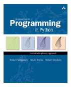
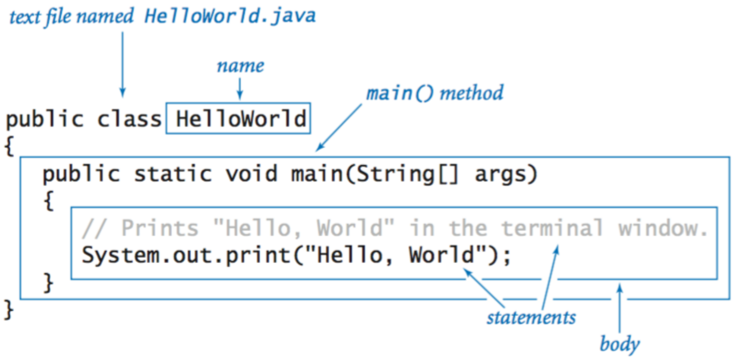
Related Booksites



Java Programming Cheatsheet

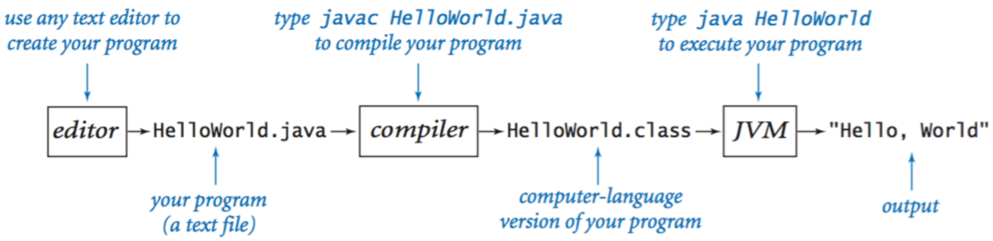
We summarize the most commonly used Java language features and APIs in the textbook.

Hello, World.

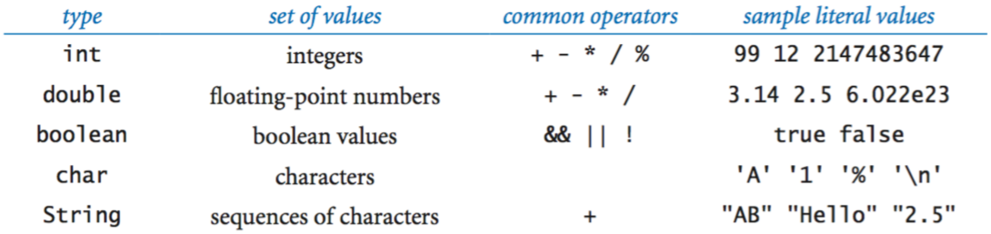


```
public class HelloWorld
{
   public static void main(String[] args)
   {
      // Prints "Hello, World" in the terminal window.
      System.out.print("Hello, World");
   }
}
```

Editing, compiling, and executing.

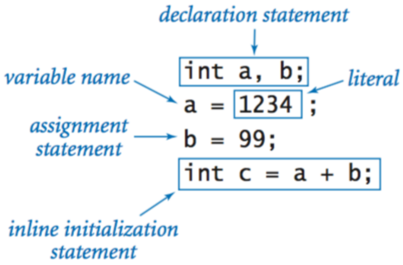

use any text editor to create your program
type javac HelloWorld.java to compile your program
type java HelloWorld to execute your program
editor
HelloWorld.java
compiler
HelloWorld.class
JVM
"Hello, World"
your program (a text file)
computer-language version of your program
output

Built-in data types.



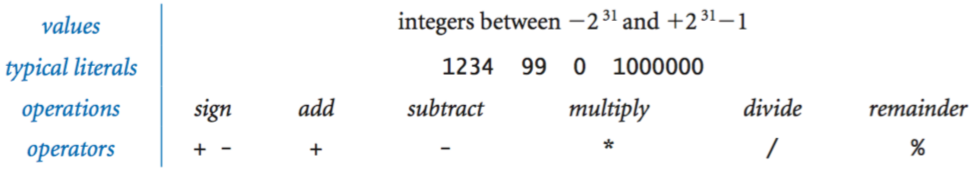
type	*set of values*	*common operators*	*sample literal values*
`int`	integers	`+ - * / %`	`99 12 2147483647`
`double`	floating-point numbers	`+ - * /`	`3.14 2.5 6.022e23`
`boolean`	boolean values	`&& || !`	`true false`
`char`	characters		`'A' '1' '%' '\n'`
`String`	sequences of characters	`+`	`"AB" "Hello" "2.5"`

Declaration and assignment statements.

