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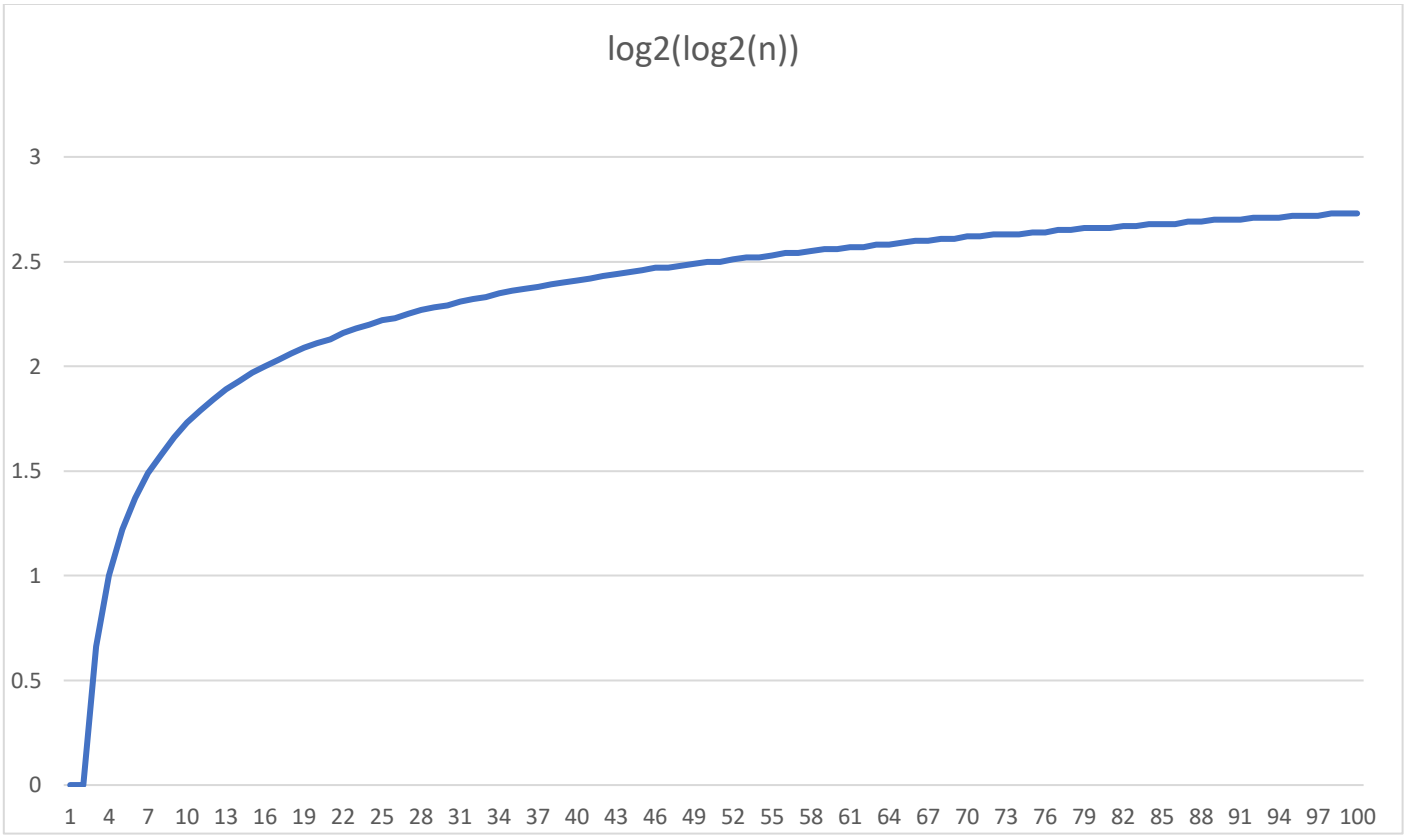
SUBJECT	Design and analysis of algorithms
EXPERIMENT NO :	01
DATE OF PERFORMANCE	30-01-2023
DATE OF SUBMISSION	30-01-2023
AIM:	To implement the various functions e.g. linear, non-linear, quadratic, exponential etc.
PROBLEM STATEMENT 1:	**For this experiment, you have to implement at least 10 functions from the following list.**
THEORY	A function is a relation between a set of inputs and a set of permissible outputs with the property that each input is related to exactly one output. Let A & B be any two non-empty sets; mapping from A to B will be a function only when every element in set A has one end, only one image in set B.
ALGORITHM:	1. Print the values of respective functions in a tabular form. 2. Copy all values in an excel sheet. 3. Plot a line graph for values of each function and observe the gradients.

PROGRAM:

