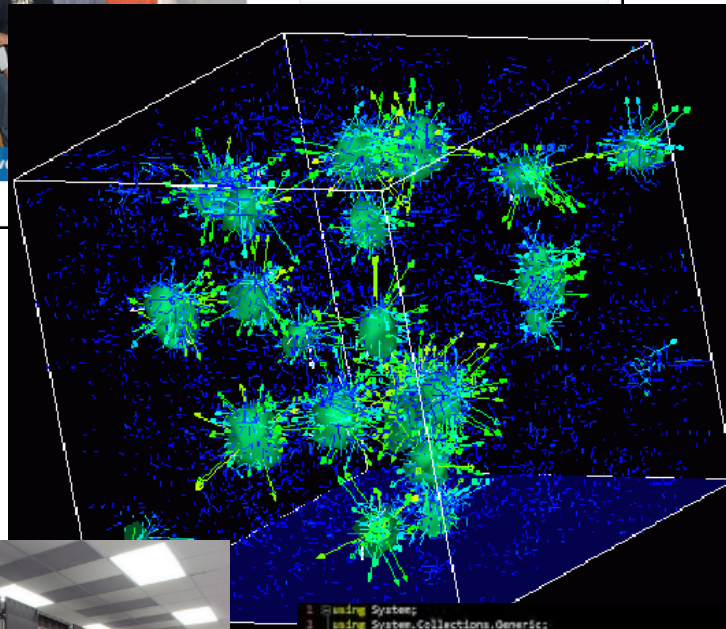


# Survey of Scientific Computing (SciComp)



```

1  using System;
2  using System.Collections.Generic;
3  using System.ComponentModel;
4  using System.Data;
5  using System.Drawing;
6  using System.Linq;
7  using System.Text;
8  using System.Windows.Forms;
9
10 namespace SimpleEvent1
11 {
12     public partial class Form1 : Form
13     {
14         Person person = new Person();
15
16         public Form1()
17         {
18             InitializeComponent();
19             person.FirstName = "Christian";
20             person.LastName = "Pano";
21         }
22
23         private void button1_Click(object sender, EventArgs e)
24         {
25             person.HairColor = textBox1.Text;
26         }
27     }
28 }