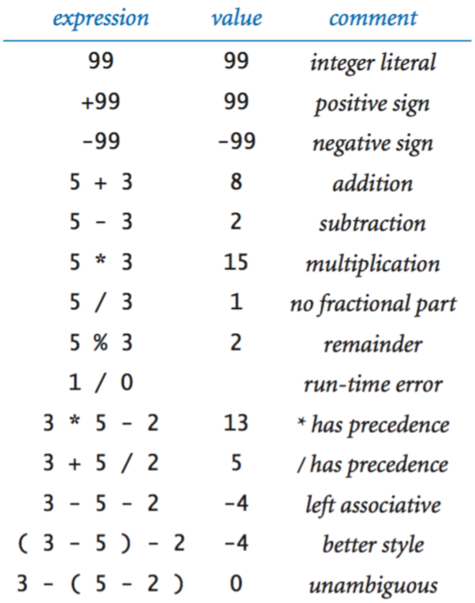


```
int a, b;
a = 1234 ;
b = 99;
int c = a + b;
```

Integers.

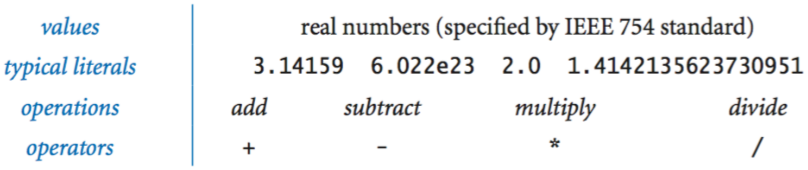


values	integers between -2^{31} and $+2^{31}-1$					
typical literals	`1234 99 0 1000000`					
operations	*sign*	*add*	*subtract*	*multiply*	*divide*	*remainder*
operators	`+ -`	`+`	`-`	`*`	`/`	`%`

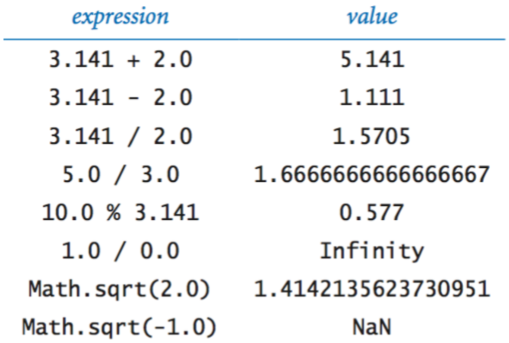


expression	*value*	*comment*
`99`	`99`	*integer literal*
`+99`	`99`	*positive sign*
`-99`	`-99`	*negative sign*
`5 + 3`	`8`	*addition*
`5 - 3`	`2`	*subtraction*
`5 * 3`	`15`	*multiplication*
`5 / 3`	`1`	*no fractional part*
`5 % 3`	`2`	*remainder*
`1 / 0`		*run-time error*
`3 * 5 - 2`	`13`	** has precedence*
`3 + 5 / 2`	`5`	*/ has precedence*
`3 - 5 - 2`	`-4`	*left associative*
`( 3 - 5 ) - 2`	`-4`	*better style*
`3 - ( 5 - 2 )`	`0`	*unambiguous*

Floating-point numbers.

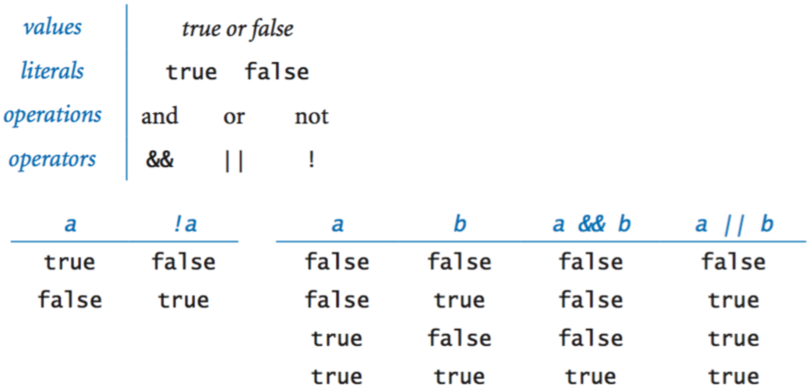


values	real numbers (specified by IEEE 754 standard)			
typical literals	`3.14159 6.022e23 2.0 1.4142135623730951`			
operations	*add*	*subtract*	*multiply*	*divide*
operators	`+`	`-`	`*`	`/`



expression	*value*
`3.141 + 2.0`	`5.141`
`3.141 - 2.0`	`1.111`
`3.141 / 2.0`	`1.5705`
`5.0 / 3.0`	`1.6666666666666667`
`10.0 % 3.141`	`0.577`
`1.0 / 0.0`	`Infinity`
`Math.sqrt(2.0)`	`1.4142135623730951`
`Math.sqrt(-1.0)`	`NaN`

Booleans.

