

Name : Samarth Gupta

UID : 2021600023

Subject : Design and analysis of algorithms

Experiment No. : 0

Aim : To implement various functions and study their graphs

Problem statement :

1) $(3/2)^n$

2) n^3

3) n

4) $(n)^{2n}$

5) $\log(n)$

6) $(\log(n))^2$

7) $\log(n!)$

8) $2^{\log(n)}$

9) $\log(n)^{\log(n)}$

10) e^n

11) $n!$

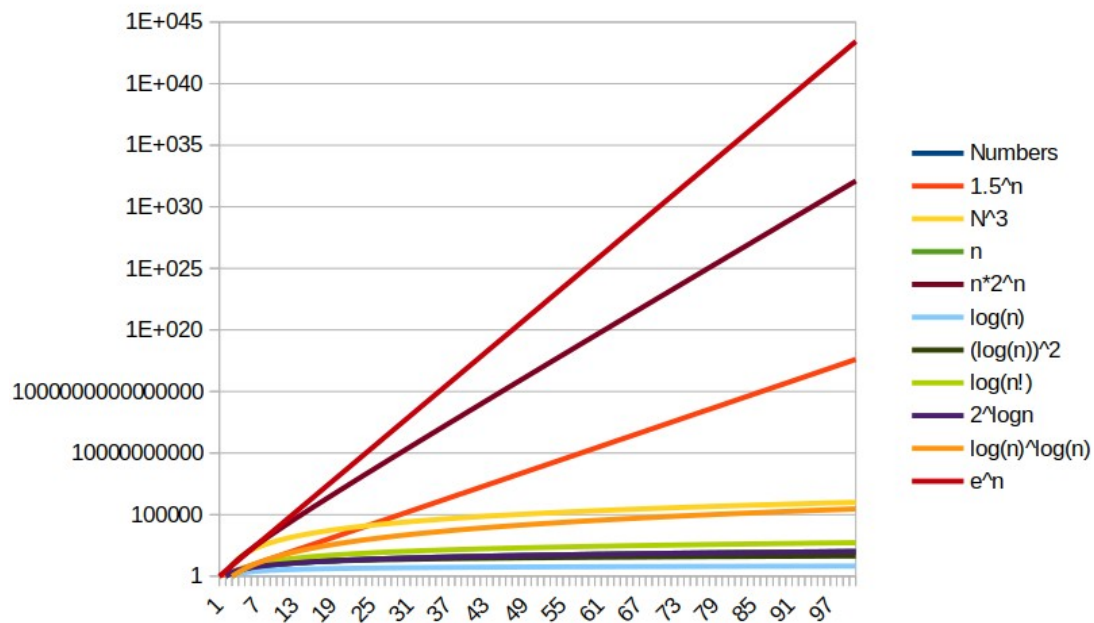
Implementation in excel :

