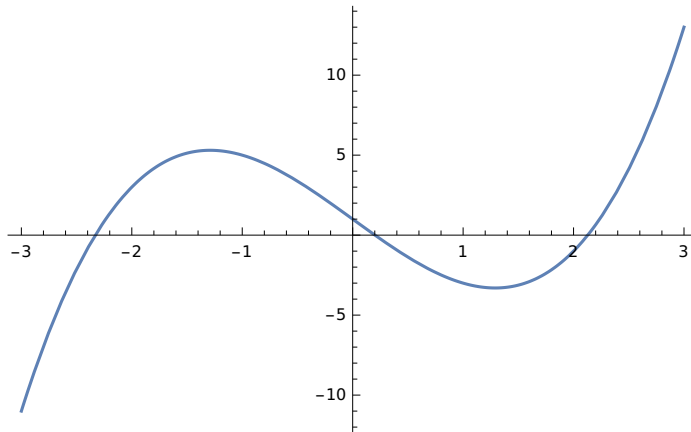- PRACTICAL 01

- QUESTION 1

In[22]:= **f[x_] := x^3 - 5 x + 1**
Plot[f[x], {x, -3, 3}]

Out[23]=

In[4]:=
```
f[x_] := x^3 - 5 x + 1
a[0] = 0;
b[0] = 1;
Do[ p[n + 1] = N[ (a[n] + b[n]) / 2 ];
 If[N[f[a[n]] × f[p[n + 1]]] < 0, a[n + 1] = a[n];
   b[n + 1] = p[n + 1], a[n + 1] = p[n + 1];
   b[n + 1] = b[n]], {n, 0, 20}]
TableForm[Table[{n, a[n], b[n], p[n + 1], f[p[n + 1]]}, {n, 0, 20}]]
```

Out[8]//TableForm=

0	0	1	0.5	-1.375
1	0	0.5	0.25	-0.234375
2	0	0.25	0.125	0.376953
3	0.125	0.25	0.1875	0.0690918
4	0.1875	0.25	0.21875	-0.0832825
5	0.1875	0.21875	0.203125	-0.00724411
6	0.1875	0.203125	0.195313	0.0308881
7	0.195313	0.203125	0.199219	0.0118129
8	0.199219	0.203125	0.201172	0.00228208
9	0.201172	0.203125	0.202148	-0.0024816
10	0.201172	0.202148	0.20166	-0.0000999043
11	0.201172	0.20166	0.201416	0.00109105
12	0.201416	0.20166	0.201538	0.000495564
13	0.201538	0.20166	0.201599	0.000197827
14	0.201599	0.20166	0.20163	0.000048961
15	0.20163	0.20166	0.201645	-0.0000254717
16	0.20163	0.201645	0.201637	0.0000117446
17	0.201637	0.201645	0.201641	-6.86358×10^{-6}
18	0.201637	0.201641	0.201639	2.44052×10^{-6}
19	0.201639	0.201641	0.20164	-2.21153×10^{-6}
20	0.201639	0.20164	0.20164	1.14493×10^{-7}

In[9]:=
```
f[x_] := x^3 - 5 x + 1
a[0] = -3.0;
b[0] = -2.0;
Do[ p[n + 1] = N[ (a[n] + b[n]) / 2 ];
  If[N[f[a[n]] × f[p[n + 1]]] < 0, a[n + 1] = a[n];
    b[n + 1] = p[n + 1], a[n + 1] = p[n + 1];
    b[n + 1] = b[n]], {n, 0, 20}]
TableForm[Table[{n, a[n], b[n], p[n + 1], f[p[n + 1]]}, {n, 0, 20}]]
```