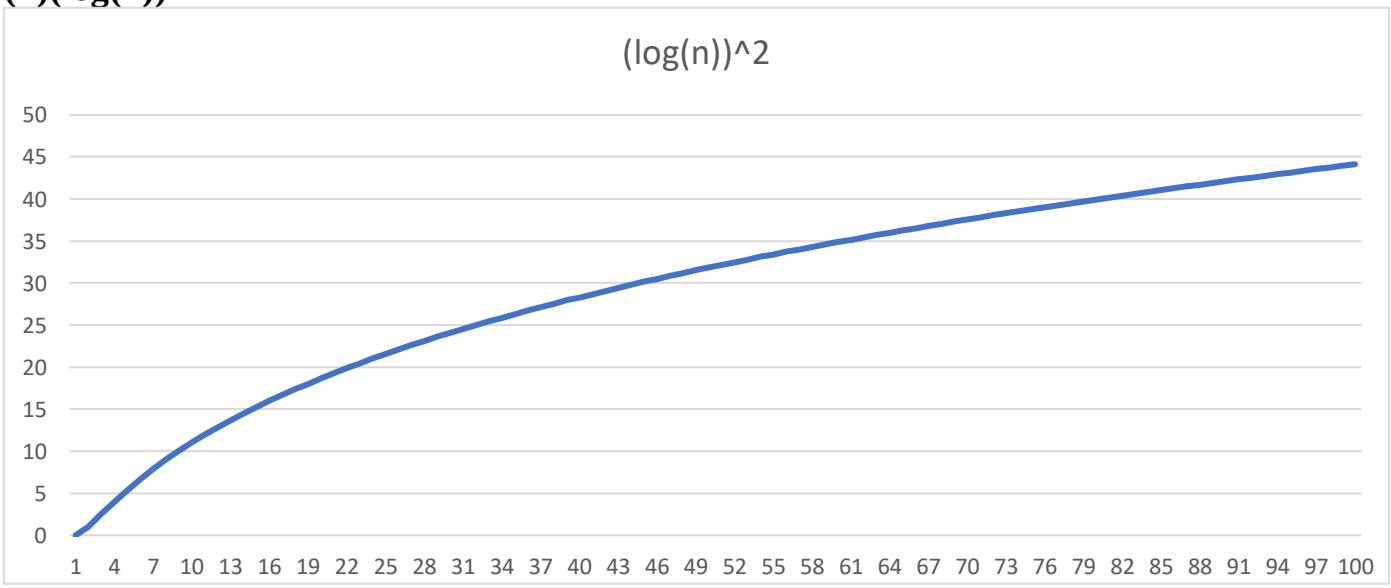
```
#include<stdio.h>
#include<math.h>
void main()
{
    int i;

printf("function\tlog2(log2(n))\t\tlog^2(n)\t2^log2(n)\tlog2(n)\t\tln(ln(n)))\t\
t
   ln(n)\t\tnln(n)\t\tn^log(log(n))\tn^3\tn\n");
   for(i=1;i<=100;i++)
   {

printf("%d\t\t\t%.2lf\t\t%.2lf\t\t%.2f\t\t%.2f\t\t%.2f\t\t\t%.2f\t\t  %.2f\t\t
        %.2f\t\t%d\t%d\n",i,log2(log2(i)),pow(log2(i),2),pow(2,log2(i)),log2(i
),
        log(log(i)),i*log(i),pow(i,log2(log2(i))),i*i*i,i);
    }
}
```

RESULT (SNAPSHOT):
Graphs Plots:
(i)log2(log2(n))



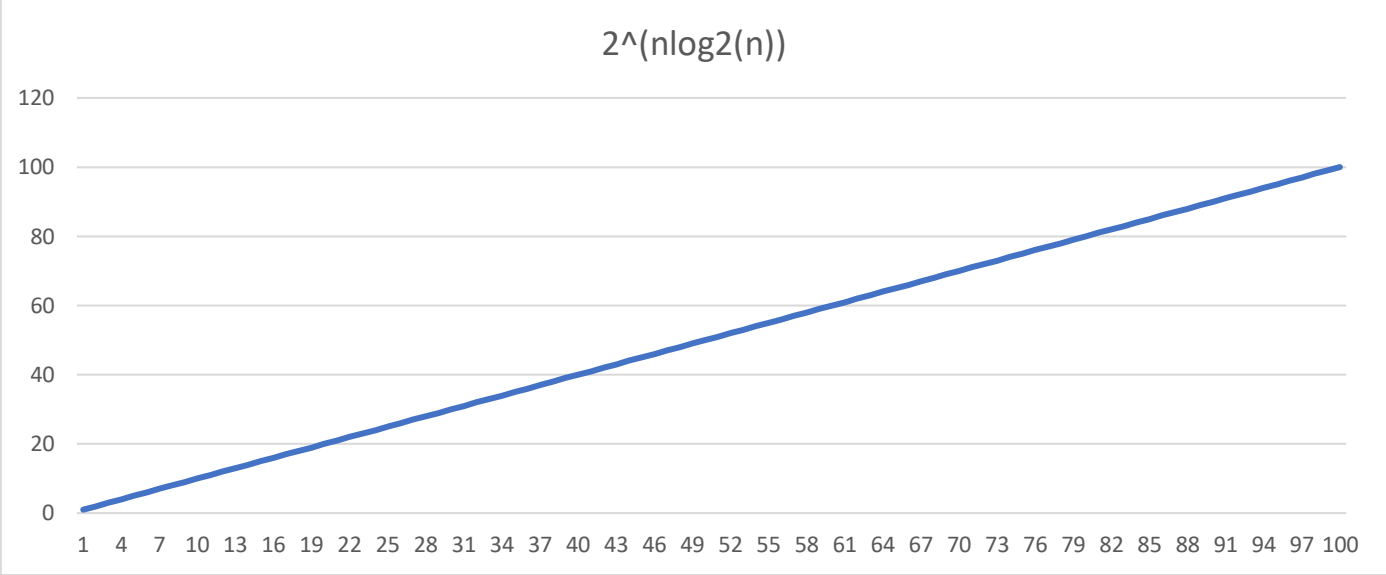
Observation: The graph is logarithmic and has values 0 for n==1 and n==2 after which the graph exponentially rises and then flattens after a point.