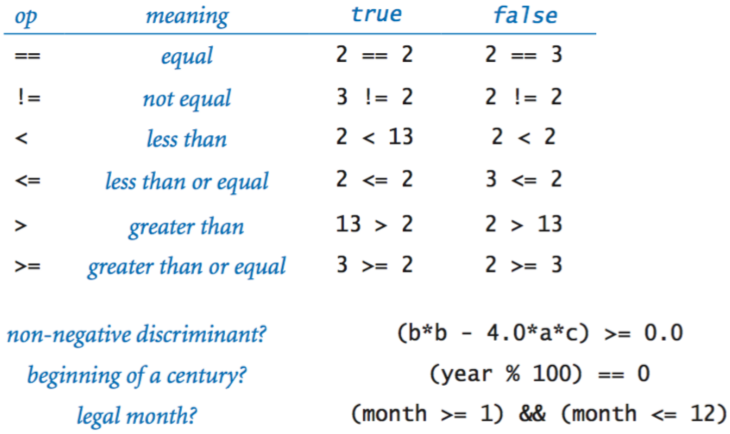


values	*true or false*		
literals	`true`	`false`	
operations	and	or	not
operators	&&	||	!

a	*!a*
`true`	`false`
`false`	`true`

a	*b*	*a && b*	*a || b*
`false`	`false`	`false`	`false`
`false`	`true`	`false`	`true`
`true`	`false`	`false`	`true`
`true`	`true`	`true`	`true`

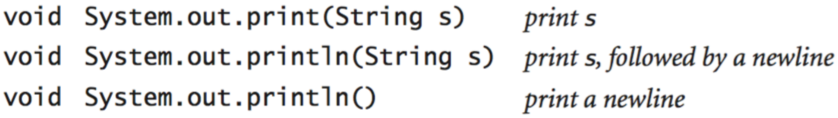
Comparison operators.



op	*meaning*	`true`	`false`
`==`	*equal*	`2 == 2`	`2 == 3`
`!=`	*not equal*	`3 != 2`	`2 != 2`
`<`	*less than*	`2 < 13`	`2 < 2`
`<=`	*less than or equal*	`2 <= 2`	`3 <= 2`
`>`	*greater than*	`13 > 2`	`2 > 13`
`>=`	*greater than or equal*	`3 >= 2`	`2 >= 3`

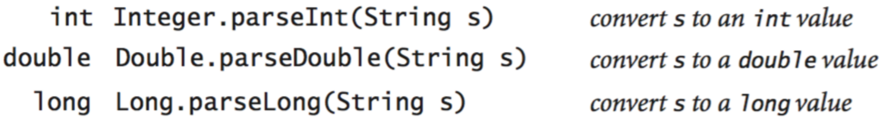
non-negative discriminant?	`(b*b - 4.0*a*c) >= 0.0`
beginning of a century?	`(year % 100) == 0`
legal month?	`(month >= 1) && (month <= 12)`

Printing.



