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Experiment No.	1

AIM:	To implement the various functions e.g. linear, non-linear, quadratic, exponential etc.
	Program 1
PROBLEM STATEMENT:	For this experiment, you have to implement at least 10 functions from the following list. $(\frac{3}{2})^n$ n^3 $\lg^2 n$ $\lg(n!)$ 2^{2^n} $n^{1/\lg n}$ $\ln\ln n$ $\lg n$ $n \cdot 2^n$ $n^{\lg\lg n}$ $\ln n$ $2^{\lg n}$ $2^{\lg n}$ $(\lg n)^{\lg n}$ e^n $(\lg n)!$ $(\sqrt{2})^{\lg n}$ $\sqrt{\lg n}$ $\lg(\lg n)$ $2^{\sqrt{2\lg n}}$ n 2^n $n\lg n$ $2^{2^{n+1}}$ Note – *lg* denotes for log_2 and *le* denotes log_e The input (i.e. n) to all the above functions varies from 0 to 100 with increment of 1. Then add the function n! in the list and execute the same for n from 0 to 20.

Algorithm/ Theory:	1. Start
	2. Declare and define 11 functions.
	3. Print the functions name.
	3. Run the for loop 100 times for invoking the functions and providing 0 to 100 as an Input.
	for(int j=0; j <= 100; j++){
	invoking function1();
	invoking function2();
	invoking function3();
	.
	.
	.
	Invoking function11();
	}
	4. After invoking the function inside loop, print the values return by the function at each input.
	5. Repeat step 3 and 4 until every function has been invoked 100 times for 100 inputs.
	6. Stop.

PROGRAM:

```
#include <stdio.h>
#include <math.h>

double func1(int i){
   return pow(2,i);
   }

int func2(int n){
   return n;
}

double  func3(double n){
   return log2(n);
}

double func4(double n){
   return n*log(n);
}

double func5(double n){
   double a = log2(n);
   return sqrt(a);
}

double func6(int n){
   return round(pow((3.0/2.0),n));
}

int func7(int n){
   return pow(n,3);
}

double func8(double n) {
   return round(pow(2, log2(n)));
}

double func9(int n){
   return n*(pow(2,n));
}

double func10(int n){
   return log2(log2(n));
}
```

```
long long factorial(int n) {
   if (n == 0) {
      return 1;
   }
   return n * factorial(n-1);
}

int main()
{
   printf("Input  ||  FUNCTION 1(n)\t || \tFUNCTION 2(2^n)\t \t ||\t \tFUNCTION3(log2(n))
||\t\t\tFUNCTION5(Sqr(log(n)))\n");
   for(int j=0; j <= 100; j++){
      printf("n=%d\t\t",j);

      //1st function call [n]
      int f2= func2(j);
      printf("%d",f2);

      //2nd function call [2^n]
      double result = func1(j);
      printf("\t\t\t\t");
      printf(" %.1f",result);

      //3rd function call [log2(n)]
      double l1 = (double) j;
      double lg = func3(l1);
      printf("\t\t\t\t");
      printf("%lf",lg);

      //4th function call [n*log(n)]
      double lg2 = func4(j);
      printf("\t\t\t\t");
      printf("%lf",lg2);

      //5th function call [Sqr(log(n))]
      double sqr = func5(j);
      printf("\t\t\t\t");
      printf(" %lf \n",sqr);

   }
printf("\n");
printf("Input  ||\tFUNCTION6((3/2)^n)  ||\tFUNCTION7(n^3)  ||\tFUNCTION8(2^log2(n))
 ||\tFUNCTION9(n*2^n)  ||\tFUNCTION10(log2(log2(n)))\n");
printf("\n");
```

```
        for(int i=0; i <= 100; i++){

        printf("n=%d\t\t",i);

//6th function call [(3/2)^n]
         double fun6 = func6(i);
        printf(" %.1lf ",fun6);

//7th function call [n^3]
        printf("\t\t\t  %d",func7(i));

//8th function call [2^log(n)]
        double fun8 = func8(i);
        printf("\t\t \t\t%.2f",fun8);

//9th function call [n*2^n]
        double fun9 = func9(i);
        printf("\t\t \t\t%.1lf",fun9);

//10th function call [log2(log2n)]
        double fun10 = func10(i);
        printf("\t\t \t\t%lf\n",fun10);
        }

//11th function call [n!]
