ΑΡΙΘΜΗΤΙΚΗ ΠΑΡΑΓΩΓΙΣΗ
Octave/Matlab

Octave

```
>> pkg load symbolic
>> syms x;
>> f = x^3-2*x^2+5;
>> diff(f,x)
ans = -(4.0)*x+(3.0)*x^(2.0)
>> diff(f,x,2)
ans = -(4.0)+(6.0)*x
```

Επίδειξη παραγώγισης μέσω matlab

```
np = 4; % number of points on a curve
func = @(t)4.*sin(t); % function
dfunc = @(t)4.*cos(t); % derivative of function
t = linspace(0,pi,np);
y = func(t);
plotrange = [0 4 -5 5]; % limits for plot with room for labels
hold on;
grid on;
axis(plotrange);
title('Numerical Differentiation Example');
% plot actual curve
tt = linspace(0,pi,100);
yy = func(tt);
plot(tt,yy,'k--');
```

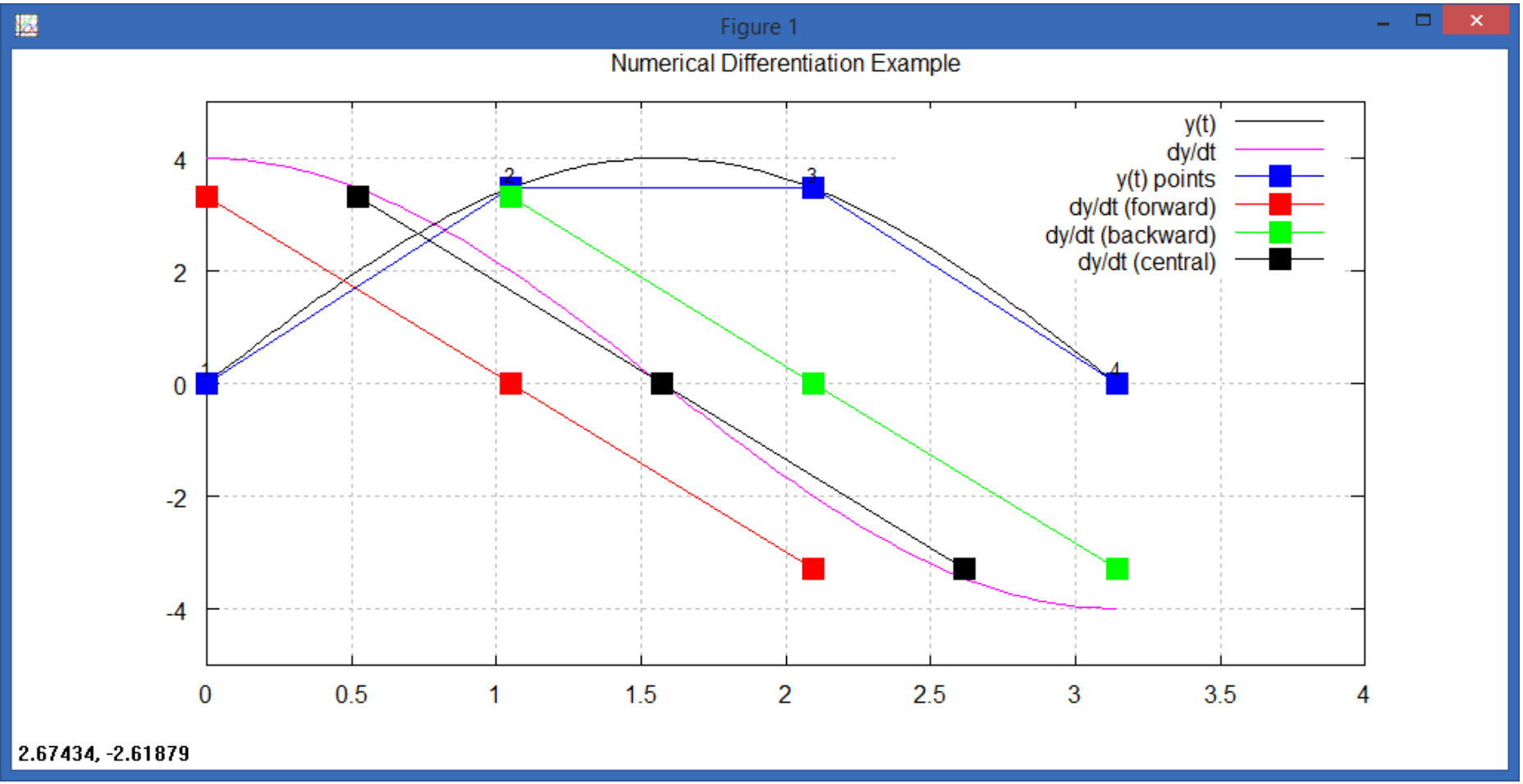
Επίδειξη παραγώγισης μέσω matlab (2)

```
% plot actual derivative
tt = linspace(0,pi,100);
yy = dfunc(tt);
plot(tt,yy,'m--');
% plot points and connecting lines
plot(t,y,'b-s');
% display point numbers
for i=1:length(t)
text(t(i),y(i)+.3,num2str(i),'horizontalalignment','center');
end
% numerical difference
dydt = diff(y)./diff(t);
```

