(x-1)*(x-2)*(x-3)$$

3.

1)  
 $\gg \text{subs}(f, 4)$   
 $ans =$

6
---

2)  
 $\gg \text{subs}(f, 1:10)$   
 $ans =$

0	0	0	6	24	60	120	210	336	504
---	---	---	---	----	----	-----	-----	-----	-----

4.

1)

```
>> syms x; mat = eye (2); sym_pol_a = x^2+1; subs(sym_pol_a, mat)
ans =
```

$$\begin{matrix} 2 & 1 \\ 1 & 2 \end{matrix}$$

Let  $mat = \begin{pmatrix} t_{11} & t_{12} \\ t_{21} & t_{22} \end{pmatrix}$ , It generate a matrix, the  $(i,j)$  element of which is obtained by substituting

the  $x$  in  $x^2 + 1$  with the  $(i,j)$  element of mat, that is,  $\begin{pmatrix} t_{11}^2 + 1 & t_{12}^2 + 1 \\ t_{21}^2 + 1 & t_{22}^2 + 1 \end{pmatrix} = \begin{pmatrix} 1^2 + 1 & 0^2 + 1 \\ 0^2 + 1 & 1^2 + 1 \end{pmatrix}$ .

2)

```
>> clear; mat = eye (2); pol_a = [1 0 1]; polyvalm(pol_a, mat)
```

ans =

$$\begin{matrix} 2 & 0 \\ 0 & 2 \end{matrix}$$

The answer is the result of  $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}^2 + \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ .

3)

```
>> syms x; mat = eye (2); pol_a = x^2+1; polyvalm(pol_a, mat)
```

??? Inputs to polyvalm must be floats, namely single or double.

Error in ==> polyvalm at 27

```
Y = diag(p(1)) * ones(m,1,superiorfloat(p,X)));
>> clear; syms x; mat = eye (2); pol_a = x^2+1; polyvalm(sym2poly(pol_a), mat)
```

ans =

$$\begin{matrix} 2 & 0 \\ 0 & 2 \end{matrix}$$

5.

1)

```
>> clear; syms x; f=x^2+x-4; g=2*x^2+1; f_plus_g_sym=f+g % in sym form
```

f\_plus\_g\_sym =

$$3*x^2+x-3$$

Or

```
>> clear; f0=[1 1 -4]; g0=[2 0 1]; f_plus_g_vector=f0+g0 % in vector form
```

f\_plus\_g\_vector =

$$\begin{matrix} 3 & 1 & -3 \end{matrix}$$

Or

```
>> clear; f0=[1 1 -4]; g0=[2 0 1]; f_plus_g_sym=poly2sym(f0)+poly2sym(g0)
```

f\_plus\_g\_sym =

$$3*x^2+x-3$$

2)

```
>> clear; syms x; f=x^2+x-4; g=2*x^2+1; f_multiply_g_sym=f*g
```

```

f_multiply_g_sym =
(x^2+x-4)*(2*x^2+1)
>> collect(f_multiply_g_sym)
ans =
2*x^4+2*x^3-7*x^2+x-4
Or
>> clear; f0=[1 1 -4]; g0=[2 0 1]; f_multiply_g_vector=conv(f0, g0)
f_multiply_g_vector =
2      2      -7      1      -4
>> poly2sym(f_multiply_g_vector)
ans =
2*x^4-7*x^2+2*x^3+x-4
3)
>> clear; syms x; f=x^2+x-4; g=2*x^2+1; subs(f, g)
ans =
(2*x^2+1)^2+2*x^2-3
4)
>> clear; f0=[1 1 -4]; g0=[2 0 1]; [q, r]=deconv(f0, g0)
q =
0.5000
r =
0      1.0000     -4.5000

```

6.

1)

```

>> clear; syms x; f=x^2; g=3*x^5+1; f_plus_g_sym=f+g
f_plus_g_sym =
x^2+3*x^5+1
Or
>> clear; f0=[0 0 0 1 0 0]; g0=[3 0 0 0 0 1]; f_plus_g_vector=f0+g0
f_plus_g_vector =
3      0      0      1      0      1
>> f_plus_g_sym =poly2sym(f_plus_g_vector)
f_plus_g_sym =
x^2+3*x^5+1
2)
>> clear; syms x; f=x^2; g=3*x^5+1; f_multiply_g_sym=f*g
f_multiply_g_sym =
x^2*(3*x^5+1)
>> poly2sym(sym2poly(f_multiply_g_sym))
ans =
3*x^7+x^2
Or
>> clear; f0=[0 0 0 1 0 0]; g0=[3 0 0 0 0 1]; f_multiply_g_vector=conv(f0, g0)
f_multiply_g_vector =

```

```

0      0      0      3      0      0      0      0      1      0      0
>> f_multiply_g_sym=poly2sym(f_multiply_g_vector)
f_multiply_g_sym=
3*x^7+x^2

```

7. for example 6.2)

1)

```

>> clear; syms x; f=x^2; g=3*x^5+1; f_multiply_g_sym=f*g
f_multiply_g_sym=
x^2*(3*x^5+1)
>> collect(f_multiply_g_sym)
ans =
3*x^7+x^2

```

Or

```

clear; f0=[0 0 0 1 0 0]; g0=[3 0 0 0 0 1]; f_multiply_g_vector=conv(f0, g0)
f_multiply_g_vector =
0      0      0      3      0      0      0      0      1      0      0
>> f_multiply_g_sym=poly2sym(f_multiply_g_vector)
f_multiply_g_sym=
3*x^7+x^2

```

2)

```

>> clear; syms x; f=x^2; g=3*x^5+1; f_multiply_g_sym=f*g
f_multiply_g_sym=
x^2*(3*x^5+1)
>> sym2poly(f_multiply_g_sym)
ans =
3      0      0      0      0      1      0      0

```

8.

1)

```
>> A=diag(1:3); p=fix(10*rand(3)); B=p'*A*p;
```

B =

100	71	171
71	135	175
171	175	329

```
>> B==B'
```

ans =

1	1	1
1	1	1
1	1	1

```
>> roots(poly(B))
```

ans =

513.6451
49.4764
0.8785

2)

```
>> A0=diag(0:2); p=fix(10*rand(3)); B0=p'*A*p;  
B =  
    144    152    44  
    152    164    50  
    44     50    17  
>> B==B'  
ans =  
    1     1     1  
    1     1     1  
    1     1     1  
>> roots(poly(B))  
ans =  
320.9116  
4.0884  
0.0000
```

9.

```
>> f=[1 2 -3 -1 -2 3]; g=[1 1 -5 -6 0];  
>> [q,r]=deconv(f,g)  
q =  
    1     1  
r =  
    0     0     1    10     4     3  
>> poly2sym(q)  
ans =  
1+x  
>> poly2sym(r)  
ans =  
x^3+10*x^2+4*x+3
```

10. Omitted.