

**“AZƏRBAYCAN HAVA YOLLARI” CJSC NATIONAL AVIATION ACADEMY**

**Individual Work № 10:**

**Topic:Libraries in C/C++**

**Subject: System software and Operating systems-2**

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**C Standard library functions or simply C Library functions are inbuilt functions in C programming.**

The prototype and data definitions of these functions are present in their respective header files. To use these functions we need to include the header file in our program. For example,

If you want to use the printf() function, the header file <stdio.h> should be included.

*#include <stdio.h>*

*int main()*

*{*

*printf("Catch me if you can.");*

*}*

If you try to use printf() without including the stdio.h header file, you will get an error.

Advantages of Using C library functions

1. They work

One of the most important reasons you should use library functions is simply because they work. These functions have gone through multiple rigorous testing and are easy to use.

2. The functions are optimized for performance

Since, the functions are "standard library" functions, a dedicated group of developers constantly make them better. In the process, they are able to create the most efficient code optimized for maximum performance.

3. It saves considerable development time

Since the general functions like printing to a screen, calculating the square root, and many more are already written. You shouldn't worry about creating them once again.

4. The functions are portable

With ever-changing real-world needs, your application is expected to work every time, everywhere. And, these library functions help you in that they do the same thing on every computer.

Example: Square root using sqrt() function

Suppose, you want to find the square root of a number.

To compute the square root of a number, you can use the sqrt() library function. The function is defined in the math.h header file.

When you run the program, the output will be:

*#include <stdio.h>*

*#include <math.h>*

*int main()*

*{*

*float num, root;*

*printf("Enter a number: ");*

*scanf("%f", &num);*

*// Computes the square root of num and stores in root.*

*root = sqrt(num);*

*printf("Square root of %.2f = %.2f", num, root);*

*return 0;*

*}*

When you run the program, the output will be:

Enter a number: 12

Square root of 12.00 = 3.46

Library Functions in Different Header Files

| C Header Files | Description |
| --- | --- |
| <assert.h> | Program assertion functions |
| [<ctype.h>](https://www.programiz.com/c-programming/library-function/ctype.h" \o "<ctype.h> header file) | Character type functions |
| <locale.h> | Localization functions |
| [<math.h>](https://www.programiz.com/c-programming/library-function/math.h" \o "<math.h> header file) | Mathematics functions |
| <setjmp.h> | Jump functions |
| <signal.h> | Signal handling functions |
| <stdarg.h> | Variable arguments handling functions |
| <stdio.h> | Standard Input/Output functions |
| <stdlib.h> | Standard Utility functions |
| [<string.h>](https://www.programiz.com/c-programming/library-function/string.h" \o "C <string.h> header) | String handling functions |
| <time.h> | Date time functions |
|  |  |

# Standard C++ Library Header Files

The Standard C++ Library can be categorized as follows:

* The Language Support Library
* The Diagnostics Library
* The General Utilities Library
* The Standard String Templates
* Localization Classes and Templates
* The Containers, Iterators and Algorithms Libraries (the Standard Template Library)
* The Standard Numerics Library
* The Standard Input/Output Library
* C++ Headers for the Standard C Library
* C++ Headers added with TR1
* TR1 Headers for the Standard C Library

****The Language Support Library**** The Language Support Library defines types and functions that will be used implicitly by C++ programs that employ such C++ language features as operators new and delete, exception handling and runtime type information (RTTI).

|  |  |
| --- | --- |
| ****Standard C++ header**** | ****Equivalent in previous versions**** |
| [<exception>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_exception.html" \l "header_exception) | <stdexcept.h> |
| [<limits>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_limits.html" \l "header_limits) | no equivalent |
| [<new>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_new.html" \l "header_new) | <new.h> |
| [<typeinfo>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_typeinfo.html" \l "header_typeinfo) | <typeinfo.h> |

****The Diagnostics Library**** The Diagnostics Library is used to detect and report error conditions in C++ programs.

|  |  |
| --- | --- |
| ****Standard C++ header**** | ****Equivalent in previous versions**** |
| [<stdexcept>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_stdexcept.html" \l "header_stdexcept) | <stdexcept.h> |

****The General Utilities Library**** The General Utilities Library is used by other components of the Standard C++ Library, especially the Containers, Iterators and Algorithms Libraries (the Standard Template Library).

|  |  |
| --- | --- |
| ****Standard C++ header**** | ****Equivalent in previous versions**** |
| [<utility>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/stl_utility.html" \l "stl_utility) | no equivalent |
| [<functional>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/stl_functional.html" \l "stl_functional) | no equivalent |
| [<memory>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/stl_memory.html" \l "stl_memory) | no equivalent |