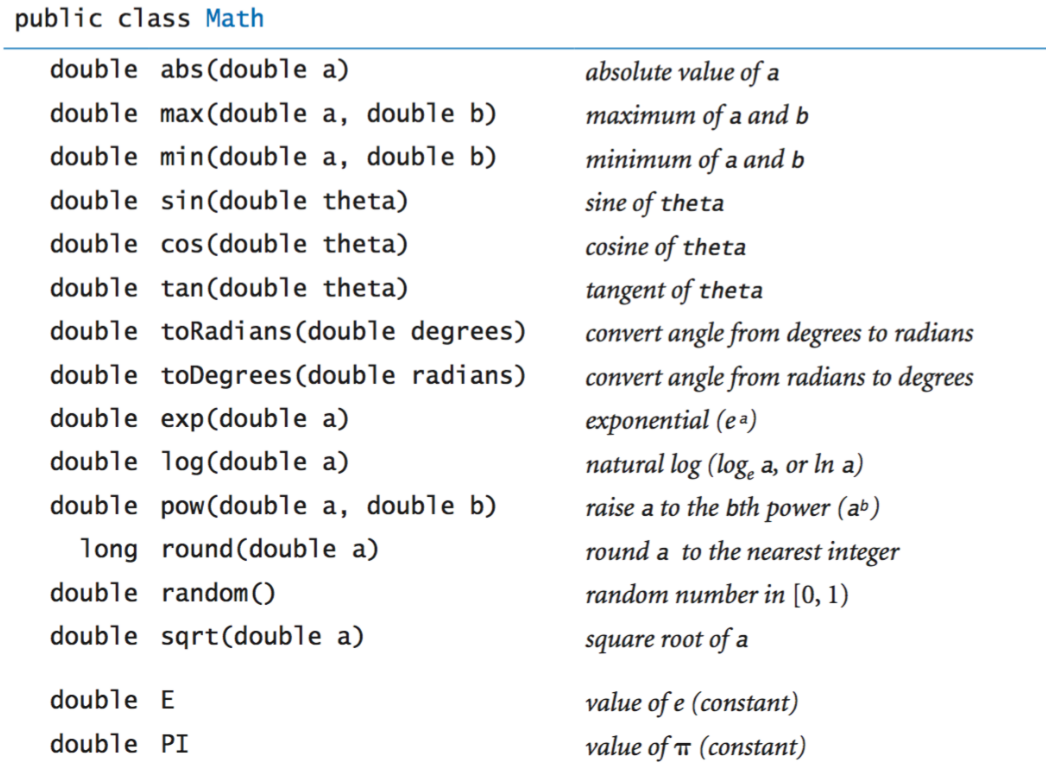
`void`	`System.out.print(String s)`	*print s*
`void`	`System.out.println(String s)`	*print s, followed by a newline*
`void`	`System.out.println()`	*print a newline*

Parsing command-line arguments.



`int`	`Integer.parseInt(String s)`	*convert s to an `int` value*
`double`	`Double.parseDouble(String s)`	*convert s to a `double` value*
`long`	`Long.parseLong(String s)`	*convert s to a `long` value*

Math library.

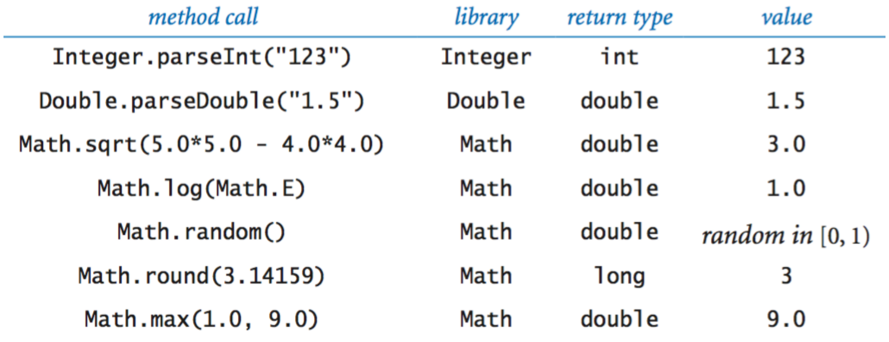


public class Math

double abs(double a)	*absolute value of* a
double max(double a, double b)	*maximum of* a *and* b
double min(double a, double b)	*minimum of* a *and* b
double sin(double theta)	*sine of* theta
double cos(double theta)	*cosine of* theta
double tan(double theta)	*tangent of* theta
double toRadians(double degrees)	*convert angle from degrees to radians*
double toDegrees(double radians)	*convert angle from radians to degrees*
double exp(double a)	*exponential* (e^a)
double log(double a)	*natural log* ($\log_e a$, *or* $\ln a$)
double pow(double a, double b)	*raise* a *to the* b*th power* (a^b)
long round(double a)	*round* a *to the nearest integer*
double random()	*random number in* [0, 1)
double sqrt(double a)	*square root of* a
double E	*value of* e *(constant)*
double PI	*value of* π *(constant)*

