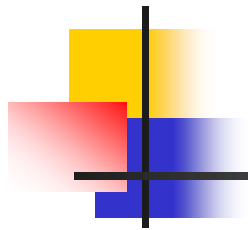




Introduction to Computer Programing

C++ Ch3 Functions

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Functions Defined in <cmath>

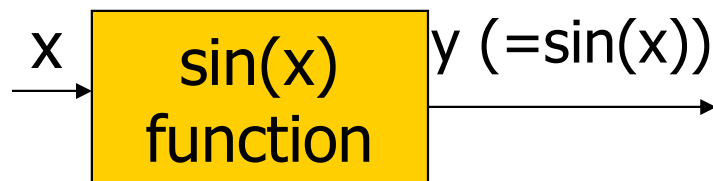
Check: <http://www.cplusplus.com/reference/cmath/>

Syntax	Meaning
<code>exp(x)</code>	e^x
<code>sqrt(x)</code>	$x^{(1/2)}$, only for positive x
<code>log(x)</code>	$\ln(x)$
<code>log10(x)</code>	$\log(x)$
<code>sin(x)</code>	$\sin(x)$, x in degree or radius?
<code>pow(a,b)</code>	a^b
....	

What is a Function?

Think about $\sin(x)$...

- No need to worry about how it is calculated.
- Wherever you go, $\sin(x)$ is $\sin(x)$: no need to worry about duplication of variables.
- Simple format – only one line gets what you want.



y: return value (output)
pow: function name
(a, b): argument (function input)



User Defined Functions: Example 1

Write a function that calculates $x*y + x/y$

(1) Function declaration

```
#include <iostream>
using namespace std;
```

```
double funtest(double, double);
```

(2) Function call
(note for $\sin(x)$ or $\text{pow}(x,y)$)

```
int main(){
    cout << funtest(2,3) << endl;
    return 0;
}
```

(3) Function definition

Function header

Function body

```
double funtest(double x, double y)
{ //this function returns value of  $xy+x/y$ 
    double a;
    a=x*y+x/y;
    return a;
}
```



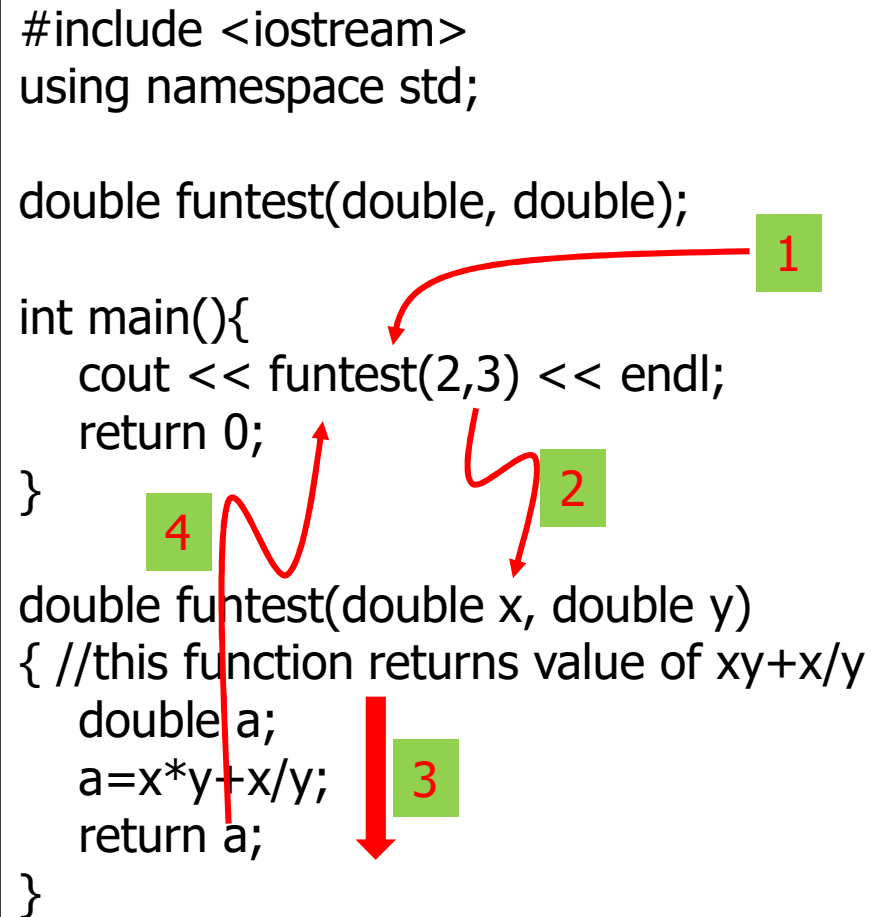
User Defined Functions: Example 1

```
#include <iostream>
using namespace std;

double funtest(double, double);

int main(){
    cout << funtest(2,3) << endl;
    return 0;
}

double funtest(double x, double y)
{ //this function returns value of xy+x/y
    double a;
    a=x*y+x/y;
    return a;
}
```



The diagram illustrates the execution flow of the provided C++ code. It features four numbered annotations in green boxes with red arrows pointing to specific lines of code:

- 1**: Points to the function declaration `double funtest(double, double);`.
- 2**: Points to the function call `funtest(2,3)` inside the `main` function.
- 3**: Points to the function definition `double funtest(double x, double y)`.
- 4**: Points to the closing brace of the `main` function, indicating the end of the program.



User Defined Functions: Example 2

Write a function that calculates x^y

(1) Function declaration

int funpower(int, int);

(2) Function call

(note for $\sin(x)$ or $\text{pow}(x,y)$)

```
int main(){  
    cout << funpower(3,4) << endl;  
    return 0;  
}
```

(3) Function definition

Function header

Function body

```
int funpower(int x, int y)  
{ // returns  $x^y$   
    int i, p=1;  
    for (i=1;i<=y;i++){  
        p=p*x;  
    }  
    return p;  
}
```



User Defined Functions: Example 2

```
#include <iostream>
using namespace std;

int funpower(int, int);

int main(){
    cout << funpower(3,4)<<endl;
    return 0;
}

int funpower(int x, int y)
{ // returns x^y
    int i, p=1;
    for (i=1;i<=y;i++){
        p=p*x;
    }
    return p;
}
```



Test Your Understanding

- Write a function that calculates the factorial of an integer (N!)
 - Input N, Output N!
- Write a function that calculates the value of a quadratic function
 - Input a, b, c, x, output ax^2+bx+c
- Write a function with input Re and Output C_D

$$C_D = \frac{24}{Re} \quad \text{for} \quad Re < 0.1$$

$$C_D = \frac{24}{Re}(1 + 0.14 Re^{0.7}) \quad \text{for} \quad 0.1 \leq Re \leq 1000$$

$$C_D = 0.44 \quad \text{for} \quad 1000 < Re \leq 350000$$

$$C_D = 0.19 - 8 \times 10^4 / Re \quad \text{for} \quad 350000 < Re$$