

예제 4.1

```
function [fx,ea,iter] = IterMeth(x,es,maxit)
    if nargin<2|isempty(es),es=0.0001;end
    if nargin<3|isempty(maxit),maxit=50;end
    iter=1; sol=1; ea=100;
    while(1)
        solold = sol;
        sol = sol+x^iter/factorial(iter);
        iter = iter+1;
        if sol ~= 0
            ea = abs((sol-solold)/sol)*100;
        end
        if ea<=es | iter>=maxit,break,end
    end
    fx = sol;
end

>> format long
>> [approxval, ea, iter] = q1(1,1e-6,100)
warning: function name 'IterMeth' does not agree with
warning: Matlab-style short-circuit operation p
warning: called from
    q1 at line 12 column 3
approxval = 2.718281826198493
ea = 9.216155641522974e-07
iter = 12
```

예제 4.3

0.171 4.3

$$f\left(\frac{\pi}{3}\right) \approx \cos\left(\frac{\pi}{4}\right) = 0.707106781$$

$$\xi_1 = \left| \frac{0.5 - 0.707106781}{0.5} \right|, 100\% = 41.4\%$$

1차 근사의 경우 1차 도함수 $f'(x) = -\sin x$ 증가

$$f\left(\frac{\pi}{3}\right) \approx \cos\left(\frac{\pi}{4}\right) - \sin\left(\frac{\pi}{4}\right)\left(\frac{\pi}{12}\right) = 0.521986659$$

$$|\xi_1| = 4.40\%$$

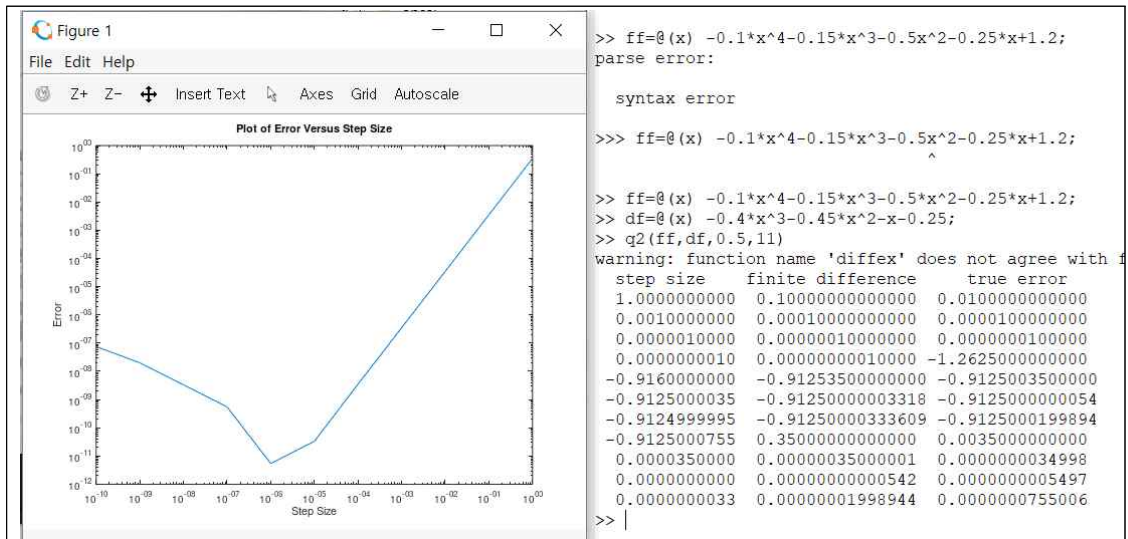
2차 근사는 $f''(x) = -\cos x$ 양의 증가

$$f\left(\frac{\pi}{3}\right) \approx \cos\left(\frac{\pi}{4}\right) - \sin\left(\frac{\pi}{4}\right)\left(\frac{\pi}{12}\right) - \frac{\cos(\pi/4)}{2}\left(\frac{\pi}{12}\right)^2$$

$$= 0.499954491$$

예제 4.5

```
function diffex(func,dfunc,x,n)
    format long
    dftrue=dfunc(x);
    h=1;
    H(1)=h;
    D(1)=(func(x+h)-func(x-h))/(2*h);
    E(1)=abs(dftrue-D(1));
    for i = 2:n
        h=h/10;
        H(i)=h;
        D(i)=(func(x+h) - func(x-h))/(2*h);
        E(i)=abs(dftrue-D(i));
    endfor
    L=[H' D' E'];
    fprintf(' step size    finite difference    true error\n');
    fprintf('%14.10f %16.14f %16.13f\n',L);
    loglog(H,E), xlabel('Step Size'),ylabel('Error')
    title('Plot of Error Versus Step Size')
    format short
endfunction
```



