

Blatt 4

Aufgabe 1

```
h=0. 1; x0=0. 6;
```

1.1 Zweipunkte-Formel

```
df2p=@(h, x0) (fx(x0) - fx(x0-h)) ./h;  
df2p(h, x0)
```

```
ans =  
0. 033005451469264
```

1.2 Dreipunkte-Endpunkt-Formel

```
df3pe=@(h, x0) 1. /(2*h) .* (-3*fx(x0)+4*fx(x0+h) - fx(x0+2*h));  
df3pe(h, x0)
```

```
ans =  
0. 038797928949271
```

1.3 Dreipunkte-Mittelpunkt-Formel

```
df3pm =@(h, x0) (fx(x0 + h) - fx(x0 - h))./(2*h);  
df3pm(h, x0)
```

```
ans =  
0. 038609406011272
```

1.4 Fünfpunkte-Mittelpunkt-Formel

```
df5pm = @(h, x0) (fx(x0 - 2.*h) - 8.*fx(x0 - h) + 8.*fx(x0 + h) - fx(x0 +  
2.*h))./(12*h);  
df5pm(h, x0)
```

```
ans =  
0. 038614573572267
```

Aufgabe 2

2.1 x_0=0.6

```
h = logspace(-5, 0, 1000);  
g1=h;  
g2=h.^2;  
g3=h.^4;  
G=[g1; g2; g3];  
x0=0. 6*ones(size(h)); % 需要和 h 保持一样维度  
% dy 精确解  
dy_exact=dfx(x0(1));  
% dy 不同算法的解析解
```

```

dy_2p=arrayfun(df2p, h, x0);
dy_3pe=arrayfun(df3pe, h, x0);
dy_3pm=arrayfun(df3pm, h, x0);
dy_5pm=arrayfun(df5pm, h, x0);
% 组合解析解
dynammeric=[dy_2p; dy_3pe; dy_3pm; dy_5pm]

```

```

dynammeric = 4×1000
109 ×
    0.000000000038623    0.000000000038623    0.000000000038623    0.000000000038623 ...
    0.000000000038624    0.000000000038624    0.000000000038624    0.000000000038624
    0.000000000038624    0.000000000038624    0.000000000038624    0.000000000038624
    0.000000000038624    0.000000000038624    0.000000000038624    0.000000000038624

```

```

% 计算误差
Error=arrayfun(@(x) abs(dy_exact-x), dynammeric)

```

```

Error = 4×1000
109 ×
    0.0000000000000001    0.0000000000000001    0.0000000000000001    0.0000000000000001 ...
    0.0000000000000000    0.0000000000000000    0.0000000000000000    0.0000000000000000
    0.0000000000000000    0.0000000000000000    0.0000000000000000    0.0000000000000000
    0.0000000000000000    0.0000000000000000    0.0000000000000000    0.0000000000000000

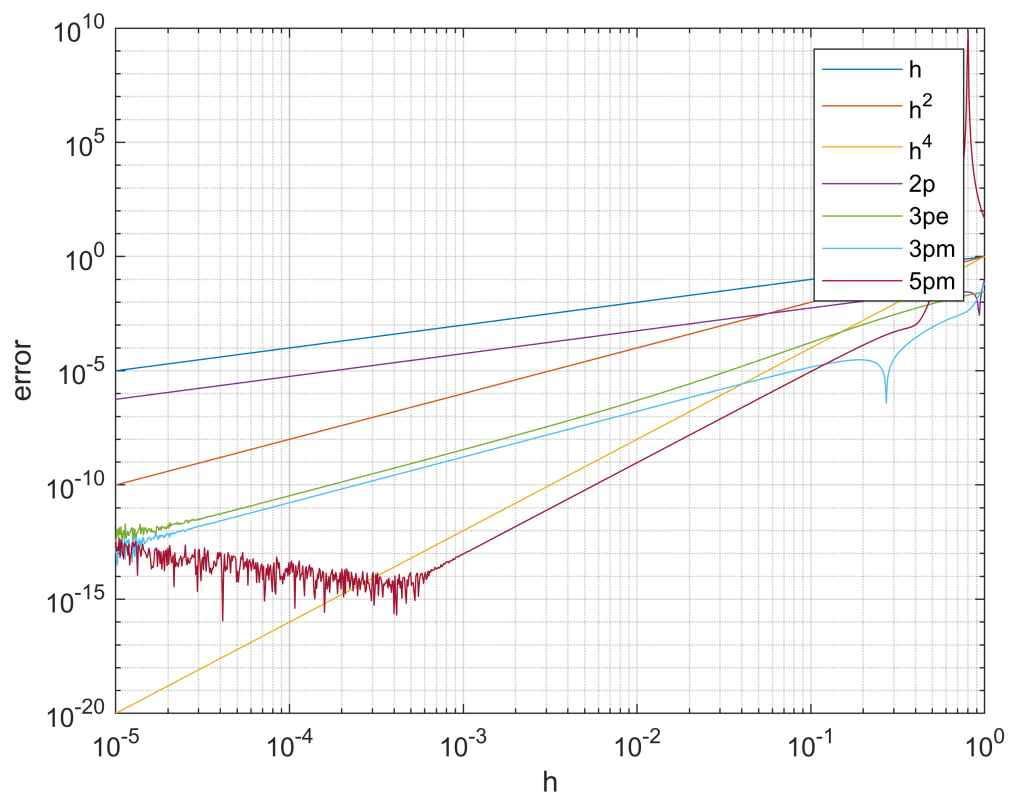
```

```

% 画图
loglog(h, G, h, Error)
%loglog(h, Error(1,:), 'r-', h, Error(2,:), 'g-', h, Error(3,:), 'b-', h, Error(1,:), 'k-
-', h, g1, 'k-', h, g2, 'k:', h, g3, 'k--');

legend('h', 'h^2', 'h^4', '2p', '3pe', '3pm', '5pm')
grid on
xlabel('h'), ylabel('error')

```



legend()

```
function y=fx(x)
y=(x/(1+x))^5;
end

function y=dfx(x)
y=5*(x/(x+1))^4.*(1./(1+x)^2);
end
```