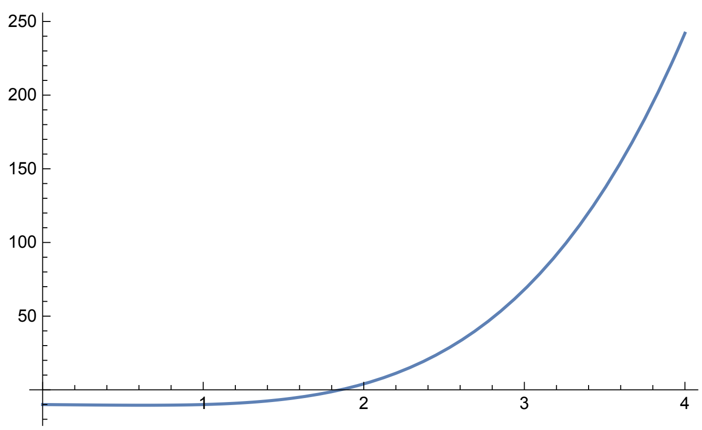
In[∘]:=
```
NewtonRaphsonErroriter[x0_, n_, error_, f_] := Module[{xk1, xk = N[x0]}, k = 0;
   Output = {{k, x0, f[x0], None}};
   approxError = 10 000 000;
   While[n > k && approxError > error, fPrimexk = f'[xk];
    If[fPrimexk == 0,
     Print["The derivative of function at ", k,
      "ith iteration is zero, we can not proceed further with the iterative scheme"];
     Break[]];
    xk1 = xk - f[xk] / fPrimexk;
    approxError = Abs[xk1 - xk];
    xk = xk1;
    k++;
    Output = Append[Output, {k, xk, f[xk], approxError}];];
   Print[NumberForm[
      TableForm[Output, TableHeadings → {None, {"k", "xk", "f[xk]", "ApproxError"}}], 8]]
    If[k < n, Print["The stated  accuracy  achieved in fewer iterations (less than",
      n, ")"],
 Print["Maximum  allowed ", n,
      " iterations are performed, stated accuracy is not achieved"]];
 Print["Root after ", k , "  iterations   xk=", NumberForm[xk, 8]];
   Print["Function value at approximated root , f[xk]=", NumberForm[f[xk], 8]];];
f[x_] := x^4 - x - 10;
error = 10^(-4);
Plot[f[x], {x, 0, 4}]
```

Out[∘]=



In[∘]:=
```
NewtonRaphsonErroriter[2, 5, error, f]
```

k	x_k	$f[x_k]$	ApproxError
0	2	4	None
1	1.8709677	0.38267457	0.12903226
2	1.8557807	0.0048181285	0.01518704
3	1.8555846	7.9489422×10^{-7}	0.00019614069
4	1.8555845	1.9539925×10^{-14}	3.2369946×10^{-8}

The stated accuracy achieved in fewer iterations (less than5)

Root after 4 iterations x_k=1.8555845

Function value at approximated root , $f[x_k]=1.9539925\times10^{-14}$

In[∘]:=
```
NewtonRaphsonErroriter[1, 7, error, f]
```

k	x_k	$f[x_k]$	ApproxError
0	1	-7	None
1	4.2685954	-9.1443575	3.2685954
2	5.7646573	-12.676557	1.4960618
3	8.4311492	-9.8802893	2.6664919
4	8.5781664	-18.568188	0.14701717
5	8.9341748	-15.14397	0.35600842
6	15.576656	-25.648537	6.6424808
7	16.049615	-21.89247	0.47295955

Maximum allowed 7 iterations are performed, stated accuracy is not achieved

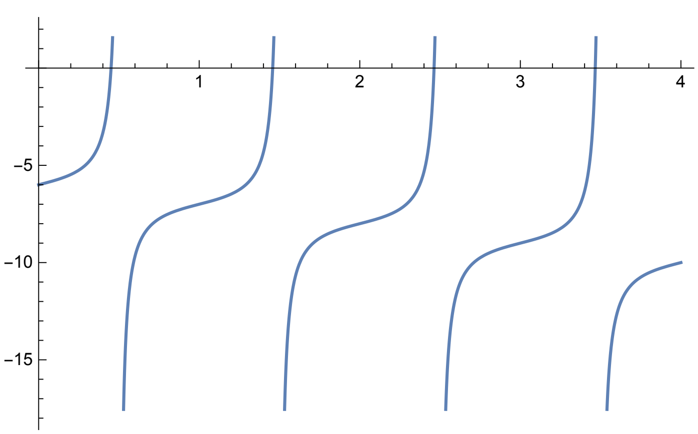
Root after 7 iterations x_k=16.049615

Function value at approximated root , $f[x_k]$=-21.89247

Question 2:

In[ ]:=
```
NewtonRaphsonErroriter[x0_, n_, error_, f_] := Module[{xk1, xk = N[x0]}, k = 0;
   Output = {{k, x0, f[x0], None}};
   approxError = 10000000;
   While[n > k && approxError > error, fPrimexk = f'[xk];
    If[fPrimexk == 0,
     Print["The derivative of function at ", k,
      "ith iteration is zero, we can not proceed further with the iterative scheme"];
     Break[]];
    xk1 = xk - f[xk] / fPrimexk;
    approxError = Abs[xk1 - xk];
    xk = xk1;
    k++;
    Output = Append[Output, {k, xk, f[xk], approxError}];];
   Print[NumberForm[
      TableForm[Output, TableHeadings → {None, {"k", "xk", "f[xk]", "ApproxError"}}], 8]]
    If[k < n, Print["The stated  accuracy  achieved in fewer iterations (less than ",
      n, ")"],
Print["Maximum  allowed ", n,
      " iterations are performed, stated accuracy is not achieved"]];
Print["Root after ", k , "  iterations  xk=", NumberForm[xk, 8]];
   Print["Function value at approximated root , f[xk]=", NumberForm[f[xk], 8]];];
f[x_] := Tan[Pi * x] - x - 6;
error = 10^(-5);
Plot[f[x], {x, 0, 4}]
```

