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| **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:**

#include<stdio.h>

#include<math.h>

double fact(double n);

int main()

{

    printf("\tn\tn^3\t2^n\tln n\tlg n\tn lg n\te^n\t(3/2)^n\tn.2^n\tn!");

    for(double i=0;i<=10;i++)

    {

        printf("\n%.0lf",i);

        printf("\t%.2lf",i);

        printf("\t%.2lf",pow(i,3));

        printf("\t%.2lf",pow(2,i));

        printf("\t%.2lf",log(i));

        printf("\t%.2lf",log2(i));

        printf("\t%.2lf",i\*log2(i));

        printf("\t%.2lf",exp(i));

        printf("\t%.2lf",pow(1.5,i));

        printf("\t%.2lf",i\*pow(2,i));

        printf("\t%.2lf",fact(i));

    }

    return !69;

}

double fact(double n)

{

    if(n==0)

    return 1;

    else

    return n\*fact(n-1);

}

**Table:**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **n** | **n^3** | **2^n** | **ln n** | **lg n** | **n lg n** | **2^2^n** | **e^n** | **(3/2)^n** | **n.2^n** | **n!** |
| 0 | 0 | 0 | 1 | -inf | -inf | -nan | 2 | 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 2 | 0 | 0 | 0 | 4 | 2.72 | 1.5 | 2 | 1 |
| 2 | 2 | 8 | 4 | 0.69 | 1 | 2 | 16 | 7.39 | 2.25 | 8 | 2 |
| 3 | 3 | 27 | 8 | 1.1 | 1.58 | 4.75 | 256 | 20.09 | 3.38 | 24 | 6 |
| 4 | 4 | 64 | 16 | 1.39 | 2 | 8 | 65536 | 54.6 | 5.06 | 64 | 24 |
| 5 | 5 | 125 | 32 | 1.61 | 2.32 | 11.6 | 4E+09 | 148.41 | 7.59 | 160 | 120 |
| 6 | 6 | 216 | 64 | 1.79 | 2.58 | 15.5 | 2E+19 | 403.43 | 11.39 | 384 | 720 |
| 7 | 7 | 343 | 128 | 1.95 | 2.81 | 19.7 | 3E+38 | 1096.63 | 17.09 | 896 | 5040 |
| 8 | 8 | 512 | 256 | 2.08 | 3 | 24 | 1E+77 | 2980.96 | 25.63 | 2048 | 40320 |
| 9 | 9 | 729 | 512 | 2.2 | 3.17 | 28.5 | 1E+154 | 8103.08 | 38.44 | 4608 | 362880 |
| 10 | 10 | 1000 | 1024 | 2.3 | 3.32 | 33.2 | inf | 22026.5 | 57.67 | 10240 | 3628800 |
| 11 | 11 | 1331 | 2048 | 2.4 | 3.46 | 38.1 | inf | 59874.1 | 86.5 | 22528 | 4E+07 |
| 12 | 12 | 1728 | 4096 | 2.48 | 3.58 | 43 | inf | 162755 | 129.75 | 49152 | 4.8E+08 |
| 13 | 13 | 2197 | 8192 | 2.56 | 3.7 | 48.1 | inf | 442413 | 194.62 | 106496 | 6.2E+09 |
| 14 | 14 | 2744 | 16384 | 2.64 | 3.81 | 53.3 | inf | 1202604 | 291.93 | 229376 | 8.7E+10 |
| 15 | 15 | 3375 | 32768 | 2.71 | 3.91 | 58.6 | inf | 3269017 | 437.89 | 491520 | 1.3E+12 |