```

## Unit 2 BNL SciComp S2

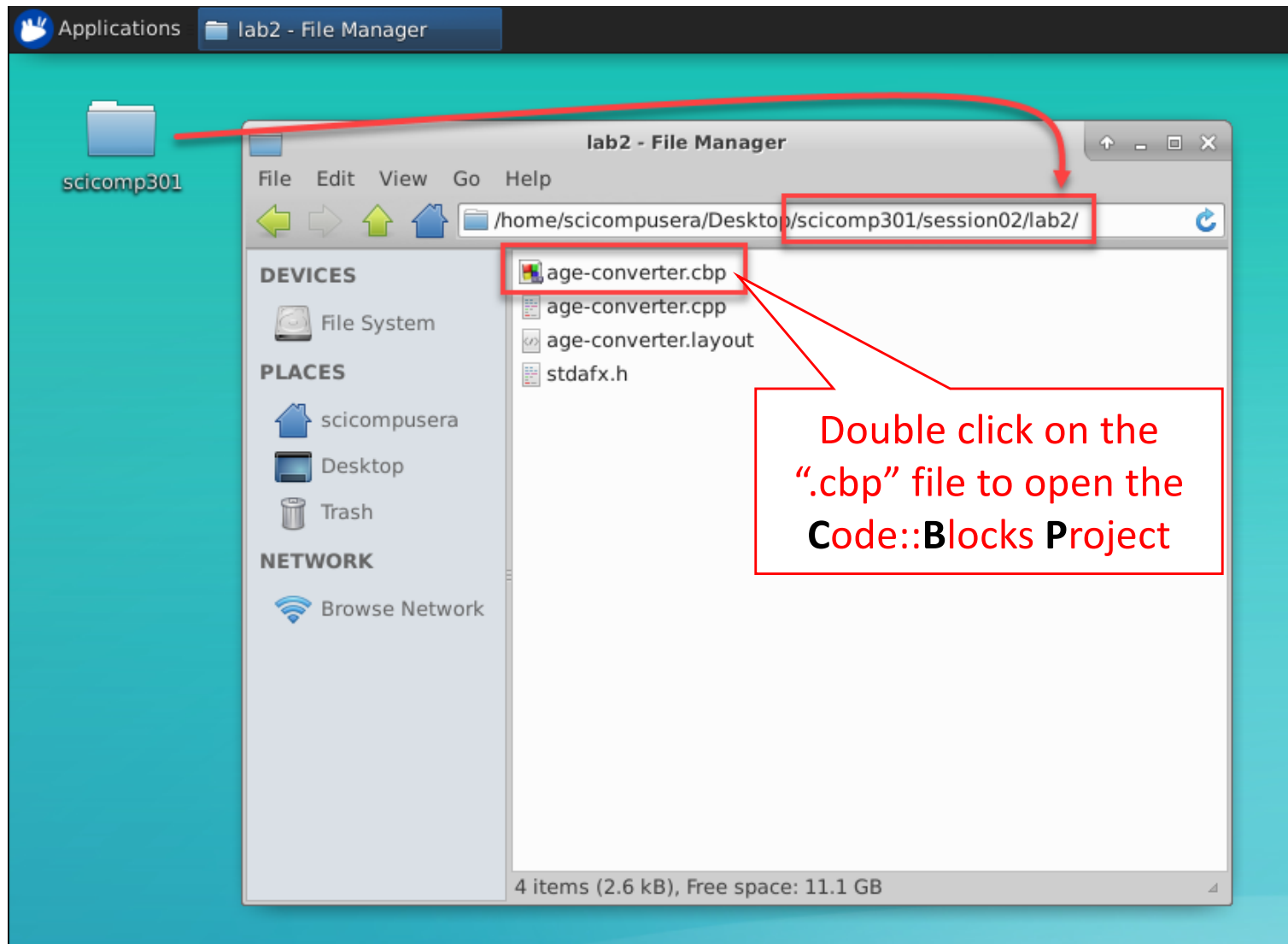
# Session Goals

- Create C++ variables using built-in data **types**
- Display the values of variables on the console
- Create simple loops with the **for()** statement