****The Standard String Templates**** The Strings Library is a facility for the manipulation of character sequences.

|  |  |
| --- | --- |
| ****Standard C++ header**** | ****Equivalent in previous versions**** |
| [<string>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_string.html" \l "header_string) | no equivalent |

****Localization Classes and Templates**** The Localization Library permits a C++ program to address the cultural differences of its various users.

|  |  |
| --- | --- |
| ****Standard C++ header**** | ****Equivalent in previous versions**** |
| [<locale>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_locale.html" \l "header_locale) | no equivalent |

****The Containers, Iterators and Algorithms Libraries (the Standard Template Library)**** The Standard Template Library (STL) is a facility for the management and manipulation of collections of objects.

|  |  |
| --- | --- |
| ****Standard C++ header**** | ****Equivalent in previous versions**** |
| [<algorithm>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/stl_algorithm.html" \l "stl_algorithm) | no equivalent |
| [<bitset>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_bitset.html" \l "header_bitset) | no equivalent |
| [<deque>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/stl_deque.html" \l "stl_deque) | no equivalent |
| [<iterator>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/stl_iterator.html" \l "stl_iterator) | no equivalent |
| [<list>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/stl_list.html" \l "stl_list) | no equivalent |
| [<map>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/stl_map.html" \l "stl_map) | no equivalent |
| [<queue>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/stl_set.html" \l "stl_set) | no equivalent |
| [<set>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/stl_set.html" \l "stl_set) | no equivalent |
| [<stack>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/stl_stack.html" \l "stl_stack) | no equivalent |
| [<unordered\_map>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/stl_unordered_map.html" \l "stl_unordered_map) | no equivalent |
| [<unordered set>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/stl_unordered_set.html" \l "stl_unordered_set) | no equivalent |
| [<vector>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/stl_vector.html" \l "stl_vector) | no equivalent |

****The Standard Numerics Library**** The Numerics Library is a facility for performing seminumerical operations.

Users who require library facilities for complex arithmetic but want to maintain compatibility with older compilers may use the compatibility complex numbers library whose types are defined in the non-standard header file <complex.h>. Although the header files <complex> and <complex.h> are similar in purpose, they are mutually incompatible.

|  |  |
| --- | --- |
| ****Standard C++ header**** | ****Equivalent in previous versions**** |
| [<complex>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_complex.html" \l "header_complex) | no equivalent |
| [<numeric>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/stl_numeric.html" \l "stl_numeric) | no equivalent |
| [<valarray>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_valarray.html" \l "header_valarray) | no equivalent |

****The Standard Input/Output Library**** The standard iostreams library differs from the compatibility iostreams in a number of important respects. To maintain compatibility between such a product and VisualAge® C++ Version 5.0 or greater, use instead the compatibility iostreams library.

|  |  |
| --- | --- |
| ****Standard C++ header**** | ****Equivalent in previous versions**** |
| [<fstream>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_fstream.html" \l "header_fstream) | no equivalent |
| [<iomanip>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_iomanip.html" \l "header_iomanip) | no equivalent |
| [<ios>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_ios.html" \l "header_ios) | no equivalent |
| [<iosfwd>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_iosfwd.html" \l "header_iosfwd) | no equivalent |
| [<iostream>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_iostream.html" \l "header_iostream) | no equivalent |
| [<istream>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_istream.html" \l "header_istream) | no equivalent |
| [<ostream>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_ostream.html" \l "header_ostream) | no equivalent |
| [<streambuf>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_streambuf.html" \l "header_streambuf) | no equivalent |
| [<sstream>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_sstream.html" \l "header_sstream) | no equivalent |
| [<strstream>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_strstream.html" \l "header_strstream) | no equivalent |

****C++ Headers for the Standard C Library**** The 1990 C International Standard specifies 18 headers which must be provided by a conforming hosted implementation. The name of each of these headers is of the form *name*.h. The C++ Standard Library includes the 1990 C Standard Library and, hence, includes these 18 headers. Additionally, for each of the 18 headers specified by the 1990 C International Standard, the C++ standard specifies a corresponding header that is functionally equivalent to its C library counterpart, but which locates all of the declarations that it contains within the std namespace. The name of each of these C++ headers is of the form c*name*, where *name* is the string that results when the “.h” extension is removed from the name of the equivalent C Standard Library header. For example, the header files <stdlib.h> and <cstdlib> are both provided by the C++ Standard Library and are equivalent in function, with the exception that all declarations in <cstdlib> are located within the std namespace.