| 16 | 16 | 4096 | 65536 | 2.77 | 4 | 64 | inf | 8886111 | 656.84 | 1E+06 | 2.1E+13 |
| 17 | 17 | 4913 | 131072 | 2.83 | 4.09 | 69.5 | inf | 2.4E+07 | 985.26 | 2E+06 | 3.6E+14 |
| 18 | 18 | 5832 | 262144 | 2.89 | 4.17 | 75.1 | inf | 6.6E+07 | 1477.9 | 5E+06 | 6.4E+15 |
| 19 | 19 | 6859 | 524288 | 2.94 | 4.25 | 80.7 | inf | 1.8E+08 | 2216.8 | 1E+07 | 1.2E+17 |
| 20 | 20 | 8000 | 1048576 | 3 | 4.32 | 86.4 | inf | 4.9E+08 | 3325.3 | 2E+07 | 2.4E+18 |
| 21 | 21 | 9261 | 2097152 | 3.04 | 4.39 | 92.2 | inf | 1.3E+09 | 4987.9 | 4E+07 | 5.1E+19 |
| 22 | 22 | 10648 | 4194304 | 3.09 | 4.46 | 98.1 | inf | 3.6E+09 | 7481.8 | 9E+07 | 1.1E+21 |
| 23 | 23 | 12167 | 8388608 | 3.14 | 4.52 | 104 | inf | 9.7E+09 | 11223 | 2E+08 | 2.6E+22 |
| 24 | 24 | 13824 | 1.7E+07 | 3.18 | 4.58 | 110 | inf | 2.6E+10 | 16834 | 4E+08 | 6.2E+23 |
| 25 | 25 | 15625 | 3.4E+07 | 3.22 | 4.64 | 116 | inf | 7.2E+10 | 25251 | 8E+08 | 1.6E+25 |
| 26 | 26 | 17576 | 6.7E+07 | 3.26 | 4.7 | 122 | inf | 2E+11 | 37877 | 2E+09 | 4E+26 |
| 27 | 27 | 19683 | 1.3E+08 | 3.3 | 4.75 | 128 | inf | 5.3E+11 | 56815 | 4E+09 | 1.1E+28 |
| 28 | 28 | 21952 | 2.7E+08 | 3.33 | 4.81 | 135 | inf | 1.4E+12 | 85223 | 8E+09 | 3E+29 |
| 29 | 29 | 24389 | 5.4E+08 | 3.37 | 4.86 | 141 | inf | 3.9E+12 | 127834 | 2E+10 | 8.8E+30 |
| 30 | 30 | 27000 | 1.1E+09 | 3.4 | 4.91 | 147 | inf | 1.1E+13 | 191751 | 3E+10 | 2.7E+32 |
| 31 | 31 | 29791 | 2.1E+09 | 3.43 | 4.95 | 154 | inf | 2.9E+13 | 287627 | 7E+10 | 8.2E+33 |
| 32 | 32 | 32768 | 4.3E+09 | 3.47 | 5 | 160 | inf | 7.9E+13 | 431440 | 1E+11 | 2.6E+35 |
| 33 | 33 | 35937 | 8.6E+09 | 3.5 | 5.04 | 166 | inf | 2.1E+14 | 647160 | 3E+11 | 8.7E+36 |
| 34 | 34 | 39304 | 1.7E+10 | 3.53 | 5.09 | 173 | inf | 5.8E+14 | 970740 | 6E+11 | 3E+38 |
| 35 | 35 | 42875 | 3.4E+10 | 3.56 | 5.13 | 180 | inf | 1.6E+15 | 1E+06 | 1E+12 | 1E+40 |
| 36 | 36 | 46656 | 6.9E+10 | 3.58 | 5.17 | 186 | inf | 4.3E+15 | 2E+06 | 2E+12 | 3.7E+41 |
| 37 | 37 | 50653 | 1.4E+11 | 3.61 | 5.21 | 193 | inf | 1.2E+16 | 3E+06 | 5E+12 | 1.4E+43 |
| 38 | 38 | 54872 | 2.7E+11 | 3.64 | 5.25 | 199 | inf | 3.2E+16 | 5E+06 | 1E+13 | 5.2E+44 |
| 39 | 39 | 59319 | 5.5E+11 | 3.66 | 5.29 | 206 | inf | 8.7E+16 | 7E+06 | 2E+13 | 2E+46 |
| 40 | 40 | 64000 | 1.1E+12 | 3.69 | 5.32 | 213 | inf | 2.4E+17 | 1E+07 | 4E+13 | 8.2E+47 |