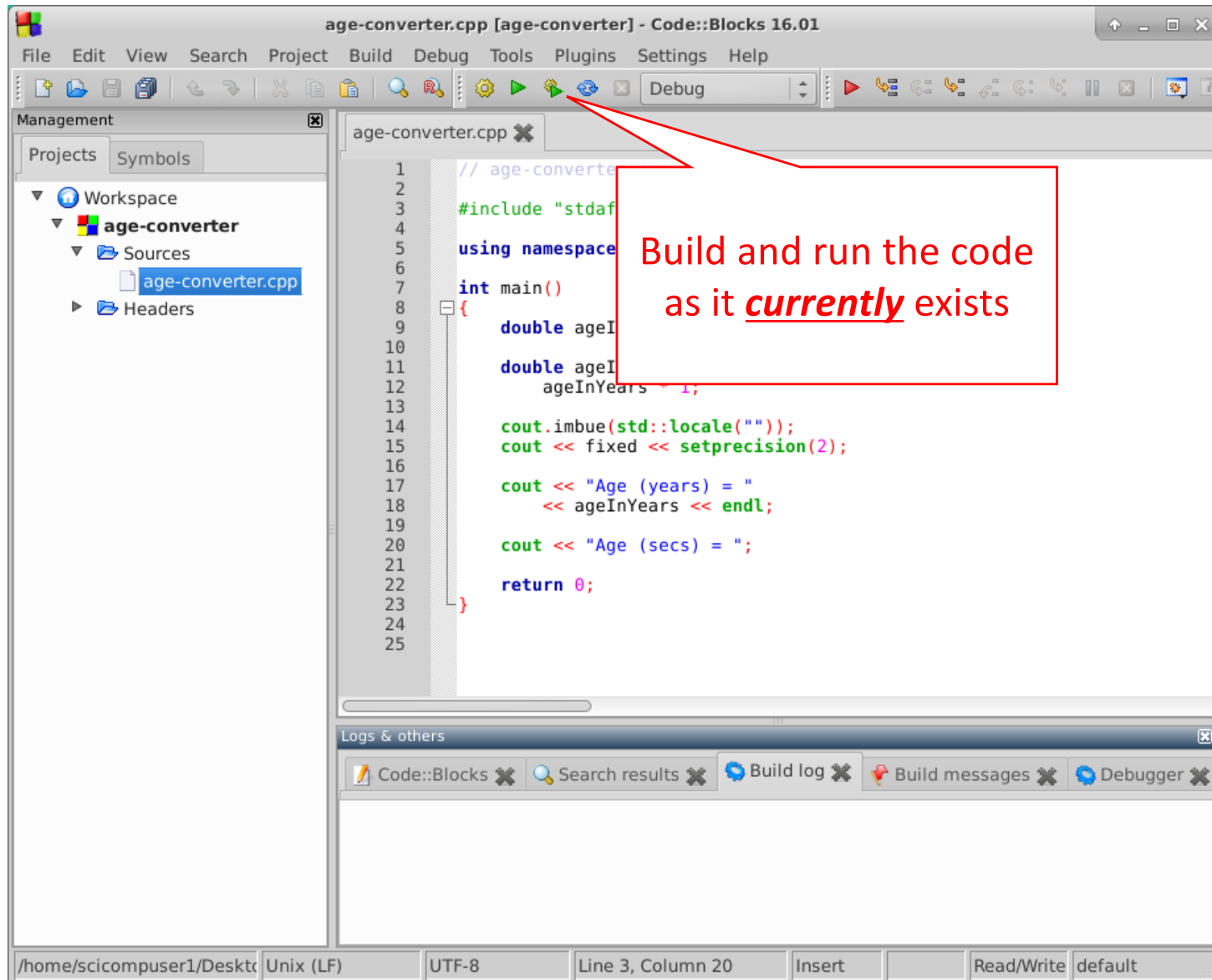
## Lab 2 – My Age In Seconds

- Your scientist has asked you to fix an existing buggy C++ console application using Code::Blocks
- Initialize a variable to hold your current age in years
- Develop and implement an equation that performs the correct **dimensional analysis** (factor label method) to convert years to seconds
- There is no need to accommodate **leap years** in the equation
- Display in the terminal window both your age in years *and* your age in seconds

