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Lab 3

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Question 1: Solve the polynomial equation by two methods.

$$y = 0.1x^5 - 0.2x^4 - x^3 + 5x^2 - 41.5x + 235$$

```
>> P = [0.1 -0.2 -1 5 -41.5 235];

>> r = roots(P)

 r

=


   -5.7132 + 0.0000i

   -0.3876 + 4.3433i

   -0.3876 - 4.3433i

    4.2442 + 1.9024i

    4.2442 - 1.9024i
```

 Other solution

```
>> y = 0.1 * x^5 - 0.2 * x^4 - x^3 + 5 * x^2 - 41.5 * x +
235;

>> solve(y)   ans =    root(z^5 - 2*z^4 - 10*z^3 +

50*z^2 - 415*z + 2350, z, 1)  root(z^5 - 2*z^4 - 10*z^3

+ 50*z^2 - 415*z + 2350, z, 2)  root(z^5 - 2*z^4 -

10*z^3 + 50*z^2 - 415*z + 2350, z, 3)  root(z^5 - 2*z^4

- 10*z^3 + 50*z^2 - 415*z + 2350, z, 4)  root(z^5 -

2*z^4 - 10*z^3 + 50*z^2 - 415*z + 2350, z, 5)
```

Question 2: Consider the polynomial $p(x) = x^4 - 5x^3 + 7x - 10$

1. Find the roots of this polynomial.

2. From these roots, reconstruct $p(x)$.

3. Find the value of $p(x)$ at x=3.

4. Evaluate the polynomial at X (matrix sense).

```
>> P = [1 -5 0 7 -10];
>> r = roots(P)  r =


   4.7856 + 0.0000i
  -1.4631 + 0.0000i
   0.8387 + 0.8513i
   0.8387 - 0.8513i
 >>

poly(r)

ans =


    1.0000   -5.0000          0    7.0000  -10.0000


>> polyval(P,3)

ans =

   -43


>> polyvalm(P,[1 2 3; 4 5 6; 7 8 9])  ans
=


       5217          6422          7617
      11836         14533         17250
      18445         22664         26873
```

Question 3: Find the following derivatives:

a. $f(x) = x^3 e^{2x}$ *at* $x = 0.6$

```
>> syms x
>> f = x^3 * exp(2*x)
```

```
   f =

x^3*exp(2*x

)

>>

diff(f)

ans =


3*x^2*exp(2*x) + 2*x^3*exp(2*x)
```

b. $f(x,y) = x^3y^4 + y\sin(x)$ *calculate* $\dfrac{dx}{dy}$, $\dfrac{dy}{dx}$

```
>> syms x y

>> diff(x^3 * y^4 + y*sin(x),y)

  ans

=

sin(x) + 4*x^3*y^3


>> diff(x^3 * y^4 + y*sin(x),x)

  ans

=



3*x^2*y^4 + y*cos(x)
```

Question 4: Evaluate the following integrals:

a. $\int \dfrac{x^3}{\sqrt{1-x}} dx$

b. $\int x^2 \cos(x) \, dx$

c. $\int_0^{4\pi} \cos(x) e^{\sqrt{x}} \, dx$

d. $\int_1^{\infty} t e^{-at} \, dt$

a.

```
>> syms x y

>> int((x^3) / (1 - x)^0.5, x)


ans

=


2*(1 - x)^(3/2) - 2*(1 - x)^(1/2) - (6*(1 - x)^(5/2))/5 + (2*(1 - x)^(7/2))/7
```

b.

```
>> int(x^2 * cos(x), x)

  ans =   sin(x)*(x^2 - 2) +

2*x*cos(x)
```

c.

```
>> int(cos(x) * exp(x^0.5),x,0,4*pi)
  ans =   int(exp(x^(1/2))*cos(x),
x, 0, 4*pi)
```

d.

```
>> syms t a

>> int(t * exp(-a * t),t, 1, inf)


ans

=


(exp(-a)*(a + 1))/a^2 - limit(exp(-a*t)*(a*t + 1), t, Inf)/a^2
```

Question 5: Solve the following systems use the two methods (solve) function and linear algebra

a. $-2x + y = 3$
$x + y = 10$

```
>> A = [-2 1; 1 1];
>> B = [3; 10];
>> C = A\B

C =

    2.3333

    7.6667
```

Other solution

```
>> syms x y
>> [x,y] = solve(-2 * x + y - 3, x + y - 10)

  x
=
7/
3
y
=
23/3
```

b. $5x + 3y - z = 10$
$3x + 2y + z = 4$
$4x - y + 3z = 12$

```
>> A = [5 3 -1; 3 2 1; 4 -1 3];
>> B = [10; 4; 12];
>> C = A\B
```

```
C =

    3.1613    -
2.2581

    -0.9677
```

Other solution

```
>> syms x y z
>> [x, y, z] = solve(5*x + 3*y - z - 10
, 3*x + 2*y + z -4, 4*x -y + 3*z -12)
  x =

98/31

y = -

70/31

z =

-30/31
```