Out[13]//TableForm=

0	-3.	-2.	-2.5	-2.125
1	-2.5	-2.	-2.25	0.859375
2	-2.5	-2.25	-2.375	-0.521484
3	-2.375	-2.25	-2.3125	0.196045
4	-2.375	-2.3125	-2.34375	-0.155853
5	-2.34375	-2.3125	-2.32813	0.021801
6	-2.34375	-2.32813	-2.33594	-0.0665984
7	-2.33594	-2.32813	-2.33203	-0.022292
8	-2.33203	-2.32813	-2.33008	-0.000218816
9	-2.33008	-2.32813	-2.3291	0.0107978
10	-2.33008	-2.3291	-2.32959	0.00529113
11	-2.33008	-2.32959	-2.32983	0.00253658
12	-2.33008	-2.32983	-2.32996	0.00115898
13	-2.33008	-2.32996	-2.33002	0.00047011
14	-2.33008	-2.33002	-2.33005	0.000125653
15	-2.33008	-2.33005	-2.33006	-0.0000465797
16	-2.33006	-2.33005	-2.33006	0.0000395373
17	-2.33006	-2.33006	-2.33006	-3.52109×10^{-6}
18	-2.33006	-2.33006	-2.33006	0.0000180081
19	-2.33006	-2.33006	-2.33006	7.24352×10^{-6}
20	-2.33006	-2.33006	-2.33006	1.86122×10^{-6}

In[14]:=
```
f[x_] := x^3 - 5 x + 1
a[0] = 2;
b[0] = 3;
```

$$Do\left[p[n+1] = N\left[\frac{(a[n] + b[n])}{2}\right];\right.$$

```
  If[N[f[a[n]] × f[p[n + 1]]] < 0, a[n + 1] = a[n];
    b[n + 1] = p[n + 1], a[n + 1] = p[n + 1];
```
$$\left.b[n+1] = b[n]], \{n, 0, 20\}\right]$$

```
TableForm[Table[{n, a[n], b[n], p[n + 1], f[p[n + 1]]}, {n, 0, 20}]]
```

Out[18]//TableForm=

n	a[n]	b[n]	p[n+1]	f[p[n+1]]
0	2	3	2.5	4.125
1	2	2.5	2.25	1.14063
2	2	2.25	2.125	-0.0292969
3	2.125	2.25	2.1875	0.530029
4	2.125	2.1875	2.15625	0.244049
5	2.125	2.15625	2.14063	0.105808
6	2.125	2.14063	2.13281	0.0378652
7	2.125	2.13281	2.12891	0.00418669
8	2.125	2.12891	2.12695	-0.0125794
9	2.12695	2.12891	2.12793	-0.00420246
10	2.12793	2.12891	2.12842	-9.40741×10^{-6}
11	2.12842	2.12891	2.12866	0.00208826
12	2.12842	2.12866	2.12854	0.00103933
13	2.12842	2.12854	2.12848	0.000514938
14	2.12842	2.12848	2.12845	0.000252759
15	2.12842	2.12845	2.12843	0.000121675
16	2.12842	2.12843	2.12843	0.0000561332
17	2.12842	2.12843	2.12842	0.0000233628
18	2.12842	2.12842	2.12842	6.97768×10^{-6}
19	2.12842	2.12842	2.12842	-1.21487×10^{-6}
20	2.12842	2.12842	2.12842	2.8814×10^{-6}

■

■ QUESTION 2

In[40]:= **f[x_] := Cos[x] − x Exp[x]**
Plot[f[x], {x, −3, 1}]