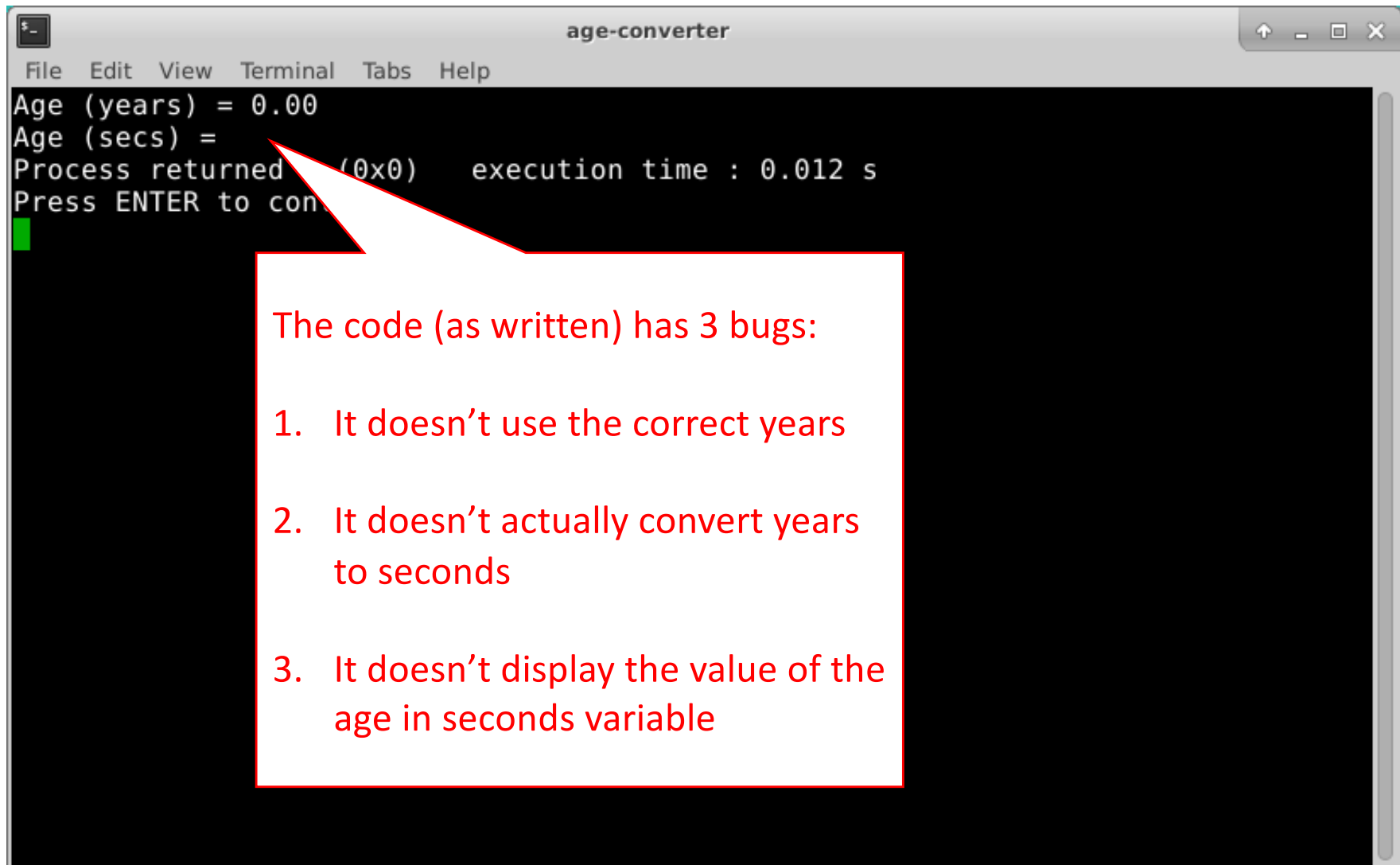
# Lab 2 – My Age In Seconds



# Lab 2 – My Age In Seconds



# Lab 2 – My Age In Seconds

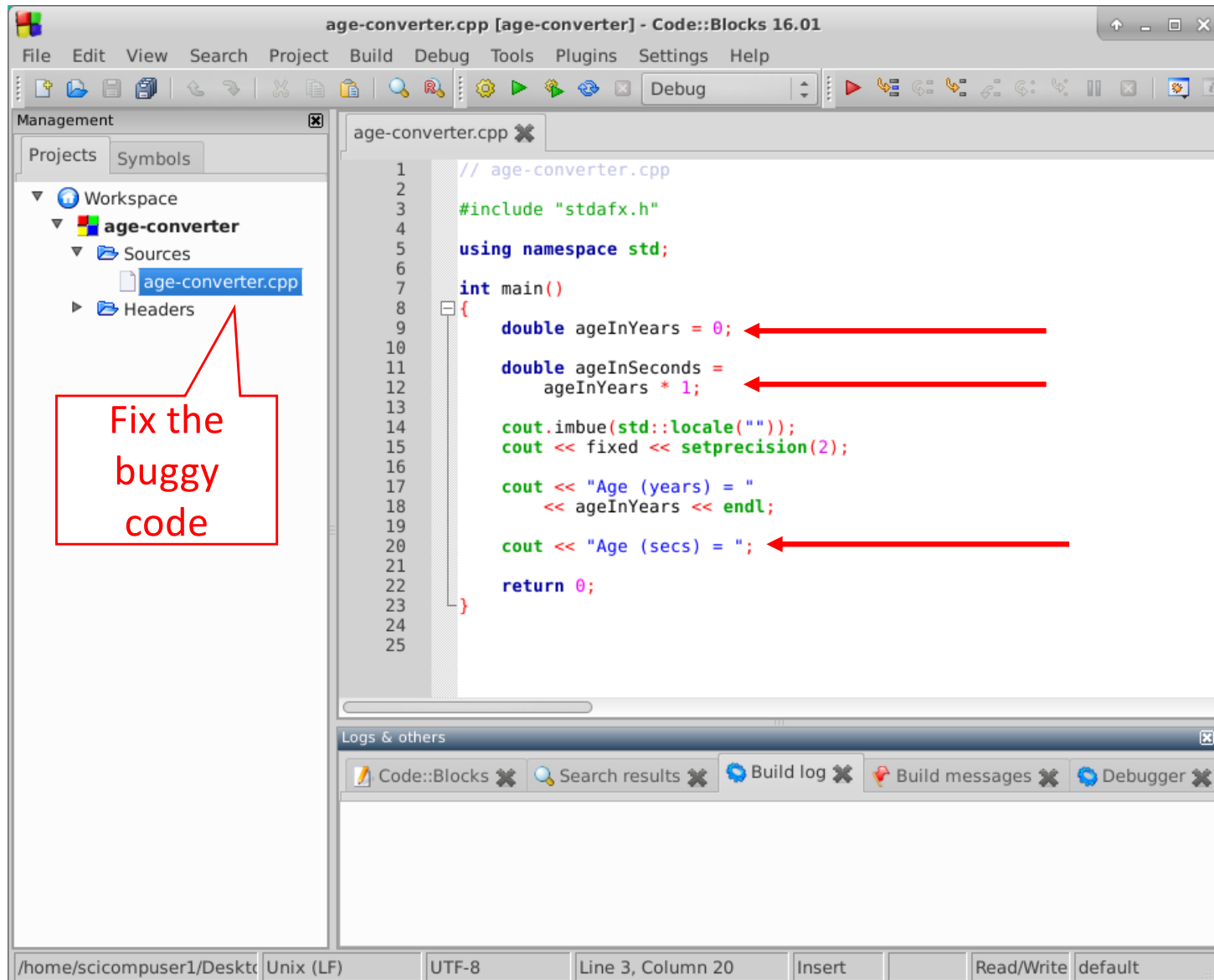


```
age-converter
File Edit View Terminal Tabs Help
Age (years) = 0.00
Age (secs) =
Process returned (0x0) execution time : 0.012 s
Press ENTER to con
```