| 41 | 41 | 68921 | 2.2E+12 | 3.71 | 5.36 | 220 | inf | 6.4E+17 | 2E+07 | 9E+13 | 3.3E+49 |
| 42 | 42 | 74088 | 4.4E+12 | 3.74 | 5.39 | 226 | inf | 1.7E+18 | 2E+07 | 2E+14 | 1.4E+51 |
| 43 | 43 | 79507 | 8.8E+12 | 3.76 | 5.43 | 233 | inf | 4.7E+18 | 4E+07 | 4E+14 | 6E+52 |
| 44 | 44 | 85184 | 1.8E+13 | 3.78 | 5.46 | 240 | inf | 1.3E+19 | 6E+07 | 8E+14 | 2.7E+54 |
| 45 | 45 | 91125 | 3.5E+13 | 3.81 | 5.49 | 247 | inf | 3.5E+19 | 8E+07 | 2E+15 | 1.2E+56 |
| 46 | 46 | 97336 | 7E+13 | 3.83 | 5.52 | 254 | inf | 9.5E+19 | 1E+08 | 3E+15 | 5.5E+57 |
| 47 | 47 | 103823 | 1.4E+14 | 3.85 | 5.55 | 261 | inf | 2.6E+20 | 2E+08 | 7E+15 | 2.6E+59 |
| 48 | 48 | 110592 | 2.8E+14 | 3.87 | 5.58 | 268 | inf | 7E+20 | 3E+08 | 1E+16 | 1.2E+61 |
| 49 | 49 | 117649 | 5.6E+14 | 3.89 | 5.61 | 275 | inf | 1.9E+21 | 4E+08 | 3E+16 | 6.1E+62 |
| 50 | 50 | 125000 | 1.1E+15 | 3.91 | 5.64 | 282 | inf | 5.2E+21 | 6E+08 | 6E+16 | 3E+64 |
| 51 | 51 | 132651 | 2.3E+15 | 3.93 | 5.67 | 289 | inf | 1.4E+22 | 1E+09 | 1E+17 | 1.6E+66 |
| 52 | 52 | 140608 | 4.5E+15 | 3.95 | 5.7 | 296 | inf | 3.8E+22 | 1E+09 | 2E+17 | 8.1E+67 |
| 53 | 53 | 148877 | 9E+15 | 3.97 | 5.73 | 304 | inf | 1E+23 | 2E+09 | 5E+17 | 4.3E+69 |
| 54 | 54 | 157464 | 1.8E+16 | 3.99 | 5.75 | 311 | inf | 2.8E+23 | 3E+09 | 1E+18 | 2.3E+71 |
| 55 | 55 | 166375 | 3.6E+16 | 4.01 | 5.78 | 318 | inf | 7.7E+23 | 5E+09 | 2E+18 | 1.3E+73 |
| 56 | 56 | 175616 | 7.2E+16 | 4.03 | 5.81 | 325 | inf | 2.1E+24 | 7E+09 | 4E+18 | 7.1E+74 |
| 57 | 57 | 185193 | 1.4E+17 | 4.04 | 5.83 | 332 | inf | 5.7E+24 | 1E+10 | 8E+18 | 4.1E+76 |
| 58 | 58 | 195112 | 2.9E+17 | 4.06 | 5.86 | 340 | inf | 1.5E+25 | 2E+10 | 2E+19 | 2.4E+78 |
| 59 | 59 | 205379 | 5.8E+17 | 4.08 | 5.88 | 347 | inf | 4.2E+25 | 2E+10 | 3E+19 | 1.4E+80 |
| 60 | 60 | 216000 | 1.2E+18 | 4.09 | 5.91 | 354 | inf | 1.1E+26 | 4E+10 | 7E+19 | 8.3E+81 |
| 61 | 61 | 226981 | 2.3E+18 | 4.11 | 5.93 | 362 | inf | 3.1E+26 | 6E+10 | 1E+20 | 5.1E+83 |
| 62 | 62 | 238328 | 4.6E+18 | 4.13 | 5.95 | 369 | inf | 8.4E+26 | 8E+10 | 3E+20 | 3.1E+85 |
| 63 | 63 | 250047 | 9.2E+18 | 4.14 | 5.98 | 377 | inf | 2.3E+27 | 1E+11 | 6E+20 | 2E+87 |
| 64 | 64 | 262144 | 1.8E+19 | 4.16 | 6 | 384 | inf | 6.2E+27 | 2E+11 | 1E+21 | 1.3E+89 |
| 65 | 65 | 274625 | 3.7E+19 | 4.17 | 6.02 | 391 | inf | 1.7E+28 | 3E+11 | 2E+21 | 8.2E+90 |