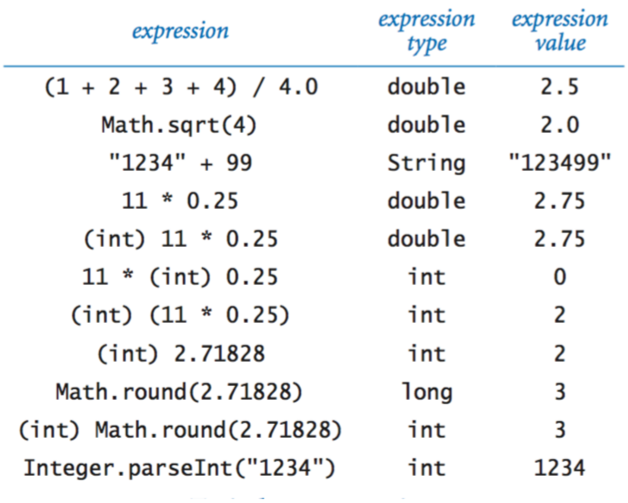
The full java.lang.Math API.

Java library calls.



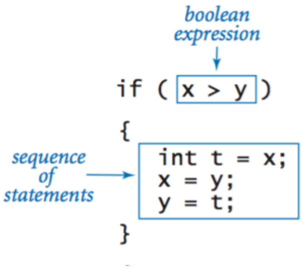
method call	*library*	*return type*	*value*
Integer.parseInt("123")	Integer	int	123
Double.parseDouble("1.5")	Double	double	1.5
Math.sqrt(5.0*5.0 - 4.0*4.0)	Math	double	3.0
Math.log(Math.E)	Math	double	1.0
Math.random()	Math	double	*random in* [0, 1)
Math.round(3.14159)	Math	long	3
Math.max(1.0, 9.0)	Math	double	9.0

Type conversion.



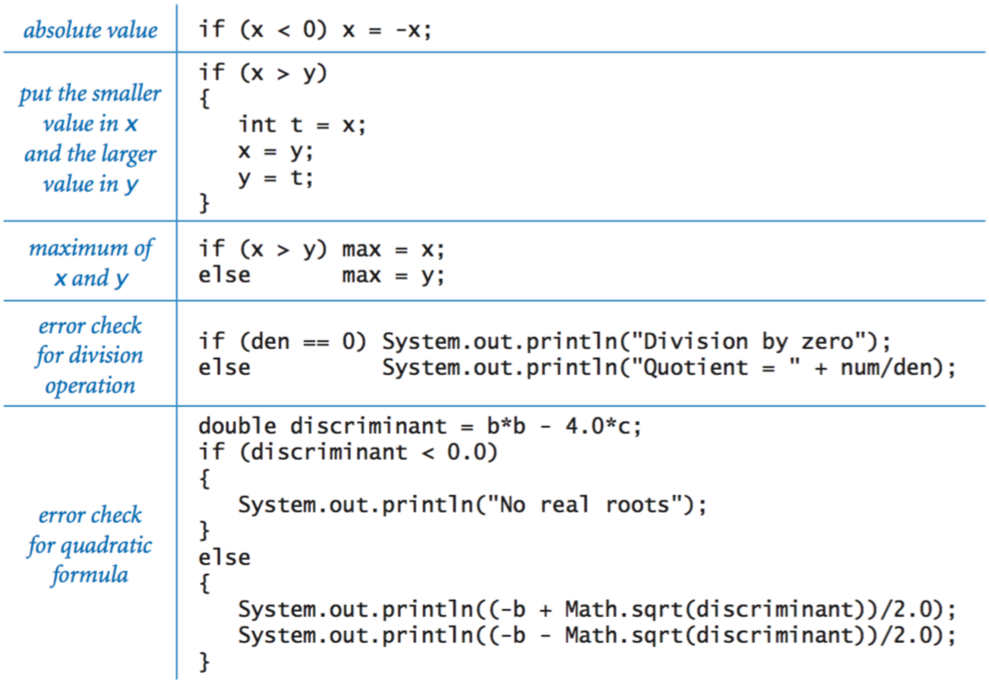
expression	*expression type*	*expression value*
(1 + 2 + 3 + 4) / 4.0	double	2.5
Math.sqrt(4)	double	2.0
"1234" + 99	String	"123499"
11 * 0.25	double	2.75
(int) 11 * 0.25	double	2.75
11 * (int) 0.25	int	0
(int) (11 * 0.25)	int	2
(int) 2.71828	int	2
Math.round(2.71828)	long	3
(int) Math.round(2.71828)	int	3
Integer.parseInt("1234")	int	1234

Anatomy of an if statement.



```
if ( x > y )
{
   int t = x;
   x = y;
   y = t;
}
```

If and if-else statements.