printf("INPUT\t\tFUNCTION11(n!)");
for (int k = 0; k <= 20; k++)
{
   printf("n=%d\n",k);

        double fun11 = factorial(k);
        printf("\t\t \t\t%lf\n",fun11);
        }
   return 0;
}
```

RESULT:

```
ine-Out-qp5n00yv.ui2' '--stderr=Microsoft-MIEngine-Error-r32xfbz5.jot' '--pid=Microsoft-MIEngine-Pid-ag0utneo.ndc' '--dbgExe=C:\msys64\mingw64\bin\gdb.exe' '--interpreter=mi'
Input  ||  FUNCTION 1(2^n)       ||     FUNCTION 2(n)           ||          FUNCTION3(log2(n)) ||          FUNCTION4(n*log(n))  ||               FUNCTION5(Sqr(log(n)))
n=0          0                          1.0                          -inf                          nan                                nan
n=1          1                          2.0                          0.000000                      0.000000                           0.000000
n=2          2                          4.0                          1.000000                      1.386294                           1.000000
n=3          3                          8.0                          1.584963                      3.295837                           1.258953
n=4          4                          16.0                         2.000000                      5.545177                           1.414214
n=5          5                          32.0                         2.321928                      8.047190                           1.523787
n=6          6                          64.0                         2.584963                      10.750557                          1.607782
n=7          7                          128.0                        2.807355                      13.621371                          1.675516
n=8          8                          256.0                        3.000000                      16.635532                          1.732051
n=9          9                          512.0                        3.169925                      19.775021                          1.780428
n=10         10                         1024.0                       3.321928                      23.025851                          1.822616
n=11         11                         2048.0                       3.459432                      26.376848                          1.859955
n=12         12                         4096.0                       3.584963                      29.818880                          1.893400
n=13         13                         8192.0                       3.700440                      33.344342                          1.923653
n=14         14                         16384.0                      3.807355                      36.946803                          1.951244
n=15         15                         32768.0                      3.906891                      40.620753                          1.976586
n=16         16                         65536.0                      4.000000                      44.361420                          2.000000
n=17         17                         131072.0                     4.087463                      48.164627                          2.021747
n=18         18                         262144.0                     4.169925                      52.026692                          2.042039
n=19         19                         524288.0                     4.247928                      55.944341                          2.061050
n=20         20                         1048576.0                    4.321928                      59.914645                          2.078925