| 66 | 66 | 287496 | 7.4E+19 | 4.19 | 6.04 | 399 | inf | 4.6E+28 | 4E+11 | 5E+21 | 5.4E+92 |
| 67 | 67 | 300763 | 1.5E+20 | 4.2 | 6.07 | 406 | inf | 1.3E+29 | 6E+11 | 1E+22 | 3.6E+94 |
| 68 | 68 | 314432 | 3E+20 | 4.22 | 6.09 | 414 | inf | 3.4E+29 | 9E+11 | 2E+22 | 2.5E+96 |
| 69 | 69 | 328509 | 5.9E+20 | 4.23 | 6.11 | 421 | inf | 9.3E+29 | 1E+12 | 4E+22 | 1.7E+98 |
| 70 | 70 | 343000 | 1.2E+21 | 4.25 | 6.13 | 429 | inf | 2.5E+30 | 2E+12 | 8E+22 | 1E+100 |
| 71 | 71 | 357911 | 2.4E+21 | 4.26 | 6.15 | 437 | inf | 6.8E+30 | 3E+12 | 2E+23 | 9E+101 |
| 72 | 72 | 373248 | 4.7E+21 | 4.28 | 6.17 | 444 | inf | 1.9E+31 | 5E+12 | 3E+23 | 6E+103 |
| 73 | 73 | 389017 | 9.4E+21 | 4.29 | 6.19 | 452 | inf | 5.1E+31 | 7E+12 | 7E+23 | 4E+105 |
| 74 | 74 | 405224 | 1.9E+22 | 4.3 | 6.21 | 460 | inf | 1.4E+32 | 1E+13 | 1E+24 | 3E+107 |
| 75 | 75 | 421875 | 3.8E+22 | 4.32 | 6.23 | 467 | inf | 3.7E+32 | 2E+13 | 3E+24 | 2E+109 |
| 76 | 76 | 438976 | 7.6E+22 | 4.33 | 6.25 | 475 | inf | 1E+33 | 2E+13 | 6E+24 | 2E+111 |
| 77 | 77 | 456533 | 1.5E+23 | 4.34 | 6.27 | 483 | inf | 2.8E+33 | 4E+13 | 1E+25 | 1E+113 |
| 78 | 78 | 474552 | 3E+23 | 4.36 | 6.29 | 490 | inf | 7.5E+33 | 5E+13 | 2E+25 | 1E+115 |
| 79 | 79 | 493039 | 6E+23 | 4.37 | 6.3 | 498 | inf | 2E+34 | 8E+13 | 5E+25 | 9E+116 |
| 80 | 80 | 512000 | 1.2E+24 | 4.38 | 6.32 | 506 | inf | 5.5E+34 | 1E+14 | 1E+26 | 7E+118 |
| 81 | 81 | 531441 | 2.4E+24 | 4.39 | 6.34 | 514 | inf | 1.5E+35 | 2E+14 | 2E+26 | 6E+120 |
| 82 | 82 | 551368 | 4.8E+24 | 4.41 | 6.36 | 521 | inf | 4.1E+35 | 3E+14 | 4E+26 | 5E+122 |
| 83 | 83 | 571787 | 9.7E+24 | 4.42 | 6.38 | 529 | inf | 1.1E+36 | 4E+14 | 8E+26 | 4E+124 |
| 84 | 84 | 592704 | 1.9E+25 | 4.43 | 6.39 | 537 | inf | 3E+36 | 6E+14 | 2E+27 | 3E+126 |
| 85 | 85 | 614125 | 3.9E+25 | 4.44 | 6.41 | 545 | inf | 8.2E+36 | 9E+14 | 3E+27 | 3E+128 |
| 86 | 86 | 636056 | 7.7E+25 | 4.45 | 6.43 | 553 | inf | 2.2E+37 | 1E+15 | 7E+27 | 2E+130 |
| 87 | 87 | 658503 | 1.5E+26 | 4.47 | 6.44 | 561 | inf | 6.1E+37 | 2E+15 | 1E+28 | 2E+132 |
| 88 | 88 | 681472 | 3.1E+26 | 4.48 | 6.46 | 568 | inf | 1.7E+38 | 3E+15 | 3E+28 | 2E+134 |
| 89 | 89 | 704969 | 6.2E+26 | 4.49 | 6.48 | 576 | inf | 4.5E+38 | 5E+15 | 6E+28 | 2E+136 |
