



2: More types, Methods, Conditionals

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- Lecture I Review
- More types
- Methods
- Conditionals

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Kinds of values that can be stored and manipulated.

boolean: Truth value (**true** or **false**).

int: Integer (0, 1, -47).

double: Real number (3.14, 1.0, -2.1).

String: Text (“hello”, “example”).

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Named location that stores a value

Example:

```
String a = "a";
```

```
String b = "letter b";
```

```
a = "letter a";
```

```
String c = a + " and " + b;
```

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Symbols that perform simple computations

- Assignment: =
- Addition: +
- Subtraction: -
- Multiplication: *
- Division: /

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```
class GravityCalculator {
    public static void main(String[] args) {
        double gravity = -9.81;
        double initialVelocity = 0.0;
        double fallingTime = 10.0;
        double initialPosition = 0.0;
        double finalPosition = .5 * gravity * fallingTime *
            fallingTime;
        finalPosition = finalPosition +
            initialVelocity * fallingTime;
        finalPosition = finalPosition + initialPosition;
        System.out.println("An object's position after " +
            fallingTime + " seconds is " +
            finalPosition);
    }
}
```

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```
double finalPosition = .5 * gravity * fallingTime *  
                        fallingTime;  
finalPosition = finalPosition + initialVelocity  
                        * fallingTime;  
finalPosition = finalPosition + initialPosition;
```

OR

```
double finalPosition = .5 * gravity * fallingTime *  
                        fallingTime;  
finalPosition = finalPosition + initialVelocity
```

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Questions from last lecture?

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Division (“/”) operates differently on integers and on doubles!

Example:

```
double a = 5.0/2.0; // a = 2.5
```

```
int b = 4/2; // b = 2
```

```
int c = 5/2; // c = 2
```

```
double d = 5/2; // d = 2.0
```

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Precedence like math, left to right

Right hand side of = evaluated first

Parenthesis increase precedence

```
double x = 3 / 2 + 1; // x = 2.0
```

```
double y = 3 / (2 + 1); // y = 1.0
```

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Java verifies that types always match

```
String five = 5; // ERROR!
```

```
./Root/Main.java:8: error: incompatible types: int cannot be converted to String
    String five = 5;
                  ^
1 error
```



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What is a casting?

- Taking an Object of one particular type and “turning it into” another Object type.

```
int a = 2;           // a = 2
double a = 2;       // a = 2.0 Implicit

int a = 18.7;       // ERROR
int a = (int)18,7;  // a = 18

double a = 2/3;     // a = 0.0
double a = (double)2/3; // a = 0.666 ...

double d = 5.25;
```

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```
double i = d;           // i = 5.0 (Implicit) UPCAST
```

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Java Methods

- A collection of statements that are grouped together to perform an operation.
 - `System.out.println()` →
 - The system actually executes several statements in order to display a message on the console.
- The only required elements of a method declaration are the method's return type, name, a pair of parentheses, (), and a body between braces, {}.

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Parts

```
class Main {  
    public static void main (String[] arguments)  
    {  
        System.out.println("Hello World");  
    }  
}
```

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Method declarations have six components:

- Modifiers.
- The return type (or void).
- The method name.
- The parameter list in parenthesis.
- An exception list.
- The method body, enclosed between braces.

```
class Main {  
    public static void main(String[] arguments)
```



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```
public static void NAME() {  
    STATEMENTS  
}
```

To call a method:

```
NAME ();
```



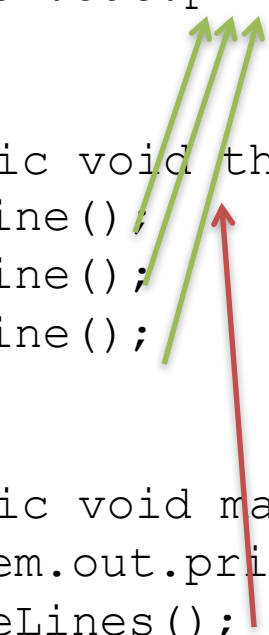
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```
class NewLine {
    public static void newLine() {
        System.out.println("");
    }

    public static void threeLines() {
        newLine();
        newLine();
        newLine();
    }

    public static void main(String[] arguments) {
        System.out.println("Line 1");
        threeLines();
    }
}
```



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```
public static void NAME (TYPE NAME) {  
    STATEMENTS  
}
```

