



Casting and Type Conversion

.NET

C# is statically typed at compile time.
After a variable is declared, it cannot be declared again or assigned a value of another type unless that type is implicitly convertible to the variable's type.
Converting one type to another is called **type conversion**.

Casting and Type Conversion

<https://docs.microsoft.com/en-us/dotnet/csharp/programming-guide/types/casting-and-type-conversions>

There are 2 types of conversions in C#:

- Implicit conversions: No special syntax. Type safe. No data loss.
- Explicit conversions (casts): Explicit conversions require the cast operator, **()**. A **cast** is required when data might be lost in the conversion, or when failure could occur.

Implicit Conversion

<https://docs.microsoft.com/en-us/dotnet/csharp/programming-guide/types/casting-and-type-conversions#implicit-conversions>

Implicit conversion is possible in:

- **numeric** types when the value to be stored can fit into the variable memory without being truncated.
- **integral** types when the range of the source **type** is at least as big as the target **type**.

```
// Implicit conversion. A long can  
// hold any value an int can hold, and more!  
int num = 2147483647;  
long bigNum = num;
```

Implicit conversion is always possible in **reference** types.

- When a class is converted to any one of its direct or indirect **base** classes or **interfaces**.
- No special syntax is necessary.
- Derived classes always contain all the members of the base class.

```
Derived d = new Derived();  
Base b = d; // Always OK.
```

Base

| |
|-----------|
| <u>f1</u> |
| <u>v1</u> |



D

| | | |
|-----------|-----------|----------|
| <u>f1</u> | <u>f2</u> | <u>B</u> |
| <u>v1</u> | <u>v2</u> | |

$B1 = D$
 ~~$B1 = f2$~~

$D2 = (\text{Base})B1;$

$D = B1$

Explicit Conversion

<https://docs.microsoft.com/en-us/dotnet/csharp/programming-guide/types/casting-and-type-conversions#explicit-conversions>

If there is a risk of losing information, you must perform a **cast**.

Specify the target **type** in **()** in front of the value or variable to be converted.

*This doesn't prevent the loss of data.

An explicit **cast** is required if you need to convert from a **base** type to a **derived** type.

```
class Test
{
    static void Main()
    {
        double x = 1234.7;
        int a;
        // Cast double to int.
        a = (int)x;
        System.Console.WriteLine(a);
    }
}
// Output: 1234
```

```
// Create a new derived type.
Giraffe g = new Giraffe();

// Implicit conversion to base type is safe.
Animal a = g;

// Explicit conversion is required to cast back
// to derived type. Note: This will compile but will
// throw an exception at run time if the right-side
// object is not in fact a Giraffe.
Giraffe g2 = (Giraffe) a;
```

Type conversion run time exceptions

<https://docs.microsoft.com/en-us/dotnet/csharp/programming-guide/types/casting-and-type-conversions#type-conversion-exceptions-at-run-time>

In some *reference* type conversions,
It is possible for a **cast** operation
that compiles correctly to fail at run
time.

A **type cast** that fails at run time will
cause an **InvalidCastException** to be
thrown.

```
using System;

class Animal
{
    public void Eat() { Console.WriteLine("Eating."); }
    public override string ToString()
    {
        return "I am an animal.";
    }
}
class Reptile : Animal { }
class Mammal : Animal { }

class UnsafeCast
{
    static void Main()
    {
        Test(new Mammal());

        // Keep the console window open in debug mode.
        Console.WriteLine("Press any key to exit.");
        Console.ReadKey();
    }

    static void Test(Animal a)
    {
        // Cause InvalidCastException at run time
        // because Mammal is not convertible to Reptile.
        Reptile r = (Reptile)a;
    }
}
```


Type-testing and cast operators – *'is'* operator

<https://docs.microsoft.com/en-us/dotnet/csharp/language-reference/operators/type-testing-and-cast#typeof-operator>

The *is* operator checks if the runtime *type* of an expression result is compatible with a given *type*.

`E is T` returns *true* if E is non-null and can be converted to *type* T by a *reference*, a *boxing*, or an *unboxing* conversion.

```
public class Base { }

public class Derived : Base { }

public static class IsOperatorExample
{
    public static void Main()
    {
        object b = new Base();
        Console.WriteLine(b is Base); // output: True
        Console.WriteLine(b is Derived); // output: False

        object d = new Derived();
        Console.WriteLine(d is Base); // output: True
        Console.WriteLine(d is Derived); // output: True
    }
}
```


Type-testing and cast operators – *'is'* operator

<https://docs.microsoft.com/en-us/dotnet/csharp/language-reference/operators/type-testing-and-cast#typeof-operator>

The *is* operator takes into account *boxing* and *unboxing* conversions but doesn't consider numeric conversions.

```
int i = 27;
Console.WriteLine(i is System.IFormattable); // output: True

object iBoxed = i;
Console.WriteLine(iBoxed is int); // output: True
Console.WriteLine(iBoxed is long); // output: False
```

Type-testing and cast operators – '*as*' operator

<https://docs.microsoft.com/en-us/dotnet/csharp/language-reference/operators/type-testing-and-cast#as-operator>

The **as** operator explicitly converts the result of an expression to a given reference or *nullable* value type. If the conversion is not possible, the **as** operator returns **null**. Unlike the **cast** operator **()**, the **as** operator never throws an exception.

`E as T`

produces the same result as

`E is T ? (T)(E) : (T)null`

The **as** operator considers only *reference*, *nullable*, *boxing*, and *unboxing* conversions.

You cannot use the **as** operator to perform a user-defined conversion. To do that, use the **cast** operator **()**.

typeof

<https://docs.microsoft.com/en-us/dotnet/csharp/language-reference/operators/type-testing-and-cast#typeof-operator>

The **typeof** operator obtains the **System.Type** instance *type*. The argument to the **typeof** operator must be the name of a *type* or a *type parameter*.

```
void PrintType<T>() => Console.WriteLine(typeof(T));

Console.WriteLine(typeof(List<string>));
PrintType<int>();
PrintType<System.Int32>();
PrintType<Dictionary<int, char>>();
// Output:
// System.Collections.Generic.List`1[System.String]
// System.Int32
// System.Int32
// System.Collections.Generic.Dictionary`2[System.Int32,System.Char]
```

typeof Operator

<https://docs.microsoft.com/en-us/dotnet/csharp/language-reference/operators/type-testing-and-cast#typeof-operator>

- An expression cannot be an argument of the **typeof** operator. To get the System.Type instance for the runtime **type** of an expression result, use **Object.GetType()**.
- Use the **typeof** operator to check if the runtime **type** of the expression result exactly matches a given **type**.

```
public class Animal { }

public class Giraffe : Animal { }

public static class TypeOfExample
{
    public static void Main()
    {
        object b = new Giraffe();
        Console.WriteLine(b is Animal); // output: True
        Console.WriteLine(b.GetType() == typeof(Animal)); // output: False

        Console.WriteLine(b is Giraffe); // output: True
        Console.WriteLine(b.GetType() == typeof(Giraffe)); // output: True
    }
}
```

This example demonstrates the difference between type checking performed with the **typeof** operator and the **is** operator.