| 90 | 90 | 729000 | 1.2E+27 | 4.5 | 6.49 | 584 | inf | 1.2E+39 | 7E+15 | 1E+29 | 1E+138 |
| 91 | 91 | 753571 | 2.5E+27 | 4.51 | 6.51 | 592 | inf | 3.3E+39 | 1E+16 | 2E+29 | 1E+140 |
| 92 | 92 | 778688 | 5E+27 | 4.52 | 6.52 | 600 | inf | 9E+39 | 2E+16 | 5E+29 | 1E+142 |
| 93 | 93 | 804357 | 9.9E+27 | 4.53 | 6.54 | 608 | inf | 2.5E+40 | 2E+16 | 9E+29 | 1E+144 |
| 94 | 94 | 830584 | 2E+28 | 4.54 | 6.55 | 616 | inf | 6.7E+40 | 4E+16 | 2E+30 | 1E+146 |
| 95 | 95 | 857375 | 4E+28 | 4.55 | 6.57 | 624 | inf | 1.8E+41 | 5E+16 | 4E+30 | 1E+148 |
| 96 | 96 | 884736 | 7.9E+28 | 4.56 | 6.58 | 632 | inf | 4.9E+41 | 8E+16 | 8E+30 | 1E+150 |
| 97 | 97 | 912673 | 1.6E+29 | 4.57 | 6.6 | 640 | inf | 1.3E+42 | 1E+17 | 2E+31 | 1E+152 |
| 98 | 98 | 941192 | 3.2E+29 | 4.58 | 6.61 | 648 | inf | 3.6E+42 | 2E+17 | 3E+31 | 9E+153 |
| 99 | 99 | 970299 | 6.3E+29 | 4.6 | 6.63 | 656 | inf | 9.9E+42 | 3E+17 | 6E+31 | 9E+155 |
| 100 | 100 | 1E+06 | 1.3E+30 | 4.61 | 6.64 | 664 | inf | 2.7E+43 | 4E+17 | 1E+32 | 9E+157 |

|  |  |
| --- | --- |
| **Function** | **Observation** |
| Function 1: n | The output increases linearly(gradually) as value of n increases. |
| Function 2: n^3 | The output increases slowly initially but as value of n becomes big, the output changes quite much |
| Function 3: 2^n | The output increases slowly initially but as value of n becomes big, the output changes quite much |
| Function 4: ln n | The output increases greatly initially but then it does not increase that much |
| Function 5: lg n | The output increases greatly initially but then it does not increase that much |
| Function 6: n lg n | The output increases linearly(gradually) as value of n increases. |
| Function 7: 2^2^n | Very high output value for small values of n |
| Function 8: e^n | The output increases slowly initially but as value of n becomes big, the output changes quite much |
| Function 9: (3/2)^n | The output increases slowly initially but as value of n becomes big, the output changes quite much |
| Function 10: n.2^n | The output increases slowly initially but as value of n becomes big, the output changes quite much |
| Function 11: n! | The output increases slowly initially but as value of n becomes big, the output changes quite much |

**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