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|---|---|
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| **UID No.** | 2021300031 |
| **Class & Division** | S.E. COMPS A (BATCH B) |
| **Experiment No.** | 1a |

**Aim:** To implement the various functions e.g. linear, non-linear, quadratic, exponential etc.

**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. Run a for loop for i from 0 till 100.
2. Perform 11 functions: n, n^3, 2^n, ln n, lg n, n lg n, e^n, (3/2)^n, n.2^n, n!

**Code:**

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

int main()
{
    printf("\t(3/2)^n\tn^3\tn\tln(n)\t2^n\t2^(lg(n))\te^n\tlg(lg(n))\tln(ln(n))\t(lg(n))^2")
;
    for(double i=0;i<100;i++){
        printf("\n%.2f\t",i);
        printf("%.2f",pow((3.0/2.0),i));
        printf("\t%.2f",pow(i,3));
        printf("\t%.2f",i);
        printf("\t%.2f",log(i));
        printf("\t%.2f",pow(2,i));
        printf("\t%.2f",pow(2,(log2(i))));
        printf("\t%.2f",pow(2.713,i));
        printf("\t%.2f",log2(log2(i)));
        printf("\t%.2f",log(log(i)));
        printf("\t%.2f",pow((log2(i)),2));
        // printf("\n");

    }

    return 0;
}
```

**Table:**

| Count | (3/2)^n | n^3 | n | ln(n) | 2^n | 2^(lg(n)) | e^n | lg(lg(n)) | ln(ln(n)) | (lg(n))^2 | fact(n) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0 | 0 | -inf | 1 | 0 | 1 | nan | nan | inf | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.5 | 1 | 1 | 0 | 2 | 1 | 2.71 | -inf | -inf | 0 | 1 |
| 2 | 2.25 | 8 | 2 | 0.69 | 4 | 2 | 7.36 | 0 | -0.37 | 1 | 1 |
| 3 | 3.38 | 27 | 3 | 1.1 | 8 | 3 | 19.97 | 0.66 | 0.09 | 2.51 | 2 |
| 4 | 5.06 | 64 | 4 | 1.39 | 16 | 4 | 54.18 | 1 | 0.33 | 4 | 6 |
| 5 | 7.59 | 125 | 5 | 1.61 | 32 | 5 | 146.98 | 1.22 | 0.48 | 5.39 | 24 |
| 6 | 11.39 | 216 | 6 | 1.79 | 64 | 6 | 398.75 | 1.37 | 0.58 | 6.68 | 120 |
| 7 | 17.09 | 343 | 7 | 1.95 | 128 | 7 | 1081.8 | 1.49 | 0.67 | 7.88 | 720 |
| 8 | 25.63 | 512 | 8 | 2.08 | 256 | 8 | 2934.93 | 1.58 | 0.73 | 9 | 5040 |
| 9 | 38.44 | 729 | 9 | 2.2 | 512 | 9 | 7962.48 | 1.66 | 0.79 | 10.05 | 40320 |
| 10 | 57.67 | 1000 | 10 | 2.3 | 1024 | 10 | 21602.2 | 1.73 | 0.83 | 11.04 | 362880 |
| 11 | 86.5 | 1331 | 11 | 2.4 | 2048 | 11 | 58606.76 | 1.79 | 0.87 | 11.97 | 3628800 |