연습문제 4.4

```
function ep = machepts
% determines the machine epsilon
e = 1;
while (1)
    if e+1<=1, break, end
    e = e/2;
end
ep = 2*e;
endfunction
```

```
>> ex44
warning: function name
ans = 2.2204e-16
```

연습문제 4.5

```
function s = small
a = 1;
while (1)
    s = a/2;
    if s==0, break, end
    a = s;
end
s = a;
endfunction
```

```
>> ex45
warning: function nam
ans = 4.9407e-324
```

연습문제 4.10

연습문제 4-10

(a) $x_i = 0$, $h = x$ 따라서 테일러 급수는

$$f(x) = f(0) + f'(0)x + \frac{f''(0)}{2!}x^2 + \frac{f^{(3)}(0)}{3!}x^3 \dots$$

지수함수의 경우 $f(0) = f'(0) = f''(0) = f^{(3)}(0) = 1$ 이고

이것들을 대입하면 $f(x) = 1 + x + \frac{1}{2!}x^2 + \frac{1}{3!}x^3 + \dots$

(b) 차간이 $e^{-1} = 0.367879$, $h = x_{i+1} - x_i = 0.75$

$$0 \rightarrow f(1) = e^{-0.25} = 0.778801$$

$$\xi_+ = \left| \frac{0.367879 - 0.778801}{0.367879} \right| \cdot 100\% = 11.7\%$$

$$1 \rightarrow f(1) = 0.778801 - 0.778801(0.75) = 0.1947$$

$$\xi_+ = \left| \frac{0.367879 - 0.1947}{0.367879} \right| \cdot 100\% = 47.1\%$$

$$2 \rightarrow f(1) = 0.778801 - 0.778801(0.75) + 0.778801 \frac{0.75^2}{2} = 0.413738$$

$$\xi_+ = \left| \frac{0.367879 - 0.413738}{0.367879} \right| \cdot 100\% = 12.5\%$$

$$3 \rightarrow f(1) = 0.778801 - 0.778801(0.75) + 0.778801 \frac{0.75^2}{2} - 0.778801 \frac{0.75^3}{6} = 0.358978$$

$$\xi_+ = \left| \frac{0.367879 - 0.358978}{0.367879} \right| \cdot 100\% = 2.42\%$$

연습문제 4-11

$$\varepsilon_s = 0.5 \times 10^{2-2} = 0.5\% \quad , \quad \text{Value} = \cos(\pi - 4) = 0.707 \dots$$

$$0 \rightarrow \cos\left(\frac{\pi}{4}\right) = 1 \quad \varepsilon_+ = \left| \frac{0.707 \dots - 1}{0.707 \dots} \right| \cdot 100\% = 41.42\%$$

$$1 \rightarrow \cos\left(\frac{\pi}{4}\right) \approx 1 - \frac{(\pi/4)^2}{2} = 0.691575$$

$$\varepsilon_+ = \left| \frac{0.707 \dots - 0.691575}{0.707 \dots} \right| \cdot 100\% = 2.19\%$$

$$\varepsilon_a = \left| \frac{0.691575 - 1}{0.691575} \right| \cdot 100\% = 44.6\%$$

$$2 \rightarrow \cos\left(\frac{\pi}{4}\right) \approx 0.691575 + \frac{(\pi/4)^4}{24} = 0.707429$$

$$\varepsilon_+ = \left| \frac{0.707 \dots - 0.707429}{0.707 \dots} \right| \cdot 100\% = 0.436\%$$

$$\varepsilon_a = 2.24\%$$

$$3 \rightarrow \cos\left(\frac{\pi}{4}\right) \approx 0.707429 - \frac{(\pi/4)^6}{720} = 0.707103$$

$$\varepsilon_+ = \left| \frac{0.707 \dots - 0.707429}{0.707} \right| \cdot 100\% = 0.0005\%$$

$$\varepsilon_a = 0.046\%$$

$$\therefore \varepsilon_a < 0.5\% \quad \text{제한종류}$$