A	B	C	D	E	F	G	H	I	J	K
Numbers	1.5^n	N^3	n	$n \cdot 2^n$	$\log(n)$	$(\log(n))^2$	$\log(n!)$	$2^{\log n}$	$\log(n)^{\log(n)}$	e^n
0	1	0	0	0	0	0	0	1		1
1	1.5	1	1	2	0	0	0	1		2.7182818285
2	2.25	8	2	8	1	1	1	2		17.3890560989
3	3.375	27	3	24	1.5849625007	2.5121061287	2.5849625007	3	2.0750215003	20.085536923
4	5.0625	64	4	64	2	4	4.5849625007	4	4	54.598150033
5	7.59375	125	5	160	2.3219280949	5.3913500778	6.9068905956	5	7.0708972973	148.4131591
6	11.390625	216	6	384	2.5849625007	6.6820311301	9.4918530963	6	11.646053008	403.42879349
7	17.0859375	343	7	896	2.8073549221	7.8812416584	12.299208018	7	18.135506687	1096.6331584
8	25.62890625	512	8	2048	3	9	15.299208018	8	27	2980.957987
9	38.443359375	729	9	4608	3.1699250014	10.048424515	18.46913302	9	38.751428039	8103.0839276
10	57.665039063	1000	10	10240	3.3219280949	11.035206268	21.791061115	10	53.953651904	22026.465795
11	86.497558594	1331	11	22528	3.4594316186	11.967667124	25.250492733	11	73.223431307	59874.141715
12	129.74633789	1728	12	49152	3.5849625007	12.851956132	28.835455234	12	97.231404697	162754.79142
13	194.61950684	2197	13	106496	3.7004397181	13.693254108	32.535894952	13	126.70308991	442413.39201
14	291.92926025	2744	14	229376	3.8073549221	14.495951503	36.343249874	14	162.41989357	1202604.2842
15	437.89389038	3375	15	491520	3.9068905956	15.263794126	40.25014047	15	205.22012336	3269017.3725
16	656.84083557	4096	16	1048576	4	16	44.25014047	16	256	8886110.5205
17	985.26125336	4913	17	2228224	4.0874628413	16.707352479	48.337603311	17	315.71466717	24154952.754
18	1477.89188	5832	18	4718592	4.1699250014	17.388274518	52.507528313	18	385.37919814	65659969.137
19	2216.8378201	6859	19	9961472	4.2479275134	18.044888159	56.755455826	19	466.0695986	178482301
20	3325.2567301	8000	20	20971520	4.3219280949	18.679062457	61.077383921	20	558.92380508	485165195.41
21	4987.8850951	9261	21	44040192	4.3923174228	19.292452342	65.469701344	21	665.14267898	1318815734
22	7481.8276427	10648	22	92274688	4.4594316186	19.886530361	69.929132962	22	785.99099582	3584912846
23	11222.741464	12167	23	192937984	4.5235619561	20.46261277	74.452694918	23	922.79842984	9744803446
24	16834.112196	13824	24	402653184	4.5849625007	21.021881133	79.037657419	24	1076.9605339	26489122130
25	25251.168294	15625	25	838860800	4.6438561898	21.565400311	83.681513609	25	1249.9397147	72004899337
26	37876.752441	17576	26	1744830464	4.7004397181	22.094133544	88.381953327	26	1443.2662035	1.9573E+11
27	56815.128662	19683	27	3623878656	4.7548875022	22.608955158	93.136840829	27	1658.5390222	5.32048E+11
28	85222.692992	21952	28	7516192768	4.8073549221	23.110661347	97.944195751	28	1897.426945	1.44626E+12
29	127834.03949	24389	29	15569256448	4.8579809951	23.599979349	102.80217675	29	2161.6694561	3.93133E+12
30	191751.05923	27000	30	32212254720	4.9068905956	24.077575317	107.70906734	30	2453.077703	1.06865E+13
31	287626.58885	29791	31	66571993088	4.9541963104	24.544061082	112.66326365	31	2773.5354451	2.90488E+13
32	431439.88327	32768	32	1.37439E+11	5	25	117.66326365	32	3125	7.8963E+13
33	647159.82491	35937	33	2.83468E+11	5.0443941194	25.445912031	122.70765777	33	3509.5031839	2.14644E+14
34	970739.73737	39304	34	5.84116E+11	5.0874628413	25.882278161	127.79512061	34	3929.1522498	5.83462E+14