| 12 | 129.75 | 1728 | 12 | 2.48 | 4096 | 12 | 159000.15 | 1.84 | 0.91 | 12.85 | 39916800 |
| 13 | 194.62 | 2197 | 13 | 2.56 | 8192 | 13 | 431367.4 | 1.89 | 0.94 | 13.69 | 479001600 |
| 14 | 291.93 | 2744 | 14 | 2.64 | 16384 | 14 | 1170299.75 | 1.93 | 0.97 | 14.5 | 6227020800 |
| 15 | 437.89 | 3375 | 15 | 2.71 | 32768 | 15 | 3175023.22 | 1.97 | 1 | 15.26 | 8.7178E+10 |
| 16 | 656.84 | 4096 | 16 | 2.77 | 65536 | 16 | 8613838.01 | 2 | 1.02 | 16 | 1.3077E+12 |
| 17 | 985.26 | 4913 | 17 | 2.83 | 131072 | 17 | 23369342.5 | 2.03 | 1.04 | 16.71 | 2.0923E+13 |
| 18 | 1477.89 | 5832 | 18 | 2.89 | 262144 | 18 | 63401026.3 | 2.06 | 1.06 | 17.39 | 3.5569E+14 |
| 19 | 2216.84 | 6859 | 19 | 2.94 | 524288 | 19 | 172006984 | 2.09 | 1.08 | 18.04 | 6.4024E+15 |
| 20 | 3325.26 | 8000 | 20 | 3 | 1048576 | 20 | 466654948 | 2.11 | 1.1 | 18.68 | 1.2165E+17 |
| 21 | 4987.89 | 9261 | 21 | 3.04 | 2097152 | 21 | 12660348 74 | 2.13 | 1.11 | 19.29 | 2.4329E+18 |
| 22 | 7481.83 | 10648 | 22 | 3.09 | 4194304 | 22 | 3434752614 | 2.16 | 1.13 | 19.89 | 5.1091E+19 |
| 23 | 11222.74 | 12167 | 23 | 3.14 | 8388608 | 23 | 9318483842 | 2.18 | 1.14 | 20.46 | 1.124E+21 |
| 24 | 16834.11 | 13824 | 24 | 3.18 | 16777216 | 24 | 2.5281E+10 | 2.2 | 1.16 | 21.02 | 2.5852E+22 |
| 25 | 25251.17 | 15625 | 25 | 3.22 | 33554432 | 25 | 6.8587E+10 | 2.22 | 1.17 | 21.57 | 6.2045E+23 |
| 26 | 37876.75 | 17576 | 26 | 3.26 | 67108864 | 26 | 1.8608E+11 | 2.23 | 1.18 | 22.09 | 1.5511E+25 |
| 27 | 56815.13 | 19683 | 27 | 3.3 | 134217728 | 27 | 5.0483E+11 | 2.25 | 1.19 | 22.61 | 4.0329E+26 |
| 28 | 852 | 21952 | 28 | 3.33 | 2684 | 28 | 1.3696E | 2.27 | 1.2 | 23.11 | 1.0889E+ |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| | 22.69 | | | | 35456 | | +12 | | | | 28 |
| 29 | 127834.04 | 24389 | 29 | 3.37 | 536870912 | 29 | 3.7157E+12 | 2.28 | 1.21 | 23.6 | 3.0489E+29 |
| 30 | 191751.06 | 27000 | 30 | 3.4 | 1073741824 | 30 | 1.0081E+13 | 2.29 | 1.22 | 24.08 | 8.8418E+30 |
| 31 | 287626.59 | 29791 | 31 | 3.43 | 2147483648 | 31 | 2.7349E+13 | 2.31 | 1.23 | 24.54 | 2.6525E+32 |
| 32 | 431439.88 | 32768 | 32 | 3.47 | 4294967296 | 32 | 7.4198E+13 | 2.32 | 1.24 | 25 | 8.2228E+33 |
| 33 | 647159.82 | 35937 | 33 | 3.5 | 8589934592 | 33 | 2.013E+14 | 2.33 | 1.25 | 25.45 | 2.6313E+35 |