The code (as written) has 3 bugs:

1. It doesn't use the correct years
2. It doesn't actually convert years to seconds
3. It doesn't display the value of the age in seconds variable

# Lab 2 – My Age In Seconds



```
1 // age-converter.cpp
2
3 #include "stdafx.h"
4
5 using namespace std;
6
7 int main()
8 {
9     double ageInYears = 0;
10
11     double ageInSeconds =
12         ageInYears * 1;
13
14     cout.imbue(std::locale(""));
15     cout << fixed << setprecision(2);
16
17     cout << "Age (years) = "
18         << ageInYears << endl;
19
20     cout << "Age (secs) = ";
21
22     return 0;
23 }
24
25
```

Fix the buggy code

Logs & others

Code::Blocks Search results Build log Build messages Debugger

/home/scicompuser1/Desktop Unix (LF) UTF-8 Line 3, Column 20 Insert Read/Write default

# Lab 2 – My Age In Seconds

```
age-converter.cpp [age-converter] - Code::Blocks 16.01
Build Debug Tools Plugins Settings Help

age-converter.cpp
1 // age-converter.cpp
2
3 #include "stdafx.h"
4
5 using namespace std;
6
7 int main()
8 {
9     double ageInYears = 49;
10
11     double ageInSeconds =
12
13
14     cout << "Age (years) = 49.00" << endl;
15     cout << "Age (secs) = 1,545,264,000.00" << endl;
16
17     cout << "Process returned 0 (0x0)    execution time : 0.011 s" << endl;
18     cout << "Press ENTER to continue." << endl;
19
20
21
22
23     return 0;
24 }
25
26
```

File Edit View Terminal Tabs

Age (years) = 49.00  
Age (secs) = 1,545,264,000.00  
Process returned 0 (0x0) execution time : 0.011 s  
Press ENTER to continue.

Your numbers will be different based upon your current age

Logs & others



# for() Loops

- **for()** loops execute all the statements within their scope as long as the 2<sup>nd</sup> part of the loop definition remains **true**

```
// Sum the numbers 1 to 10
double sum = 0;
for (double n = 1; n <= 10; n = n + 1)
{
    sum = sum + n;
}
```



The 3-part loop definition

- The three parts of the **for()** loop definition are:
  1. A statement to **declare the loop counter** variable
  2. A Boolean condition to define **how long** the loop should run
  3. An iterator statement to **adjust the loop counter** after each pass

## Lab 3 –Temperature Converter

- Fix the code to calculate the correct Celsius temperature for a given Fahrenheit temperature
- Display values between **-44°F** and **216°F** *inclusive*
- Your code should increment in steps of **4°F**
- The research question your scientists wants you to solve:

What is the **one temperate that is the same**  
in both Fahrenheit and Celsius?