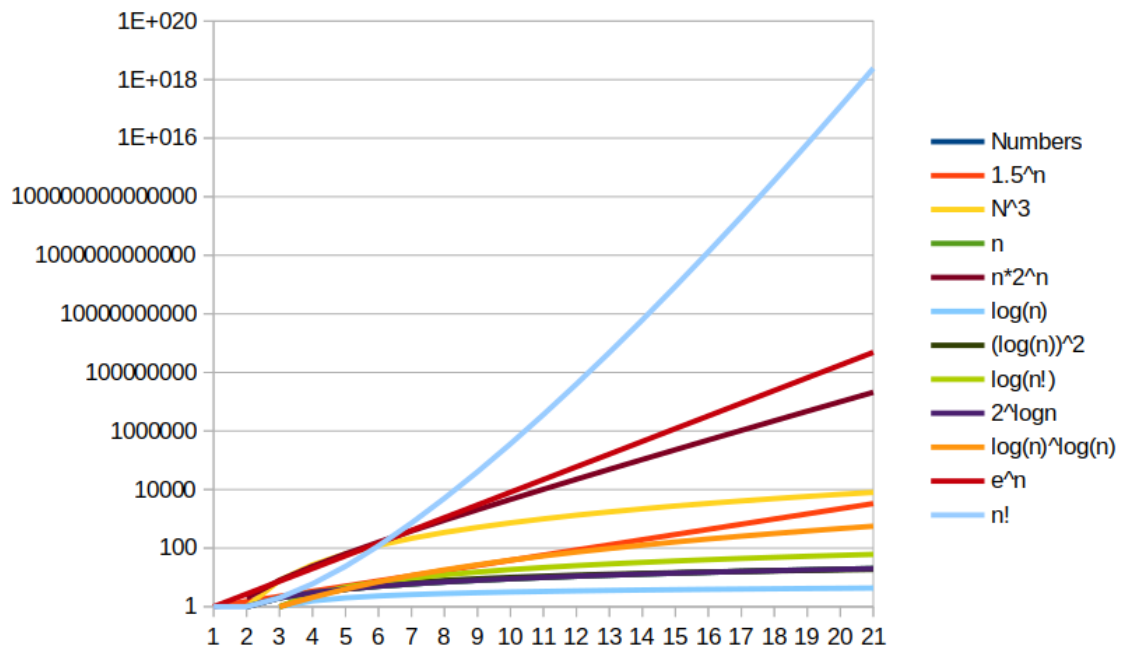
A	B	C	D	E	F	G	H	I	J	K
35	1456109.606	42875	35	1.20259E+12	5.1292830169	26.309544268	132.92440363	35	4386.1308215	1.58601E+15
36	2184164.4091	46656	36	2.4739E+12	5.1699250014	26.728124521	138.09432863	36	4882.6998243	4.31123E+15
37	3276246.6136	50653	37	5.08524E+12	5.2094533656	27.138404369	143.303782	37	5421.1984117	1.17191E+16
38	4914369.9204	54872	38	1.04454E+13	5.2479275134	27.540743186	148.55170951	38	6004.0448896	3.18559E+16
39	7371554.8806	59319	39	2.14405E+13	5.2854022189	27.935476615	153.83711173	39	6633.7376368	8.65934E+16
40	11057332.321	64000	40	4.39805E+13	5.3219280948	28.322918647	159.15903982	40	7312.8560226	2.35385E+17
41	16585998.481	68921	41	9.016E+13	5.3575520046	28.703363482	164.51659183	41	8044.0613214	6.39843E+17
42	24878997.722	74088	42	1.84718E+14	5.3923174228	29.077087188	169.90890925	42	8830.0976238	1.73272E+18
43	37318496.583	79507	43	3.78232E+14	5.4262647547	29.444349188	175.33517401	43	9673.7927461	4.72784E+18
44	55977744.875	85184	44	7.74056E+14	5.4594316186	29.805393599	180.79460562	44	10678.059136	1.28516E+19
45	83966617.312	91125	45	1.5833E+15	5.4918530963	30.160450432	186.28645872	45	11545.894774	3.49343E+19
46	125949926	97336	46	3.23696E+15	5.5235619561	30.509736682	191.81002068	46	12580.384079	9.49612E+19
47	188924889	103823	47	6.61466E+15	5.5545888517	30.853457311	197.36460953	47	13684.698801	2.58131E+20
48	283387333.43	110592	48	1.35108E+16	5.5849625007	31.191806134	202.94957203	48	14862.098919	7.01674E+20
49	425081000.14	117649	49	2.75845E+16	5.6147098441	31.524966634	208.56428187	49	16115.933537	1.90735E+21
50	637621500.21	125000	50	5.6295E+16	5.6438561898	31.853112691	214.20813806	50	17449.64177	5.18471E+21
51	956432250.32	132651	51	1.14842E+17	5.672425342	32.17640926	219.88056341	51	18866.753636	1.40935E+22
52	1434648375	140608	52	2.34187E+17	5.7004397181	32.49501298	225.58100312	52	20370.890943	3.83101E+22
53	2151972563	148877	53	4.73782E+17	5.7279204546	32.809072734	231.30892358	53	21965.76817	1.04138E+23
54	3227958845	157464	54	9.72778E+17	5.7548875022	33.118730163	237.06381108	54	23655.193355	2.83075E+23
55	4841938267	166375	55	1.98158E+18	5.7813597135	33.424120137	242.84517079	55	25443.06897	7.69479E+23
56	7262907401	175616	56	4.03523E+18	5.8073549221	33.725371191	248.65252572	56	27333.392801	2.09166E+24
57	10894361101	185193	57	8.21457E+18	5.8328900142	34.022605917	254.8541573	57	29330.258827	5.68572E+24
58	16341541652	195112	58	1.67174E+19	5.8579809951	34.315941339	260.34339673	58	31437.858091	1.54554E+25
59	24512312478	205379	59	3.40112E+19	5.8826430494	34.605489246	266.22603977	59	33660.479576	4.20121E+25
60	36768468717	216000	60	6.91753E+19	5.9068909596	34.891356508	272.12393037	60	36002.511074	1.14201E+26
61	55152703075	226981	61	1.40656E+20	5.9307373376	35.173645367	278.06366771	61	38468.440055	3.1043E+26
62	82729054613	238328	62	2.85925E+20	5.9541963104	35.452453703	284.01786402	62	41062.854536	8.43836E+26
63	1.24094E+11	250047	63	5.81072E+20	5.9772799235	35.727875284	289.99514394	63	43790.443949	2.29378E+27
64	1.8614E+11	262144	64	1.18059E+21	6	36	295.99514394	64	46656	6.23515E+27
65	2.79211E+11	274625	65	2.39808E+21	6.022367813	36.268914075	302.01751175	65	49664.417537	1.69489E+28
66	4.18816E+11	287496	66	4.86994E+21	6.0443941194	36.53470027	308.06190587	66	52820.695408	4.60719E+28
67	6.28224E+11	300763	67	9.88745E+21	6.0660891905	36.797438067	314.12799506	67	56129.937324	1.25236E+29
68	9.42336E+11	314432	68	2.00701E+22	6.0874628413	37.057203844	320.21545791	68	59597.352715	3.40428E+29
69	1.4135E+12	328509	69	4.07304E+22	6.1085244568	37.314071039	326.32398236	69	63228.257587	9.25378E+29
70	2.12026E+12	343000	70	8.26414E+22	6.1292830169	37.568110302	332.45326538	70	67028.075382	2.51544E+30

