$f(x) = x^3 + 4x^2 - 10$의 근을 Newton−Raphson Method을 이용하여 구하는 프로그램작성

(1)M−file작성 : 파일명을 NR.m으로 저장

```
function [x,f,Rel] = NR(x,epsi)
Ex = 1.36524;
f = x^3+4*x^2-10
while abs(f)>epsi
   f1 = 3*x^2+8*x;
   x = x-f/f1
   f = x^3+4*x^2-10;
   Rel = (Ex-x)*100/Ex;
   fprintf('%10.7f | %10.7f | %10.7f | \n',x,f,Rel)
end
fprintf('x = %10.6f \n',x)
```

(2)commad window에서 다음과 같이 실행

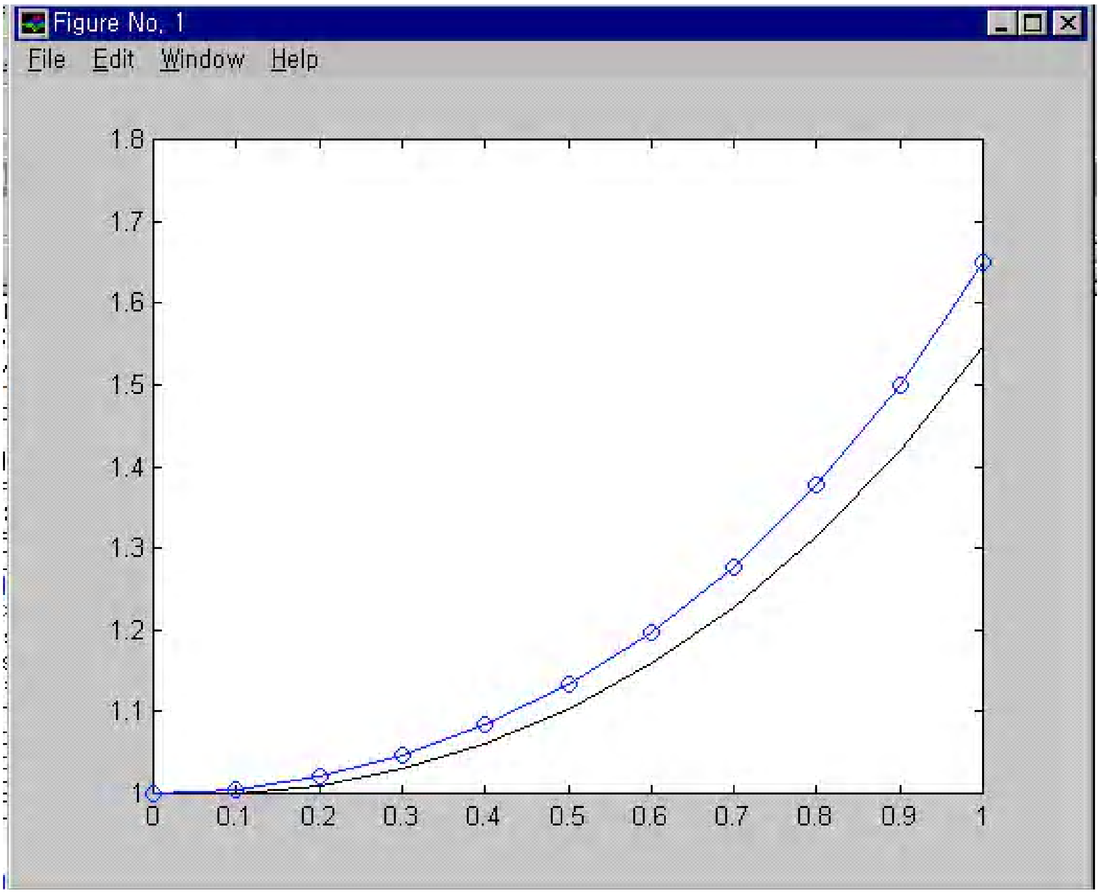
```
» NR(1.5,0.0001)

f =    2.3750

x =    1.3733
 1.3733333 |  0.1343455 | -0.5928140 |

x =    1.3653
 1.3652620 |  0.0005285 | -0.0016125 |

x =    1.3652
 1.3652300 |  0.0000000 |  0.0007315 |

x =   1.365230


ans =    1.3652
»
```

