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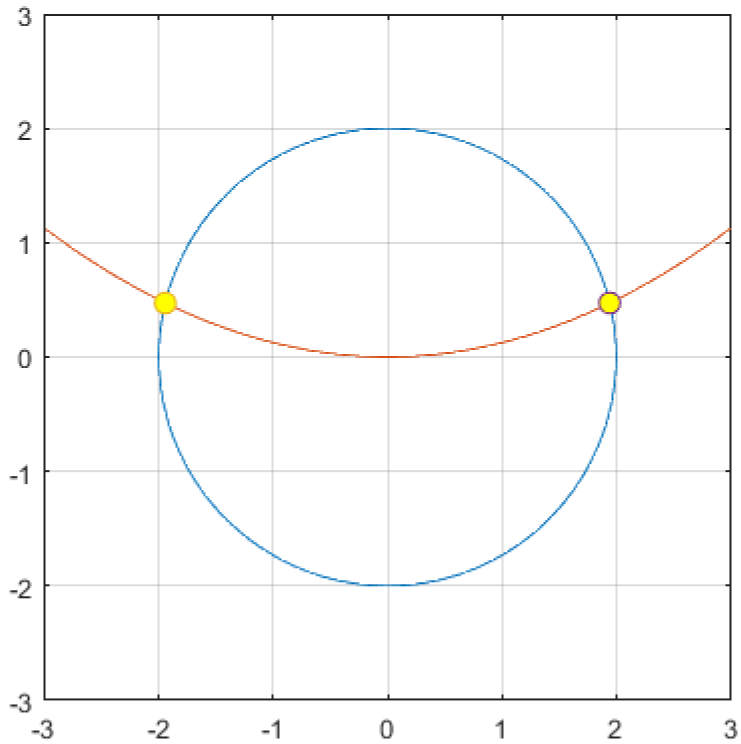
Exercitiul 1

```
syms x y;
f=x.^2+y.^2-4;
g=x.^2/8-y;

J=[diff(f1,x),diff(f1,y);diff(f2,x),diff(f2,y)];%Jacobianul
fprintf('Jacobianul: ');
J

f=matlabFunction(f,'vars',{x,y});
g=matlabFunction(g,'vars',{x,y});
figure(1);
fimplicit(f,[-3,3,-3,3]) %Reprezentarea grafica a curbei C1
hold on
grid on
fimplicit(g,[-3,3,-3,3]) %Reprezentarea grafica a curbei C2

axis equal

eps=10^(-6);
F=@(x,y) [f(x,y);g(x,y)];
J=matlabFunction(J,'vars',{x,y});

x0=[-2;0]; %punctul de pornire pentru primul punct
[xaprox,N]=MetNewton(F,J,x0,eps);
xaprox
plot(xaprox(1),xaprox(2),'o','MarkerSize',8,'MarkerFaceColor','y');
grid on
hold on
x0=[2;0];%punctul de pornire pentru al doilea punct
[xaprox,N]=MetNewton(F,J,x0,eps);
xaprox
plot(xaprox(1),xaprox(2),'o','MarkerSize',8,'MarkerFaceColor','y');
```

```
Jacobianul:
J =

[ 2*x,  y/2]
[ x/4,   -1]
```

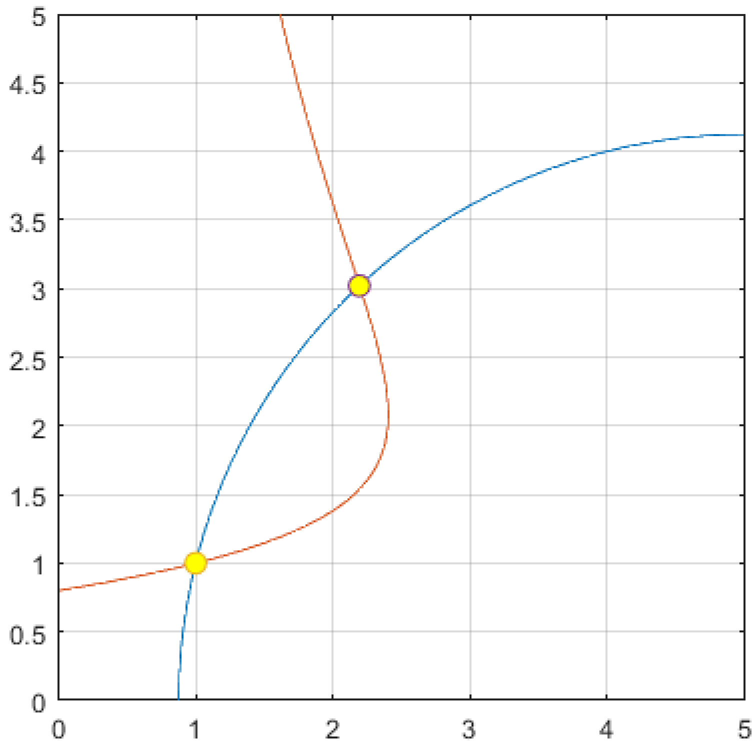


Exercitiul 2

```
syms x1 x2
f=x1.^2-10.*x1+x2.^2+8;
g=x1.*x2.^2+x1-10.*x2+8;

J=[diff(f,x1),diff(f,x2);diff(g,x1),diff(g,x2)];%Jacobianul
fprintf('Jacobianul: ');
J
f=matlabFunction(f,'vars',{x1,x2});
g=matlabFunction(g,'vars',{x1,x2});
figure(2);
fimplicit(f,[0,5,0,5]) %Reprezentarea grafica a curbei C1
hold on
grid on
fimplicit(g,[0,5,0,5]) %Reprezentarea grafica a curbei C2

axis equal

eps=10^(-6);
F=@(x1,x2) [f(x1,x2);g(x1,x2)];
J=matlabFunction(J,'vars',{x1,x2});
x0=[0;0];%Punctul de pornire pentru prima solutie
[xaprox,N]=MetNewton(F,J,x0,eps);
xaprox
```

```