(ii)(log(n))^2



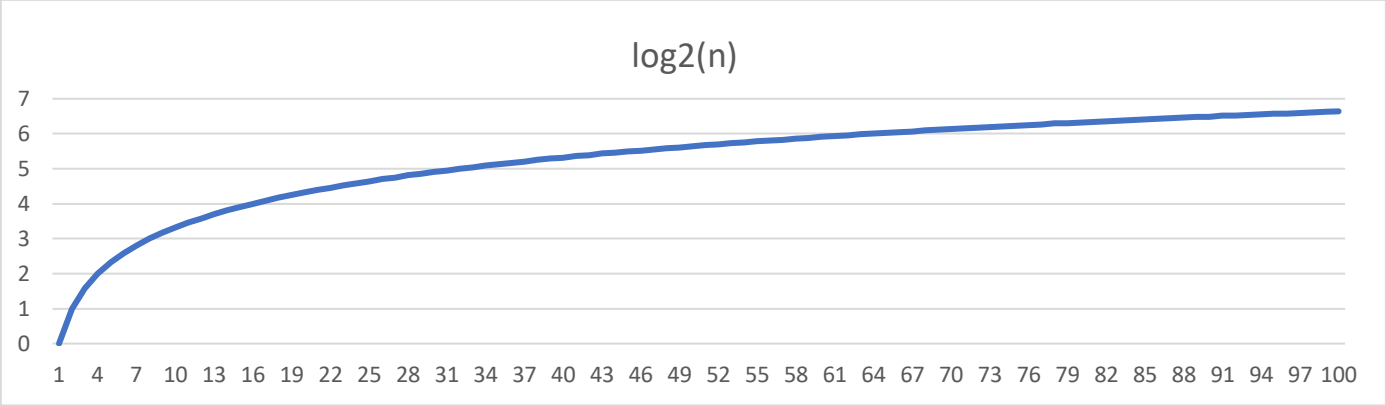
Observation: The graph is logarithmic and has values 0 for n==1 after which the graph exponentially rises and then flattens after a point.

(iii)2^(log2(n))



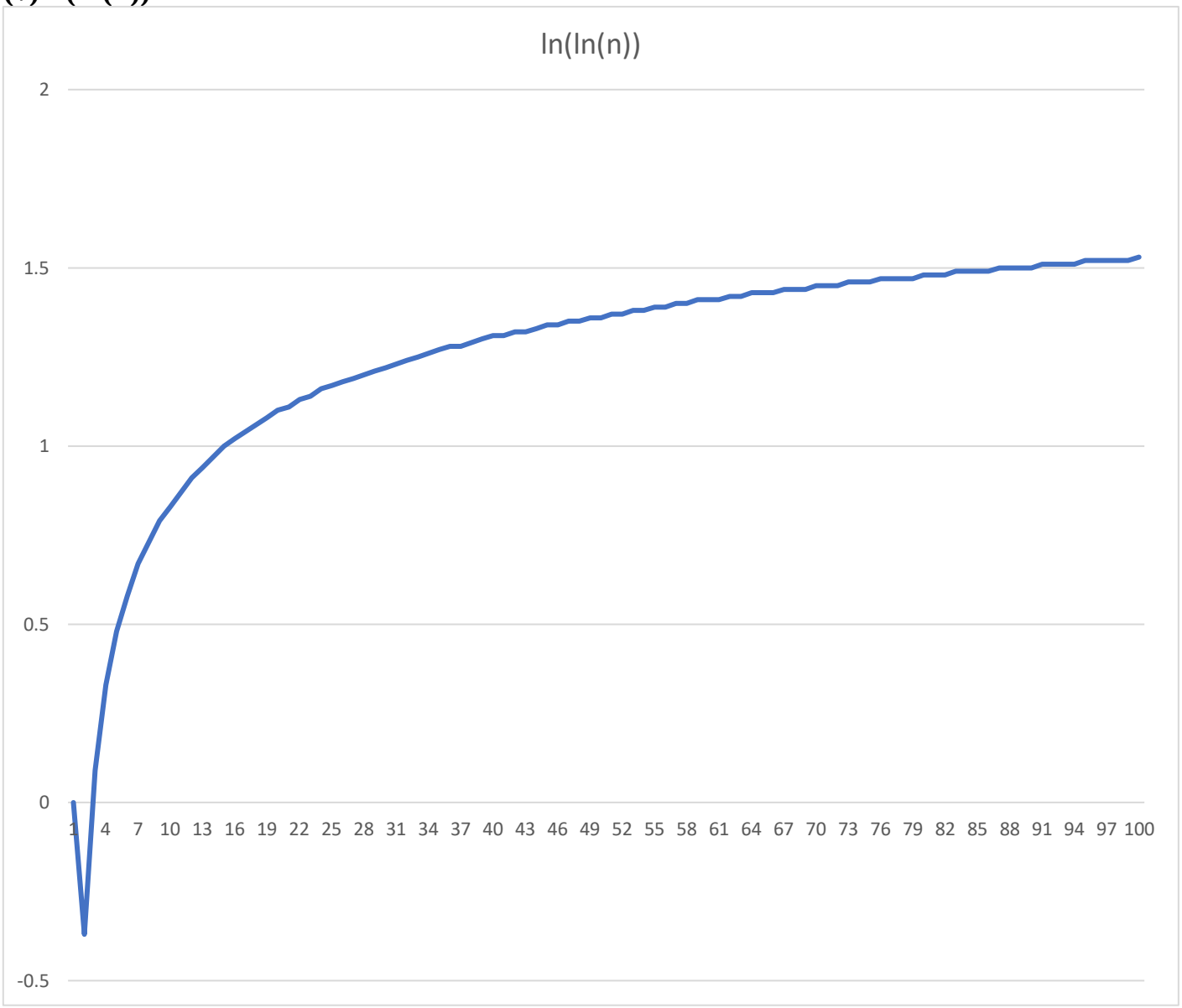
Observation: The graph is linear graph.

