Topics Covered

- Arrays
- Inheritance
- Polymorphism
- Exception Handling

Array

- What is array?
  - Java provides a data structure, the **Array**, which stores a fixed-size sequential collection of elements of the same type.
  - A specific element in array is accessed by its **index**.
- Example :
  - Instead of declaring individual variables, for example, num0, num1, num2…., we can declare one array variable, “num” and num[0], num[1], num[2] is used to access individual variables.

Array

- Array be of one or multiple dimension, first we will learn “one dimensional array”.
- *Declaring array variables*
  - General form of an one dimensional array declaration is:
    - `Type var-name[ ];`
  - Type declares **base type**(the type of which all elements in the array is) of an array
  - Example : `int our_first_array[];`

Array

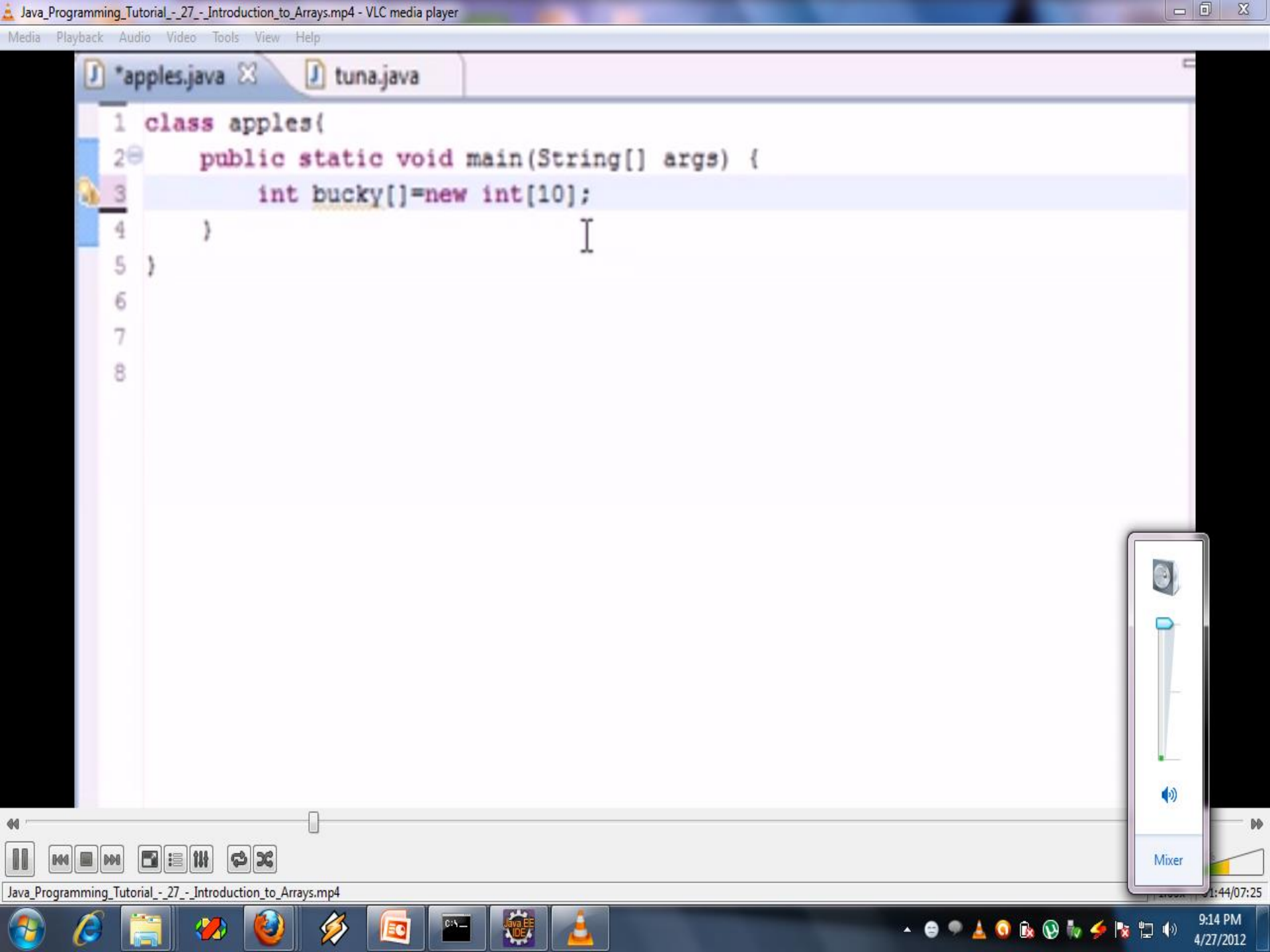
- This declaration establishes that *our_first_array* is an array variable, but it is not created yet.
- Our_first_array returns null if it is tried to be accessed, because it is not given any value.

Array

- *Creating Arrays* :
  - So, to actually create array variable, we have to allocate memory for the variable, so as for each element of the array.
  - For this a operator is used, named **new**.
  - So, the general form of creating array :
    - type array-var[ ] = new type[size];
  - Here, the **size** is the number of elements of same type in the array.

Array

- "new" allocates memory for size amount of elements of the corresponding type.
- Example :
  - `int our_first_array[] = new int[10];`
- So the array "our_first_array" is a collection of 10 integer variable.
- And "new" allocates 10 integer size memory for 10 integer values,
- Another way :
  - `int[] our_first_array = new int[10];`