absolute value	`if (x < 0) x = -x;`

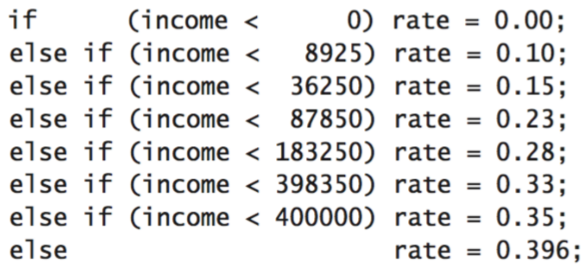
put the smaller value in x and the larger value in y	`if (x > y)`
	`{`
	`   int t = x;`
	`   x = y;`
	`   y = t;`
	`}`

maximum of x and y	`if (x > y) max = x;`
	`else       max = y;`

error check for division operation	`if (den == 0) System.out.println("Division by zero");`
	`else          System.out.println("Quotient = " + num/den);`

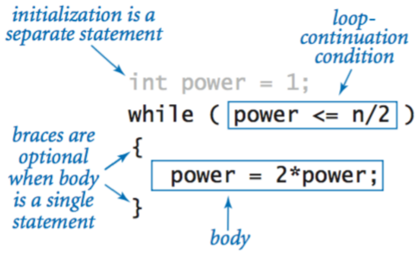
error check for quadratic formula	`double discriminant = b*b - 4.0*c;`
	`if (discriminant < 0.0)`
	`{`
	`   System.out.println("No real roots");`
	`}`
	`else`
	`{`
	`   System.out.println((-b + Math.sqrt(discriminant))/2.0);`
	`   System.out.println((-b - Math.sqrt(discriminant))/2.0);`
	`}`

Nested if-else statement.



```
if      (income <      0) rate = 0.00;
else if (income <   8925) rate = 0.10;
else if (income <  36250) rate = 0.15;
else if (income <  87850) rate = 0.23;
else if (income < 183250) rate = 0.28;
else if (income < 398350) rate = 0.33;
else if (income < 400000) rate = 0.35;
else                      rate = 0.396;
```

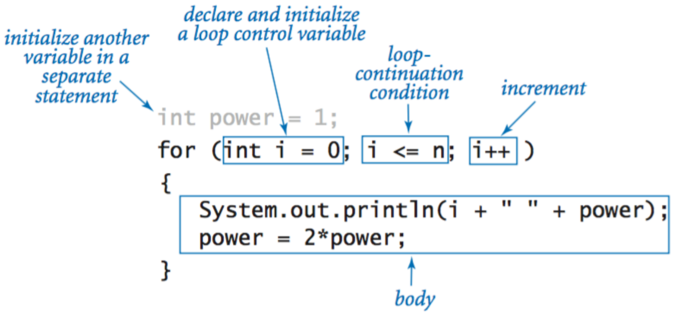
Anatomy of a while loop.



```
int power = 1;
while ( power <= n/2 )
{
   power = 2*power;
}
```

initialization is a separate statement
loop-continuation condition
braces are optional when body is a single statement
body

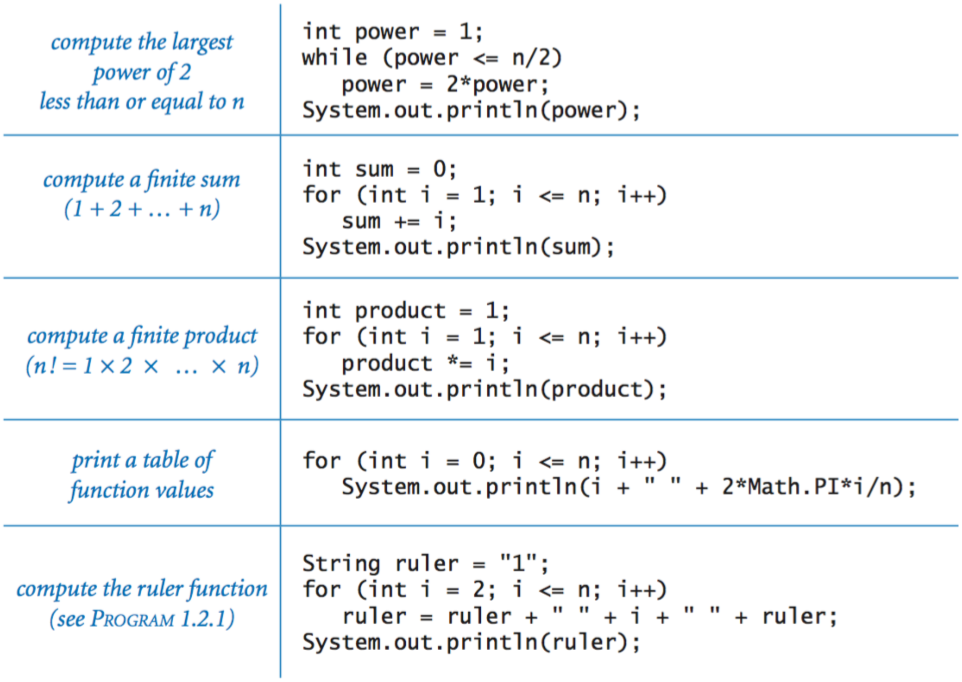
Anatomy of a for loop.



```
int power = 1;
for (int i = 0; i <= n; i++ )
{
   System.out.println(i + " " + power);
   power = 2*power;
}
```