plot(xaprox(1),xaprox(2),'o','MarkerSize',8,'MarkerFaceColor','y');
grid on
hold on

x0=[3;2];%Punctul de pornire pentru a doua solutie
[xaprox,N]=MetNewton(F,J,x0,eps);
xaprox
plot(xaprox(1),xaprox(2),'o','MarkerSize',8,'MarkerFaceColor','y');
```

```
Jacobianul:
J =

[ 2*x1 - 10,         2*x2]
[  x2^2 + 1, 2*x1*x2 - 10]


xaprox =

    1.0000
    1.0000


xaprox =

    2.1934
    3.0205
```

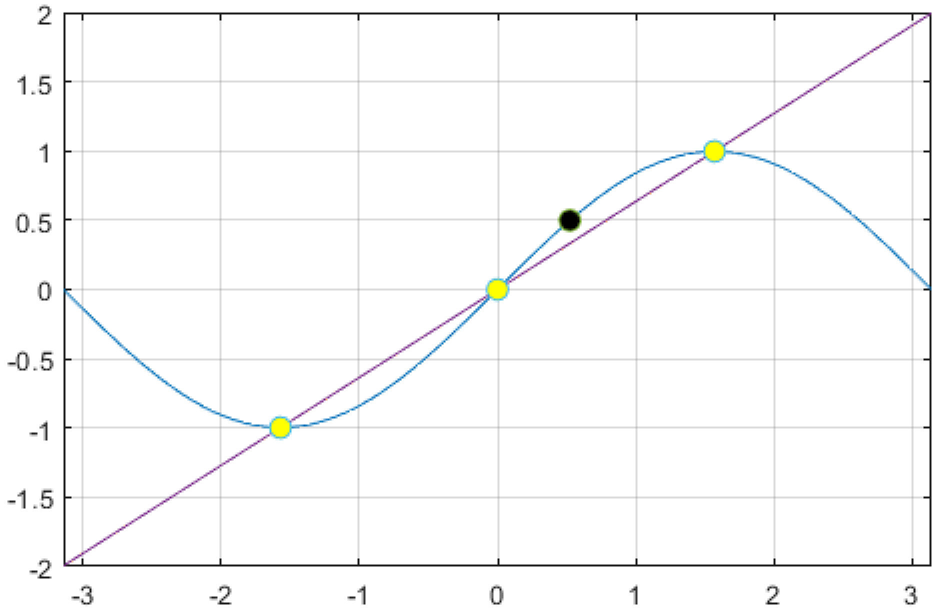


Exercitiul 3

```
f=@(x)sin(x);
x=linspace(-pi/2,pi/2,3);
y=f(x);
y=y';

figure(3);
fplot(f,[-pi,pi]);
hold on
grid on
axis equal
fprintf( 'Prin metoda directa\n');
a = MetDirecta(x,y);
a
syms X;
Pn = 0;
for i=1:length(a)
    Pn = Pn + a(i)*X^(i-1);
end
Pn
Pn = matlabFunction(Pn, 'vars', X);

fprintf('|Pn(pi/6) - f(pi/6)|=');
abs(Pn(pi/6) - f(pi/6))
```

```
fplot(Pn,[-pi,pi]);

% Prin metoda Lagrange
fprintf( 'Prin metoda Lagrange\n');
fprintf( '|Pn(pi/6) - f(pi/6)|=');
abs(MetLagrange(x,y,[pi/6]) - f(pi/6)) %Eroarea metodei Lagrange in
 pi/6

plot(linspace(-pi,pi,100), MetLagrange(x,y,linspace(-pi,pi,100)));
%reprezentarea grafica a polinomului obtinut prin metoda Lagrange

% Prin metoda Newton
fprintf( 'Prin metoda Newton\n');
fprintf( '|Pn(pi/6) - f(pi/6)|=');
abs(MetNewtonDetPol(x,y,[pi/6]) - f(pi/6))%Eroarea metodei Newton in
 pi/6

plot(linspace(-pi,pi,100), MetNewtonDetPol(x,y,linspace(-pi,pi,100)));
%reprezentarea grafica a polinomului obtinut prin metoda Newton

plot(pi/6, f(pi/6), 'o','MarkerSize', 8, 'MarkerFaceColor', 'k');
plot(x, y, 'o',  'MarkerSize', 8,'MarkerFaceColor', 'y');
```

```