Java_Programming_Tutorial_-_27_-_Introduction_to_Arrays.mp4 - VLC media player
Media Playback Audio Video Tools View Help
*apples.java
tuna.java
1 class apples{
2 public static void main(String[] args) {
3 int bucky[]=new int[10];
4 }
5 }
6
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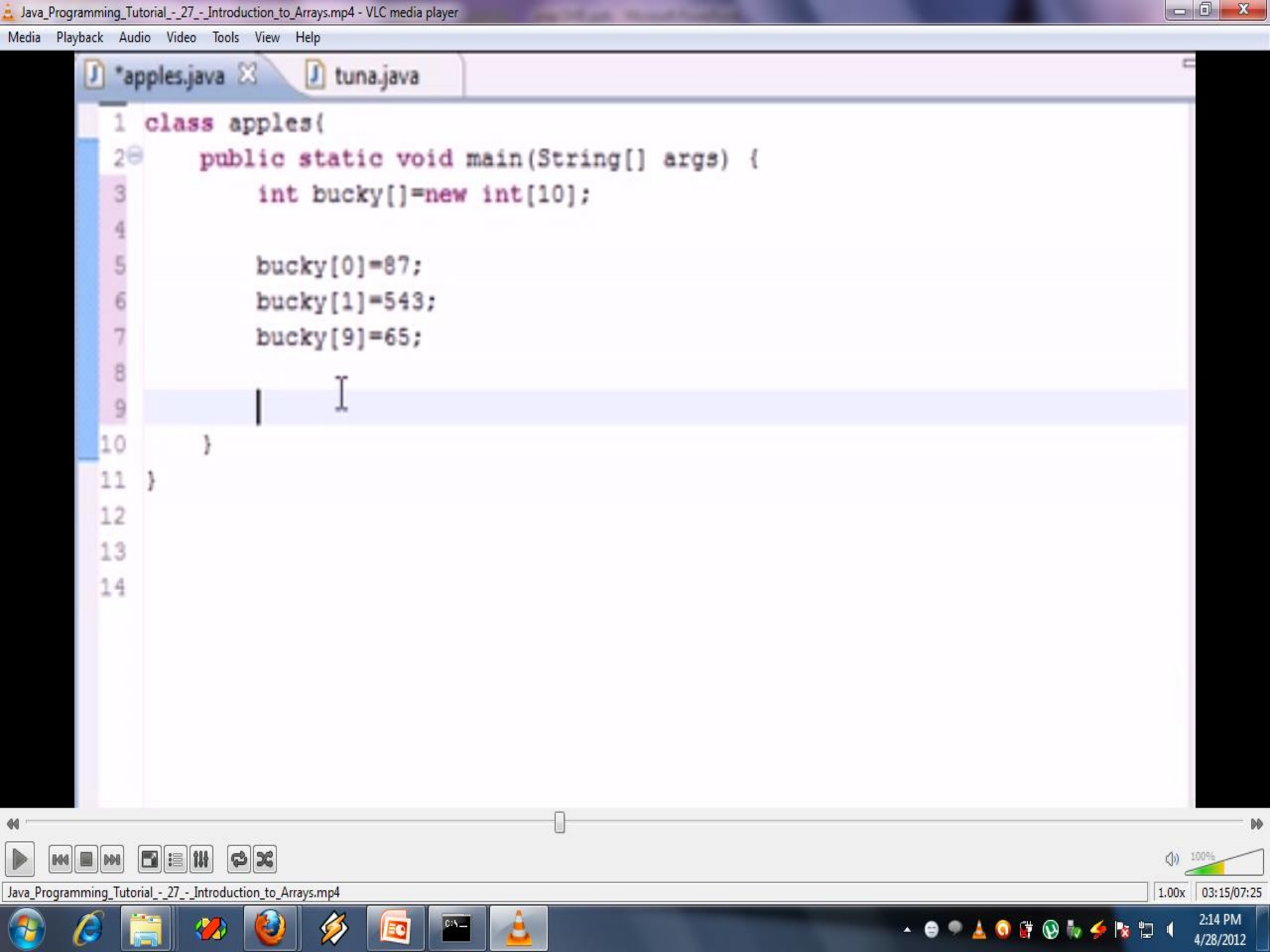
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Media Playback Audio Video Tools View Help
*apples.java
tuna.java
class apples{
public static void main(String[] args) {
int bucky[]=new int[10];
bucky[0]=87;
bucky[1]=543;
bucky[9]=65;
}
}
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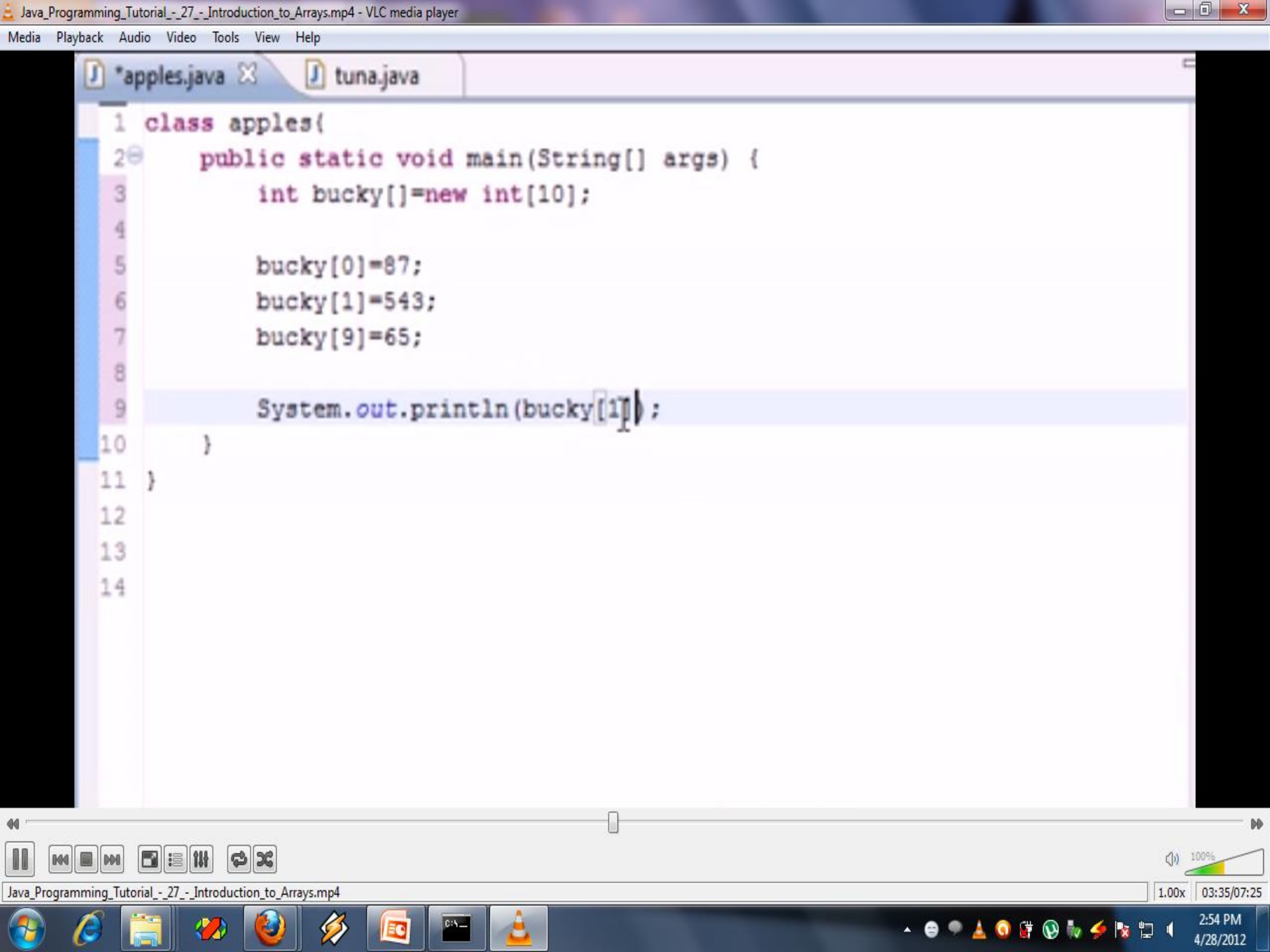
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Media Playback Audio Video Tools View Help
*apples.java
tuna.java
class apples{
public static void main(String[] args) {
int bucky[]=new int[10];
bucky[0]=87;
bucky[1]=543;
bucky[9]=65;