| 34 | 970739.74 | 39304 | 34 | 3.53 | 1.718E+10 | 34 | 5.4613E+14 | 2.35 | 1.26 | 25.88 | 8.6833E+36 |
| 35 | 1456109.61 | 42875 | 35 | 3.56 | 3.436E+10 | 35 | 1.4816E+15 | 2.36 | 1.27 | 26.31 | 2.9523E+38 |
| 36 | 2184164.41 | 46656 | 36 | 3.58 | 6.8719E+10 | 36 | 4.0197E+15 | 2.37 | 1.28 | 26.73 | 1.0333E+40 |
| 37 | 3276246.61 | 50653 | 37 | 3.61 | 1.3744E+11 | 37 | 1.0905E+16 | 2.38 | 1.28 | 27.14 | 3.7199E+41 |
| 38 | 4914369.92 | 54872 | 38 | 3.64 | 2.7488E+11 | 38 | 2.9586E+16 | 2.39 | 1.29 | 27.54 | 1.3764E+43 |
| 39 | 7371554.88 | 59319 | 39 | 3.66 | 5.4976E+11 | 39 | 8.0268E+16 | 2.4 | 1.3 | 27.94 | 5.2302E+44 |
| 40 | 11057332.32 | 64000 | 40 | 3.69 | 1.0995E+12 | 40 | 2.1777E+17 | 2.41 | 1.31 | 28.32 | 2.0398E+46 |
| 41 | 16585998.48 | 68921 | 41 | 3.71 | 2.199E+12 | 41 | 5.908E+17 | 2.42 | 1.31 | 28.7 | 8.1592E+47 |
| 42 | 24878997.72 | 74088 | 42 | 3.74 | 4.398E+12 | 42 | 1.6028E+18 | 2.43 | 1.32 | 29.08 | 3.3453E+49 |
| 43 | 37318496.58 | 79507 | 43 | 3.76 | 8.7961E+12 | 43 | 4.3485E+18 | 2.44 | 1.32 | 29.44 | 1.405E+51 |
| 44 | 55977744.87 | 85184 | 44 | 3.78 | 1.7592E+13 | 44 | 1.1798E+19 | 2.45 | 1.33 | 29.81 | 6.0415E+52 |
| 45 | 839 | 91125 | 45 | 3.81 | 3.51 | 45 | 3.2007E | 2.46 | 1.34 | 30.16 | 2.6583E+ |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| | 66617.31 | | | | 84E+13 | | +19 | | | | 54 |
| 46 | 125949926 | 97336 | 46 | 3.83 | 7.0369E+13 | 46 | 8.6834E+19 | 2.47 | 1.34 | 30.51 | 1.1962E+56 |
| 47 | 188924889 | 103823 | 47 | 3.85 | 1.4074E+14 | 47 | 2.3558E+20 | 2.47 | 1.35 | 30.85 | 5.5026E+57 |
| 48 | 283387333.4 | 110592 | 48 | 3.87 | 2.8147E+14 | 48 | 6.3913E+20 | 2.48 | 1.35 | 31.19 | 2.5862E+59 |
| 49 | 425081000.1 | 117649 | 49 | 3.89 | 5.6295E+14 | 49 | 1.734E+21 | 2.49 | 1.36 | 31.52 | 1.2414E+61 |
| 50 | 637621500.2 | 125000 | 50 | 3.91 | 1.1259E+15 | 50 | 4.7042E+21 | 2.5 | 1.36 | 31.85 | 6.0828E+62 |
| 51 | 956432250.3 | 132651 | 51 | 3.93 | 2.2518E+15 | 51 | 1.2763E+22 | 2.5 | 1.37 | 32.18 | 3.0414E+64 |
| 52 | 1434648375 | 140608 | 52 | 3.95 | 4.5036E+15 | 52 | 3.4625E+22 | 2.51 | 1.37 | 32.5 | 1.5511E+66 |
| 53 | 2151972563 | 148877 | 53 | 3.97 | 9.0072E+15 | 53 | 9.3938E+22 | 2.52 | 1.38 | 32.81 | 8.0658E+67 |
| 54 | 3227958845 | 157464 | 54 | 3.99 | 1.8014E+16 | 54 | 2.5485E+23 | 2.52 | 1.38 | 33.12 | 4.2749E+69 |