(iv)log2(n)



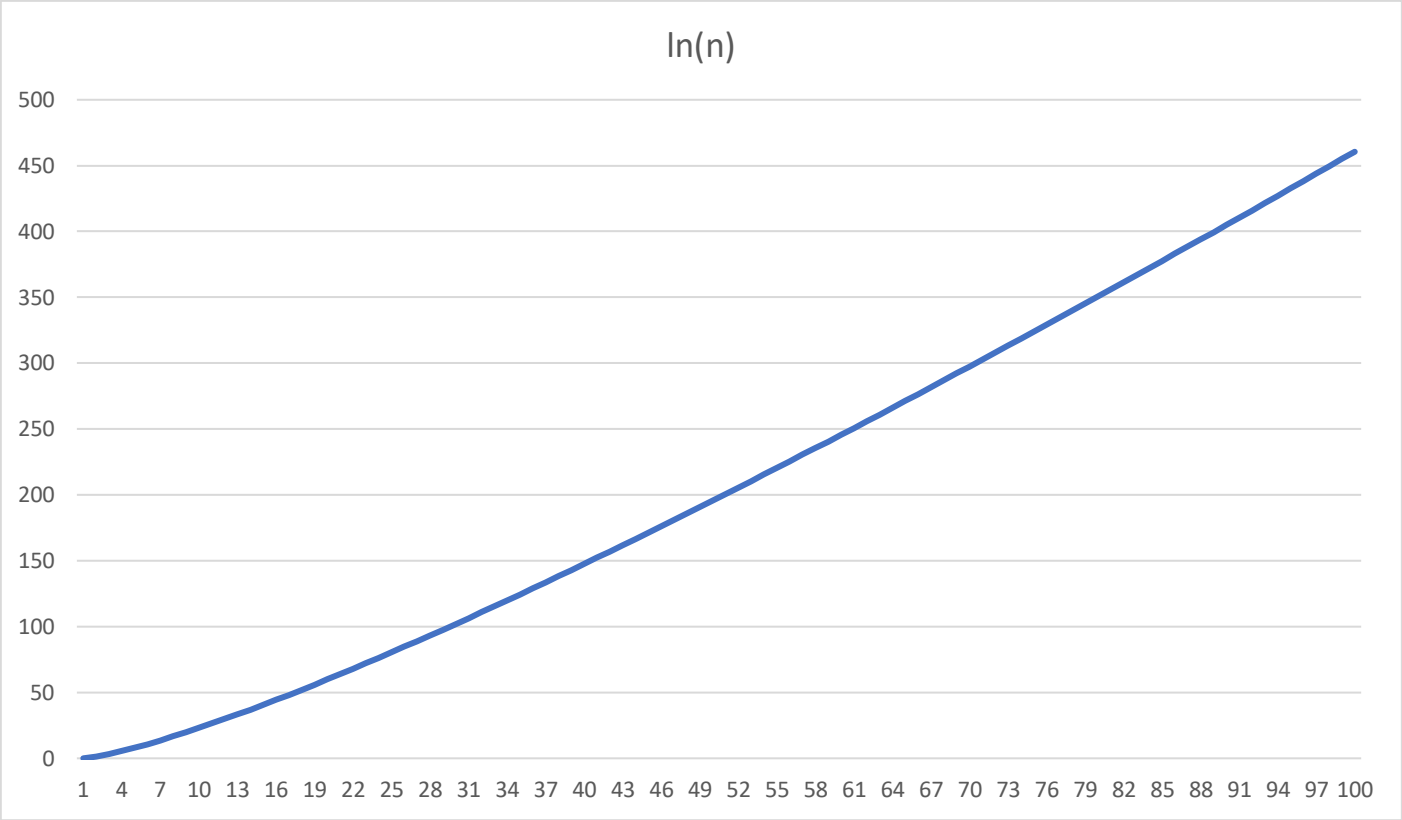
Observation: The graph is logarithmic graph which exponentially rises and then flattens after a point.

(v)ln(ln(n))



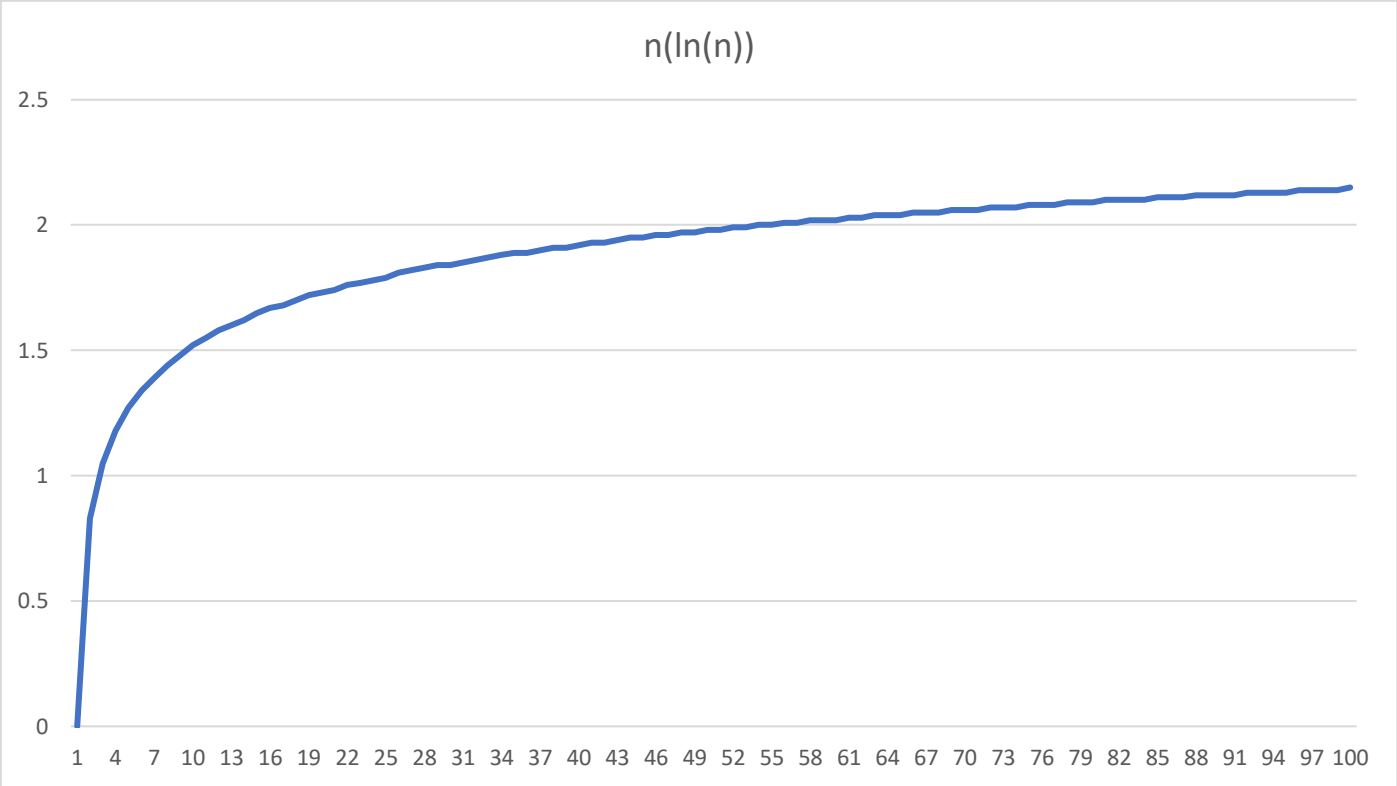
Observation: The graph is logarithmic and has negative values for first two values of n after which the graph exponentially rises and then flattens after a point.