y'=xy를 Euler method로 풀고 exact solution과 비교하시오.

```
n=10;
x=0;y=1
h=1/n
t='-------------------------';
disp(t)
for i=0:10
   y1(i+1,1)=y;
   x=i*h;
   f=x*y;
   y=y+h*f;
   x0(i+1,1)=x;
end
%EXact
y=dsolve('Dy=x*y','y(0)=1','x')
y0=subs(y,x0,'x')
yex=sym2poly(y0)
fprintf('\n')
disp(t)
disp('h  Exact Euler')
disp(t)
h=(0:0.1:1);
for i=1:11
   fprintf('\n %3.1f %8.5f %8.5f',h(i),yex(i),y1(i));
end
fprintf('\n')
disp(t)
plot(h,y1,'k-',h,yex,'b-o')
```

```
y =     1

h =    0.1000

y = exp(1/2*x^2)

 y0 =
[          1]
[  exp(1/200)]
[   exp(1/50)]
[  exp(9/200)]
[   exp(2/25)]
```

```
[     exp(1/8)]
[    exp(9/50)]
[ exp(49/200)]
[    exp(8/25)]
[ exp(81/200)]
[     exp(1/2)]

yex =
    1.0000
    1.0050
    1.0202
    1.0460
    1.0833
    1.1331
    1.1972
    1.2776
    1.3771
    1.4993
    1.6487

-------------------------
h        Exact    Euler
-------------------------


 0.0   1.00000   1.00000
 0.1   1.00501   1.00000
 0.2   1.02020   1.01000
 0.3   1.04603   1.03020
 0.4   1.08329   1.06111
 0.5   1.13315   1.10355
 0.6   1.19722   1.15873
 0.7   1.27762   1.22825
 0.8   1.37713   1.31423
 0.9   1.49930   1.41937
 1.0   1.64872   1.54711
-------------------------
```



다음 미분 방정식을 풀어라 $\frac{dy}{dt} = 1 + y^2$, I.C: y(0)=1

sol>

i) 초기조건이 없을 때
▯ dsolve('Dy=1+y^2', 'x')

ans = tan(x−C1)

ii) 초기조건이 있을 때
▯ dsolve('Dy=1+y^2', 'y(0)=1')

ans = tan(t+1/4*pi)

다음 미분방정식을 풀어라

$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} - 3y = 0$, B.C: y(0)=0, y(1)=1

sol>

□ y=dsolve('D2y-2*Dy-3*y=0', 'x')

y = (C1+C2*exp(3*x)*exp(x))/exp(x)

□ y=dsolve('D2y-2*Dy-3*y=0', 'y(0)=0, y(1)=1', 'x')

y = (1/(exp(-1)-exp(3))-1/(exp(-1)-exp(3))*exp(3*x)*exp(x))/exp(x)

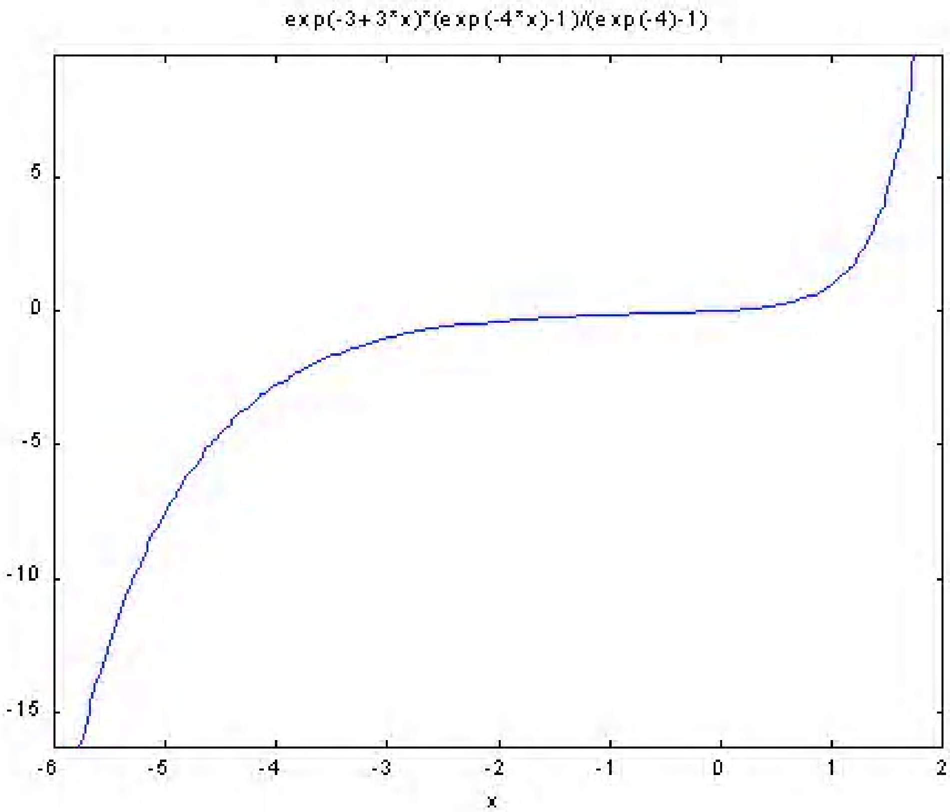
□ simple(y)

