

Typecasting in Java (Beginner to Advanced)

1. Introduction to Typecasting

Typecasting is converting a variable of one data type into another.

Java has:

- Primitive Typecasting
- Reference (Object) Typecasting

2. Primitive Typecasting

Two Types:

a) Widening (Implicit) Casting

Converts a smaller type to a larger type (automatic).

Example:

```
int a = 10;  
double b = a;
```

b) Narrowing (Explicit) Casting

Converts a larger type to a smaller type (you must do it manually).

Example:

```
double x = 9.78;  
int y = (int) x;
```

3. Practical Examples of Primitive Casting

Byte to Int and Int to Byte

```
byte b = 100;  
int i = b;  
byte b2 = (byte) i;
```

Overflow Example

```
int a = 130;  
byte b = (byte) a; // Output: -126
```

4. Typecasting with Expressions

Example:

```
int x = 10;  
int y = 3;  
float result = (float) x / y; // 3.3333333
```

5. Reference (Object) Typecasting (OOP)

a) Upcasting (Widening)

Child -> Parent (automatic)
Animal a = new Dog();

b) Downcasting (Narrowing)

Parent -> Child (explicit)
Dog d = (Dog) a;

Be careful with downcasting! Use instanceof:

```
if (a instanceof Dog) {  
    Dog d = (Dog) a;  
}
```

6. Typecasting with Interfaces

Example:

```
interface Animal {}  
class Dog implements Animal {}  
Animal a = new Dog();  
Dog d = (Dog) a;
```

7. Wrapper Classes and Autoboxing

Example:

```
int a = 10;  
Integer obj = a; // Autoboxing  
int b = obj;    // Unboxing
```

8. Casting in Collections (Generics)

Example:

```
List list = new ArrayList();  
list.add("hello");
```

```
String s = (String) list.get(0);
```

9. Practice Exercises

1. Convert a double to int, and observe rounding.
2. Cast between different primitive types in an expression.
3. Create a class hierarchy and perform upcasting and downcasting safely.
4. Try instanceof checks before downcasting.
5. Experiment with wrapper classes and collections.

10. Mini Project Ideas

- Animal Simulation using polymorphism and casting.
- Calculator with mixed data types (float, int, double).
- Type Detection Tool using instanceof and reflection.

11. Resources to Learn More

- [Oracle Docs](https://docs.oracle.com/javase/tutorial/java/nutsandbolts/datatypes.html) on Typecasting:
<https://docs.oracle.com/javase/tutorial/java/nutsandbolts/datatypes.html>
- Book: "Effective Java" by Joshua Bloch
- Java tutorials on YouTube (e.g., Telusko, CodeWithHarry, Java Brains)