Lab 4

Q1)

```
a =
    -2.220446049250313e-16

b =
   NaN

c =
   Inf
```

Observation

i) 4/3 is 1.333333... Since MATLAB cannot store an unlimited number of digit sequences, this number is rounded. This (4/3-1)*3 becomes a value near to one but not exactly one as a result of the rounding. MATLAB shows that (4/3-1)*3-1=-2.220446049250313e-16 (it is equal to machine epsilon, type eps in the comment window).

ii) Since exp(−50) is very close to zero(Underflow), fl(1+fl(exp(−50)))=1. Therefore, we get 5*(0/0). This leads to the output NaN (Not-a-Number)

iii) Since exp(750) is very high number(Overflow). fl(exp(750))=Inf (`Infinity`).

Q2)

a)

log10(abs(error))

-p	i)	ii)	iii)
1.0000	-2.8733	-2.0792	-1.2864
2.0000	-4.8750	-3.0792	-2.2996
3.0000	-6.8748	-4.0782	-3.3009
4.0000	-8.4968	-3.7504	-4.3010
5.0000	-6.3395	-0.9556	-5.3010
6.0000	-4.5872	-0.4771	-6.3011
7.0000	-2.6089	5.3464	-7.3060
8.0000	-0.4771	-0.4771	-8.2163
9.0000	-0.4771	-0.4771	-7.0823
10.0000	-0.4771	-0.4771	-7.0823
11.0000	-0.4771	-0.4771	-7.0823
12.0000	-0.4771	-0.4771	-4.0511
13.0000	-0.4771	-0.4771	-3.0973
14.0000	-0.4771	26.3464	-3.0973
15.0000	-0.4771	29.3464	-0.9577
16.0000	-0.4771	-0.4771	0

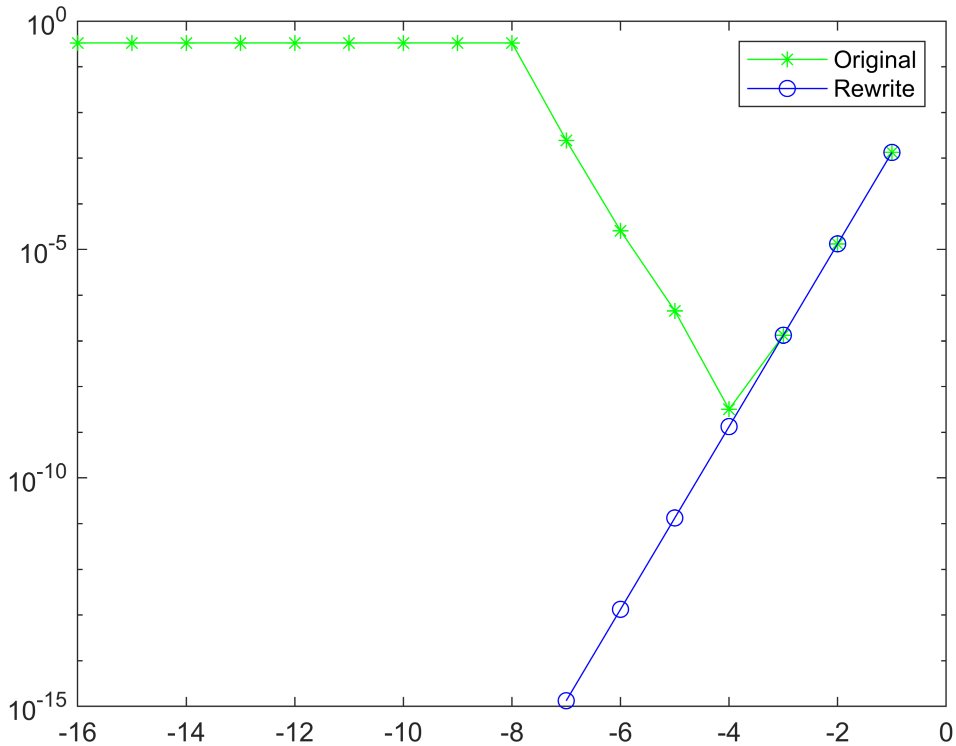
b) After rewrite

-p	i)	ii)	iii)
1.0000	-2.8751	-2.0792	-1.2868
2.0000	-4.8751	-3.0792	-2.2996
3.0000	-6.8751	-4.0792	-3.3009