y = exp(-3+3*x)*(exp(-4*x)-1)/(exp(-4)-1)

□ pretty(y)

```
exp(-3 + 3 x) (exp(-4 x) - 1)
------------------------------
         exp(-4) - 1
```

□ ezplot(y,[-6,2])



다음 미분 방정식을 ODE 23으로 풀고 그림을 그려라.

$$\frac{d^2x}{dt^2} - \mu(1-x^2)\frac{dx}{dt} + x = 0 \leftarrow \text{Van der pol Equation}$$

$0<t<30$, x(0)=1, $\mu=2$, dx/dt=0

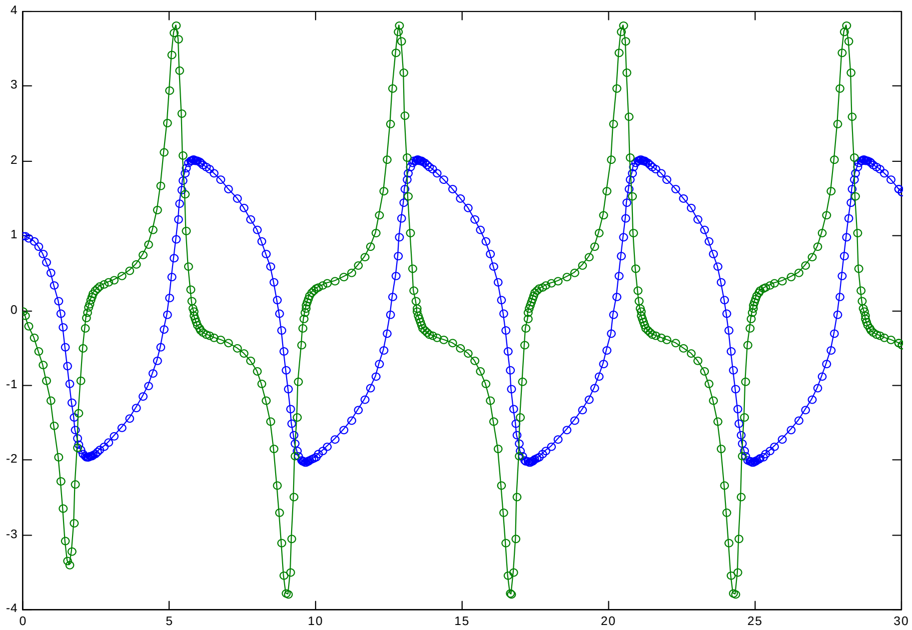
sol>

(1)Mfile작성

```
function yprime=vdpol(t,y)
mu=2;
yprime=[y(2);mu*(1-y(1)^2)*y(2)-y(1)]
```

```
» ODE23('vdpol',[0;30],[1;0]);

yprime =
    0.3341
    0.1594
yprime =
```

```
    0.3370
    0.1623
yprime =
    0.3432
    0.1469
yprime =
    0.3562
    0.1316
```



.

.

.

.

.

.

.

.

.

.

```
 [t,y]=ODE23('vdpol',[0;30],[1;0]);

yprime =

    3.6555
   -4.0765

yprime =

    3.6041
   -5.1991

yprime =

    3.4002
   -7.6449

.
.
.
.
.
.
.
.
.

yprime =

   -0.2467
   -0.5323


yprime =

   -0.2515
   -0.5085


yprime =

   -0.2606
   -0.4591
```

```
yprime =

   -0.4509
   -0.2000

» plot(t(:,1),y(:,2))
```