

## Efficient program to calculate $e^x$

The value of **Exponential Function**  $e^x$  can be expressed using following **Taylor Series**.

$$e^x = 1 + x/1! + x^2/2! + x^3/3! + \dots$$

*How to efficiently calculate the sum of above series?*

The series can be re-written as

$$e^x = 1 + (x/1) (1 + (x/2) (1 + (x/3) (\dots)))$$

Let the sum needs to be calculated for n terms, we can calculate sum using following loop.

```
for (i = n - 1, sum = 1; i > 0; --i )
    sum = 1 + x * sum / i;
```

Following is implementation of the above idea.

```
// Efficient program to calculate e raise to the power x
#include <stdio.h>

//Returns approximate value of e^x using sum of first n terms of Taylor
float exponential(int n, float x)
{
    float sum = 1.0f; // initialize sum of series

    for (int i = n - 1; i > 0; --i )
        sum = 1 + x * sum / i;

    return sum;
}

// Driver program to test above function
```

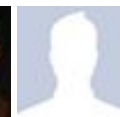
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```
int main()
{
    int n = 10;
    float x = 1.0f;
    printf("e^x = %f", exponential(n, x));
    return 0;
}
```

Output:

e^x = 2.718282

This article is compiled by **Rahul** and reviewed by GeeksforGeeks team. Please write comments if you find anything incorrect, or you want to share more information about the topic discussed above



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K.kaushik · 11 months ago

A simple java code for the program:

If any error is there please reply to inform me...

//considering calculation upto 10 imes.

```
public class Exponent {
```

```
    public static double getExponent(double x, int i)
```

```
{
```

```
    if(i == 0)
```

```
        return 1; // as e^0 = 0;
```

```
    if(i > 10)
```

```
        return 1;
```

```
    else
```

```
{
```

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```
double y = getExponent(x, i + 1),  
return 1 + (x / i) * y;
```

[see more](#)

1 ^ | v .



**K.kaushik** → K.kaushik · 11 months ago

For greater accuracy **in** output **while** calculating  $e^x$  you may r

^ | v .



**K.kaushik** → K.kaushik · 11 months ago

a typo is there :  $e^0 = 1$  .. Sorry for the inconvenience.

^ | v .



**A Chakraborty** · a year ago

*/\*A more efficient program for calculating  $e^x$  (which doesn't involve*

*Simple Recursion is used.*

*We know  $e^x = 1 + x + x^2/2! + \dots + x^n/n!$*

*Thus the  $n$ 'th term  $T_n = x^n/n!$*

*$n+1$ 'th term  $T_{n+1} = x^{n+1}/(n+1)!$*

*dividing the two relations we get.*

*$T_{n+1} = T_n * (x/(n+1))$ .*

*Calculated in Get().*

*Main() not written! \*/*

**#include <stdio.h>**

705



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```
float Calc(float);  
float Get(int, float);
```

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@Those who know python :  
here is the high precision solution.  
<https://github.com/jermenkoo/s...>

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**Jitendra Khushwaha** · a year ago

@Those who know python :  
here is the high precision solution.  
<https://github.com/jermenkoo/s...>

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**Raison** · a year ago

It's may not get good precision, even change to double version. For low precis

^ | v .



**Hello** · a year ago

You have an error in your for loop after sum = 1. You meant to put a semi-col

```
/* Paste your code here (You may delete these lines if not writing c
```

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**Kartik** → Hello · a year ago

Thanks for pointing this out. We have replaced comma with semicolon

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**Akshat Gupta** · a year ago

Nicely **done!!**



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