initialize another variable in a separate statement
declare and initialize a loop control variable
loop-continuation condition
increment
body

Loops.



compute the largest power of 2 less than or equal to n	`int power = 1;`
	`while (power <= n/2)`
	`   power = 2*power;`
	`System.out.println(power);`

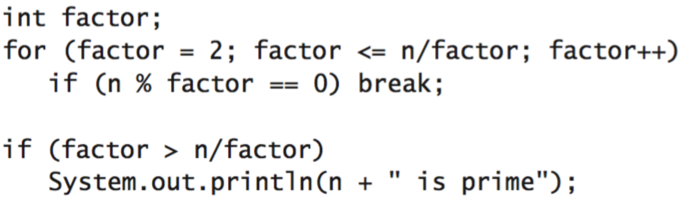
compute a finite sum (1 + 2 + … + n)	`int sum = 0;`
	`for (int i = 1; i <= n; i++)`
	`   sum += i;`
	`System.out.println(sum);`

compute a finite product (n! = 1 × 2 × … × n)	`int product = 1;`
	`for (int i = 1; i <= n; i++)`
	`   product *= i;`
	`System.out.println(product);`

print a table of function values	`for (int i = 0; i <= n; i++)`
	`   System.out.println(i + " " + 2*Math.PI*i/n);`

compute the ruler function (see Program 1.2.1)	`String ruler = "1";`
	`for (int i = 2; i <= n; i++)`
	`   ruler = ruler + " " + i + " " + ruler;`
	`System.out.println(ruler);`

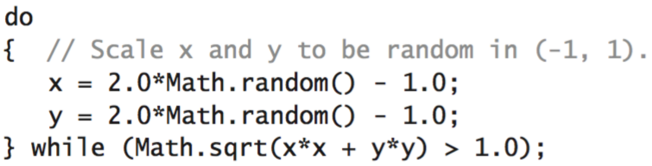
Break statement.



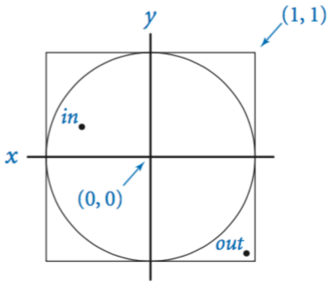
```
int factor;
for (factor = 2; factor <= n/factor; factor++)
   if (n % factor == 0) break;

if (factor > n/factor)
   System.out.println(n + " is prime");
```

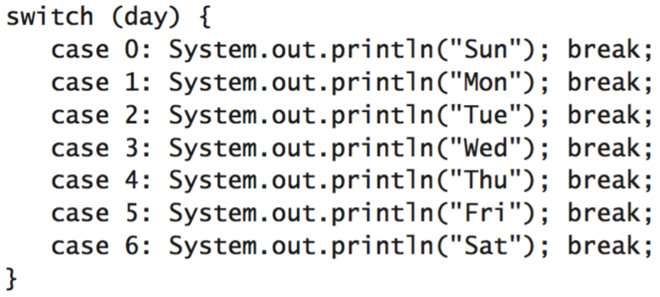
Do-while loop.



```
do
{  // Scale x and y to be random in (-1, 1).
   x = 2.0*Math.random() - 1.0;
   y = 2.0*Math.random() - 1.0;
} while (Math.sqrt(x*x + y*y) > 1.0);
```

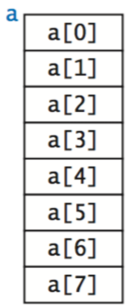


Switch statement.