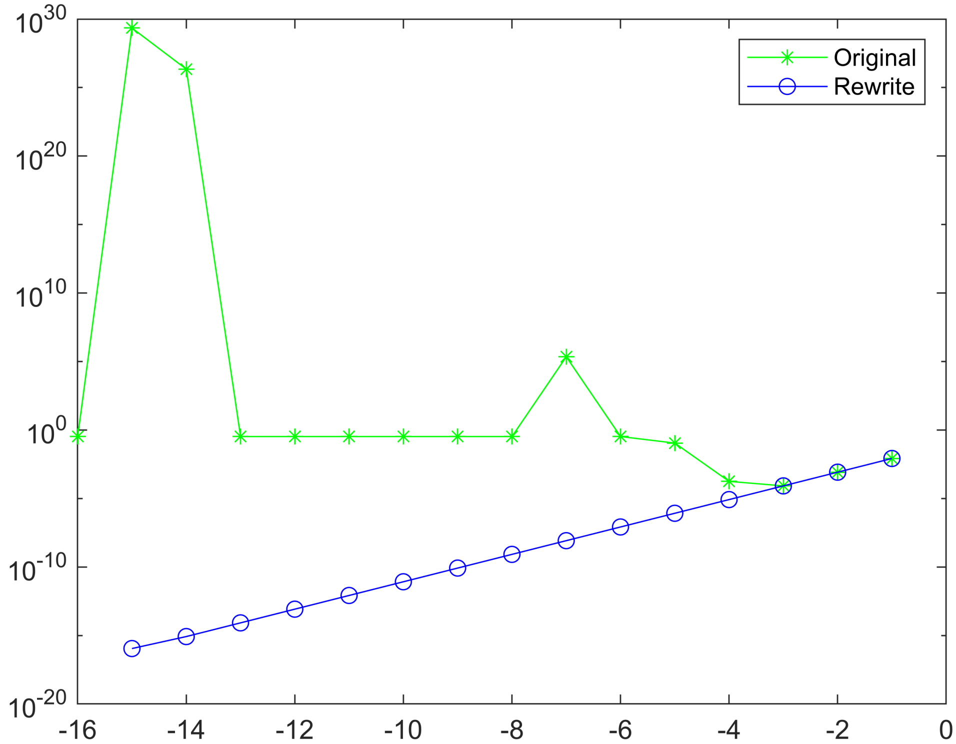
```
 4.0000   -8.8751   -5.0792   -4.3010
 5.0000  -10.8751   -6.0792   -5.3010
 6.0000  -12.8750   -7.0792   -6.3010
 7.0000  -14.8754   -8.0792   -7.3010
 8.0000      -Inf   -9.0792   -8.3010
 9.0000      -Inf  -10.0792   -9.3010
10.0000      -Inf  -11.0792  -10.3010
11.0000      -Inf  -12.0792  -11.3010
12.0000      -Inf  -13.0792  -12.3010
13.0000      -Inf  -14.0795  -13.3014
14.0000      -Inf  -15.0795  -14.2918
15.0000      -Inf  -15.9546  -15.3525
16.0000      -Inf      -Inf      -Inf
```

c) Graph

i)