System.out.println(bucky[1]);
}
}
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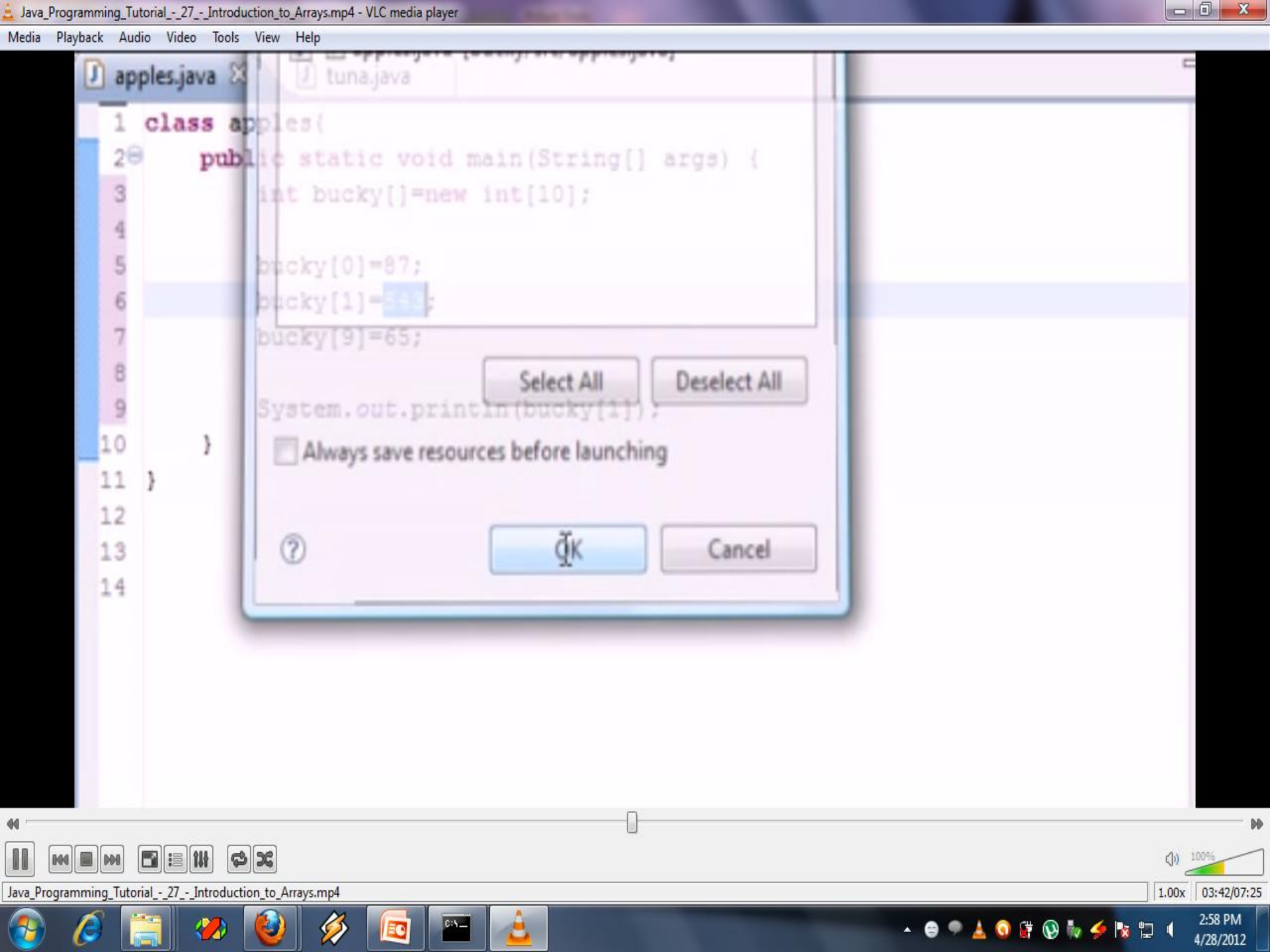
Java_Programming_Tutorial_-_27_-_Introduction_to_Arrays.mp4 - VLC media player
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apples.java
tuna.java
class apples{
public static void main(String[] args) {
int bucky[]=new int[10];
bucky[0]=87;
bucky[1]=
bucky[9]=65;
System.out.println(bucky[1]);
}
}
Select All
Deselect All
Always save resources before launching
OK
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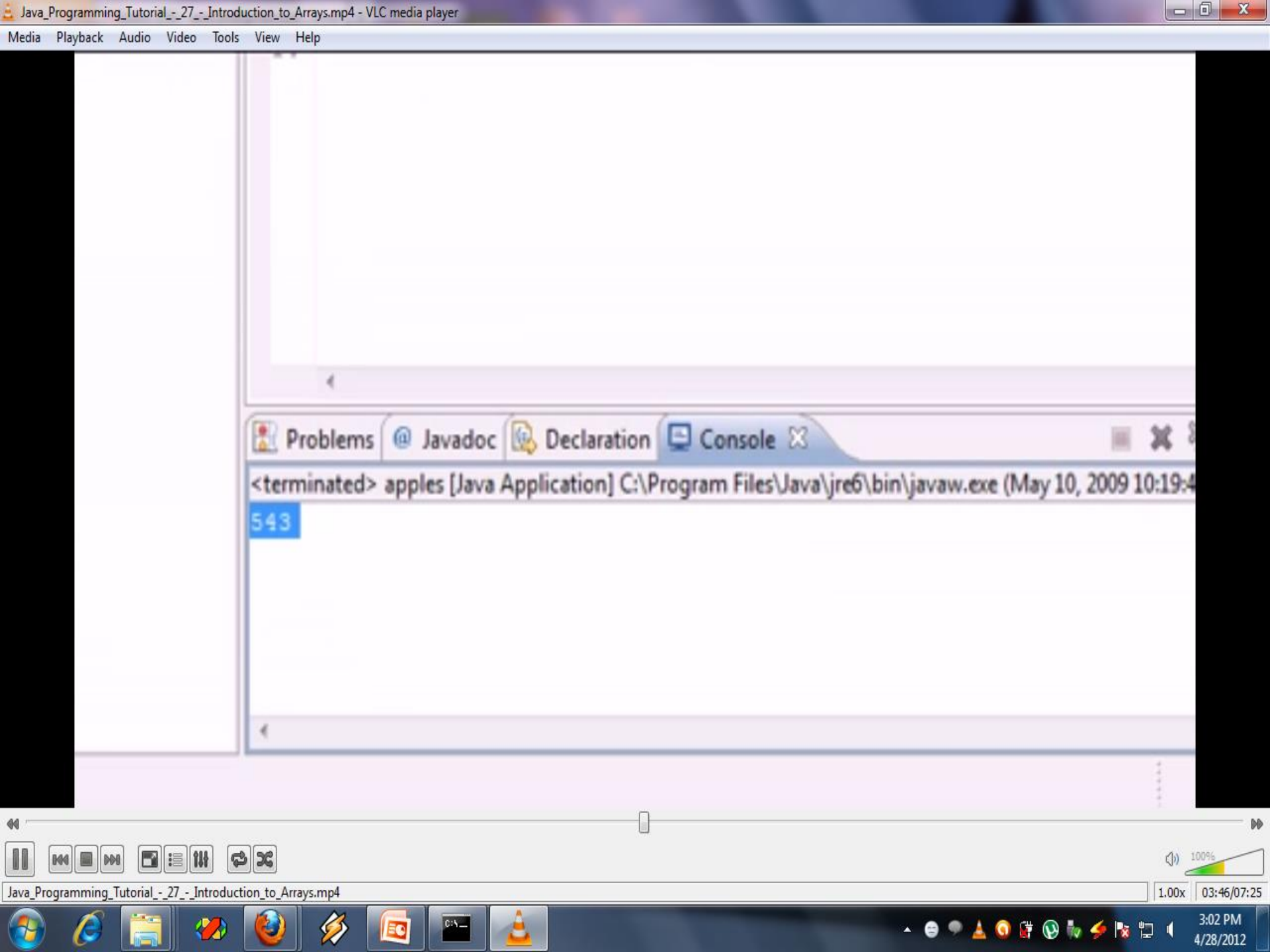
Java_Programming_Tutorial_-_27_-_Introduction_to_Arrays.mp4 - VLC media player
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Problems Javadoc Declaration Console
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543
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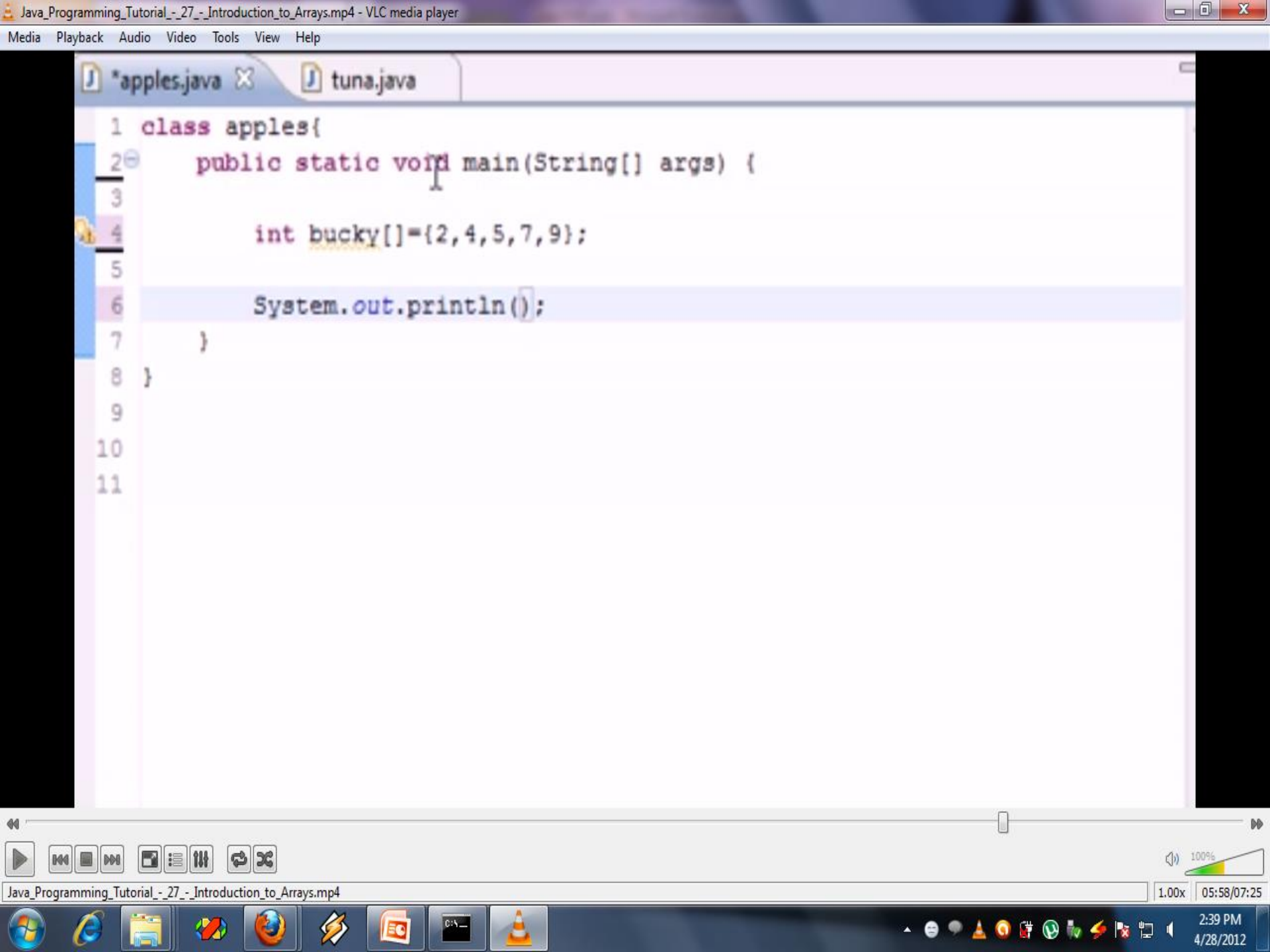
Array