(vi)ln(n)



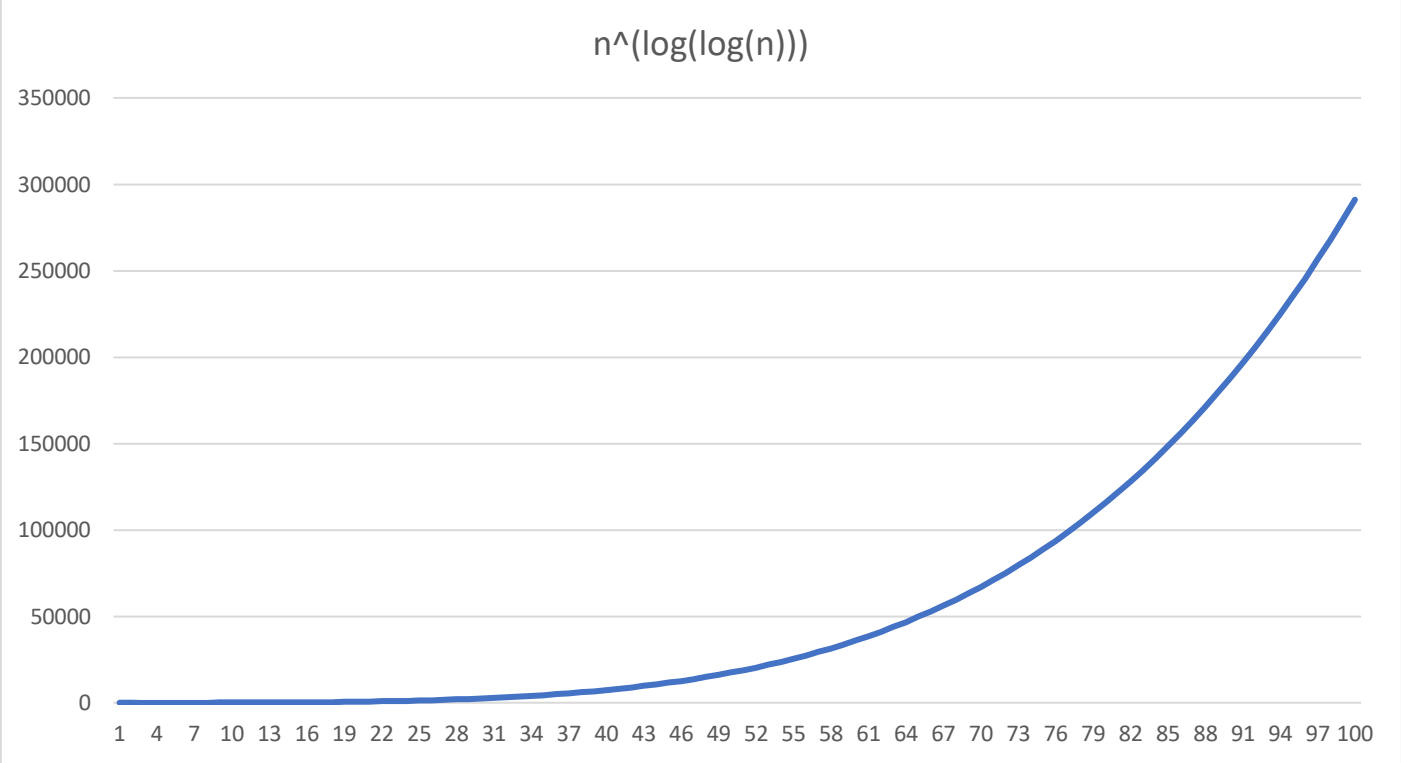
Observation: The graph is logarithmic and has values 0 for n==1 after which the graph exponentially rises and then flattens after a point.

(vii)n(ln(n))