A	B	C	D	E	F	G	H	I	J	K
71	3.18038E+12	357911	71	1.67644E+23	6.1497471195	37.819389634	338.6030125	71	71002.337824	6.83767E+30
72	4.77057E+12	373248	72	3.4001E+23	6.1699250014	38.067974523	344.7729375	72	75156.685783	1.85867E+31
73	7.15586E+12	389017	73	6.89466E+23	6.1898245589	38.3192807	350.96276206	73	79496.870115	5.05239E+31
74	1.07338E+13	405224	74	1.39782E+24	6.2094533656	38.5573111	357.17221542	74	84028.752523	1.37338E+32
75	1.61007E+13	421875	75	2.83342E+24	6.2288186905	38.798182279	363.40103412	75	88758.3064	3.73324E+32
76	2.4151E+13	438976	76	5.7424E+24	6.2479275134	39.036598213	369.64896163	76	93691.617678	1.0148E+33
77	3.62265E+13	456533	77	1.16359E+25	6.2667865407	39.272613547	375.91574817	77	98834.885678	2.75851E+33
78	5.43398E+13	474552	78	2.35741E+25	6.2854022189	39.506281053	382.20115039	78	104194.42395	7.49842E+33
79	8.15097E+13	493039	79	4.77526E+25	6.3037807482	39.737651721	388.50493114	79	109776.66113	2.03828E+34
80	1.22265E+14	512000	80	9.67141E+25	6.3219280949	39.966774837	394.82685923	80	115588.14177	5.54062E+34
81	1.83397E+14	531441	81	1.95846E+26	6.3398500029	40.193698059	401.16670923	81	121635.52718	1.5061E+35
82	2.75095E+14	551368	82	3.96528E+26	6.3575520046	40.418467491	407.52426124	82	127925.59628	4.094E+35
83	4.12643E+14	571787	83	8.02727E+26	6.3750394313	40.641127751	413.89930067	83	134465.24644	1.11286E+36
84	6.18965E+14	592704	84	1.6248E+27	6.3923174228	40.861722034	420.29161809	84	141261.49432	3.02508E+36
85	9.28447E+14	614125	85	3.28828E+27	6.4093909361	41.080292172	426.70100903	85	148321.47668	8.22301E+36
86	1.39267E+15	636056	86	6.65393E+27	6.4262647547	41.296878698	433.12727378	86	155652.45128	2.23525E+37
87	2.08901E+15	658503	87	1.34626E+28	6.4429434958	41.511520891	439.57021728	87	163261.79763	6.07603E+37
88	3.13351E+15	681472	88	2.72347E+28	6.4594316186	41.724256836	446.0296489	88	171157.01793	1.65164E+38
89	4.70026E+15	704969	89	5.50883E+28	6.475733431	41.935123469	452.50538233	89	179345.7378	4.48961E+38
90	7.05039E+15	729000	90	1.11415E+29	6.4918530963	42.144156624	458.99723543	90	187835.70719	1.2204E+39
91	1.05756E+16	753571	91	2.25305E+29	6.5077946402	42.351391079	465.50503007	91	196634.80119	3.3174E+39
92	1.58634E+16	778688	92	4.55562E+29	6.5235619561	42.556860595	472.02859202	92	205751.02085	9.01763E+39
93	2.37951E+16	804357	93	9.21027E+29	6.5391588111	42.760597957	478.56775083	93	215192.494	2.45125E+40
94	3.56926E+16	830584	94	1.86186E+30	6.5545888517	42.962635015	485.12233968	94	224967.47615	6.66318E+40
95	5.35389E+16	857375	95	3.76334E+30	6.5698556083	43.163002714	491.69219529	95	235084.35123	1.81124E+41
96	8.03084E+16	884736	96	7.6059E+30	6.5849625007	43.361731136	498.27715779	96	245551.63247	4.92346E+41
97	1.20463E+17	912673	97	1.53703E+31	6.5999128422	43.558849524	504.87707064	97	256377.96323	1.33833E+42
98	1.86094E+17	941192	98	3.10574E+31	6.61647098441	43.754386322	511.49178048	98	267572.11782	3.63797E+42
99	2.71041E+17	970299	99	6.27487E+31	6.6293566201	43.948369196	518.1211371	99	279143.00231	9.88903E+42
100	4.06561E+17	1000000	100	1.26765E+32	6.6438561898	44.14082507	524.76499329	100	291099.65537	2.68812E+43