| 55 | 4841938267 | 166375 | 55 | 4.01 | 3.6029E+16 | 55 | 6.9141E+23 | 2.53 | 1.39 | 33.42 | 2.3084E+71 |
| 56 | 7262907401 | 175616 | 56 | 4.03 | 7.2058E+16 | 56 | 1.8758E+24 | 2.54 | 1.39 | 33.73 | 1.2696E+73 |
| 57 | 10894361101 | 185193 | 57 | 4.04 | 1.4412E+17 | 57 | 5.0891E+24 | 2.54 | 1.4 | 34.02 | 7.11E+74 |
| 58 | 16341541652 | 195112 | 58 | 4.06 | 2.8823E+17 | 58 | 1.3807E+25 | 2.55 | 1.4 | 34.32 | 4.0527E+76 |
| 59 | 24512312478 | 205379 | 59 | 4.08 | 5.7646E+17 | 59 | 3.7457E+25 | 2.56 | 1.41 | 34.61 | 2.3506E+78 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 60 | 36768468717 | 216000 | 60 | 4.09 | 1.1529E+18 | 60 | 1.0162E+26 | 2.56 | 1.41 | 34.89 | 1.3868E+80 |
| 61 | 55152703075 | 226981 | 61 | 4.11 | 2.3058E+18 | 61 | 2.757E+26 | 2.57 | 1.41 | 35.17 | 8.321E+81 |
| 62 | 82729054613 | 238328 | 62 | 4.13 | 4.6117E+18 | 62 | 7.4798E+26 | 2.57 | 1.42 | 35.45 | 5.0758E+83 |
| 63 | 1.24094E+11 | 250047 | 63 | 4.14 | 9.2234E+18 | 63 | 2.0293E+27 | 2.58 | 1.42 | 35.73 | 3.147E+85 |
| 64 | 1.8614E+11 | 262144 | 64 | 4.16 | 1.8447E+19 | 64 | 5.5054E+27 | 2.58 | 1.43 | 36 | 1.9826E+87 |
| 65 | 2.79211E+11 | 274625 | 65 | 4.17 | 3.6893E+19 | 65 | 1.4936E+28 | 2.59 | 1.43 | 36.27 | 1.2689E+89 |
| 66 | 4.18816E+11 | 287496 | 66 | 4.19 | 7.3787E+19 | 66 | 4.0522E+28 | 2.6 | 1.43 | 36.53 | 8.2477E+90 |
| 67 | 6.28224E+11 | 300763 | 67 | 4.2 | 1.4757E+20 | 67 | 1.0994E+29 | 2.6 | 1.44 | 36.8 | 5.4434E+92 |
| 68 | 9.42336E+11 | 314432 | 68 | 4.22 | 2.9515E+20 | 68 | 2.9825E+29 | 2.61 | 1.44 | 37.06 | 3.6471E+94 |
| 69 | 1.4135E+12 | 328509 | 69 | 4.23 | 5.903E+20 | 69 | 8.0916E+29 | 2.61 | 1.44 | 37.31 | 2.48E+96 |
| 70 | 2.12026E+12 | 343000 | 70 | 4.25 | 1.1806E+21 | 70 | 2.1953E+30 | 2.62 | 1.45 | 37.57 | 1.7112E+98 |
| 71 | 3.18038E+12 | 357911 | 71 | 4.26 | 2.3612E+21 | 71 | 5.9557E+30 | 2.62 | 1.45 | 37.82 | 1.198E+100 |
| 72 | 4.77057E+12 | 373248 | 72 | 4.28 | 4.7224E+21 | 72 | 1.6158E+31 | 2.63 | 1.45 | 38.07 | 8.505E+101 |
| 73 | 7.15586E+12 | 389017 | 73 | 4.29 | 9.4447E+21 | 73 | 4.3836E+31 | 2.63 | 1.46 | 38.31 | 6.123E+103 |
| 74 | 1.07338E+1 | 405224 | 74 | 4.3 | 1.8889E+22 | 74 | 1.1893E+32 | 2.63 | 1.46 | 38.56 | 4.47E+105 |

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| | 3 | | | | | | | | | | |