To call:

```
NAME (EXPRESSION) ;
```



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```
class Square {
    public static void printSquare(int x) {
        System.out.println(x*x);
    }

    public static void main(String[] arguments) {
        int value = 2;
        printSquare(value);
        printSquare(3);
        printSquare(value*2);
    }
}
```

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What's wrong here?

```
class Square {  
    public static void printSquare(int x) {  
        System.out.println(x*x);  
    }  
  
    public static void main(String[] arguments) {  
        printSquare("hello");  
        printSquare(5.5);  
    }  
}
```

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What's wrong here?

```
class Square {  
    public static void printSquare(double x) {  
        System.out.println(x*x);  
    }  
  
    public static void main(String[] arguments) {  
        printSquare(5);  
    }  
}
```

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```
[...] NAME (TYPE NAME, TYPE NAME) {  
    STATEMENTS  
}
```

To call:

```
NAME (arg1, arg2);
```



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```
class Multiply {
    public static void times (double a, double b) {
        System.out.println(a * b);
    }

    public static void main(String[] arguments) {
        times (2, 2);
        times (3, 4);
    }
}
```

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```
public static TYPE NAME () {  
  
    STATEMENTS  
  
    return EXPRESSION;  
  
}
```

void means “no returned value”

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```
class Square3 {
    public static void printSquare(double x) {
        System.out.println(x*x);
    }
    public static void main(String[] arguments) {
        printSquare(5);
    }
}
```

```
class Square4 {
    public static double square(double x) {
        return x*x;
    }
    public static void main(String[] arguments) {
```

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Variables live in the block ({}) where they are defined (**scope**)

- Scope starts where the variable is declared
- ... and ends with the block where it was declared
- (the variable lives within the block)

Method parameters are like defining a new variable in the method



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```
class SquareChange {
    public static void printSquare(int x) {
        System.out.println("printSquare x = " + x);
        x = x * x;
        System.out.println("printSquare x = " + x);
    }

    public static void main(String[] arguments) {
        int x = 5;
        System.out.println("main x = " + x);
        printSquare(x);
        System.out.println("main x = " + x);
    }
}
```