Out[ ]=



In[ ]:= **NewtonRaphsonErroriter[0.45, 20, error, f]**

k	x_k	$f[x_k]$	ApproxError
0	0.45	-0.13624849	None
1	0.45106965	0.0029771478	0.001069653
2	0.45104727	1.3607342×10^{-6}	0.000022383938
3	0.45104726	2.8510527×10^{-13}	1.0240154×10^{-8}

The stated accuracy achieved in fewer iterations (less than 20)

Root after 3 iterations x_k=0.45104726

Function value at approximated root , $f[x_k]=2.8510527\times10^{-13}$

NewtonRaphsonErroriter[0.52, 20, error, f];

k	xk	f[xk]	ApproxError
0	0.52	-22.414545	None
1	0.54816525	-13.106354	0.028165248
2	0.64365016	-8.7070057	0.095484917
3	1.2047871	-6.4550114	0.5611369
4	2.8566646	-9.3400915	1.6518775
5	6.104502	-11.763872	3.2478374
6	10.798585	-17.531943	4.6940825
7	15.374695	-18.967001	4.5761109
8	16.30658	-20.868605	0.93188455
9	18.722573	-25.911666	2.4159925
10	22.658345	-30.499949	3.9357729
11	25.041839	-30.909635	2.3834937
12	39.114056	-44.739572	14.072217
13	56.440441	-57.15851	17.326385
14	57.077033	-62.830188	0.63659239
15	84.007891	-89.983095	26.930858
16	125.98693	-132.02801	41.979041
17	187.48416	-173.40522	61.497228
18	187.62084	-196.12726	0.13667754
19	196.58562	-206.21309	8.9647854
20	201.3283	-205.65784	4.7426748

Maximum allowed 20iterations are performed, stated accuracy is not achieved

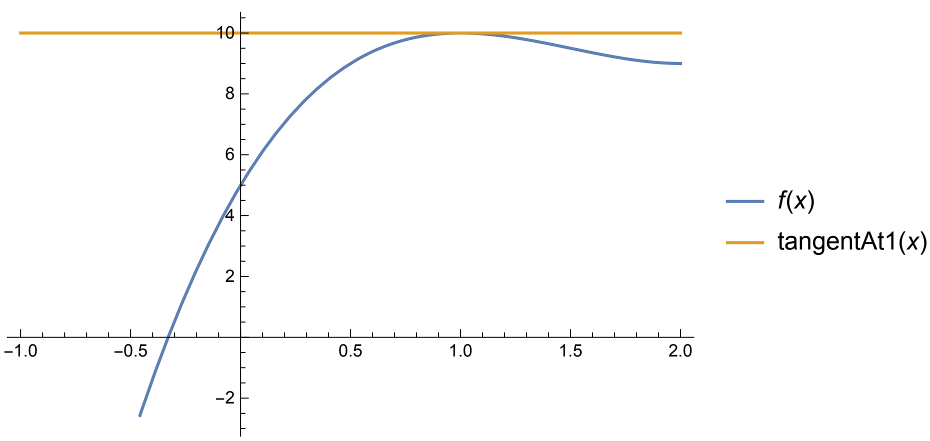
Root after 20iterations xk= 201.3283

Function value at approximated root, f[xk]= -205.65784

Question 3:

In[∘]:=
```
NewtonRaphsonErroriter[x0_, n_, error_, f_] := Module[{xk1, xk = N[x0]}, k = 0;
    Output = {{k, x0, f[x0], None}};
    approxError = 10000000;
    While[n > k && approxError > error, fPrimexk = f'[xk];
     If[fPrimexk == 0,
      Print["The derivative of function at ", k,
       "ith iteration is zero, we can not proceed further with the iterative scheme"];
      Break[]];
     xk1 = xk - f[xk] / fPrimexk;
     approxError = Abs[xk1 - xk];
     xk = xk1;
     k++;
     Output = Append[Output, {k, xk, f[xk], approxError}];];
    Print[NumberForm[
       TableForm[Output, TableHeadings → {None, {"k", "x_k", "f[x_k]", "ApproxError"}}], 8]]
     If[k < n, Print["The stated  accuracy  achieved in fewer iterations (less than",
       n, ")"],
 Print["Maximum  allowed", n,
       "iterations are performed, stated accuracy is not achieved"]];
 Print["Root after ", k , "  iterations  x_k=", NumberForm[xk, 8]];
    Print["Function value at approximated root , f[x_k]=", NumberForm[f[xk], 8]];];
f[x_] := 2 * x^3 - 9 * x^2 + 12 * x + 5;
tangentAt1[x_] = f[1] + f'[1] * (x - 1);
Plot[{f[x], tangentAt1[x]}, {x, -1, 2}, PlotLegends → "Expressions"]
NewtonRaphsonErroriter[1, 20, error, f]
```

Out[∘]=



The derivative of function at 0
 ith iteration is zero, we can not proceed further with the iterative scheme

k	x_k	$f[x_k]$	ApproxError
0	1	10	None

The stated accuracy achieved in fewer iterations (less than20)

Root after 0 iterations x_k=1.

Function value at approximated root , $f[x_k]$=10.