Key to MATLAB Exercise 6 – Polynomial

1.

1)

```
>> a=[1 0 0 0 3 -4]
a =
     1     0     0     0     3    -4
```

2)

```
>> a2=[1 0 0 0]
a2 =
     1     0     0     0
```

3)

```
>> r=[0 1 -3]; poly(r)
ans =
     1     2    -3     0
```

4)

```
>> a=[1 -2; -3 -4]; poly(a)
ans =
     1     3   -10
```

2.

1)

```
>> a=[1 2 3]; poly(a)
ans =
     1    -6    11    -6
```

2)

```
>> syms x; f=(x-1)*(x-2)*(x-3)
f =
  (x-1)*(x-2)*(x-3)
```

3)

```
>> pretty(f)
                                    (x - 1) (x - 2) (x - 3)
```

4)

```
>> horner(f)
ans =
  (x-1)*(x-2)*(x-3)
```

3.

1)

```
>> subs(f, 4)
ans =
     6
```

2)

```
>> 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 =
     2     1
     1     2
```

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 =
     2     0
     0     2
```

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 =
     2     0
     0     2
```

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 =
     3     1    -3
```

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.