n=21         21                         2097152.0                    4.392317                      63.934971                          2.095786
n=22         22                         4194304.0                    4.459432                      68.002934                          2.111737
n=23         23                         8388608.0                    4.523562                      72.116367                          2.126867
n=24         24                         16777216.0                   4.584963                      76.273292                          2.141253
n=25         25                         33554432.0                   4.643856                      80.471896                          2.154961
n=26         26                         67108864.0                   4.700440                      84.710510                          2.168050
n=27         27                         134217728.0                  4.754888                      88.987595                          2.180570
n=28         28                         268435456.0                  4.807355                      93.301726                          2.192568
n=29         29                         536870912.0                  4.857981                      97.651579                          2.204083
n=30         30                         1073741824.0                 4.906891                      102.035921                         2.215150
n=31         31                         2147483648.0                 4.954196                      106.453603                         2.225802
n=32         32                         4294967296.0                 5.000000                      110.903549                         2.236068
n=33         33                         8589934592.0                 5.044394                      115.384750                         2.245973
n=34         34                         17179869184.0                5.087463                      119.896258                         2.255540
n=35         35                         34359738368.0                5.129283                      124.437182                         2.264792
n=36         36                         68719476736.0                5.169925                      129.006682                         2.273747
n=37         37                         137438953472.0               5.209453                      133.603963                         2.282423
n=38         38                         274877906944.0               5.247928                      138.228274                         2.290836
n=39         39                         549755813888.0               5.285402                      142.878904                         2.299000
n=40         40                         1099511627776.0              5.321928                      147.555178                         2.306930
n=41         41                         2199023255552.0              5.357552                      152.256455                         2.314639
n=42         42                         4398046511104.0              5.392317                      156.982124                         2.322136
n=43         43                         8796093022208.0              5.426265                      161.731605                         2.329434
n=44         44                         17592186044416.0             5.459432                      166.504344                         2.336543
n=45         45                         35184372088832.0             5.491853                      171.299812                         2.343470
n=46         46                         70368744177664.0             5.523562                      176.117504                         2.350226