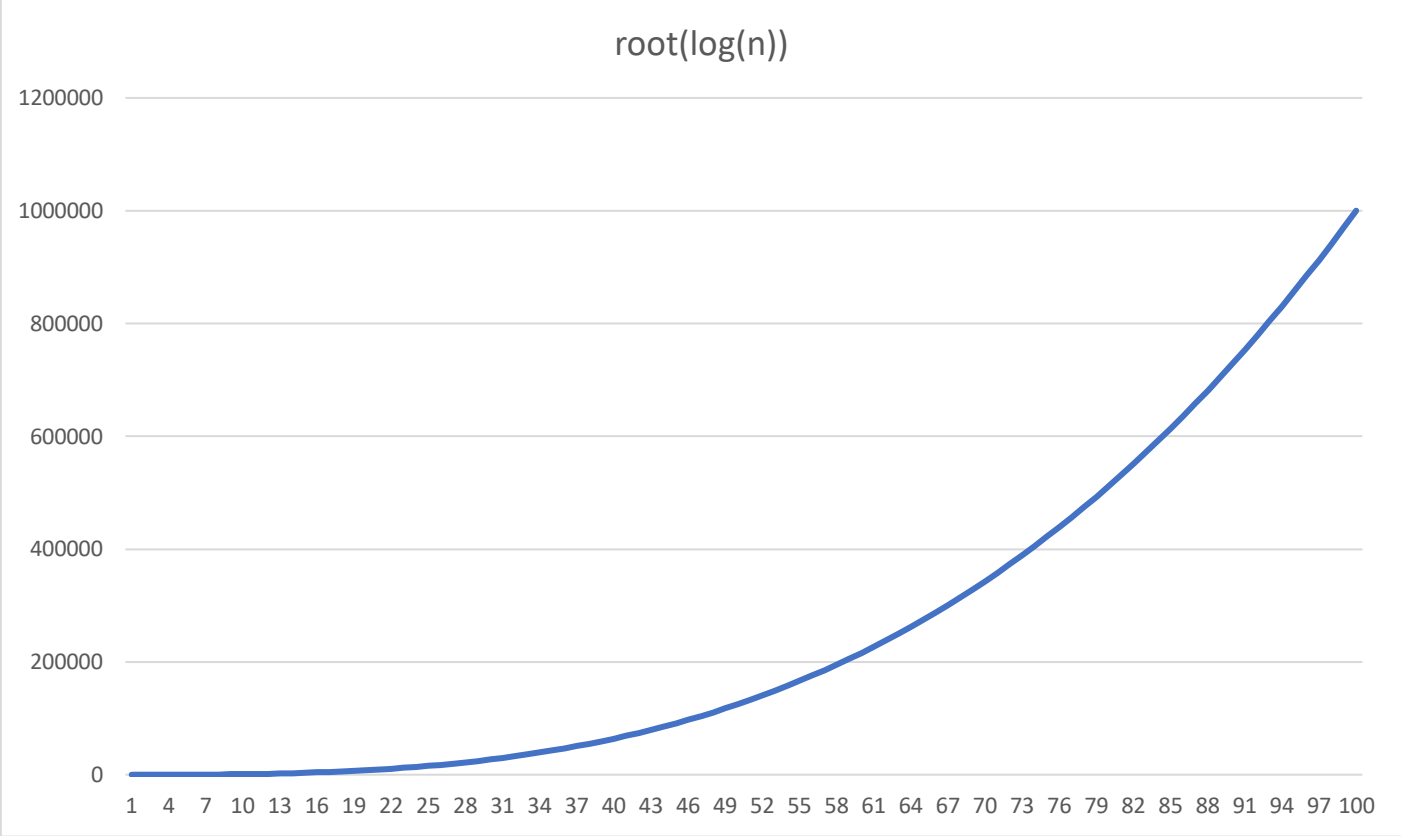
Observation: The graph is logarithmic graph which the graph exponentially rises and then flattens after a point.

(viii)n^(log(log(n))



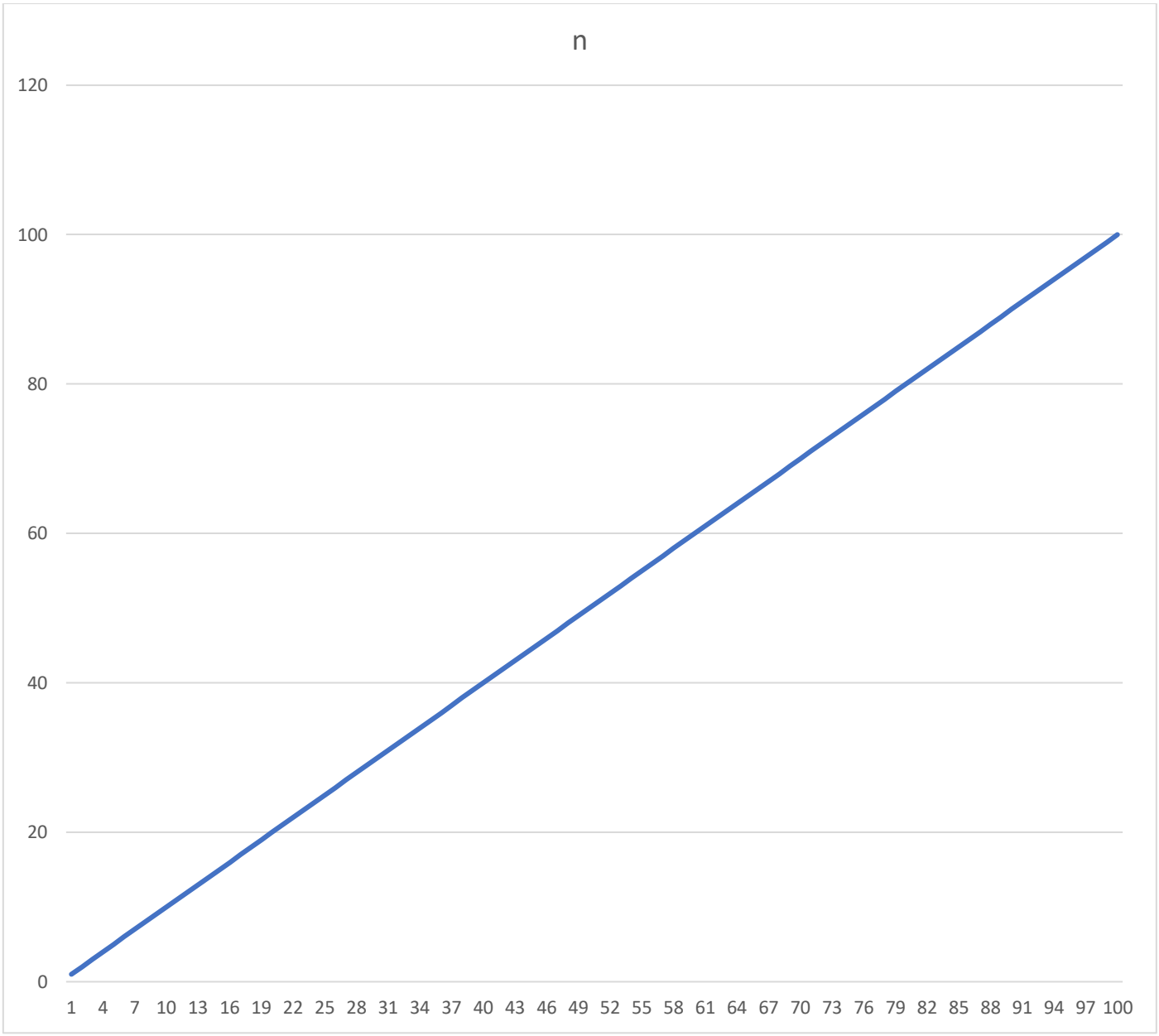
Observation: The graph is logarithmic and has value 1 for n==1 after which the graph is constant for a few values and then exponentially rises after a point.