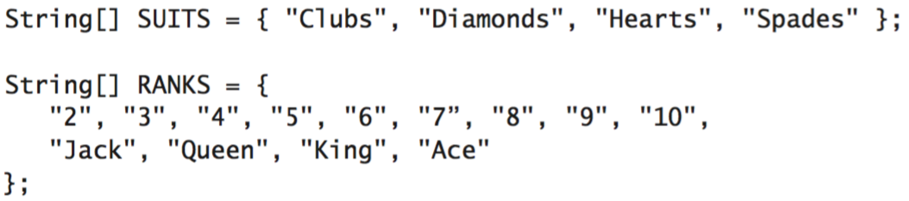


```
switch (day) {
   case 0: System.out.println("Sun"); break;
   case 1: System.out.println("Mon"); break;
   case 2: System.out.println("Tue"); break;
   case 3: System.out.println("Wed"); break;
   case 4: System.out.println("Thu"); break;
   case 5: System.out.println("Fri"); break;
   case 6: System.out.println("Sat"); break;
}
```

Arrays.



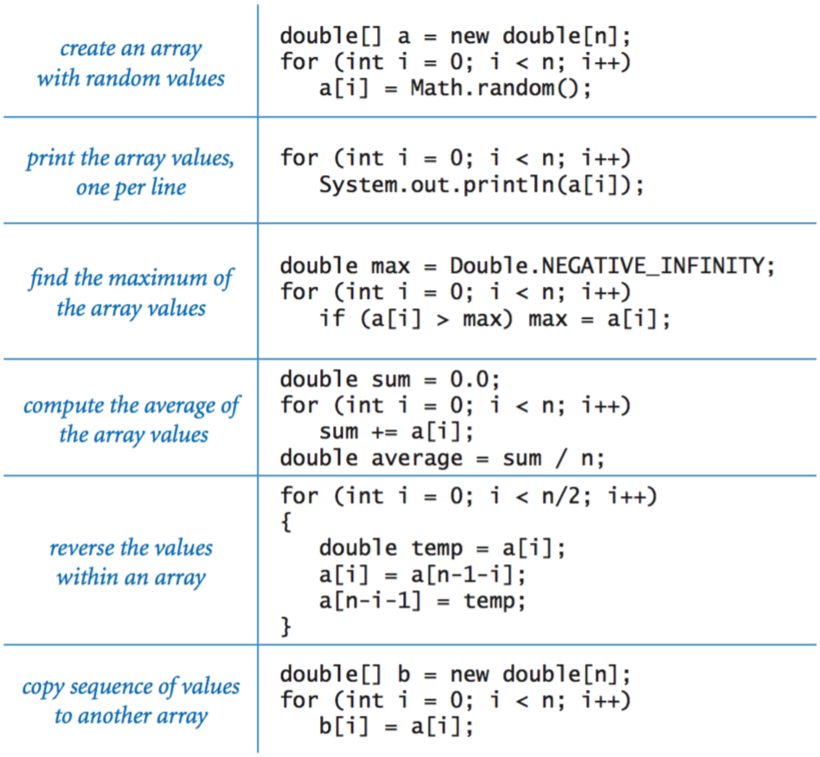
Inline array initialization.



```
String[] SUITS = { "Clubs", "Diamonds", "Hearts", "Spades" };

String[] RANKS = {
   "2", "3", "4", "5", "6", "7", "8", "9", "10",
   "Jack", "Queen", "King", "Ace"
};
```

Typical array-processing code.



create an array with random values	`double[] a = new double[n];`
	`for (int i = 0; i < n; i++)`
	`   a[i] = Math.random();`

print the array values, one per line	`for (int i = 0; i < n; i++)`
	`   System.out.println(a[i]);`

find the maximum of the array values	`double max = Double.NEGATIVE_INFINITY;`
	`for (int i = 0; i < n; i++)`
	`   if (a[i] > max) max = a[i];`

compute the average of the array values	`double sum = 0.0;`
	`for (int i = 0; i < n; i++)`
	`   sum += a[i];`
	`double average = sum / n;`

reverse the values within an array	`for (int i = 0; i < n/2; i++)`
	`{`
	`   double temp = a[i];`
	`   a[i] = a[n-1-i];`
	`   a[n-i-1] = temp;`
	`}`

copy sequence of values to another array	`double[] b = new double[n];`
	`for (int i = 0; i < n; i++)`
	`   b[i] = a[i];`

Two-dimensional arrays.