|  |  |
| --- | --- |
| ****Standard C++ Header**** | ****Corresponding Standard C & C++ Header**** |
| [<cassert>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_cassert.html" \l "header_cassert) | <assert.h> |
| [<cctype>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_cctype.html" \l "header_cctype) | <ctype.h> |
| [<cerrno>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_cerrno.html" \l "header_cerrno) | <errno.h> |
| [<cfloat>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_cfloat.html" \l "header_cfloat) | <float.h> |
| [<ciso646>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_ciso646.html" \l "header_ciso646) | <iso646.h> |
| [<climits>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_climits.html" \l "header_climits) | <limits.h> |
| [<clocale>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_clocale.html" \l "header_clocale) | <locale.h> |
| [<cmath>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_cmath.html" \l "header_cmath) | <math.h> |
| [<csetjmp>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_csetjmp.html" \l "header_csetjmp) | <setjmp.h> |
| [<csignal>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_csignal.html" \l "header_csignal) | <signal.h> |
| [<cstdarg>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_cstdarg.html" \l "header_cstdarg) | <stdarg.h> |
| [<cstddef>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_cstddef.html" \l "header_cstddef) | <stddef.h> |
| [<cstdio>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_cstdio.html" \l "header_cstdio) | <stdio.h> |
| [<cstdlib>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_cstdlib.html" \l "header_cstdlib) | <stdlib.h> |
| [<cstring>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_cstring.html" \l "header_cstring) | <string.h> |
| [<ctime>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_ctime.html" \l "header_ctime) | <time.h> |
| [<cwchar>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_cwchar.html" \l "header_cwchar) | <wchar.h> |
| [<cwctype>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_cwctype.html" \l "header_cwctype) | <wctype.h> |

**C++ Headers added with TR1:** The following headers are added with TR1.

|  |
| --- |
| ****Standard C++ Header**** |
| [<array>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_array.html" \l "header_array) |
| [<random>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_random.html" \l "header_random) |
| [<regex>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_regex.html" \l "header_regex) |
| [<type\_traits>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_type_traits.html" \l "header_type_traits) |
| [<tuple>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_tuple.html" \l "header_tuple) |
| [<unordered\_map>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/stl_unordered_map.html" \l "stl_unordered_map) |
| [<unordered\_set>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/stl_unordered_set.html" \l "stl_unordered_set) |

****TR1 Headers for the Standard C Library**** In addition to the 18 headers that were introduced in the 1990 C International Standard, the 1999 C International Standard specifies new 5 headers which must be provided by a conforming hosted implementation. The name of each of these headers is of the form name.h. TR1 includes the 1999 C Standard Library and, hence, includes these 5 headers. Additionally, for each of the 5 headers specified by the 1999 C International Standard, the C++ standard specifies a corresponding header that is functionally equivalent to its C library counterpart, but which locates all of the declarations that it contains within the std namespace. The name of each of these C++ headers is of the form cname, where name is the string that results when the ".h" extension is removed from the name of the equivalent C Standard Library header. For example, the header files <fenv.h> and <cfenv> are both provided by TR1 and are equivalent in function, with the exception that all declarations in <cfenv> are located within the std namespace.

|  |  |
| --- | --- |
| **TR1 Header** | **Corresponding C & TR1 Header** |
| [<cfenv>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_cfenv.html" \l "header_cfenv) | <fenv.h> |
| [<cinttypes>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_cinttypes.html" \l "header_cinttypes) | <inttypes.h> |
| [<cstdbool>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_cstdbool.html" \l "header_cstdbool) | <stdbool.h> |
| [<cstdint>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_cstdint.html" \l "header_cstdint) | <stdint.h> |
| [<ctgmath>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_ctgmath.html" \l "header_ctgmath) | <tgmath.h> |

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* **[<algorithm>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/stl_algorithm.html)**
* **[<array>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_array.html)**
* **[<bitset>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_bitset.html)**
* **[<cassert>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_cassert.html)**
* **[<cctype>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_cctype.html)**
* **[<cerrno>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_cerrno.html)**
* **[<cfenv>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_cfenv.html)**
* **[<cfloat>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_cfloat.html)**
* **[<cinttypes>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_cinttypes.html)**
* **[<ciso646>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_ciso646.html)**
* **[<climits>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_climits.html)**
* **[<clocale>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_clocale.html)**
* **[<cmath>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_cmath.html)**
* **[<complex>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_complex.html)**
* **[<csetjmp>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_csetjmp.html)**
* **[<csignal>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_csignal.html)**
* **[<cstdarg>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_cstdarg.html)**
* **[<cstdbool>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_cstdbool.html)**
* **[<cstddef>](https://www.ibm.com/docs/en/SSGH3R_13.1.3/com.ibm.xlcpp1313.aix.doc/standlib/header_cstddef.html)**
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