(ix)root(log(n))



Observation: The graph is logarithmic and has value 1 for n==1 after which the graph is constant for a few values and then exponentially rises after a point.

(x)n



Observation: The graph is linear graph.

OUTPUT:

function	log2(log2(n))	log^2(n)	2^log2(n)	log2(n)	ln(ln(n)))	ln(n)	nln(n)	n^log(log(n))	n^3	n
1	-inf	0.00	1.00	0.00	-inf	0.00	1.00	1.00	1	1
2	0.00	1.00	2.00	1.00	-0.37	1.39	1.00	1.44	8	2
3	0.66	2.51	3.00	1.58	0.09	3.30	2.08	1.44	27	3
4	1.00	4.00	4.00	2.00	0.33	5.55	4.00	1.44	64	4
5	1.22	5.39	5.00	2.32	0.48	8.05	7.07	1.44	125	5
6	1.37	6.68	6.00	2.58	0.58	10.75	11.65	1.44	216	6
7	1.49	7.88	7.00	2.81	0.67	13.62	18.14	1.44	343	7
8	1.58	9.00	8.00	3.00	0.73	16.64	27.00	1.44	512	8
9	1.66	10.05	9.00	3.17	0.79	19.78	38.75	1.44	729	9
10	1.73	11.04	10.00	3.32	0.83	23.03	53.95	1.44	1000	10
11	1.79	11.97	11.00	3.46	0.87	26.38	73.22	1.44	1331	11
12	1.84	12.85	12.00	3.58	0.91	29.82	97.23	1.44	1728	12
13	1.89	13.69	13.00	3.70	0.94	33.34	126.70	1.44	2197	13
14	1.93	14.50	14.00	3.81	0.97	36.95	162.42	1.44	2744	14
15	1.97	15.26	15.00	3.91	1.00	40.62	205.22	1.44	3375	15
16	2.00	16.00	16.00	4.00	1.02	44.36	256.00	1.44	4096	16
17	2.03	16.71	17.00	4.09	1.04	48.16	315.71	1.44	4913	17
18	2.06	17.39	18.00	4.17	1.06	52.03	385.38	1.44	5832	18
19	2.09	18.04	19.00	4.25	1.08	55.94	466.07	1.44	6859	19
20	2.11	18.68	20.00	4.32	1.10	59.91	558.92	1.44	8000	20
21	2.13	19.29	21.00	4.39	1.11	63.93	665.14	1.44	9261	21
22	2.16	19.89	22.00	4.46	1.13	68.00	785.99	1.44	10648	22
23	2.18	20.46	23.00	4.52	1.14	72.12	922.80	1.44	12167	23
24	2.20	21.02	24.00	4.58	1.16	76.27	1076.96	1.44	13824	24
25	2.22	21.57	25.00	4.64	1.17	80.47	1249.94	1.44	15625	25
26	2.23	22.09	26.00	4.70	1.18	84.71	1443.27	1.44	17576	26
27	2.25	22.61	27.00	4.75	1.19	88.99	1658.54	1.44	19683	27
28	2.27	23.11	28.00	4.81	1.20	93.30	1897.43	1.44	21952	28
29	2.28	23.60	29.00	4.86	1.21	97.65	2161.67	1.44	24389	29
30	2.29	24.08	30.00	4.91	1.22	102.04	2453.08	1.44	27000	30
31	2.31	24.54	31.00	4.95	1.23	106.45	2773.54	1.44	29791	31
32	2.32	25.00	32.00	5.00	1.24	110.90	3125.00	1.44	32768	32
33	2.33	25.45	33.00	5.04	1.25	115.38	3509.50	1.44	35937	33
34	2.35	25.88	34.00	5.09	1.26	119.90	3929.15	1.44	39304	34
35	2.36	26.31	35.00	5.13	1.27	124.44	4386.13	1.44	42875	35
36	2.37	26.73	36.00	5.17	1.28	129.01	4882.70	1.44	46656	36
37	2.38	27.14	37.00	5.21	1.28	133.60	5421.20	1.44	50653	37
38	2.39	27.54	38.00	5.25	1.29	138.23	6004.04	1.44	54872	38
39	2.40	27.94	39.00	5.29	1.30	142.88	6633.74	1.44	59319	39
40	2.41	28.32	40.00	5.32	1.31	147.56	7312.86	1.44	64000	40
41	2.42	28.70	41.00	5.36	1.31	152.26	8044.06	1.44	68921	41
42	2.43	29.08	42.00	5.39	1.32	156.98	8830.10	1.44	74088	42
43	2.44	29.44	43.00	5.43	1.32	161.73	9673.79	1.44	79507	43
44	2.45	29.81	44.00	5.46	1.33	166.50	10578.06	1.44	85184	44
45	2.46	30.16	45.00	5.49	1.34	171.30	11545.89	1.44	91125	45
46	2.47	30.51	46.00	5.52	1.34	176.12	12580.38	1.44	97336	46
47	2.47	30.85	47.00	5.55	1.35	180.96	13684.70	1.44	103823	47
48	2.48	31.19	48.00	5.58	1.35	185.82	14862.10	1.44	110592	48
49	2.49	31.52	49.00	5.61	1.36	190.70	16115.93	1.44	117649	49
50	2.50	31.85	50.00	5.64	1.36	195.60	17449.64	1.44	125000	50
51	2.50	32.18	51.00	5.67	1.37	200.52	18866.75	1.44	132651	51
52	2.51	32.50	52.00	5.70	1.37	205.46	20370.89	1.44	140608	52
53	2.52	32.81	53.00	5.73	1.38	210.43	21965.77	1.44	148877	53
54	2.52	33.12	54.00	5.75	1.38	215.41	23655.19	1.44	157464	54
55	2.53	33.42	55.00	5.78	1.39	220.40	25443.07	1.44	166375	55
56	2.54	33.73	56.00	5.81	1.39	225.42	27333.39	1.44	175616	56
57	2.54	34.02	57.00	5.83	1.40	230.45	29330.26	1.44	185193	57
58	2.55	34.32	58.00	5.86	1.40	235.51	31437.86	1.44	195112	58
59	2.56	34.61	59.00	5.88	1.41	240.57	33660.48	1.44	205379	59
60	2.56	34.89	60.00	5.91	1.41	245.66	36002.51	1.44	216000	60
61	2.57	35.17	61.00	5.93	1.41	250.76	38468.44	1.44	226981	61
62	2.57	35.45	62.00	5.95	1.42	255.88	41062.85	1.44	238328	62
63	2.58	35.73	63.00	5.98	1.42	261.02	43790.44	1.44	250047	63
64	2.58	36.00	64.00	6.00	1.43	266.17	46656.00	1.44	262144	64
65	2.59	36.27	65.00	6.02	1.43	271.34	49664.42	1.44	274625	65