Prin metoda directa

a =

         0    0.6366         0


Pn =

(5734161139222659*X)/9007199254740992

|Pn(pi/6) - f(pi/6)|=
ans =

    0.1667

Prin metoda Lagrange
|Pn(pi/6) - f(pi/6)|=
ans =

    0.1667

Prin metoda Newton
|Pn(pi/6) - f(pi/6)|=
ans =

    0.1667
```

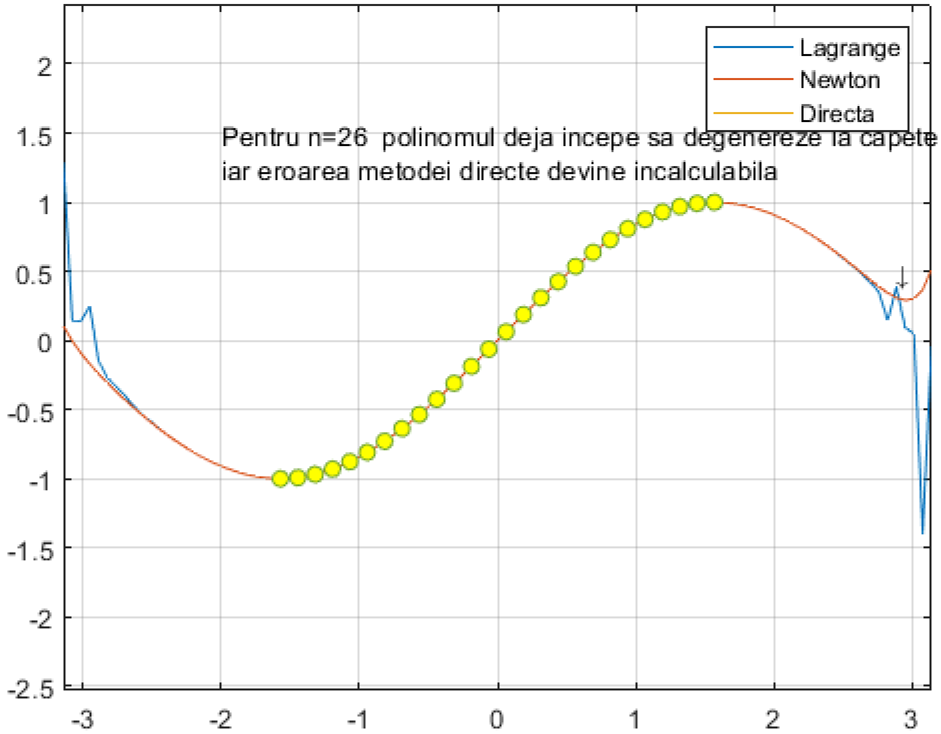


Exercitiul 4

```
f = @(x)sin(x);
n = 26;
x = linspace(-pi/2,pi/2,n);
y = f(x);
y = y';

figure(4);

fprintf( 'Prin metoda Lagrange\n');
fprintf( '|Pn(pi/6) - f(pi/6)|=');
abs(MetLagrange(x,y,[pi/6]) - f(pi/6))
plot(linspace(-pi,pi,100), MetLagrange(x,y,linspace(-pi,pi,100)));

hold on;
grid on;
axis equal;

fprintf( 'Prin metoda Newton\n');
fprintf( '|Pn(pi/6) - f(pi/6)|=');
abs(MetNewtonDetPol(x,y,[pi/6]) - f(pi/6))
plot(linspace(-pi,pi,100), MetNewtonDetPol(x,y,linspace(-pi,pi,100)));

fprintf( 'Prin metoda directa\n');
```

```
fprintf( '|Pn(pi/6) - f(pi/6)|= ');
abs(MetDirectaEx4(x,y,[pi/6]) - f(pi/6))
plot(linspace(-pi,pi,100), MetDirectaEx4(x,y,linspace(-pi,pi,100)));

plot(x, y, 'o', 'MarkerSize', 6,'MarkerFaceColor', 'y' );
legend('Lagrange', 'Newton', 'Directa');
txt='Pentru n=26  polinomul deja incepe sa degenereze la capete';
text(-2,1.5,txt);
txt2='\downarrow';
text(2.888,0.5,txt2);
txt='iar eroarea metodei directe devine incalculabila';
text(-2,1.25,txt);
hold off;
```

```
Prin metoda Lagrange
|Pn(pi/6) - f(pi/6)|=
ans =

   3.8858e-16

Prin metoda Newton
|Pn(pi/6) - f(pi/6)|=
ans =

   6.1062e-16

Prin metoda directa
|Pn(pi/6) - f(pi/6)|=
ans =

   NaN
```



Algoritmii functiilor

```
function [xaprox,N]=MetNewton(F,J,x0,eps)