Out[41]=

In[30]:=
```
a[0] = 0;
b[0] = 1;
```

$$Do\left[p[n+1] = N\left[\frac{(a[n] + b[n])}{2}\right];\right.$$

```
 If[N[f[a[n]] × f[p[n + 1]]] < 0, a[n + 1] = a[n];
   b[n + 1] = p[n + 1], a[n + 1] = p[n + 1];
   b[n + 1] = b[n]], {n, 0, 20}]

TableForm[Table[{n, a[n], b[n], p[n + 1], f[p[n + 1]]}, {n, 0, 20}]]
```
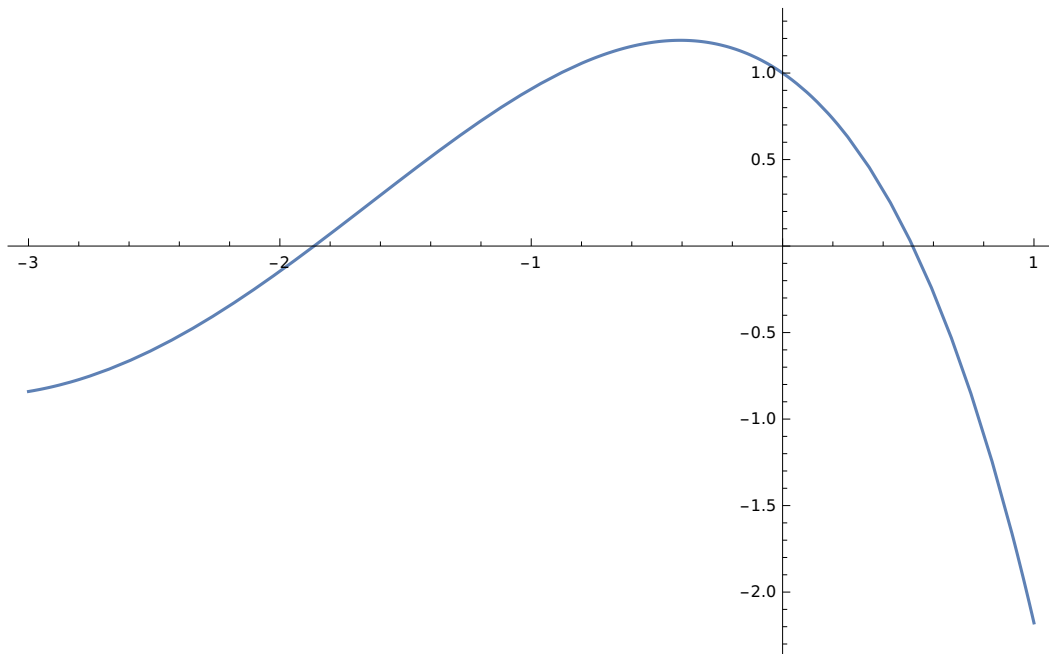
Out[33]//TableForm=

n	a[n]	b[n]	p[n+1]	f[p[n+1]]
0	0	1	0.5	0.0532219
1	0.5	1	0.75	−0.856061
2	0.5	0.75	0.625	−0.356691
3	0.5	0.625	0.5625	−0.141294
4	0.5	0.5625	0.53125	−0.0415122
5	0.5	0.53125	0.515625	0.00647534
6	0.515625	0.53125	0.523438	−0.017362
7	0.515625	0.523438	0.519531	−0.0054044
8	0.515625	0.519531	0.517578	0.000545184
9	0.517578	0.519531	0.518555	−0.00242718
10	0.517578	0.518555	0.518066	−0.000940389
11	0.517578	0.518066	0.517822	−0.00019745
12	0.517578	0.517822	0.5177	0.000173905
13	0.5177	0.517822	0.517761	−0.0000117633
14	0.5177	0.517761	0.517731	0.0000810732
15	0.517731	0.517761	0.517746	0.0000346556
16	0.517746	0.517761	0.517754	0.0000114463
17	0.517754	0.517761	0.517757	$−1.58461 \times 10^{-7}$
18	0.517754	0.517757	0.517756	5.64392×10^{-6}
19	0.517756	0.517757	0.517756	2.74273×10^{-6}
20	0.517756	0.517757	0.517757	1.29214×10^{-6}

```
In[34]:= a[0] = -2.0;
      b[0] = -1.0;
      Do[p[n + 1] = N[(a[n] + b[n])/2];
```
$$Do\left[p[n + 1] = N\left[\frac{(a[n] + b[n])}{2}\right]\right];$$
```
       If[N[f[a[n]] × f[p[n + 1]]] < 0, a[n + 1] = a[n];
         b[n + 1] = p[n + 1], a[n + 1] = p[n + 1];
         b[n + 1] = b[n]], {n, 0, 20}]

      TableForm[Table[{n, a[n], b[n], p[n + 1], f[p[n + 1]]}, {n, 0, 20}]]
```