| 75 | 1.61007E+13 | 421875 | 75 | 4.32 | 3.7779E+22 | 75 | 3.2265E+32 | 2.64 | 1.46 | 38.8 | 3.308E+107 |
| 76 | 2.4151E+13 | 438976 | 76 | 4.33 | 7.5558E+22 | 76 | 8.7536E+32 | 2.64 | 1.47 | 39.04 | 2.481E+109 |
| 77 | 3.62265E+13 | 456533 | 77 | 4.34 | 1.5112E+23 | 77 | 2.3748E+33 | 2.65 | 1.47 | 39.27 | 1.885E+111 |
| 78 | 5.43398E+13 | 474552 | 78 | 4.36 | 3.0223E+23 | 78 | 6.4429E+33 | 2.65 | 1.47 | 39.51 | 1.452E+113 |
| 79 | 8.15097E+13 | 493039 | 79 | 4.37 | 6.0446E+23 | 79 | 1747968923346178591872620701941760 0.002.66 | 1.47 | 39.74 | | 1.132E+115 |
| 80 | 1.22265E+14 | 512000 | 80 | 4.38 | 1.2089E+24 | 80 | 4742239689038183003977451899243724 8.002.66 | 1.48 | 39.97 | | 8.946E+116 |
| 81 | 1.83397E+14 | 531441 | 81 | 4.39 | 2.4179E+24 | 81 | 1286569627636058951856975152184033 28.002.66 | 1.48 | 40.19 | | 7.157E+118 |
| 82 | 2.75095E+14 | 551368 | 82 | 4.41 | 4.8357E+24 | 82 | 3490463399776628138564288635731968 00.002.67 | 1.48 | 40.42 | | 5.797E+120 |
| 83 | 4.12643E+14 | 571787 | 83 | 4.42 | 9.6714E+24 | 83 | 9469627203593993541877464670666752 00.002.67 | 1.49 | 40.64 | | 4.754E+122 |
| 84 | 6.18965E+14 | 592704 | 84 | 4.43 | 1.9343E+25 | 84 | 2.5691E+36 | 2.68 | 1.49 | 40.86 | 3.946E+124 |
| 85 | 9.28447E+14 | 614125 | 85 | 4.44 | 3.8686E+25 | 85 | 6.97E+36 | 2.68 | 1.49 | 41.08 | 3.314E+126 |
| 86 | 1.39267E+1 | 636056 | 86 | 4.45 | 7.7371E+25 | 86 | 1.891E+37 | 2.68 | 1.49 | 41.3 | 2.817E+128 |

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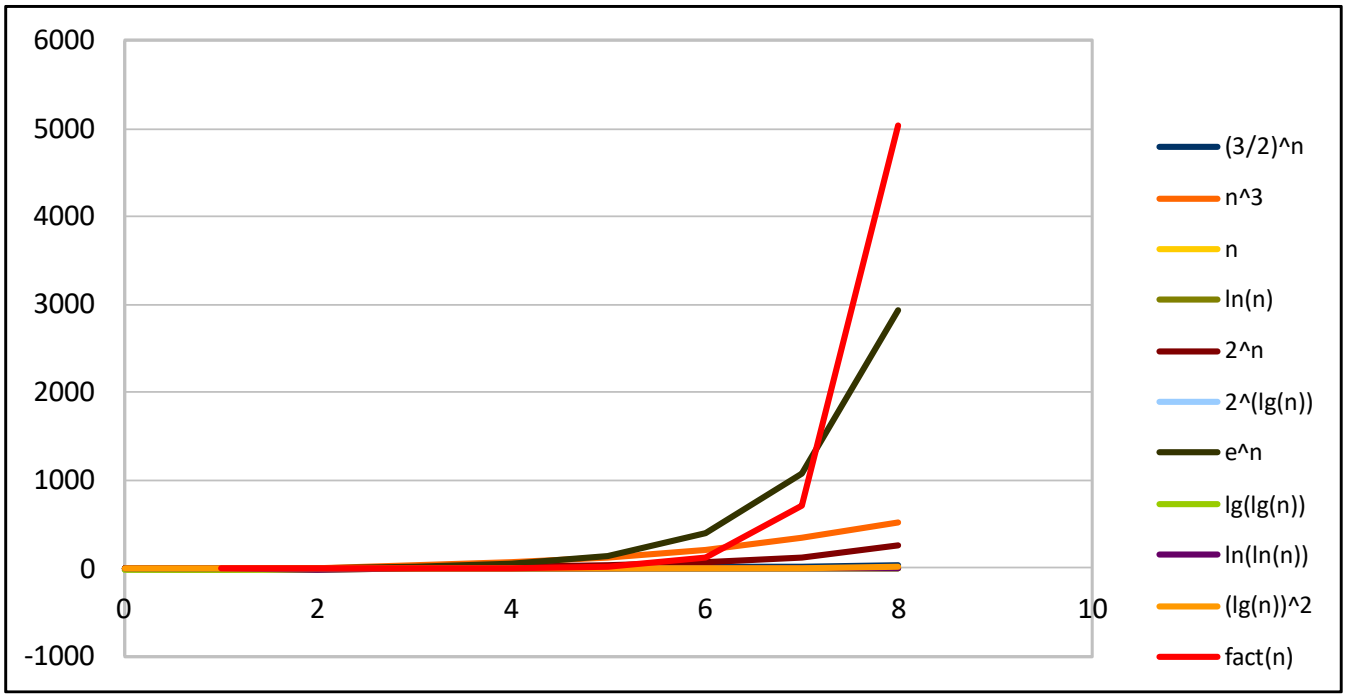
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5 | | | | | | | | | | |
| 87 | 2.08901E+15 | 658503 | 87 | 4.47 | 1.5474E+26 | 87 | 5.1302E+37 | 2.69 | 1.5 | 41.51 | 2.423E+130 |
| 88 | 3.13351E+15 | 681472 | 88 | 4.48 | 3.0949E+26 | 88 | 1.3918E+38 | 2.69 | 1.5 | 41.72 | 2.108E+132 |
| 89 | 4.70026E+15 | 704969 | 89 | 4.49 | 6.1897E+26 | 89 | 3.776E+38 | 2.7 | 1.5 | 41.94 | 1.855E+134 |
| 90 | 7.05039E+15 | 729000 | 90 | 4.5 | 1.2379E+27 | 90 | 1.0244E+39 | 2.7 | 1.5 | 42.14 | 1.651E+136 |
| 91 | 1.05756E+16 | 753571 | 91 | 4.51 | 2.4759E+27 | 91 | 2.7793E+39 | 2.7 | 1.51 | 42.35 | 1.486E+138 |
| 92 | 1.58634E+16 | 778688 | 92 | 4.52 | 4.9518E+27 | 92 | 7.5402E+39 | 2.71 | 1.51 | 42.56 | 1.352E+140 |