- *Another way of creating and assigning values to an array :*
- The syntax will be :
  - Type array-name[] = {value1, value2, value3};
  - Here, at the same time, array declaration + creation + value assignment is done.
  - The total number of values indicates the size of the array.
  - int our_first_array[] = {10, 20, 30, 40}
  - IMP : In this process, “new” is not needed.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Media Playback Audio Video Tools View Help
*apples.java
tuna.java
1 class apples{
2 public static void main(String[] args) {
3
4 int bucky[]={2,4,5,7,9};
5
6 System.out.println();
7 }
8 }
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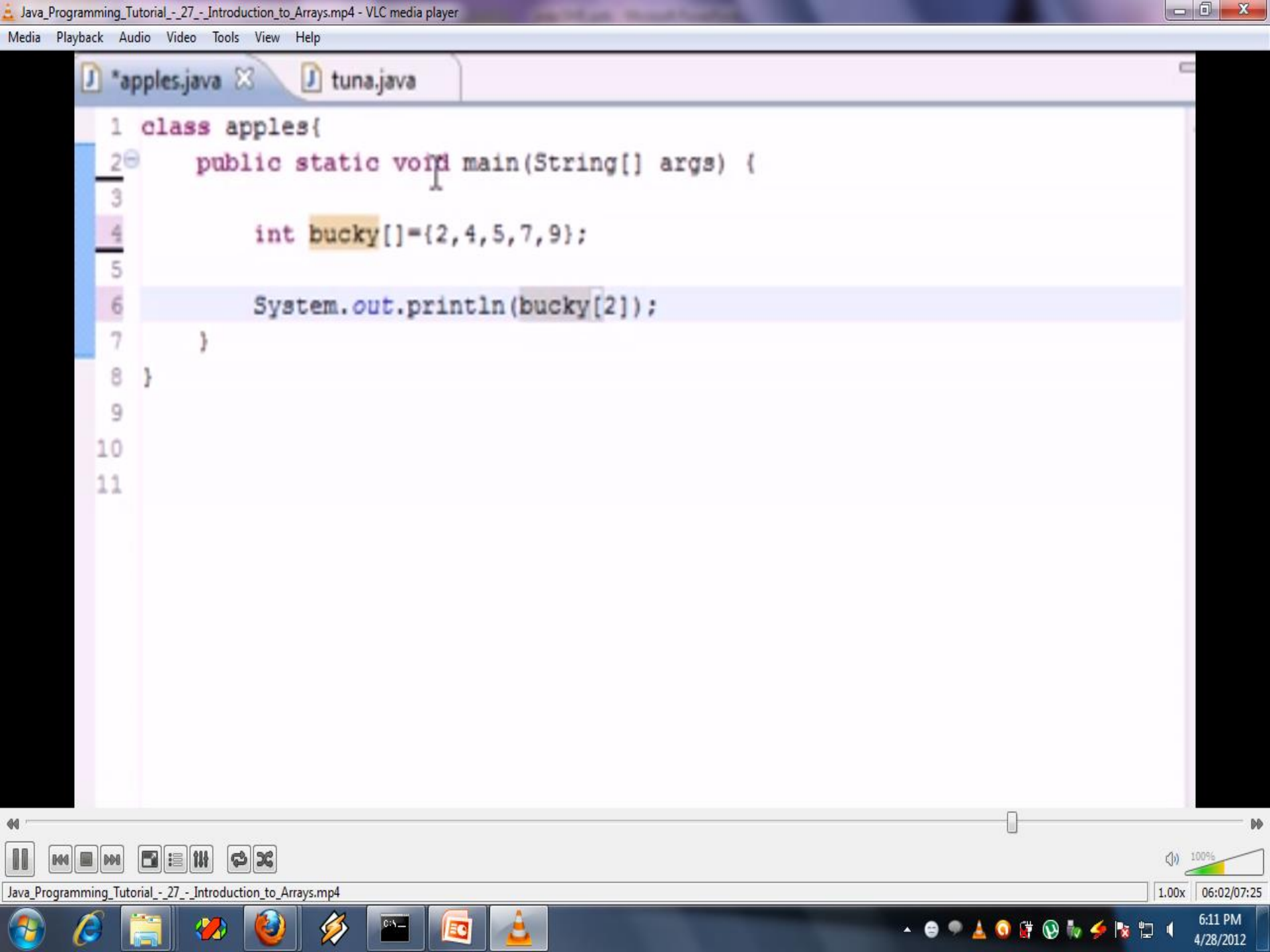
Java_Programming_Tutorial_-_27_-_Introduction_to_Arrays.mp4 - VLC media player
Media Playback Audio Video Tools View Help
*apples.java