65	2.59	36.27	65.00	6.02	1.43	271.34	49664.42	1.44	274625	65
66	2.60	36.53	66.00	6.04	1.43	276.52	52820.70	1.44	287496	66
67	2.60	36.80	67.00	6.07	1.44	281.71	56129.94	1.44	300763	67
68	2.61	37.06	68.00	6.09	1.44	286.93	59597.35	1.44	314432	68
69	2.61	37.31	69.00	6.11	1.44	292.15	63228.26	1.44	328509	69
70	2.62	37.57	70.00	6.13	1.45	297.39	67028.08	1.44	343000	70
71	2.62	37.82	71.00	6.15	1.45	302.65	71002.34	1.44	357911	71
72	2.63	38.07	72.00	6.17	1.45	307.92	75156.69	1.44	373248	72
73	2.63	38.31	73.00	6.19	1.46	313.20	79496.87	1.44	389017	73
74	2.63	38.56	74.00	6.21	1.46	318.50	84028.75	1.44	405224	74
75	2.64	38.80	75.00	6.23	1.46	323.81	88758.31	1.44	421875	75
76	2.64	39.04	76.00	6.25	1.47	329.14	93691.62	1.44	438976	76
77	2.65	39.27	77.00	6.27	1.47	334.47	98834.89	1.44	456533	77
78	2.65	39.51	78.00	6.29	1.47	339.82	104194.42	1.44	474552	78
79	2.66	39.74	79.00	6.30	1.47	345.19	109776.66	1.44	493039	79
80	2.66	39.97	80.00	6.32	1.48	350.56	115588.14	1.44	512000	80
81	2.66	40.19	81.00	6.34	1.48	355.95	121635.53	1.44	531441	81
82	2.67	40.42	82.00	6.36	1.48	361.35	127925.60	1.44	551368	82
83	2.67	40.64	83.00	6.38	1.49	366.76	134465.25	1.44	571787	83
84	2.68	40.86	84.00	6.39	1.49	372.19	141261.49	1.44	592704	84
85	2.68	41.08	85.00	6.41	1.49	377.63	148321.48	1.44	614125	85
86	2.68	41.30	86.00	6.43	1.49	383.07	155652.45	1.44	636056	86
87	2.69	41.51	87.00	6.44	1.50	388.53	163261.80	1.44	658503	87
88	2.69	41.72	88.00	6.46	1.50	394.01	171157.02	1.44	681472	88
89	2.70	41.94	89.00	6.48	1.50	399.49	179345.74	1.44	704969	89
90	2.70	42.14	90.00	6.49	1.50	404.98	187835.71	1.44	729000	90
91	2.70	42.35	91.00	6.51	1.51	410.49	196634.80	1.44	753571	91
92	2.71	42.56	92.00	6.52	1.51	416.00	205751.02	1.44	778688	92
93	2.71	42.76	93.00	6.54	1.51	421.53	215192.49	1.44	804357	93
94	2.71	42.96	94.00	6.55	1.51	427.07	224967.48	1.44	830584	94
95	2.72	43.16	95.00	6.57	1.52	432.62	235084.35	1.44	857375	95
96	2.72	43.36	96.00	6.58	1.52	438.18	245551.63	1.44	884736	96
97	2.72	43.56	97.00	6.60	1.52	443.75	256377.96	1.44	912673	97
98	2.73	43.75	98.00	6.61	1.52	449.33	267572.12	1.44	941192	98
99	2.73	43.95	99.00	6.63	1.52	454.92	279143.00	1.44	970299	99
100	2.73	44.14	100.00	6.64	1.53	460.52	291099.66	1.44	1000000	100

CONCLUSION :	By performing this experiment I have inferred the values of different functions of time complexities for varied inputs and the behaviour of graphs of each function.