Out[37]//TableForm=

0	-2.	-1.	-1.5	0.405432
1	-2.	-1.5	-1.75	0.125858
2	-2.	-1.75	-1.875	-0.0119929
3	-1.875	-1.75	-1.8125	0.0565254
4	-1.875	-1.8125	-1.84375	0.0221467
5	-1.875	-1.84375	-1.85938	0.0050448
6	-1.875	-1.85938	-1.86719	-0.00348236
7	-1.86719	-1.85938	-1.86328	0.000779185
8	-1.86719	-1.86328	-1.86523	-0.0013521
9	-1.86523	-1.86328	-1.86426	-0.000286585
10	-1.86426	-1.86328	-1.86377	0.000246268
11	-1.86426	-1.86377	-1.86401	-0.0000201664
12	-1.86401	-1.86377	-1.86389	0.000113049
13	-1.86401	-1.86389	-1.86395	0.0000464408
14	-1.86401	-1.86395	-1.86398	0.0000131371
15	-1.86401	-1.86398	-1.864	-3.51469×10^{-6}
16	-1.864	-1.86398	-1.86399	4.81118×10^{-6}
17	-1.864	-1.86399	-1.86399	6.4824×10^{-7}
18	-1.864	-1.86399	-1.864	-1.43323×10^{-6}
19	-1.864	-1.86399	-1.864	-3.92493×10^{-7}
20	-1.864	-1.86399	-1.864	1.27874×10^{-7}

■ QUESTION 3

In[56]:= `f[x_] := x^2 - 5 x + 2`

`Plot[f[x], {x, -3, 3}]`

Out[57]=
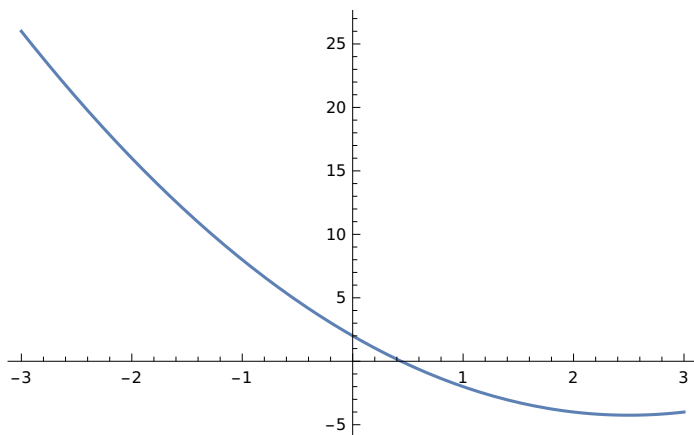
In[58]:= `a[0] = 0;`

`b[0] = 1;`

$$Do\left[p[n+1] = N\left[\frac{(a[n] + b[n])}{2}\right];\right.$$

`If[N[f[a[n]] × f[p[n+1]]] < 0, a[n+1] = a[n];`

`b[n+1] = p[n+1], a[n+1] = p[n+1];`

$$\left.b[n+1] = b[n]], \{n, 0, 20\}\right]$$

`TableForm[Table[{n, a[n], b[n], p[n+1], f[p[n+1]]}, {n, 0, 20}]]`

Out[61]//TableForm=

0	0	1	0.5	-0.25
1	0	0.5	0.25	0.8125
2	0.25	0.5	0.375	0.265625
3	0.375	0.5	0.4375	0.00390625
4	0.4375	0.5	0.46875	-0.124023
5	0.4375	0.46875	0.453125	-0.0603027
6	0.4375	0.453125	0.445313	-0.0282593
7	0.4375	0.445313	0.441406	-0.0121918
8	0.4375	0.441406	0.439453	-0.00414658
9	0.4375	0.439453	0.438477	-0.000121117
10	0.4375	0.438477	0.437988	0.00189233
11	0.437988	0.438477	0.438232	0.000885546
12	0.438232	0.438477	0.438354	0.0003822
13	0.438354	0.438477	0.438416	0.000130538
14	0.438416	0.438477	0.438446	4.7097×10^{-6}
15	0.438446	0.438477	0.438461	-0.0000582037
16	0.438446	0.438461	0.438454	-0.0000267471
17	0.438446	0.438454	0.43845	-0.0000110187
18	0.438446	0.43845	0.438448	-3.1545×10^{-6}
19	0.438446	0.438448	0.438447	7.77597×10^{-7}
20	0.438447	0.438448	0.438447	-1.18845×10^{-6}