tuna.java
1 class apples{
2 public static void main(String[] args) {
3
4 int bucky[]={2,4,5,7,9};
5
6 System.out.println(bucky[2]);
7 }
8 }
9
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Java_Programming_Tutorial_-_27_-_Introduction_to_Arrays.mp4
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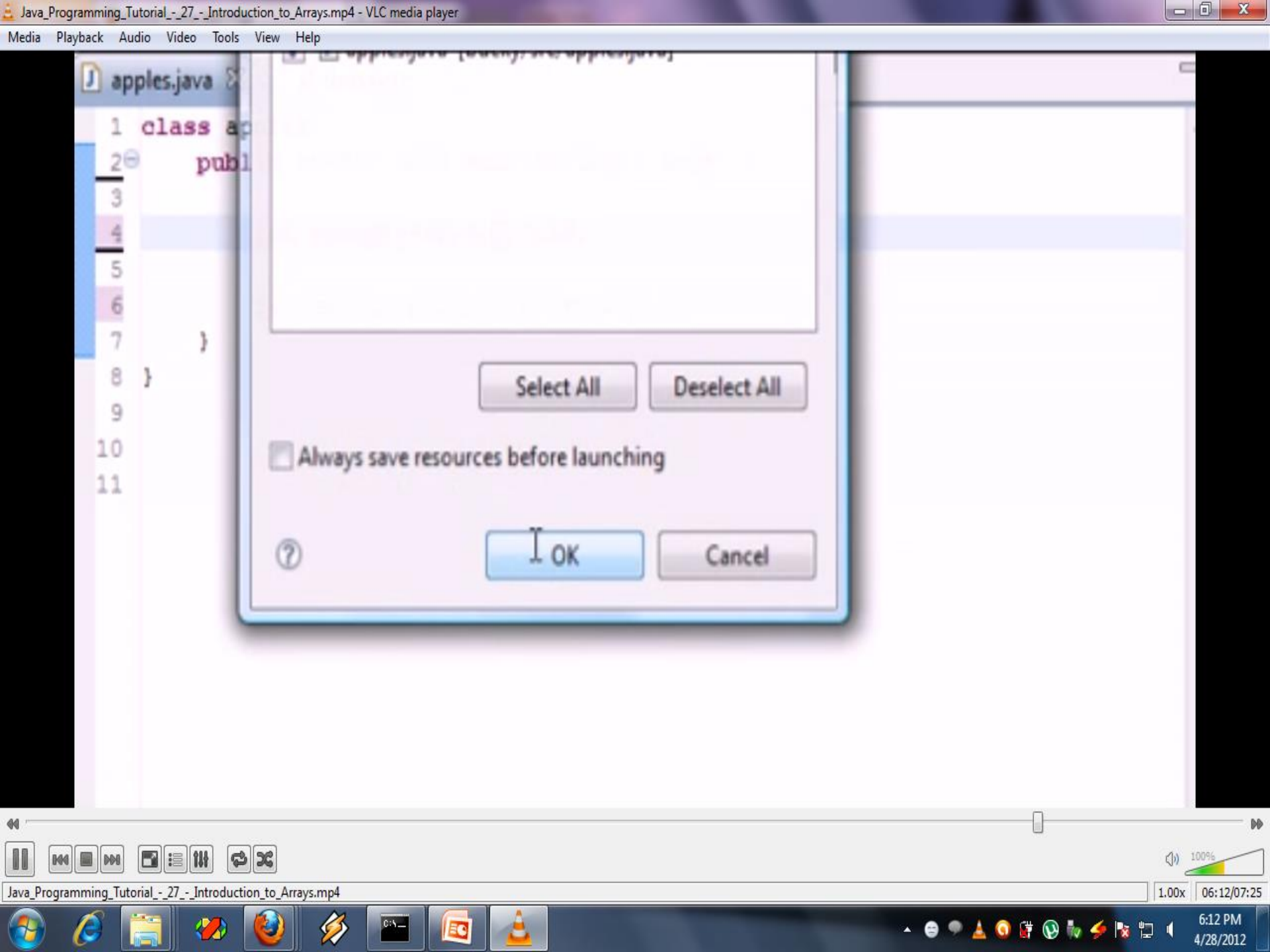
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Media Playback Audio Video Tools View Help
apples.java
1 class a
2 publ
3
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7 }
8 }
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Deselect All
Always save resources before launching
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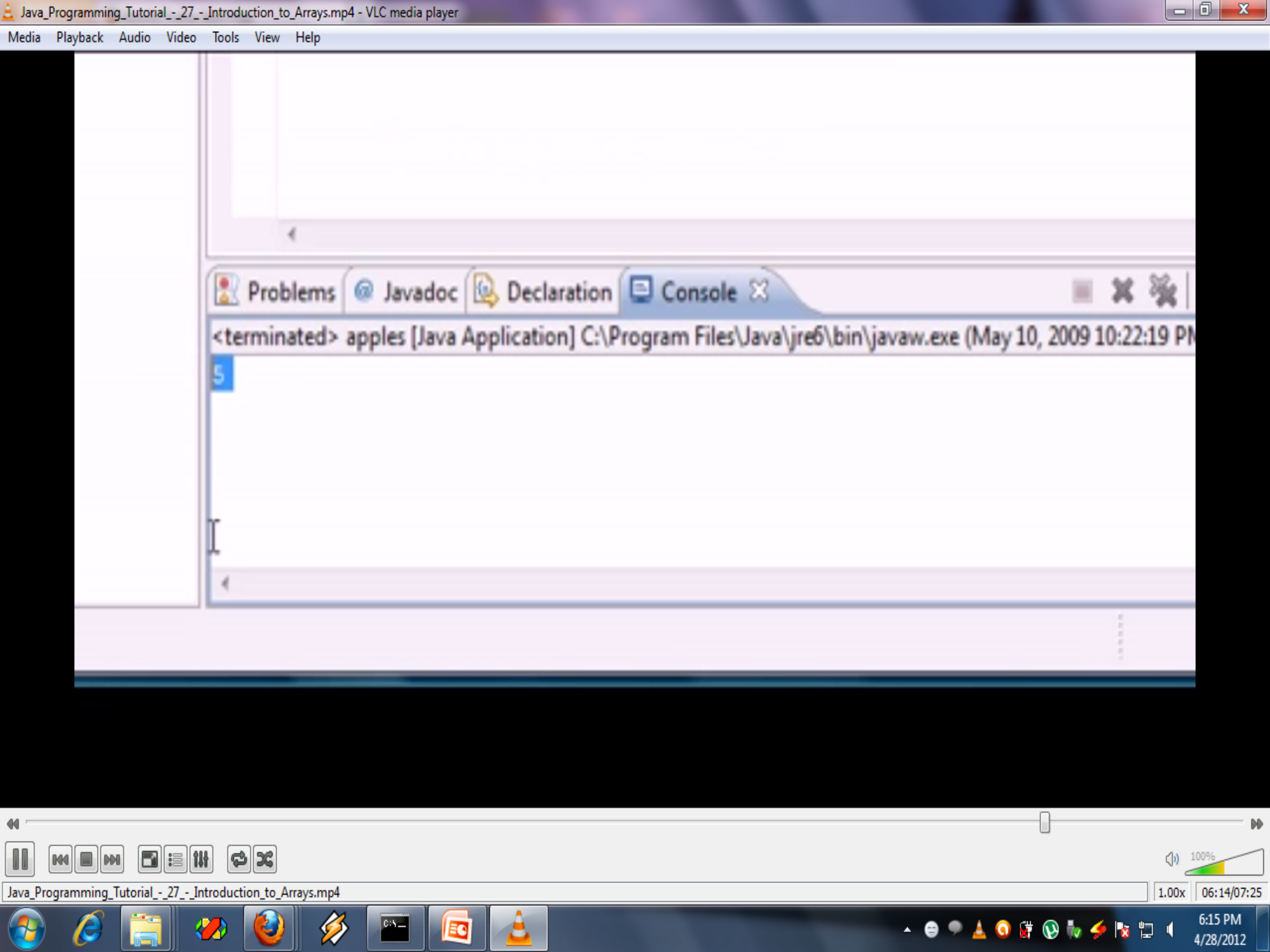
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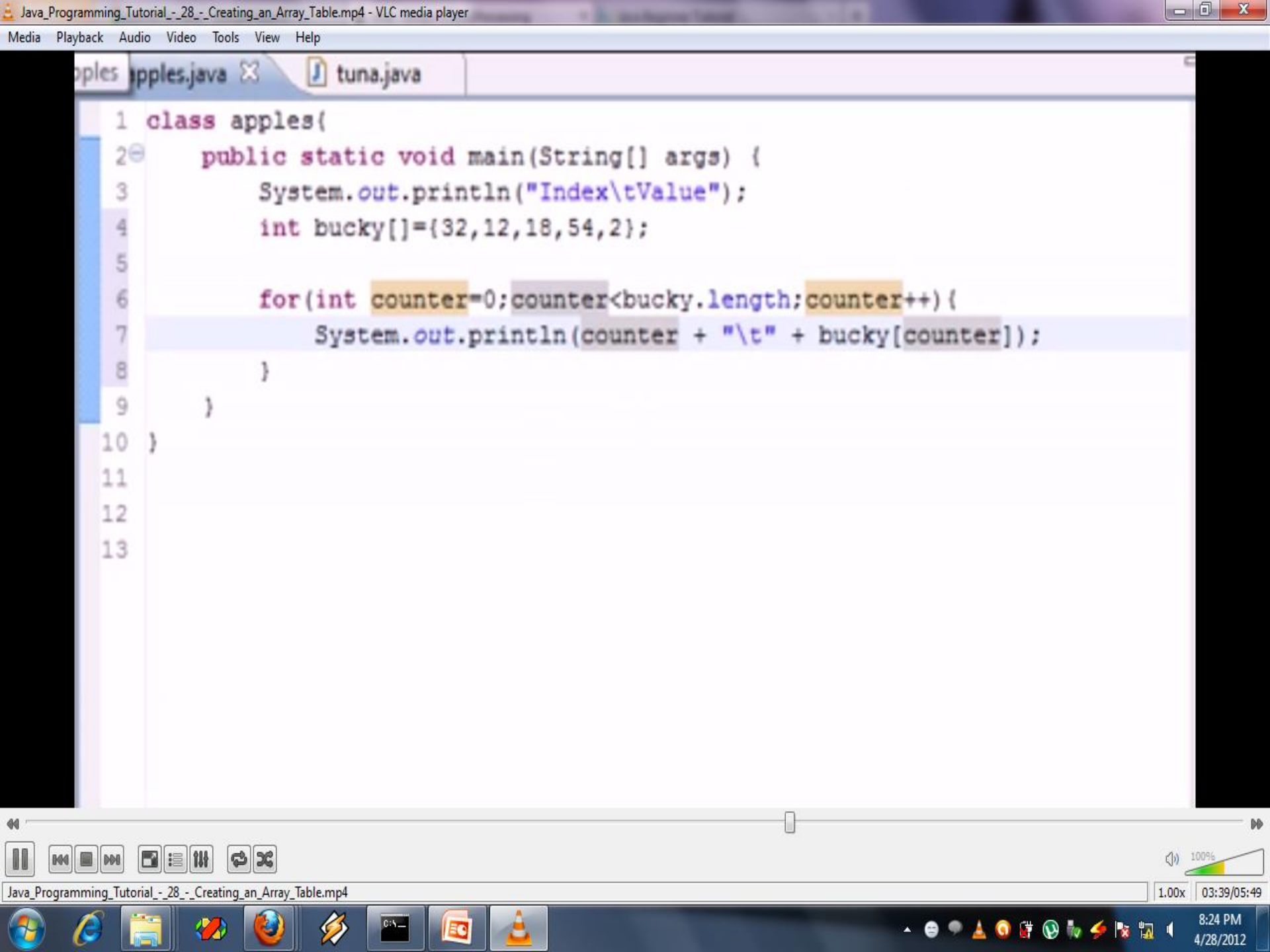
Array