n=47         47                         140737488355328.0            5.554589                      180.956937                         2.356818
n=48         48                         281474976710656.0            5.584963                      185.817649                         2.363253
n=49         49                         562949953421312.0            5.614710                      190.699195                         2.369538
n=50         50                         1125899906842624.0           5.643856                      195.601150                         2.375680
n=51         51                         2251799813685248.0           5.672425                      200.523107                         2.381685
n=52         52                         4503599627370496.0           5.700440                      205.464673                         2.387559
                                                                                                                                    Ln 54, Col 155
```

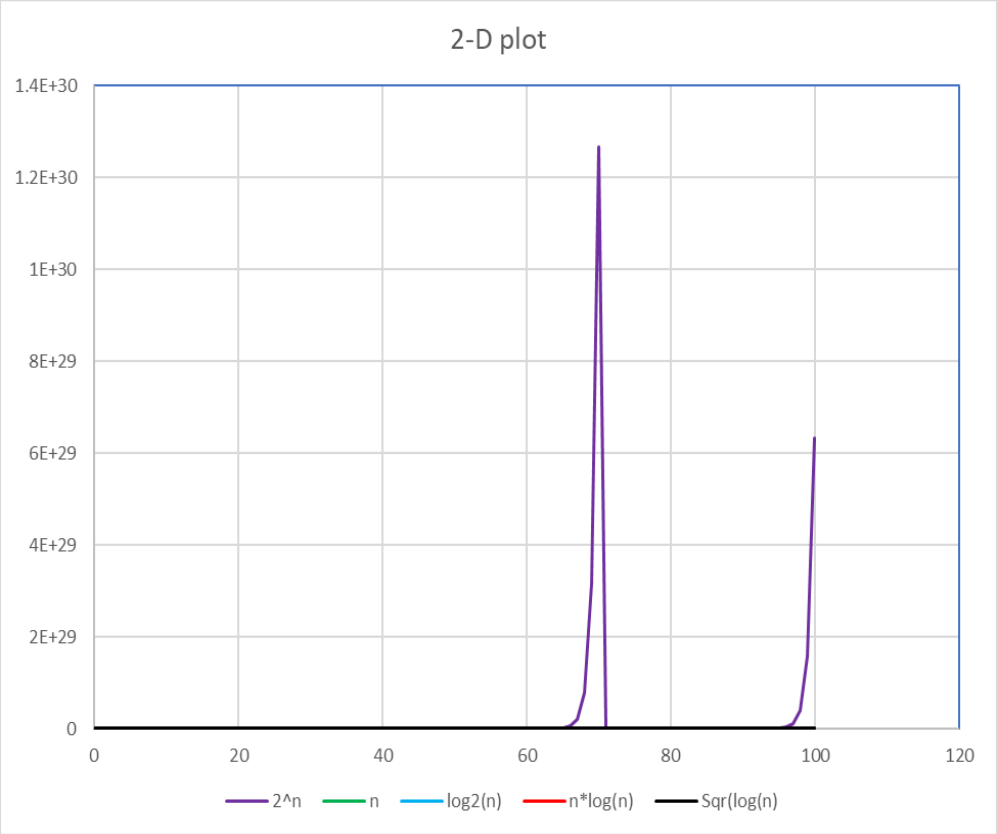
```
n=53         53                         9007199254740992.0           5.727920                      210.425471                         2.393307
n=54         54                         18014398509481984.0          5.754888                      215.405139                         2.398935
n=55         55                         36028797018963968.0          5.781360                      220.403325                         2.404446
n=56         56                         72057594037927936.0          5.807355                      225.419695                         2.409845
n=57         57                         144115188075855872.0         5.832890                      230.453922                         2.415138
n=58         58                         288230376151711744.0         5.857981                      235.505695                         2.420327
n=59         59                         576460752303423488.0         5.882643                      240.574709                         2.425416
n=60         60                         1152921504606846976.0        5.906891                      245.660674                         2.430410
n=61         61                         2305843009213693952.0        5.930737                      250.763306                         2.435311
n=62         62                         4611686018427387904.0        5.954196                      255.882332                         2.440122
n=63         63                         9223372036854775808.0        5.977280                      261.017488                         2.444848
n=64         64                         18446744073709551616.0       6.000000                      266.168517                         2.449490
n=65         65                         36893488147419103232.0       6.022368                      271.335173                         2.454051
n=66         66                         73786976294838206464.0       6.044394                      276.517213                         2.458535
n=67         67                         147573952589676412928.0      6.066089                      281.714405                         2.462943
n=68         68                         295147905179352825856.0      6.087463                      286.926524                         2.467278
n=69         69                         590295810358705651712.0      6.108524                      292.153349                         2.471543
