

MATLAB

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المرحلة الثانية - صباحي

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Lecture 16

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Creating Polynomials in MATLAB prog.

Example (1):

Create the following polynomial and display it in MATLAB prog.

$$X^4 + 3X^3 - 15X^2 - 2X + 9$$

Answer:

$$\rightarrow a = [1 \ 3 \ -15 \ -2 \ 9] \leftarrow$$

$$a = \begin{matrix} 1 & 3 & -15 & -2 & 9 \end{matrix}$$

Example (2): Create the following polynomial and display it in MATLAB

$$X^4 - 2X^2 + 3$$

Answer:

$$\rightarrow y = [1 \ 0 \ -2 \ 0 \ 3] \leftarrow$$

$$y = \begin{matrix} 1 & 0 & -2 & 0 & 3 \end{matrix}$$

Example (3): Create the following polynomial and display it in MATLAB prog.

$$7t^4 - 9$$

Answer:

$$\rightarrow z = [7 \ 0 \ 0 \ 0 \ -9] \leftarrow$$

$$z = \begin{matrix} 7 & 0 & 0 & 0 & -9 \end{matrix}$$

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Computing the Value of a Polynomial

Example (1): Compute the value of the following polynomial at $x=3$ in MATLAB prog.

$$x^4 + 3x^3 - 15x^2 - 2x + 9$$

Answer:

```
>> v = [1 3 -15 -2 9];
```

```
>> polyval(v, 3)
```

```
ans =  
30
```

Example (2): Compute the value of the following polynomial at $x=2$ in MATLAB prog.

$$f(x) = x^4 - 2x^2 + 3$$

Answer:

```
>> f = [1 0 -2 0 3];
```

```
>> polyval(f, 2)
```

```
ans =  
11
```

Example (3): Compute the value of the following polynomial at $t=-1$ and $t=2$ in MATLAB prog.

$$7t^4 - 9$$

Answer:

```
>> z = [7 0 0 0 -9];
```

```
>> polyval(z, -1)
```

```
ans =  
-2
```

```
>> polyval(z, 2)
```

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ans = 103

Finding the Roots of a Polynomial in MATLAB prog.

Example (1): Use MATLAB prog. to find the roots of the polynomial $t^4 + 3t^3 - 15t^2 - 2t + 9$, and check your answers.

Answer:

```
>> w = [1 3 -15 -2 9];
```

```
>> roots(w)
```

```
ans =  
-5.5745  
 2.5836  
-0.7951  
 0.7860
```

```
>> poly(ans)
```

```
ans =  
 1.0000  3.0000 -15.0000 -2.0000  9.0000
```

Example (2): Use MATLAB prog. to find the roots of the polynomial $x^4 + 3x^3 - 3x^2 - 11x - 6$, and then compute the value of the given polynomial at $x=3$.

Answer:

```
>> w = [1 3 -3 -11 -6];
```

```
>> roots(w)
```

```
ans =  
 2.0000  
-3.0000  
-1.0000 + 0.0000i  
-1.0000 - 0.0000i
```

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```
>> S = polyval(w, 3) ↵
```

```
S = 96
```

```
>> poly(ans) ↵
```

```
ans = 1.0000 3.0000 -3.0000 -11.0000 -6.0000
```

Example (3): Use MATLAB prog. to find the roots of the polynomial $t^4 + t^3 - 7t^2 - t + 6$, and check your answers, and then compute the value of the given polynomial at $t = -1$.

Answer:

```
>> u = [1 1 -7 -1 6]; ↵
```

```
u =  
1 1 -7 -1 6
```

```
>> roots(u) ↵
```

```
ans =  
-3.0000  
-1.0000  
2.0000  
1.0000
```

```
>> poly(ans) ↵
```

```
ans =  
1.0000 1.0000 -7.0000 -1.0000 6.0000
```

```
>> polyval(u, -1) ↵
```

```
ans = 0
```

Exercises: (1) Use MATLAB prog. to find the roots of the polynomial $f(x) = x^3 + 2x^2 + 10x - 20$, and check your answers,

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and then compute the value of the given polynomial at $x = 1$.

(2) Use MATLAB prog. to find the roots of the polynomial $x^4 - 9x^3 - 2x^2 + 120x - 130$, and check your answers, and then compute the value of the given polynomial at $x = -1$.

Computing the Derivative of a Function in MATLAB prog.

Example (1): Find the derivative of the function $F(x) = x^3 - 3x^2 + 10x - 22$ in MATLAB prog.

Answer:

```
>> syms x ↵
```

```
>> f = x^3 - 3*x^2 + 10*x - 22; ↵
```

```
>> diff(f) ↵
```

```
ans =  
3*x^2 - 6*x + 10
```

Example (2): Find the derivative of the function $y = 2w^2 + 3w - 1$ in MATLAB prog.

Answer:

```
>> syms w ↵
```

```
>> y = 2*w^2 + 3*w - 1; ↵
```

```
>> diff(y) ↵
```

```
ans = 4*w + 3
```

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Example (3): Compute the derivative of the function $f(x) = 3x^3 - 4x$ at $x=1$ in MATLAB prog.

Answer:

```
>> syms x ↵
```

```
>> f = 3*x^3 - 4*x; ↵
```

```
>> diff(f) ↵
```

```
ans =  
9*x^2 - 4
```

```
>> x = 1; ↵
```

```
>> eval(ans) ↵
```

```
ans =  
5
```

Example (4): Compute the derivative of the function $f(x) = 3\sin x + \cos x$ at $x=0$ in MATLAB prog.

Answer:

```
>> syms x ↵
```

```
>> f = 3*sin(x) + cos(x); ↵
```

```
>> d = diff(f) ↵
```

```
d =  
3*cos(x) - sin(x)
```

```
>> x = 0; ↵
```

```
>> eval(d) ↵
```

```
ans =  
3
```