- An way of having the size of an array, for example, our_first_array is
  - array_name.**length**
  - Example : *our_first_array.length*
- Following are some examples of using array in different cases:
  - Sum up the elements of an array

Creating table of elements of an array


Java_Programming_Tutorial_-_28_-_Creating_an_Array_Table.mp4 - VLC media player
Media Playback Audio Video Tools View Help
apples.java
tuna.java
class apples{
public static void main(String[] args) {
System.out.println("Index\tValue");
int bucky[]={32,12,18,54,2};
for(int counter=0;counter<bucky.length;counter++){
System.out.println(counter + "\t" + bucky[counter]);
}
}
}
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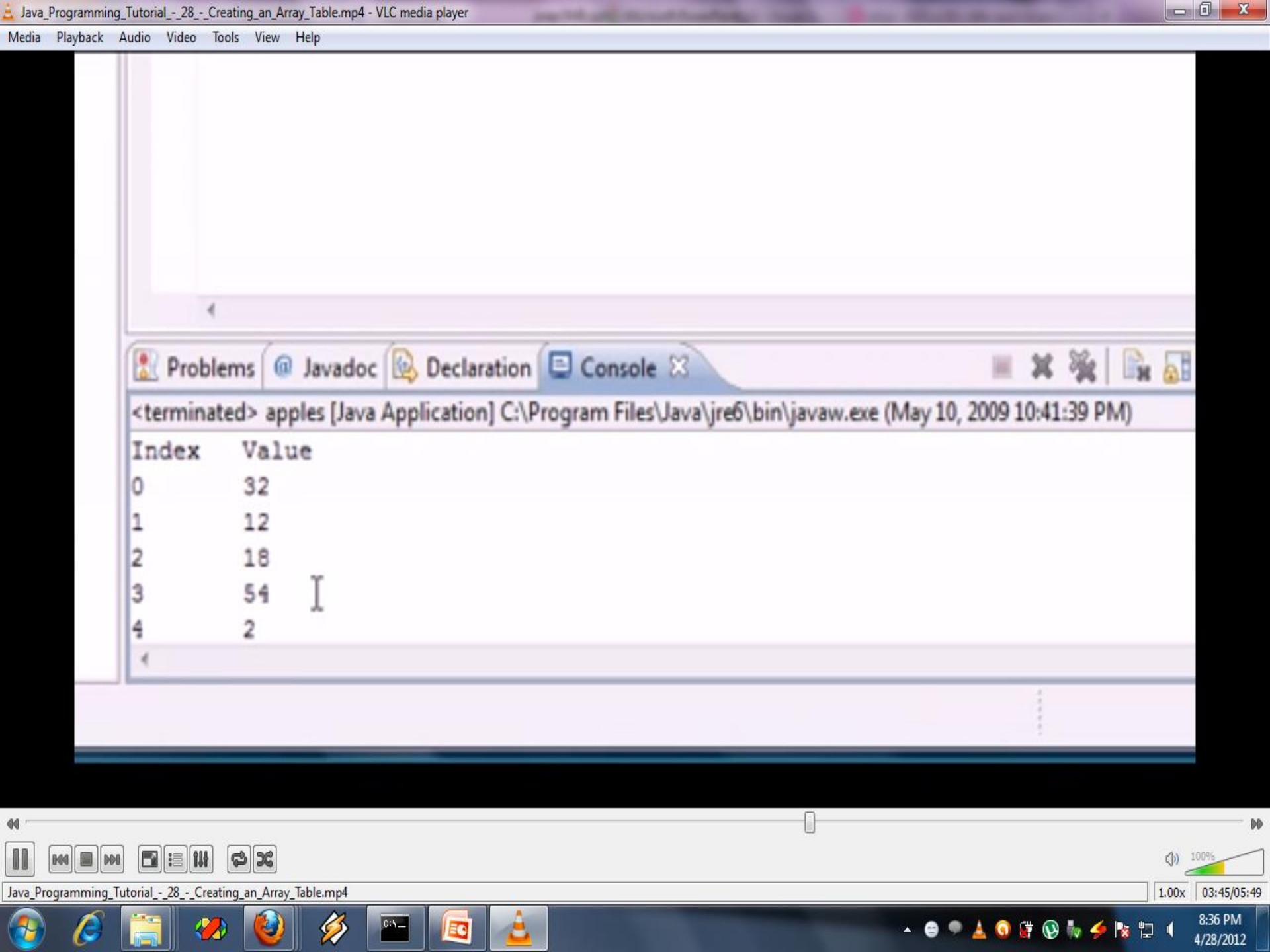
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Media Playback Audio Video Tools View Help
Problems Javadoc Declaration Console
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Index Value
0 32
1 12
2 18
3 54
4 2
Java_Programming_Tutorial_-_28_-_Creating_an_Array_Table.mp4
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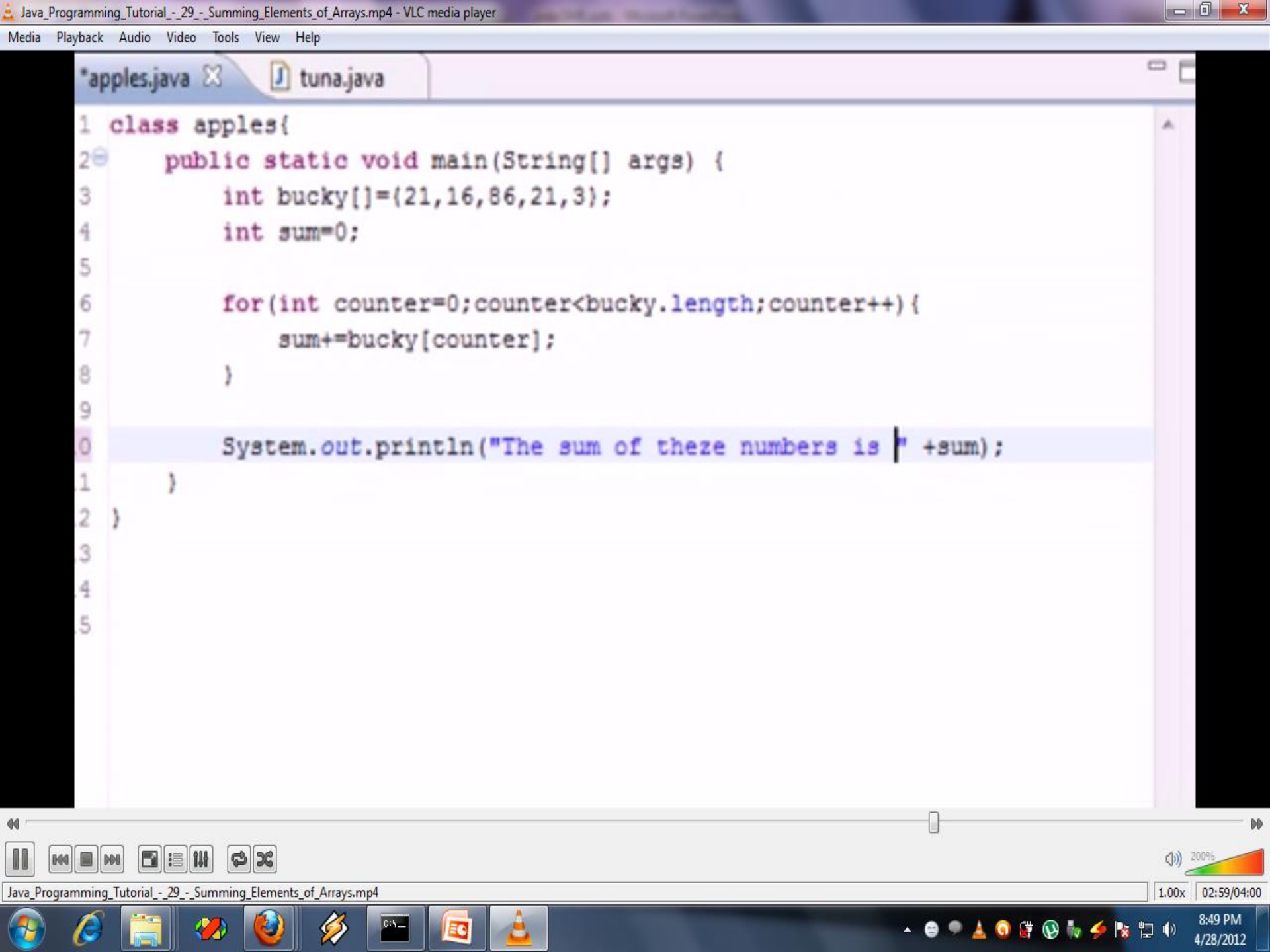
Sum up the elements of an array


