b)Central Difference

```
format long

% initializing value of h and x
h = [0.5 0.1 0.05 0.025 0.0125];
x = 0.1;

%definig f(x) and explicit f'(x)
f = @ (x) (1./(1 + 25*x.^2));
fprime = @ (x) ((-50.*x)./((1+25.*x^2)^2));

%calculating actual and approx value and error
actualValue = fprime(x);
centralApprox = (f(x+h)- f(x-h))./(2*h);
errorCentral = abs(centralApprox - actualValue);

% calculating centraHalf with half of h, for richardson extrapolation
h2 = [0.5 0.1 0.05 0.025 0.0125]/2;
centralHalf = (f(x+h2)- f(x-h2))./(2*h2);

%calculating the order of method
% we don't have p(0),so first value of p matrix is Nan

pCentral = [NaN 0 0 0 0];

for i = 2:length(h)
x = log(errorCentral(i) / errorCentral(i-1));
y = log(h(i)/h(i-1));
pCentral(i) = x/y;
end

%Creating a table for central difference
T1 = table;
T1.Central_diff = centralApprox';
T1.Error = errorCentral';
T1.p_order = pCentral'
```

T1 =

Central_diff	Error	p_order
-0.1	3.1	NaN
-2.5	0.7	0.924594259855155
-3.01176470588235	0.188235294117648	1.89481776330794
-3.15222410343235	0.0477758965676474	1.97818230640893
-3.18801381524541	0.0119861847545861	1.99491043039042

c) RicharsSon Extrapolation

```
%finding approx using richardson extrapolation and error
richardApprox = centralHalf + (1/3)*(centralHalf - centralApprox);
errorRichard = abs(richardApprox-actualValue);

%calculating the order of method
% we don't have p(0),so first value of p matrix is Nan
pRichard = [NaN 0 0 0 0];

for j = 2:length(h)
x = log(errorRichard(j) / errorRichard(j-1));
y = log(h(j)/h(j-1));
pRichard(j) = x/y;
end

%Creating table for richardson extrapolation
T2 = table;
T2.Richard_diff = richardApprox';
T2.Error = errorRichard';
T2.p_order = pRichard'
```

T2 =

Richard_diff	Error	p_order
-1.01692307692308	2.18307692307692	NaN
-3.18235294117647	0.0176470588235302	2.99354291671052
-3.19904390261569	0.000956097384313903	4.20612637120801
-3.1999437191831	5.62808168989015e-05	4.08644239880716
-3.19999654211673	3.45788327171803e-06	4.02468219536228

Published with MATLAB® R2016b