k=1;
x(:,k)=x0;
while true
    k=k+1;
    z=J(x(1,k-1),x(2,k-1))\(-F(x(1,k-1),x(2,k-1)));
    x(:,k)=x(:,k-1)+z;
    if norm(z,2)<eps
        break;
    end
end

xaprox=x(:,k);
N=k;
end

function [a]=MetDirecta(x,y)

n=length(x)-1;

for i=1:n+1
    A(i,1)=1;
end
```

```
for i=1:n+1
    for j=2:n+1
        A(i,j)=x(i)^(j-1);
    end
end

a=GaussPivTot(A,y);
%a=A\transpose(A);
end

function [y] = MetLagrange(X, Y, x)
  syms variabila;
  n = length(X);
  Pn = 0;

  for k=1:n
      Lnk = 1;
      for i=1:n
          if i==k
              continue
          end
          Lnk = Lnk * (variabila-X(i)) / (X(k)-X(i));
      end
      Pn = Pn + Lnk*Y(k);
  end

  Pn = matlabFunction(Pn, 'vars', variabila);
  y = Pn(x);
end

function [y] = MetNewtonDetPol(X, Y, x)
  syms variabila;
  n = length(X);
  Pn = 0;

  for i=1:n
      for j=1:n
          if j==1
              A(i,j)=1;
          elseif j>i
              A(i,j)=0;
          else
              prod = 1;
              for k=1:j-1
                  prod = prod * (X(i)-X(k));
              end
              A(i,j) = prod;
          end
      end
  end
  c = SubsAsc(A, Y');

  for i=1:n-1
```

```
            coeficient = c(i);
            for k=1:i-1
                coeficient = coeficient * (variabila - X(k));
            end
            Pn = Pn + coeficient;
        end

        Pn = matlabFunction(Pn, 'vars', variabila);
        y = Pn(x);
    end

function [x] = SubsAsc(A,b)
n = length(b);
x(1) = 1/A(1,1) * b(1);
k=1;
for k=2:n-1

    sum = 0;
    for j=1:k-1