n=70         70                         1180591620717411303424.0     6.129283                      297.394667                         2.475739
n=71         71                         2361183241434822606848.0     6.149747                      302.650271                         2.479868
n=72         72                         4722366482869645213696.0     6.169925                      307.919961                         2.483933
n=73         73                         9444732965739290427392.0     6.189825                      313.203539                         2.487936
n=74         74                         18889465931478580854784.0    6.209453                      318.500817                         2.491877
n=75         75                         37778931862957161709568.0    6.228819                      323.811609                         2.495760
n=76         76                         75557863725914323419136.0    6.247928                      329.135734                         2.499585
n=77         77                         151115727451828646838272.0   6.266787                      334.473017                         2.503355
n=78         78                         302231454903657293676544.0   6.285402                      339.823288                         2.507070
n=79         79                         604462909807314587353088.0   6.303781                      345.186380                         2.510733
n=80         80                         1208925819614629174706176.0  6.321928                      350.562131                         2.514344
n=81         81                         2417851639229258349412352.0  6.339850                      355.950382                         2.517906
n=82         82                         4835703278458516698824704.0  6.357552                      361.350978                         2.521419
n=83         83                         9671406556917033397649408.0  6.375039                      366.763770                         2.524884
n=84         84                         19342813113834066795298816.0 6.392317                      372.188611                         2.528303
n=85         85                         38685626227668133590597632.0 6.409391                      377.625357                         2.531677
n=86         86                         77371252455336267181195264.0 6.426265                      383.073867                         2.535008
n=87         87                         154742504910672534362390528.0 6.442943                     388.534006                         2.538295
n=88         88                         309485009821345068724781056.0 6.459432                     394.005640                         2.541541
n=89         89                         618970019642690137449562112.0 6.475733                     399.488637                         2.544746
n=90         90                         1237940039285380274899124224.0 6.491853                    404.982870                         2.547912
n=91         91                         2475880078570760549798248448.0 6.507795                    410.488215                         2.551038
n=92         92                         4951760157141521099596496896.0 6.523562                    416.004549                         2.554126
n=93         93                         9903520314283042199192993792.0 6.539159                    421.531753                         2.557178
n=94         94                         19807040628566084398385987584.0 6.554589                   427.069710                         2.560193
n=95         95                         39614081257132168796771975168.0 6.569856                   432.618305                         2.563173