# Lab 3 – Temperature Converter

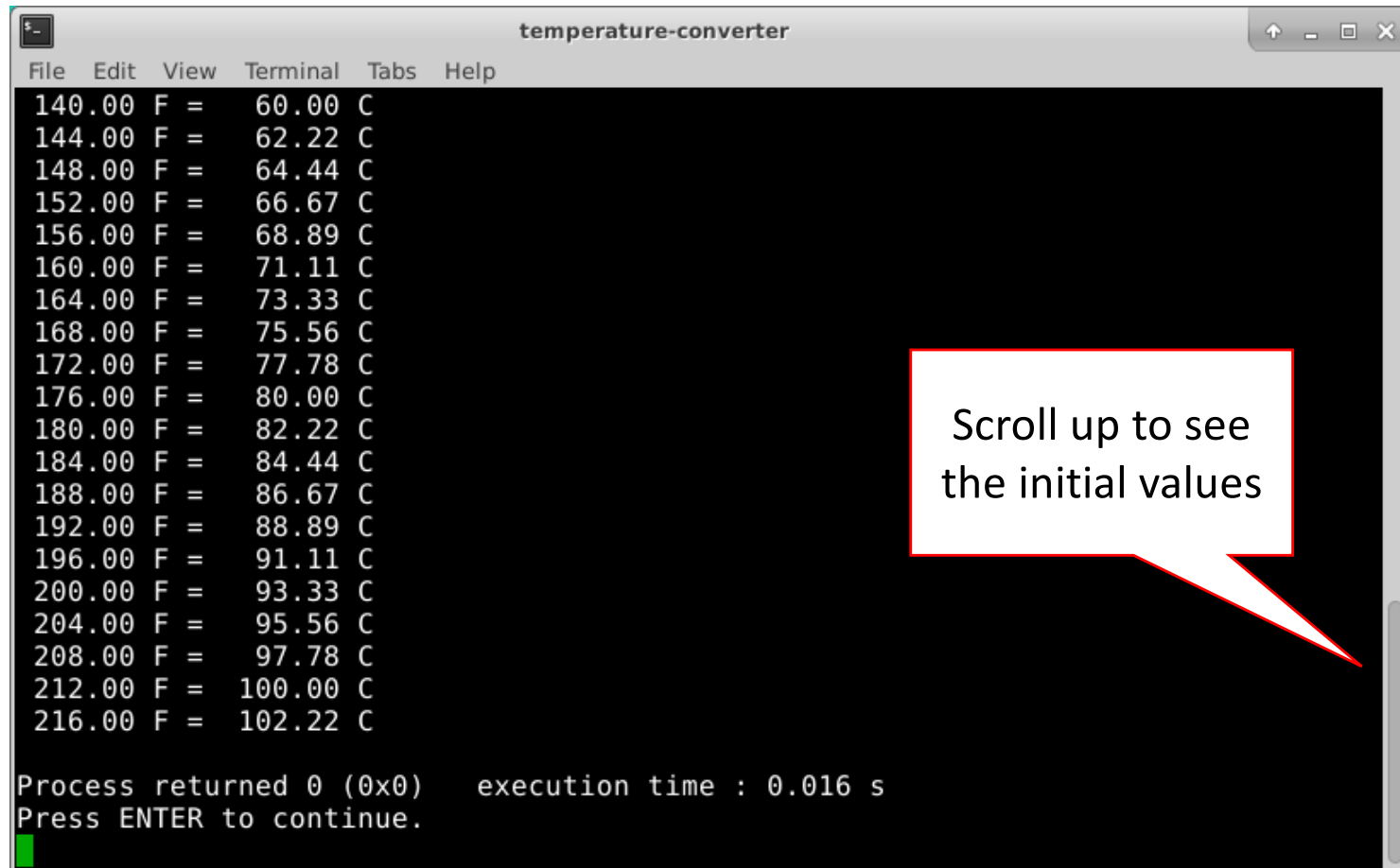
The screenshot shows a C++ IDE window titled "temperature-converter.cpp [temperature-converter] - Code::Blocks 16.01". The left sidebar shows a project tree with "Workspace", "temperature-c", "Sources", and "Headers". The main editor displays the following code:

```
1 // temperature-converter.cpp
2
3 #include "stdafx.h"
4
5 using namespace std;
6
7 int main()
8 {
9     cout.imbue(std::locale(""));
10    cout << fixed << setprecision(2);
11
12    for (double degF{ -44 }; degF <= 216; degF += 4) {
13
14        double degC = 0;
15
16        cout << setw(7) << right << degF << " F = "
17        << setw(7) << right << degC << " C"
18        << endl;
19    }
20    return 0;
21 }
```

Annotations with red boxes and arrows point to specific parts of the code:

- A box containing "Same as degF = 44" points to the initial value `-44` in the for loop.
- A box containing "Same as degF = degF + 4" points to the increment `degF += 4` in the for loop.
- A box containing "Set next column width" points to the `setw(7)` call on line 16.
- A box containing "Right justify next column" points to the `right` manipulator on line 16.