Java_Programming_Tutorial_-_29_-_Summing_Elements_of_Arrays.mp4 - VLC media player
Media Playback Audio Video Tools View Help
*apples.java
tuna.java
class apples{
public static void main(String[] args) {
int bucky[]={21,16,86,21,3};
int sum=0;
for(int counter=0;counter<bucky.length;counter++){
sum+=bucky[counter];
}
System.out.println("The sum of theze numbers is " +sum);
}
}
Java_Programming_Tutorial_-_29_-_Summing_Elements_of_Arrays.mp4
1.00x
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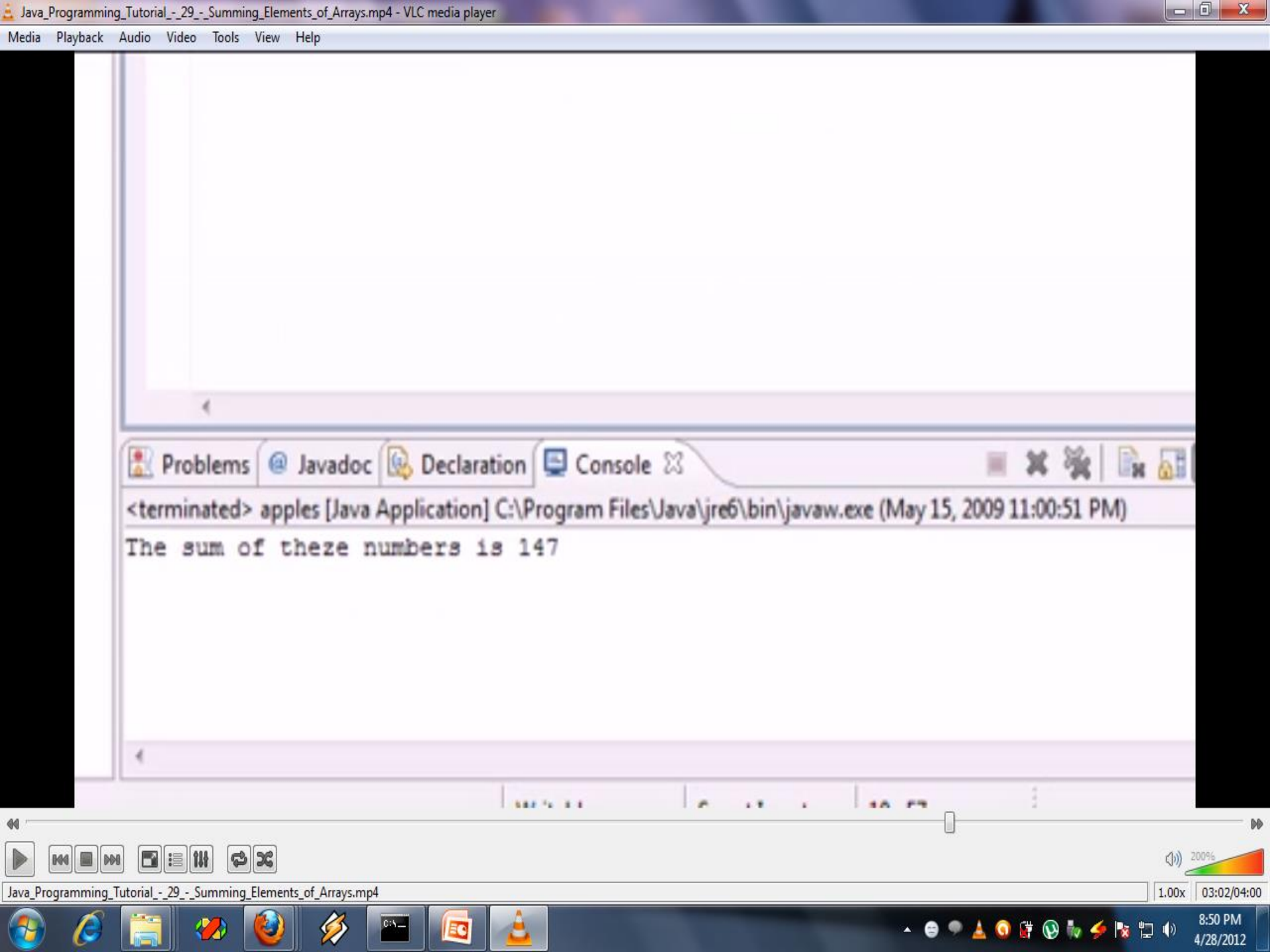
Java_Programming_Tutorial_-_29_-_Summing_Elements_of_Arrays.mp4 - VLC media player
Media Playback Audio Video Tools View Help
Problems Javadoc Declaration Console
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The sum of theze numbers is 147
Java_Programming_Tutorial_-_29_-_Summing_Elements_of_Arrays.mp4
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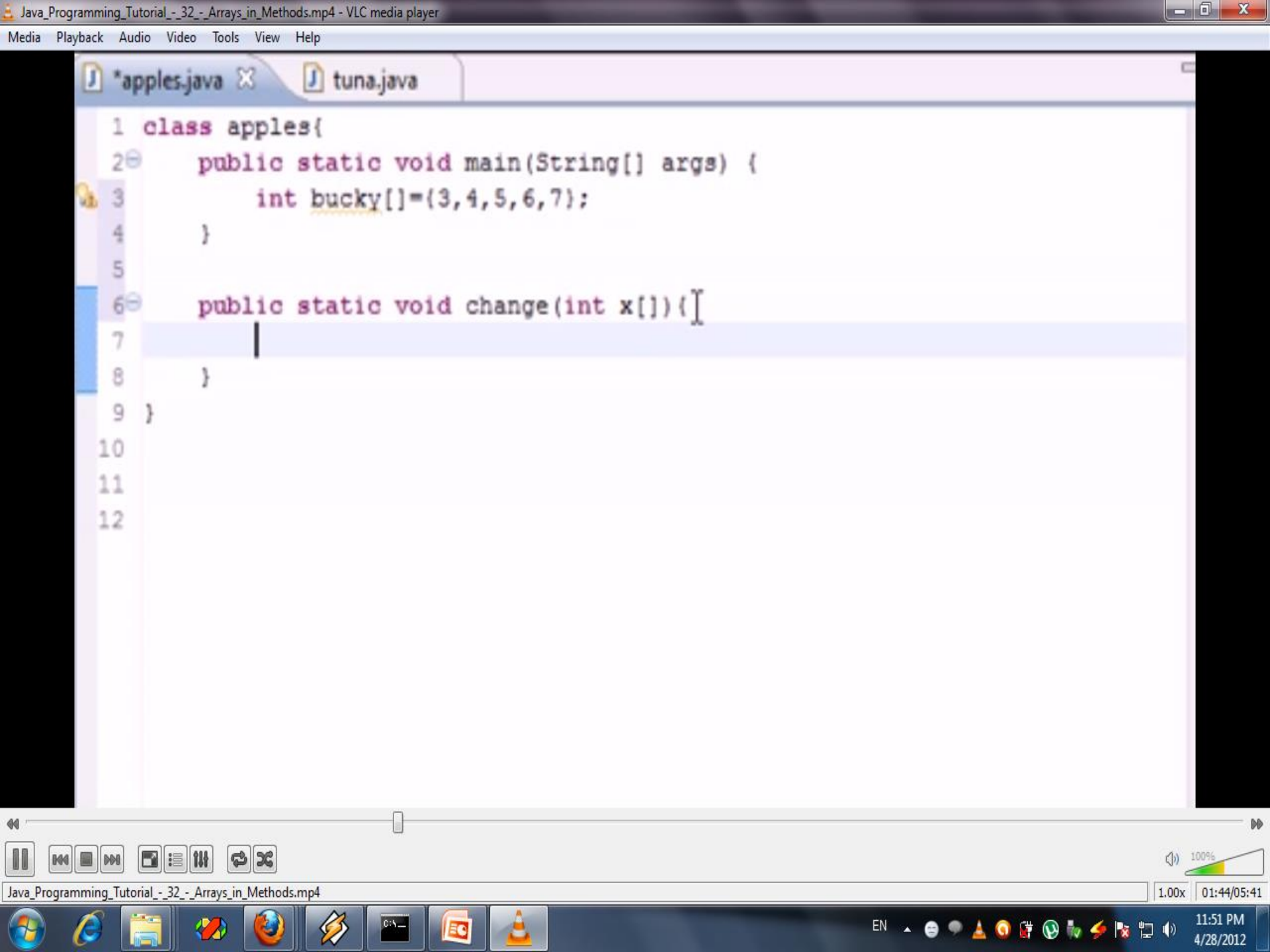
How to use arrays with methods(how to pass an array to a method, and catch up that array in the method)