n=96         96                         79228162514264337593543950336.0 6.584963                   438.177426                         2.566118
n=97         97                         158456325028528675187087900672.0 6.599913                  443.746965                         2.569030
n=98         98                         316912650057057350374175801344.0 6.614710                  449.326813                         2.571908
n=99         99                         633825300114114700748351602688.0 6.629357                  454.916865                         2.574754
n=100        100                        1267650600228229401496703205376.0 6.643856                 460.517019                         2.577568
```

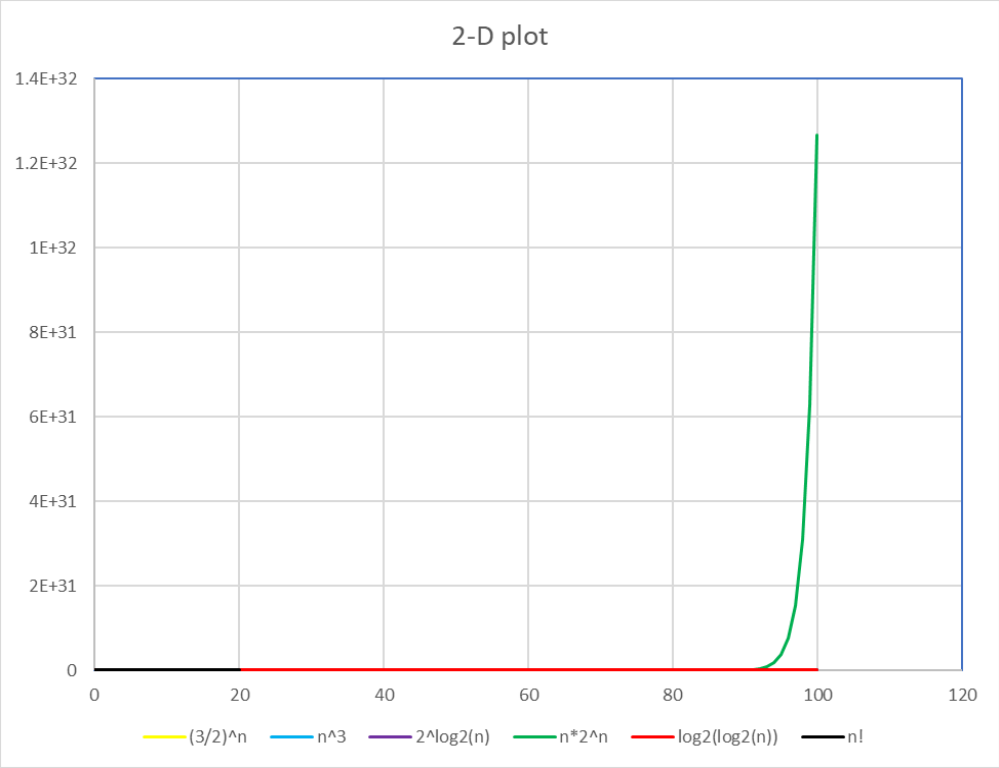
Input	FUNCTION6((3/2)^n)	FUNCTION7(n^3)	FUNCTION8(2^log2(n))	FUNCTION9(n*2^n)	FUNCTION10(log2(log2(n)))
n=0	1.0	0	0.00	0.0	nan
n=1	2.0	1	1.00	1.0	-inf
n=2	2.0	8	2.00	2.0	0.000000
n=3	3.0	27	3.00	3.0	0.664449
n=4	5.0	64	4.00	4.0	1.000000
n=5	8.0	125	5.00	5.0	1.215323
n=6	11.0	216	6.00	6.0	1.370143
n=7	17.0	343	7.00	7.0	1.489211
n=8	26.0	512	8.00	8.0	1.584963
n=9	38.0	729	9.00	9.0	1.664449
n=10	58.0	1000	10.00	10.0	1.732021
n=11	86.0	1331	11.00	11.0	1.790535
n=12	130.0	1728	12.00	12.0	1.841958
n=13	195.0	2197	13.00	13.0	1.887697
n=14	292.0	2744	14.00	14.0	1.928789
n=15	438.0	3375	15.00	15.0	1.966021
n=16	657.0	4096	16.00	16.0	2.000000
n=17	985.0	4913	17.00	17.0	2.031206
n=18	1478.0	5832	18.00	18.0	2.060021
n=19	2217.0	6859	19.00	19.0	2.086759
n=20	3325.0	8000	20.00	20.0	2.111675
n=21	4988.0	9261	21.00	21.0	2.134982
n=22	7482.0	10648	22.00	22.0	2.156860
n=23	11223.0	12167	23.00	23.0	2.177459
n=24	16834.0	13824	24.00	24.0	2.196910
n=25	25251.0	15625	25.00	25.0	2.215323
n=26	37877.0	17576	26.00	26.0	2.232796
n=27	56815.0	19683	27.00	27.0	2.249411
n=28	85223.0	21952	28.00	28.0	2.265243
n=29	127834.0	24389	29.00	29.0	2.280357
n=30	191751.0	27000	30.00	30.0	2.294809
n=31	287627.0	29791	31.00	31.0	2.308651
n=32	431440.0	32768	32.00	32.0	2.321928
n=33	647160.0	35937	33.00	33.0	2.334681
n=34	970740.0	39304	34.00	34.0	2.346946
n=35	1456110.0	42875	35.00	35.0	2.358757
n=36	2184164.0	46656	36.00	36.0	2.370143
n=37	3276247.0	50653	37.00	37.0	2.381132
n=38	4914370.0	54872	38.00	38.0	2.391748
n=39	7371555.0	59319	39.00	39.0	2.402013
n=40	11057332.0	64000	40.00	40.0	2.411949
n=41	16585998.0	68921	41.00	41.0	2.421574
n=42	24878998.0	74088	42.00	42.0	2.430905
n=43	37318497.0	79507	43.00	43.0	2.439959
n=44	55977745.0	85184	44.00	44.0	2.448751
n=45	83966617.0	91125	45.00	45.0	2.457293
n=46	125949926.0	97336	46.00	46.0	2.465599
n=47	188924889.0	103823	47.00	47.0	2.473680
n=48	283387333.0	110592	48.00	48.0	2.481548
n=49	425081000.0	117649	49.00	49.0	2.489211
n=50	637621500.0	125000	50.00	50.0	2.496681

n=50	637621500.0	125000	50.00	50.0	2.496681
n=51	956432250.0	132651	51.00	51.0	2.503966
n=52	1434648375.0	140608	52.00	52.0	2.511073
n=53	2151972563.0	148877	53.00	53.0	2.518011
n=54	3227958845.0	157464	54.00	54.0	2.524788
n=55	4841938267.0	166375	55.00	55.0	2.531409
n=56	7262907401.0	175616	56.00	56.0	2.537881
n=57	10894361101.0	185193	57.00	57.0	2.544211
n=58	16341541652.0	195112	58.00	58.0	2.550404
n=59	24512312478.0	205379	59.00	59.0	2.556464
n=60	36768468717.0	216000	60.00	60.0	2.562399
n=61	55152703075.0	226981	61.00	61.0	2.568211
n=62	82729054613.0	238328	62.00	62.0	2.573907
n=63	124093581920.0	250047	63.00	63.0	2.579489
n=64	186140372879.0	262144	64.00	64.0	2.584963
n=65	279210559319.0	274625	65.00	65.0	2.590331
n=66	418815838979.0	287496	66.00	66.0	2.595598