# Lab 3 – Temperature Converter



temperature-converter

File Edit View Terminal Tabs Help

|        |     |        |   |
|--------|-----|--------|---|
| 140.00 | F = | 60.00  | C |
| 144.00 | F = | 62.22  | C |
| 148.00 | F = | 64.44  | C |
| 152.00 | F = | 66.67  | C |
| 156.00 | F = | 68.89  | C |
| 160.00 | F = | 71.11  | C |
| 164.00 | F = | 73.33  | C |
| 168.00 | F = | 75.56  | C |
| 172.00 | F = | 77.78  | C |
| 176.00 | F = | 80.00  | C |
| 180.00 | F = | 82.22  | C |
| 184.00 | F = | 84.44  | C |
| 188.00 | F = | 86.67  | C |
| 192.00 | F = | 88.89  | C |
| 196.00 | F = | 91.11  | C |
| 200.00 | F = | 93.33  | C |
| 204.00 | F = | 95.56  | C |
| 208.00 | F = | 97.78  | C |
| 212.00 | F = | 100.00 | C |
| 216.00 | F = | 102.22 | C |

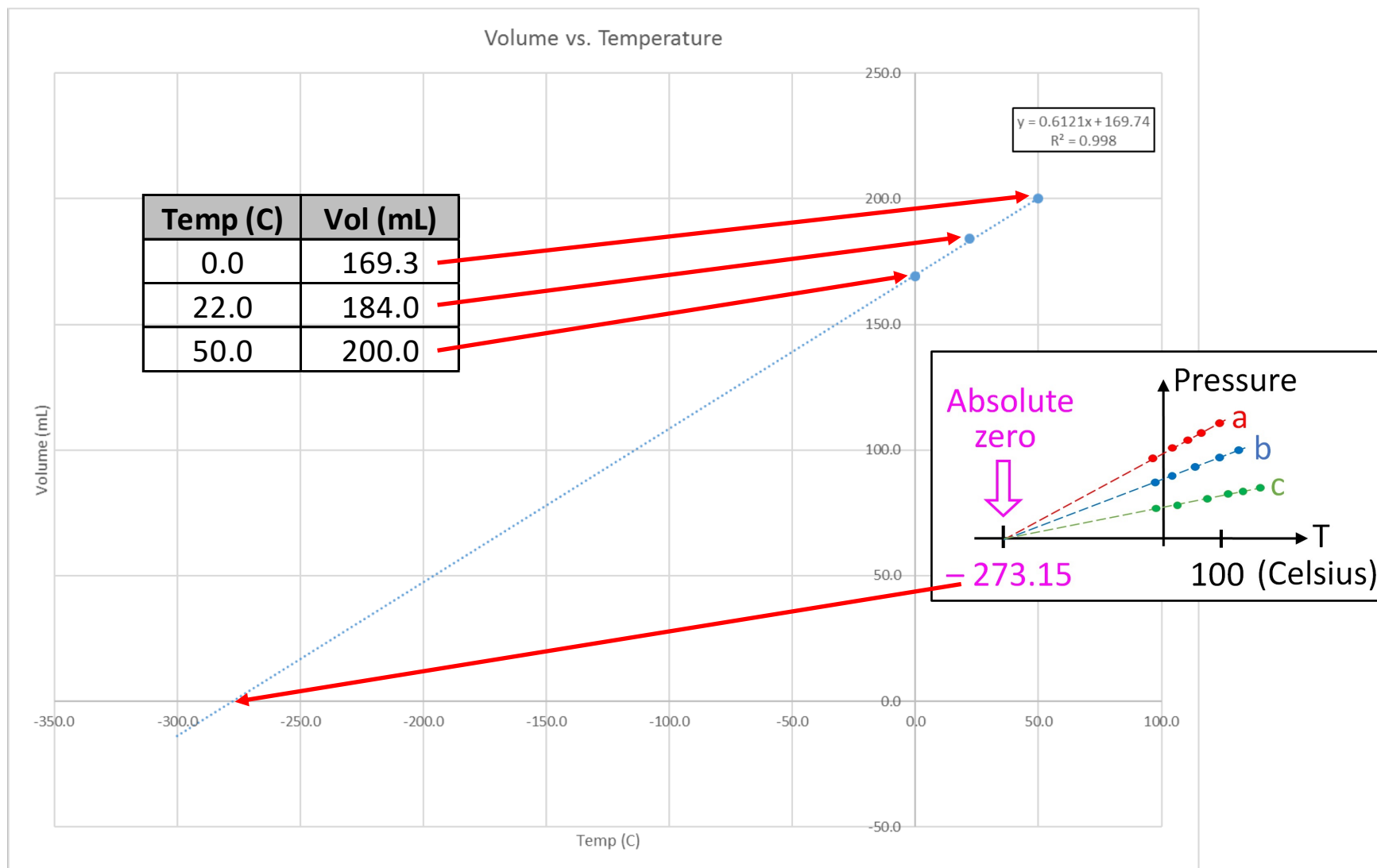
Process returned 0 (0x0)    execution time : 0.016 s  
Press ENTER to continue.