Graph 1 :



Graph 2 :



code :

```
public class functions {
    public static void main(String[] args) {
        for (int i = 0; i < 100; i++) {
            //Calling all 10 functions with n as the argument
        }
        for (int i = 0; i < 20; i++) {
            //calling all 11 functions with n! as the argument
        }
    }
}
```

```
    }  
}
```

```
public static double first(int n){  
    return Math.pow(1.5, n);  
}
```

```
public static double second(int n){  
    return Math.pow(n, 3);  
}
```

```
public static double third(int n){  
    return Math.pow(2, Math.pow(2, n));  
}
```

```
public static double fourth(int n){  
    return n * Math.pow(2, n);  
}
```

```
public static double fifth(int n){  
    return Math.pow((Math.log(n)/Math.log(2)), 2);  
}
```

```
public static double sixth(int n){  
    int s = 1;  
    for (int i = 1; i <= n ; i++) {  
  
        s = s * n;  
  
    }  
    return Math.log(s)/Math.log(2);  
}
```

```
public static double seventh(int n){  
    return Math.log(n)/Math.log(2);  
}
```

```
public static double eighth(int n){  
    return Math.pow(2, (Math.log(n)/Math.log(2)));  
}
```

```

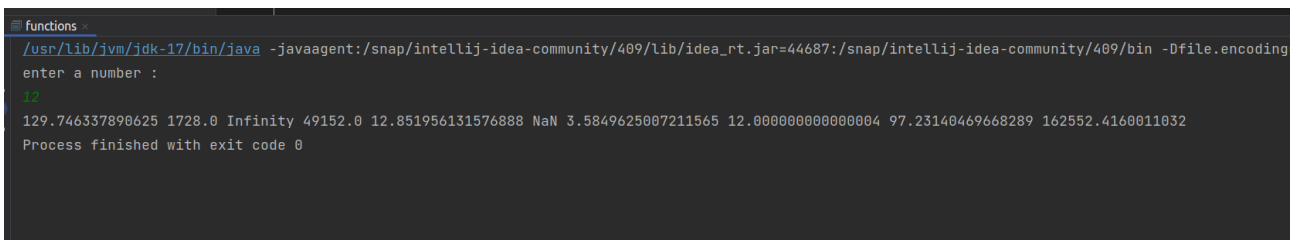
    }

    public static double ninth(int n){
        return Math.pow(Math.log(n)/Math.log(2), Math.log(n)/Math.log(2));
    }

    public static double tenth(int n){
        return Math.pow(2.718, n);
    }
}

```

Output :



```

functions
/usr/lib/jvm/jdk-17/bin/java -javaagent:/snap/intellij-idea-community/409/lib/idea_rt.jar=44687:/snap/intellij-idea-community/409/bin -Dfile.encoding
enter a number :
13
129.746337898625 1728.0 Infinity 49152.0 12.851956131576888 NaN 3.5849625007211565 12.000000000000004 97.23140469668289 162552.4160011032
Process finished with exit code 0

```

Conclusion :

Learnt how implement the various graphs of functions in excel.
 Learnt about the various and their domains and ranges respectively.