n=67	628223758468.0	300763	67.00	67.0	2.600767
n=68	942335637702.0	314432	68.00	68.0	2.605841
n=69	1413503456554.0	328509	69.00	69.0	2.610824
n=70	2120255184830.0	343000	70.00	70.0	2.615718
n=71	3180382777245.0	357911	71.00	71.0	2.620527
n=72	4770574165868.0	373248	72.00	72.0	2.625253
n=73	7155861248802.0	389017	73.00	73.0	2.629899
n=74	10733791873203.0	405224	74.00	74.0	2.634466
n=75	16100687809805.0	421875	75.00	75.0	2.638959
n=76	24151031714707.0	438976	76.00	76.0	2.643378
n=77	36226547572061.0	456533	77.00	77.0	2.647726
n=78	54339821358091.0	474552	78.00	78.0	2.652005
n=79	81509732037136.0	493039	79.00	79.0	2.656217
n=80	122264598055705.0	512000	80.00	80.0	2.660365
n=81	183396897083557.0	531441	81.00	81.0	2.664449
n=82	275095345625335.0	551368	82.00	82.0	2.668471
n=83	412643018438003.0	571787	83.00	83.0	2.672434
n=84	618964527657005.0	592704	84.00	84.0	2.676339
n=85	928446791485507.0	614125	85.00	85.0	2.680187
n=86	1392670187228261.0	636056	86.00	86.0	2.683980
n=87	2089005280842391.0	658503	87.00	87.0	2.687720
n=88	3133507921263587.0	681472	88.00	88.0	2.691407
n=89	4700261881895380.0	704969	89.00	89.0	2.695044
n=90	7050392822843069.0	729000	90.00	90.0	2.698630
n=91	10575589234264604.0	753571	91.00	91.0	2.702169
n=92	15863383851396906.0	778688	92.00	92.0	2.705660
n=93	23795075777095360.0	804357	93.00	93.0	2.709105
n=94	35692613665643040.0	830584	94.00	94.0	2.712505
n=95	53538920498464560.0	857375	95.00	95.0	2.715862
n=96	80308380747696832.0	884736	96.00	96.0	2.719175
n=97	120462571121545248.0	912673	97.00	97.0	2.722447
n=98	180693856682317856.0	941192	98.00	98.0	2.725678
n=99	271040785023476800.0	970299	99.00	99.0	2.728869
n=100	406561177535215296.0	1000000	100.00	100.0	2.732021

```
INPUT          FUNCTION11(n*n=1!)n=0
                              1.000000
n=1
                              1.000000
n=2
                              2.000000
n=3
                              6.000000
n=4
                              24.000000
n=5
                              120.000000
n=6
                              720.000000
n=7
                              5040.000000
n=8
                              40320.000000
n=9
                              362880.000000
n=10
                              3628800.000000
n=11
                              39916800.000000
n=12
                              479001600.000000
n=13
                              6227020800.000000
n=14
                              87178291200.000000
n=15
                              1307674368000.000000
n=16
                              20922789888000.000000
n=17
                              355687428096000.000000
n=18
                              6402373705728000.000000
n=19
                              121645100408832000.000000
n=20
                              2432902008176640000.000000
PS D:\Engineering\Program>
```

Graph:


2-D plot
1.4E+30
1.2E+30
1E+30
8E+29
6E+29
4E+29
2E+29
0
0
20
40
60
80
100
120
2^n
n
log2(n)
n*log(n)
Sqr(log(n))


2-D plot
1.4E+32
1.2E+32
1E+32
8E+31
6E+31
4E+31
2E+31
0
0
20
40
60
80
100
120
(3/2)^n
n^3
2^log2(n)
n*2^n
log2(log2(n))
n!

Observation:	We have plotted 2-D graph, X-axis representing 0 to 100 inputs and Y-axis representing the value Generated by the functions. By observing the output of each function in the graph, most of the function has produces Almost same value or value nearer to each other, therefore in the graph it is difficult to spot the difference between the output generated by every function.
Conclusion:	Thus, we have implemented various functions e.g. linear, non-linear, quadratic, exponential etc.