Scroll up to see the initial values

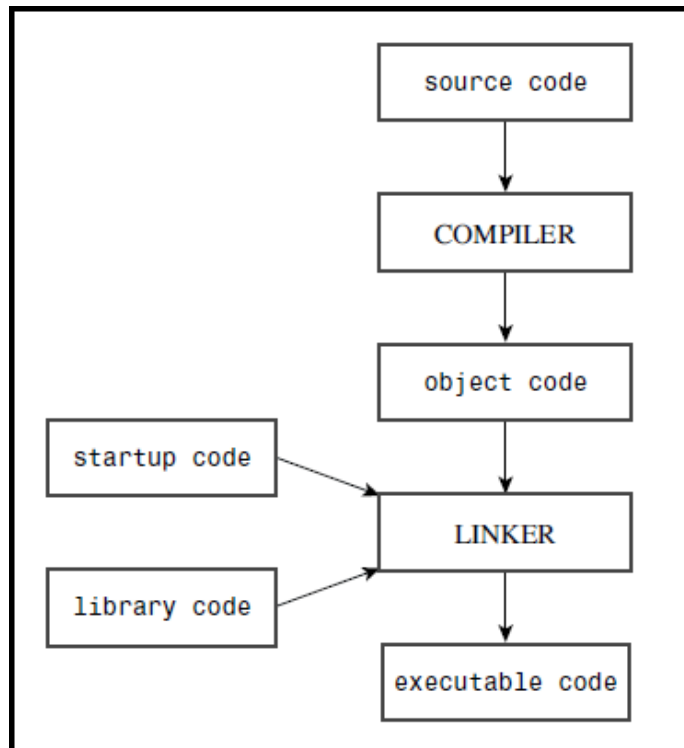
What is the **one temperate that is the same**  
in both Fahrenheit and Celsius?

# How did we calculate absolute zero in 1779?

( $PV = nRT$ )



# C++ Build Process



|      |  |
|------|--|
| .h   | header files - function declarations                     |
| .cpp | function definitions                                     |
| .obj | output of compiler                                       |
| .lib | output of linker - static library, embedded in final EXE |
| .dll | Windows shared object - dynamic link library             |
| .exe | Windows executable - final output of linker              |

| Header File Naming Conventions |                        |            |   |
|--------------------------------|------------------------|------------|---|
| Kind of Header                 | Convention             | Example    | Comments  |
| C++ old style                  | Ends in .h             | iostream.h | Usable by C++ programs  |
| C old style                    | Ends in .h             | math.h     | Usable by C and C++ programs  |
| C++ new style                  | No extension           | iostream   | Usable by C++ programs, uses namespace std                              |
| Converted C                    | c prefix, no extension | cmath      | Usable by C++ programs, might use non-C features, such as namespace std |

A header between <> brackets (preferred) adds symbols to the compiler's **std** namespace, not the user's global namespace like "header.h" will

## Now you know...

- How to build & run a C++ console (shell) application
- The C++ build process is two phase: **compiling** then **linking**

# Now you know...

- C++ intrinsic **data types**
- Declaring and defining variables
- Statements and scopes **{}**
- Operators & Precedence
- Assignment Operator
- How to write messages and variables to the console window
- **for()** loops
- $-40^{\circ} \text{ F} = -40^{\circ} \text{ C}$
- Absolute Zero =  $-273.15^{\circ} \text{ C}$