        sum=sum + A(k,j)*x(j);
    end
    x(k) = 1/A(k,k)*(b(k) - sum);
end
end

function [x] = GaussPivTot(A,b)
n=length(b); %n=size(A,1)
index=1:n;
A=[A,b];
for k=1:n-1
   max = abs(A(k,k));
   for i=k:n
       for j=k:n
           if abs(A(i,j)) > max
               max = abs(A(i,j));
               p=i;
               m=j;
           end
       end
   end
if(max==0)
    fprintf('Sistem incompatibil sau nedeterminat');
    x='error';
    return;
end
if p~=k
    A([p,k], :) = A([k,p], :);
end

if m~=k
    A(:, [m,k]) = A (:, [k,m]);
    index([m,k])=index([k,m]);
end
```

```
for l=k+1:n
    mlk = A(l,k)/A(k,k);
    A(l,:) = A(l,:) - mlk*A(k,:);
end
end

if A(n,n) == 0
    fprintf('Sistem incompatibil sau nedeterminat');
    x='error';
    return;
end

y = SubsDesc(A(1:n, 1:n), A(:, n+1));

for i=1:n
    x(index(i)) = y(i);
end

end

function [x] = SubsDesc(A,b)
n = length(b);
x(n) = 1/A(n,n) * b(n);
k = n - 1;

while k>0
    sum=0;
    for j=k+1:n
        sum = sum + A(k,j)*x(j);
    end
    x(k) = 1/A(k,k) * (b(k) - sum);
    k=k-1;
end
end

function [y] = MetDirectaEx4(X, Y, x)
  syms variabila;
  n = length(X);
  for i=1:n
      A(i,1)=1;
  end

  for i=1:n
      for j=2:n
          A(i,j) = X(i)^(j-1);
      end
  end

  a = GaussPivTot(A, Y);
  %a=A\transpose(A)
  Pn = 0;

  for i=1:length(a)
    Pn = Pn + a(i)*variabila^(i-1);
```

```
  end

  Pn = matlabFunction(Pn, 'vars', variabila);
  y = Pn(x);
end
```

```
xaprox =

   -1.9435
    0.4721


xaprox =

    1.9435
    0.4721
```

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