

Students: Section 5.4 is a part of 2 assignments: CSC108 CH05.1-5.7 C5A ▾
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Includes: CA
Due: 04/03/2025, 11:59 PM EDT

5.4 Writing mathematical functions

Mathematical functions

A function is commonly defined to compute a mathematical calculation involving several numerical parameters and returning a numerical result. The program below uses a function to convert a person's height in U.S. units (feet and inches) into total centimeters.

Figure 5.4.1: Program with a function to convert height in feet/inches to centimeters.

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

/* Converts a height in feet/inches to centimeters */
double HeightFtInToCm(int heightFt, int heightIn) {
    const double CM_PER_IN = 2.54;
    const int IN_PER_FT = 12;
    int totIn;
    double cmVal;

    totIn = (heightFt * IN_PER_FT) + heightIn; // Total inches
    cmVal = totIn * CM_PER_IN; // Conv inch to cm
    return cmVal;
}

int main() {
    int userFt; // User defined feet
    int userIn; // User defined inches

    // Prompt user for feet/inches
    cout << "Enter feet: ";
    cin >> userFt;

    cout << "Enter inches: ";
    cin >> userIn;

    // Output the conversion result
    cout << "Centimeters: ";
    cout << HeightFtInToCm(userFt, userIn) << endl;
    return 0;
}
```

Enter feet: 5
Enter inches: 8
Centimeters: 172.72

Feedback?

Human average height is increasing, attributed to better nutrition. Source: [Our World in Data: Human height](#).

PARTICIPATION ACTIVITY | 5.4.1: Mathematical functions.

Indicate which is a valid use of the HeightFtInToCm() function above. x is type double.

- 1) $x = \text{HeightFtInToCm}(5, 0);$
 Valid
 Not valid
- 2) $x = 2 * (\text{HeightFtInToCm}(5, 0) + 1.0);$
 Valid
 Not valid
- 3) $x = (\text{HeightFtInToCm}(5, 0) + \text{HeightFtInToCm}(6, 1)) / 2.0;$
 Valid
 Not valid
- 4) Suppose int pow(int y, int z) returns y to the power of z. Is the following valid?
 $x = \text{pow}(2, \text{pow}(3, 2));$
 Valid
 Not valid

Feedback?

zyDE 5.4.1: Temperature conversion.

Complete the program by writing and calling a function that converts a temperature from Celsius into Fahrenheit using the formula:

```
Load default template... 100
Run
```

```
1 #include <iostream>
2 using namespace std;
3
4 // FINISH: Define CelsiusToFahrenheit function here
5
6 int main() {
7     double tempF;
8     double tempC;
9
10    cout << "Enter temperature in Celsius: " << endl;
11    cin >> tempC;
12
13    tempF = 0.0; // FIXME
14
15    cout << "Fahrenheit: " << tempF;
16
17    return 0;
18}
```

Feedback?

Calling functions in expressions

A function call evaluates to the returned value. Thus, a function call often appears within an expression. Ex: $5 + \text{computeSquare}(4)$ evaluates to $5 + 16$, or 21.

A function with a void return type cannot be used within an expression, instead being used in a statement like: `outputData(x, y);`

PARTICIPATION ACTIVITY | 5.4.2: Function called twice in an expression.

Start 2x speed

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

int ComputeSquare(int numToSquare) {
    return numToSquare * numToSquare;
}

int main() {
    int c2;

    c2 = ComputeSquare(7) + ComputeSquare(9);
    cout << "7 squared plus 9 squared is " << c2 << endl;
    return 0;
}
```

7 squared plus 9 squared is 130

Captions ▾

Feedback?

PARTICIPATION ACTIVITY | 5.4.3: Calls in an expression.

Given the definitions below, which are valid statements?

```
double SquareRoot(double x) { ... }
void PrintVal(double x) { ... }
double y;
```

- 1) $y = \text{SquareRoot}(49.0);$
 Valid
 Invalid
- 2) $\text{SquareRoot}(49.0) = z;$
 Valid
 Invalid
- 3) $y = 1.0 + \text{SquareRoot}(144.0);$
 Valid
 Invalid
- 4) $y = \text{SquareRoot}(\text{SquareRoot}(16.0));$
 Valid
 Invalid
- 5) $y = \text{SquareRoot}();$
 Valid
 Invalid
- 6) $\text{SquareRoot}(9.0);$
 Valid
 Invalid
- 7) $y = \text{PrintVal}(9.0);$
 Valid
 Invalid
- 8) $\text{PrintVal}(9.0);$
 Valid
 Invalid

Feedback?

Modular functions for mathematical expressions

Modularity allows more complex functions to incorporate simpler functions. Complex mathematical functions often call other mathematical functions. Ex: A function that calculates the volume or surface area of a cylinder calls a function that returns the area of the cylinder's base, which is needed for both calculations.

Figure 5.4.2: Program that calculates cylinder volume and surface area by calling a modular function for the cylinder's base.

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

double CalcCircularBaseArea(double radius) {
    return M_PI * radius * radius;
}

double CalcCylinderVolume(double baseRadius, double height) {
    return CalcCircularBaseArea(baseRadius) * height;
}

double CalcCylinderSurfaceArea(double baseRadius, double height) {
    return (2 * M_PI * baseRadius * height) + (2 * CalcCircularBaseArea(baseRadius));
}

int main() {
    double radius; // User defined radius
    double height; // User defined height

    // Prompt user for radius
    cout << "Enter base radius: ";
    cin >> radius;

    // Prompt user for height
    cout << "Enter height: ";
    cin >> height;

    // Output the cylinder volume result
    cout << "Cylinder volume: ";
    cout << CalcCylinderVolume(radius, height) << endl;

    // Output the cylinder surface area result
    cout << "Cylinder surface area: ";
    cout << CalcCylinderSurfaceArea(radius, height) << endl;

    return 0;
}
```

Enter base radius: 10
Enter height: 5
Cylinder volume: 1570.8
Cylinder surface area:
942.478

Feedback?

PARTICIPATION ACTIVITY | 5.4.1: Writing mathematical functions.

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Complete the function ConvertToPounds() that has one integer parameter as a mass in kilograms. The function returns a double as the mass converted to pounds, given that 1 kilogram = 2.20462 pounds.

Ex: If the input is 13, then the output is:

28.6601 pounds

```
1 #include <iostream>
2 using namespace std;
3
4 double ConvertToPounds(int userKilograms) {
5     const double KG_TO_LBS = 2.20462;
6
7     /* Your code goes here */
8
9 }
```

```
10 int main() {
11     int numKilograms;
12
13     cin >> numKilograms;
14
15     cout << ConvertToPounds(numKilograms);
16     cout << " pounds" << endl;
17
18 }
```

1 2 3

Check Next level

Feedback?

How was this section?

Provide section feedback

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5.5 Functions with branches