Επίδειξη παραγώγισης μέσω matlab (3)

```
% forward difference - plot numerical derivative at first point
tt = t(1:end-1);
plot(tt,dydt,'r-s');
% backward difference - plot numerical derivative at 2nd point
tt = t(2:end);
plot(tt,dydt,'g-s');
% central difference - plot numerical derivative at midpoint
tt = t(1:end-1) + diff(t)./2;
plot(tt,dydt,'k-s');
% fini
legend('y(t)','dy/dt','y(t) points',...
    'dy/dt (forward)','dy/dt (backward)','dy/dt (central)');
```

Επίδειξη παραγώγισης μέσω matlab (4)



Εμπρός Διαφορές

```
% 2-point forward difference formula for 1-st derivative
% Input:
% f - Matlab inline function
% x - point where the derivative is computed
% h - stepsize
% r - computed value of the derivative
% Examples:
% r=d1fd2p(@sin,0,.1);
% r=d1fd2p(inline('sin(x)-cos(x)'),.1);

function r = d1fd2p(f,x,h)
r = (f(x+h)-f(x))/h;
```

Χρήση

>>d1fd2p(inline('x+sin(x)'),1,0.1)

ans = 1.4974

Κεντρικές Διαφορές

```
% Usage: r = d1cd3p(f,x,h)
% 3-point centered-difference formula for 1-st derivative
% Input:
% f - Matlab inline function
% x - point where the derivative is computed
% h - stepsize
% Output:
% r - computed value of the derivative
% Examples:
% r=d1cd3p(@sin,0,0.1);
% r=d1cd3p(inline('sin(x)'),0,0.1);
% r=d1cd3p(inline('sin(x)-cos(x)'),0,0.1);
function r = d1cd3p(f,x,h)
r = (f(x+h)-f(x-h))/(h*2);
```

Χρήση

>>d1cd3p(inline('x+sin(x)'),1,0.1)

ans = 1.5394

Κεντρικές Διαφορές για 2η παράγωγο

```
% 3-point centered-difference formula for 2-nd derivative
% Input:
% f - Matlab inline function
% x - point where the derivative is computed
% h - stepsize
% Output:
% r - computed value of the derivative
% Examples:
% r=d2cd3p(@sin,0,0.1);
% r=d2cd3p(inline('sin(x)-cos(x)'),0,0.1);
function r = d2cd3p(f,x,h)
r = (f(x+h)-2*f(x)+f(x-h))/(h*h);
```

Χρήση

>> d2cd3p(inline('x+sin(x)'),1,0.1)

ans = -0.84077

Με χρήση ενσωματωμένων συναρτήσεων του matlab

$x^4-12x^3+25x+116$

» p=[1 -12 0 25 116];

Παραγώγιση με χρήση της “**polyder**”:

» pd=polyder(p)

pd =

4 -36 0 25

Με χρήση ενσωματωμένων συναρτήσεων του matlab (2)

```
» x=0:0.1:1;
» y=[-0.447 1.978 3.28 6.16 7.08 7.34 7.66 9.56
9.48 9.30 11.2];
» p=polyfit(x,y,2)
p =
-9.8108 20.1293 -0.0317
» pd=polyder(p)
pd =
-19.6217 20.1293
» slope_of_p=polyval(pd,0.5)
slope_of_p =
10.3185
```