| 93 | 2.37951E+16 | 804357 | 93 | 4.53 | 9.9035E+27 | 93 | 2.0456E+40 | 2.71 | 1.51 | 42.76 | 1.244E+142 |
| 94 | 3.56926E+16 | 830584 | 94 | 4.54 | 1.9807E+28 | 94 | 5.5498E+40 | 2.71 | 1.51 | 42.96 | 1.157E+144 |
| 95 | 5.35389E+16 | 857375 | 95 | 4.55 | 3.9614E+28 | 95 | 1.5057E+41 | 2.72 | 1.52 | 43.16 | 1.087E+146 |
| 96 | 8.03084E+16 | 884736 | 96 | 4.56 | 7.9228E+28 | 96 | 4.0849E+41 | 2.72 | 1.52 | 43.36 | 1.033E+148 |
| 97 | 1.20463E+17 | 912673 | 97 | 4.57 | 1.5846E+29 | 97 | 1.1082E+42 | 2.72 | 1.52 | 43.56 | 9.917E+149 |
| 98 | 1.80694E+17 | 941192 | 98 | 4.58 | 3.1691E+29 | 98 | 3.0066E+42 | 2.73 | 1.52 | 43.75 | 9.619E+151 |
| 99 | 2.71041E+17 | 970299 | 99 | 4.6 | 6.3383E+29 | 99 | 8.157E+42 | 2.73 | 1.52 | 43.95 | 9.427E+153 |




| Functions | Observation |
|---|---|
| (3/2)^n | Exponential function with a=1.5; gradient increases as a value of n increases |
| N^3 | Cubic graph passing through the origin with coefficient of cubic variable as 1 and other constants 0 |
| N | Linear graph with slope 1 passing through the origin with co-efficient of cubic variable as 1 and other constants 0 |
| ln(n) | The output increases greatly initially but then it does not increase that much. |
| 2^n | The output increases slowly initially but as value of n becomes big, the output changes quite much |
| 2^(log(n)) | Solving the equation gives back n as (a^logn=n). Linear graph with a slope 1 and passing through the origin. |
| e^n | Natural exponential function |
| log(log(n)) | Logarithm of logarithm of n; Gradient decreases as n increases. |
| ln(ln(n)) | The ouptut increases slowly and then there is a sudden drastic increase and decrease in the ouput. |
| (lg(n))^2 | It increases continuously |
| factorial(n) | Follows the function N!=n X (n-1) X (n-2) X….. 2 X 1; value of function increases rapidly |

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| Final | The gradients of logarithmic functions decrease as n increases, while for exponential functions it increases as n increases |
| | and remaining functions are linear |

**Overall observation:** The output increases as value of n increases

**Conclusion:** Successfully executed the program for 11 different functions and also observed the trend for 100 values of n by creating graphs