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```
class Scope {
    public static void main(String[] arguments) {
        int x = 5;
        if (x == 5) {
            int x = 6;
            int y = 72;
            System.out.println("x = " + x + "
                               y = " + y);
        }
    }
    System.out.println("x = " + x + " y = " + y);
}
```

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Methods as the way of encapsulating functionality

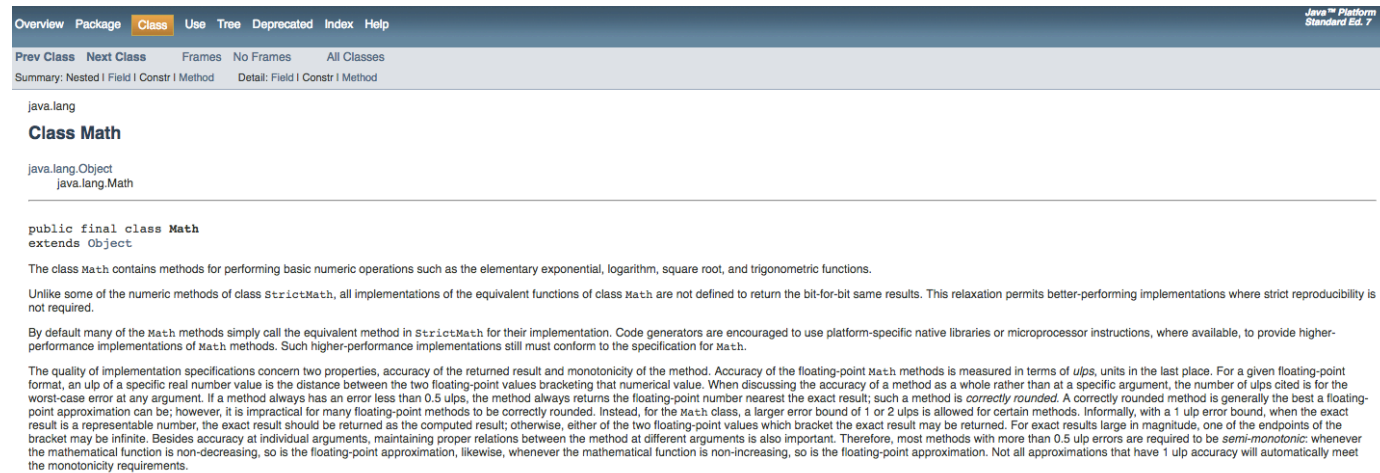
- Big programs are built out of small methods
- Methods can be individually developed, tested and reused
- User of method does not need to know how it works
 - Black box operations
- In Computer Science, this is called “abstraction”

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Encapsulated
functionality that we
can use without
having to master
inner details



The screenshot shows the Java Platform Standard Ed. 7 documentation for the `Math` class. It includes navigation tabs (Overview, Package, Class, Use, Tree, Deprecated, Index, Help), a breadcrumb trail (Summary: Nested | Field | Constr | Method | Detail: Field | Constr | Method), and the class declaration: `public final class Math extends Object`. The text below the declaration explains that the `Math` class contains methods for performing basic numeric operations and that its methods are implemented by calling equivalent methods in `StrictMath`. It also discusses the accuracy of floating-point methods in terms of *ulps* (units in the last place) and the importance of maintaining proper relations between the method at different arguments.

```
public class Main {  
    public static void main(String[] arguments) {  
        int x = 90;  
        Math.sin(x);  
        Math.cos(Math.PI / 2);  
        Math.pow(2, 3);  
    }  
}
```

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```
if (CONDITION) {
```

```
STATEMENTS
```

```
/* statements performed  
when the boolean expression  
results true */
```

¹
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```
public static void test(int x) {  
    if (x > 5) {  
        System.out.println(x + " is > 5");  
    }  
}  
  
public static void main(String[] arguments) {  
    test(6);  
    test(5);  
    test(4);  
}
```

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$x > y$: x is greater than y

$x < y$: x is less than y

$x \geq y$: x is greater than or equal to x

$x \leq y$: x is less than or equal to y

$x == y$: x equals y

(equality: `==`, assignment: `=`)

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`&&`: logical AND

`||`: logical OR

```
if (x > 6) {  
    if (x < 9) {  
        ...  
    }  
}
```

→ ...

```
if ( x > 6 && x < 9) {  
    ...  
}
```

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```
if (CONDITION) {
```

```
STATEMENTS
```

```
} else {
```

```
STATEMENTS
```

```
/* performed when CONDITION is  
not true */
```

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```
public static void test(int x) {  
    if (x > 5) {  
        System.out.println(x + " is > 5");  
    } else {  
        System.out.println(x + " is not > 5");  
    }  
}  
  
public static void main(String[] arguments) {  
    test(6);  
    test(5);  
}
```

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```
if (CONDITION) {  
    STATEMENTS  
} else if (CONDITION) {  
    STATEMENTS  
} else if (CONDITION) {  
    STATEMENTS  
} else {  
    STATEMENTS
```

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```
public static void test(int x) {  
    if (x > 5) {  
        System.out.println(x + " is > 5");  
    } else if (x == 5) {  
        System.out.println(x + " equals 5");  
    } else {  
        System.out.println(x + " is < 5");  
    }  
}  
  
public static void main(String[] arguments) {  
    test(6);  
    test(5);  
}
```

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