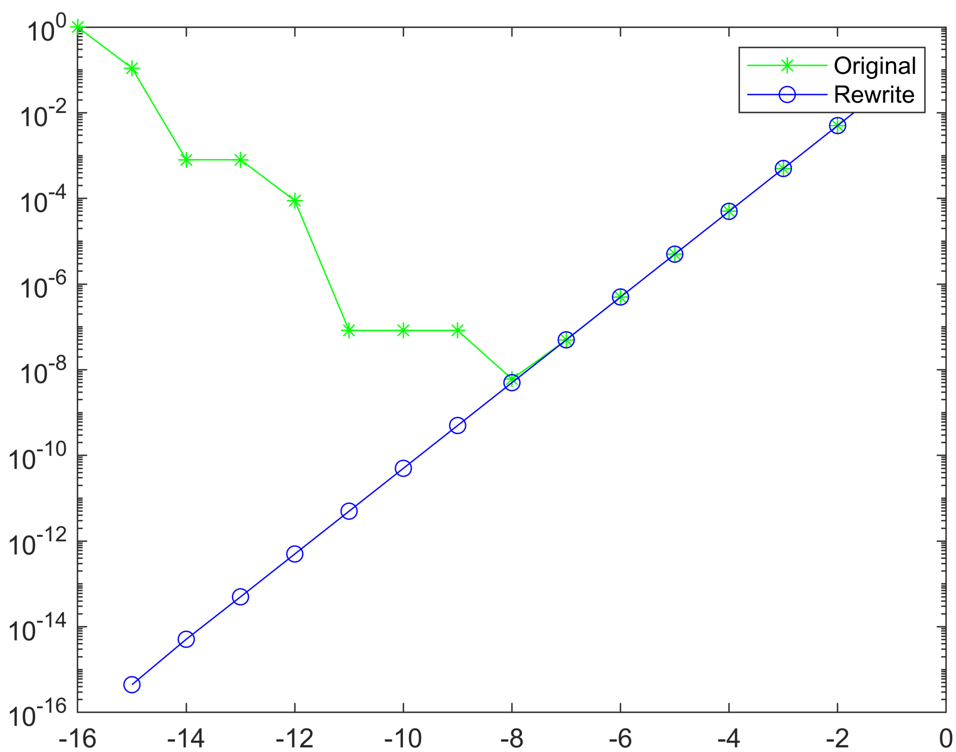


ii)



Original
Rewrite
10^30
10^20
10^10
10^0
10^-10
10^-20
-16
-14
-12
-10
-8
-6
-4
-2
0

iii)



Original
Rewrite
10^0
10^-2
10^-4
10^-6
10^-8
10^-10
10^-12
10^-14
10^-16
-16
-14
-12
-10
-8
-6
-4
-2
0

Q3)

a)

```
clear
p=randn(5,1);
x=randn(10,1);
t=Horner(p,x);
Error=norm(t-polyval(p,x))
```

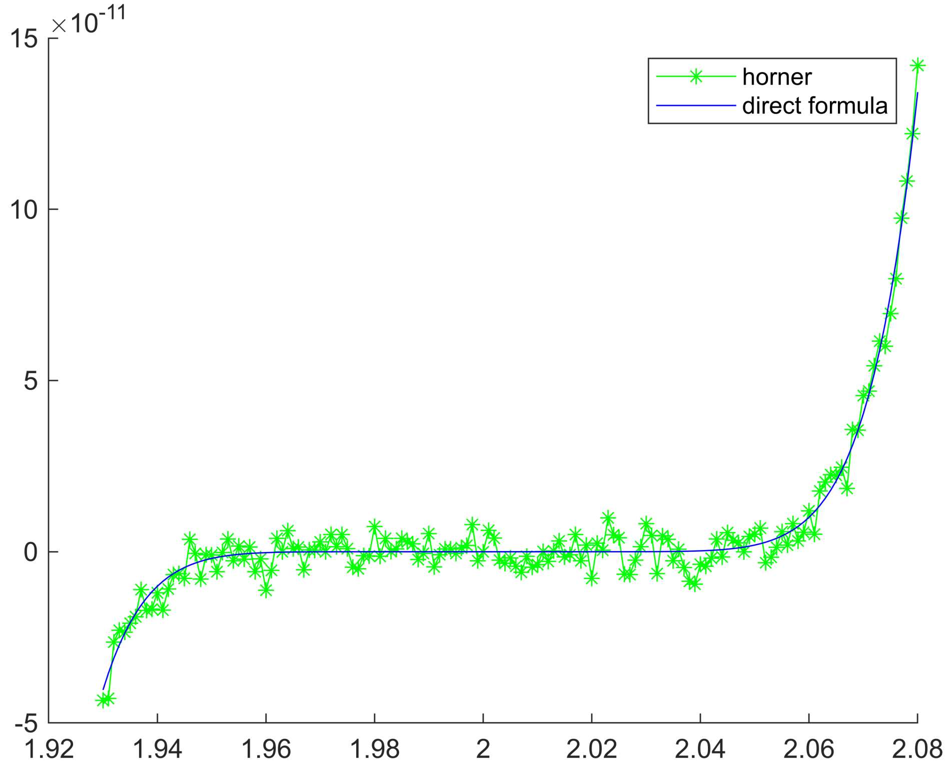
```
Error = 0
```

b)

```
clc
clear
p=[1 -18 144 -672 2016 -4032 5376 -4608 2304 -512];
x0=1.95;x1=2.05;tol=10^(-9);
x2=bisect(p,x0+.02,x1-.01,tol)
x3=bisect(p,x0+0.01,x1-.02,tol)
x4=bisect(p,x0+.03,x1-.02,tol)
```

```
x2 =
     1.974433209151029e+00
x3 =
     2.016027311831712e+00
x4 =
     1.998782740831375e+00
```

c) Graph



Observation

b) What do you observe?

It fails to pick the correct interval and is showing the wrong root.

c) Do the plots differ from one another? if yes, can you think of possible reasons?

Yes, the Horner method fails to evaluate the polynomial near x=2.

Explain the results obtained in part (b) in the light of the difference in the plots.

The graph crosses the x-axis multiple times near x=2 in the Horner method. This causes problems in picking the correct interval.

Functions