Java_Programming_Tutorial_-_32_-_Arrays_in_Methods.mp4 - VLC media player
Media Playback Audio Video Tools View Help
*apples.java
tuna.java
1 class apples{
2 public static void main(String[] args) {
3 int bucky[]={3,4,5,6,7};
4 }
5
6 public static void change(int x[]){
7
8 }
9 }
10
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Java_Programming_Tutorial_-_32_-_Arrays_in_Methods.mp4
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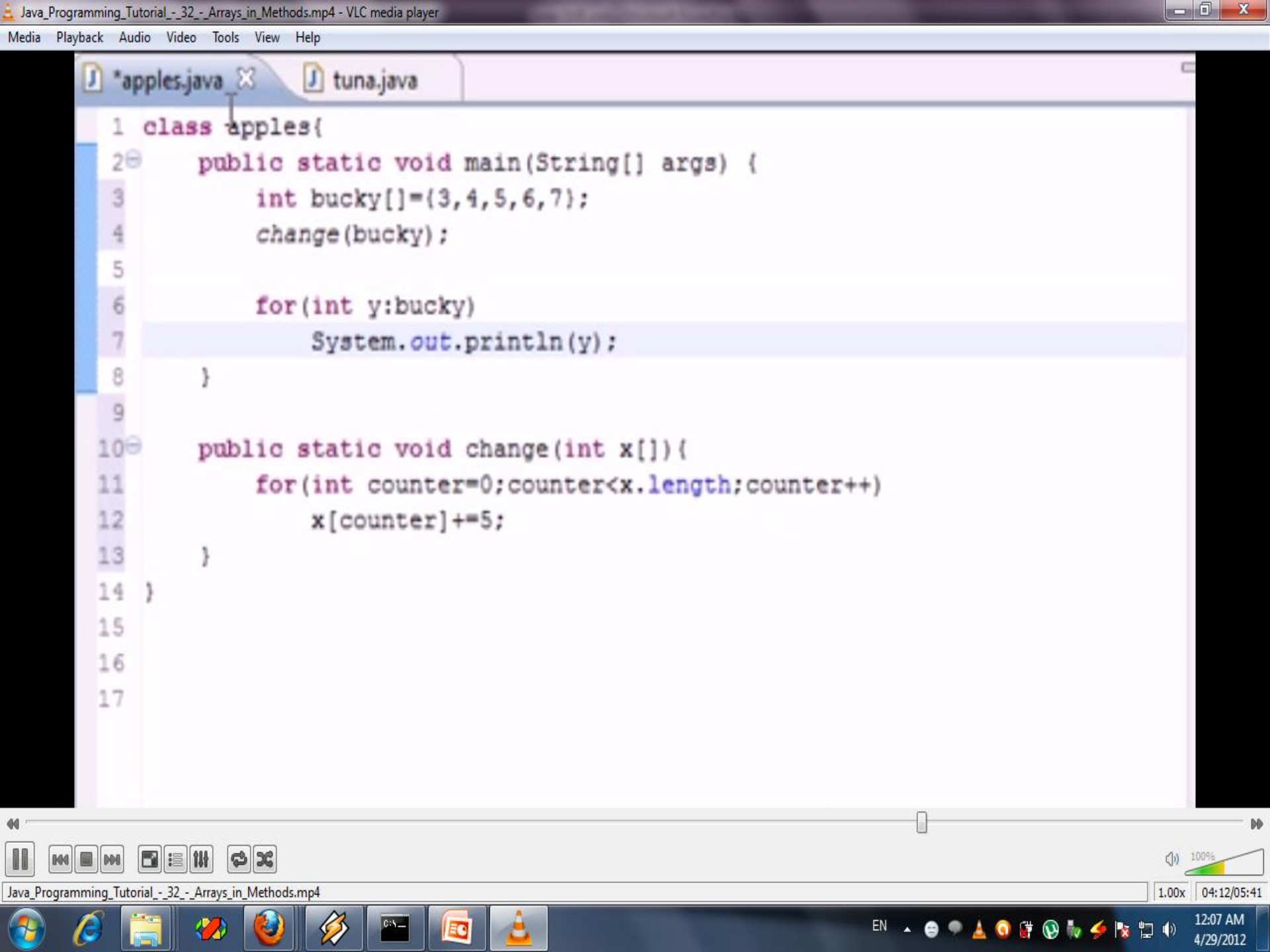
Java_Programming_Tutorial_-_32_-_Arrays_in_Methods.mp4 - VLC media player
Media Playback Audio Video Tools View Help
*apples.java
tuna.java
1 class apples{
2 public static void main(String[] args) {
3 int bucky[]={3,4,5,6,7};
4 change(bucky);
5
6 for(int y:bucky)
7 System.out.println(y);
8 }
9
10 public static void change(int x[]){
11 for(int counter=0;counter<x.length;counter++)
12 x[counter]+=5;
13 }
14 }
15
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Java_Programming_Tutorial_-_32_-_Arrays_in_Methods.mp4
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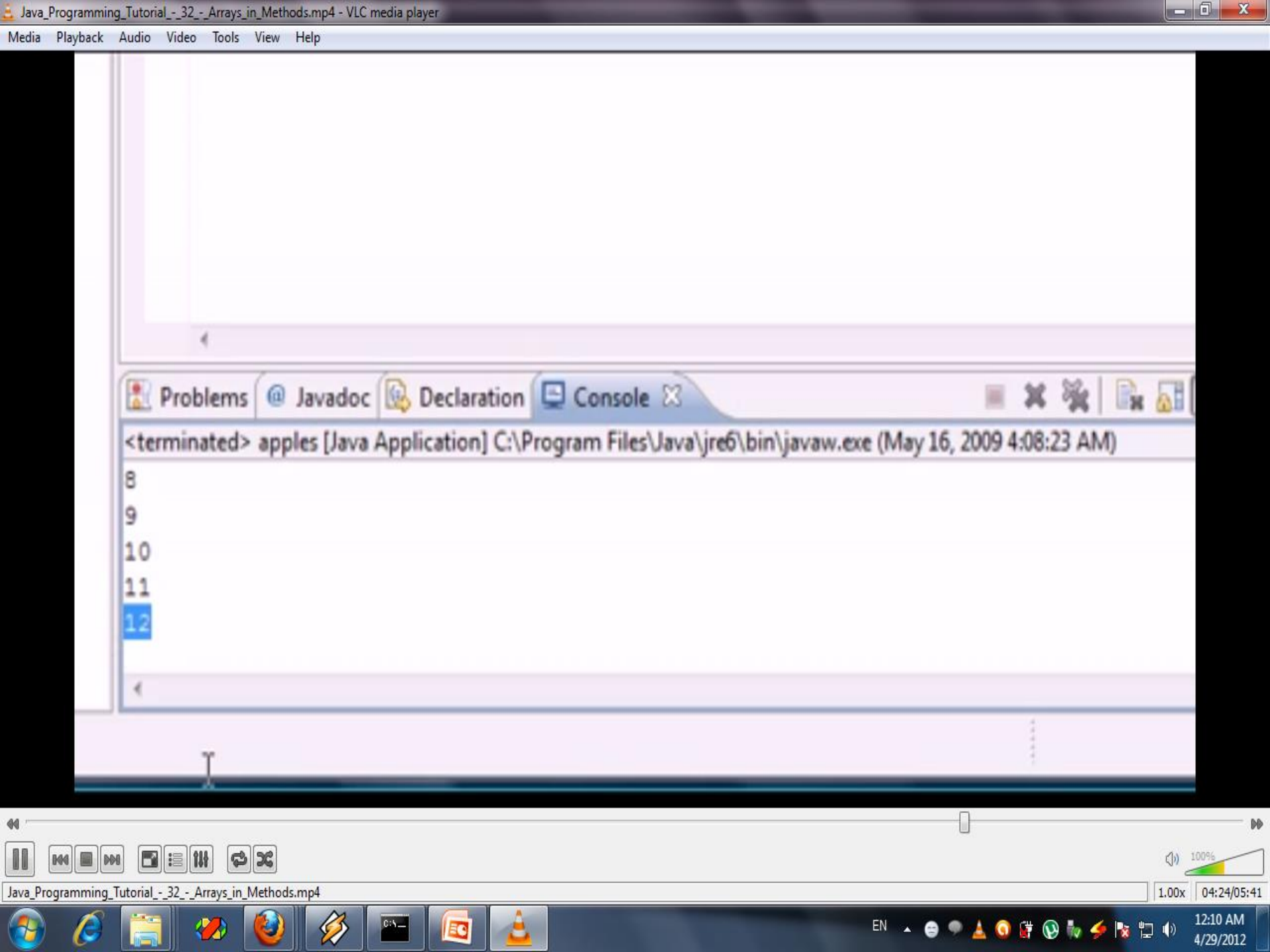
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Problems Javadoc Declaration Console
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Java_Programming_Tutorial_-_32_-_Arrays_in_Methods.mp4
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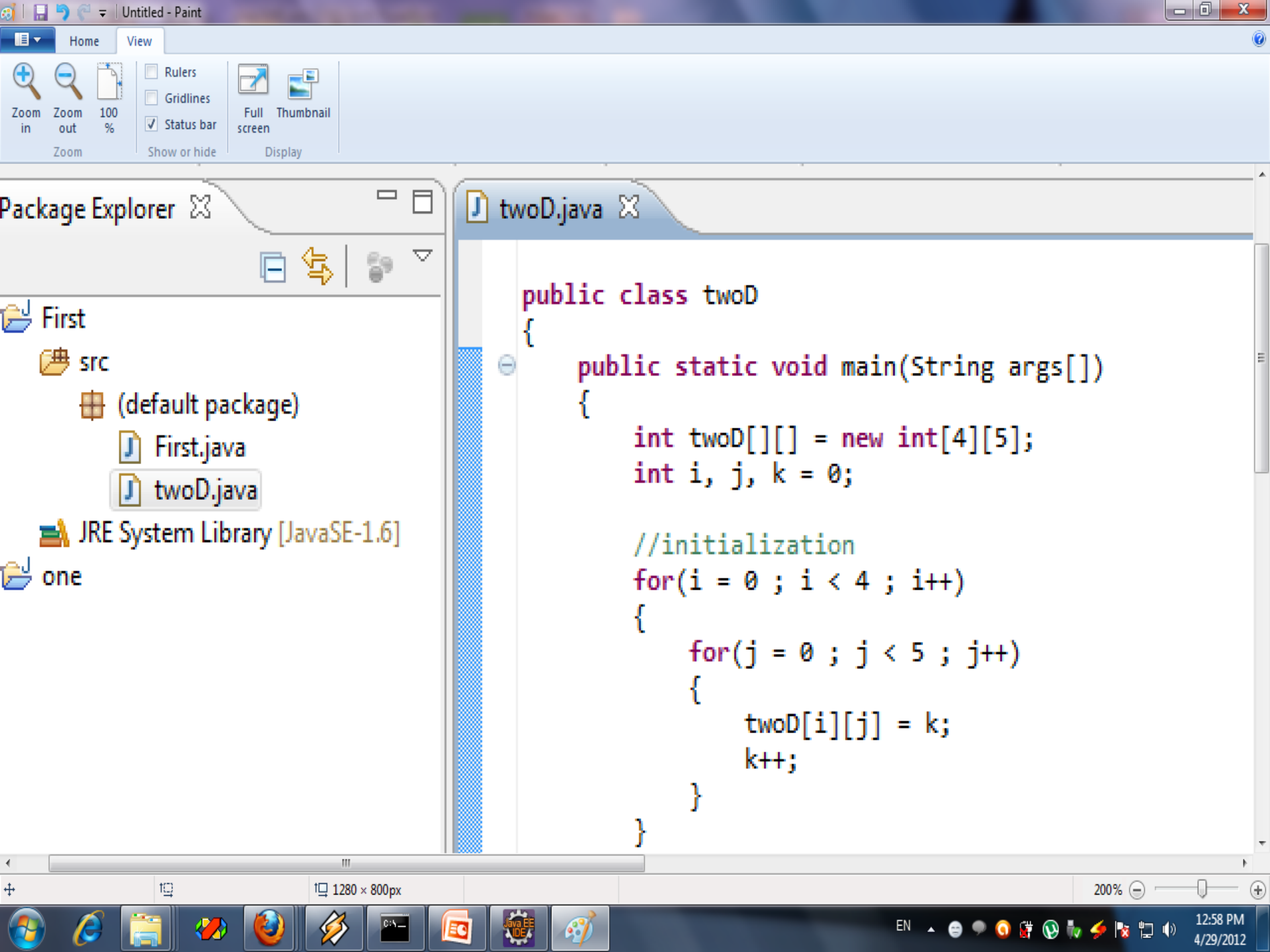
4/29/2012

Multidimensional Arrays

- Multidimensional arrays are '*array of arrays*'.
- Declaration, creation and initialization of multidimensional arrays are almost same like one-dimensional arrays with some small differences.
- The implementation of multi dimensional array has two pair square brackets after the array name, if it is a two dimensional array.

Multidimensional Arrays

- Following is a declaration of two-dimensional array :
  - int twoDarray[ ][ ] = new int[4][5];
  - Similarly, int[ ][ ] twoDarray = new int[4][5];
  - A two-dimensional array is created here, where, there are 4 rows and 5 columns.
  - Here, an array of arrays is created if int datatype.
  - Following is an example of initialization and then displaying the values of a two-dimensional array:


Untitled - Paint
Home
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Zoom in
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Zoom
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Status bar
Show or hide
Full screen
Thumbnail
Display
Package Explorer
First
src
(default package)
First.java
twoD.java
JRE System Library [JavaSE-1.6]
one
twoD.java
public class twoD
{
public static void main(String args[])
{
int twoD[][] = new int[4][5];
int i, j, k = 0;
//initialization
for(i = 0 ; i < 4 ; i++)
{
for(j = 0 ; j < 5 ; j++)
{
twoD[i][j] = k;
k++;
}
}
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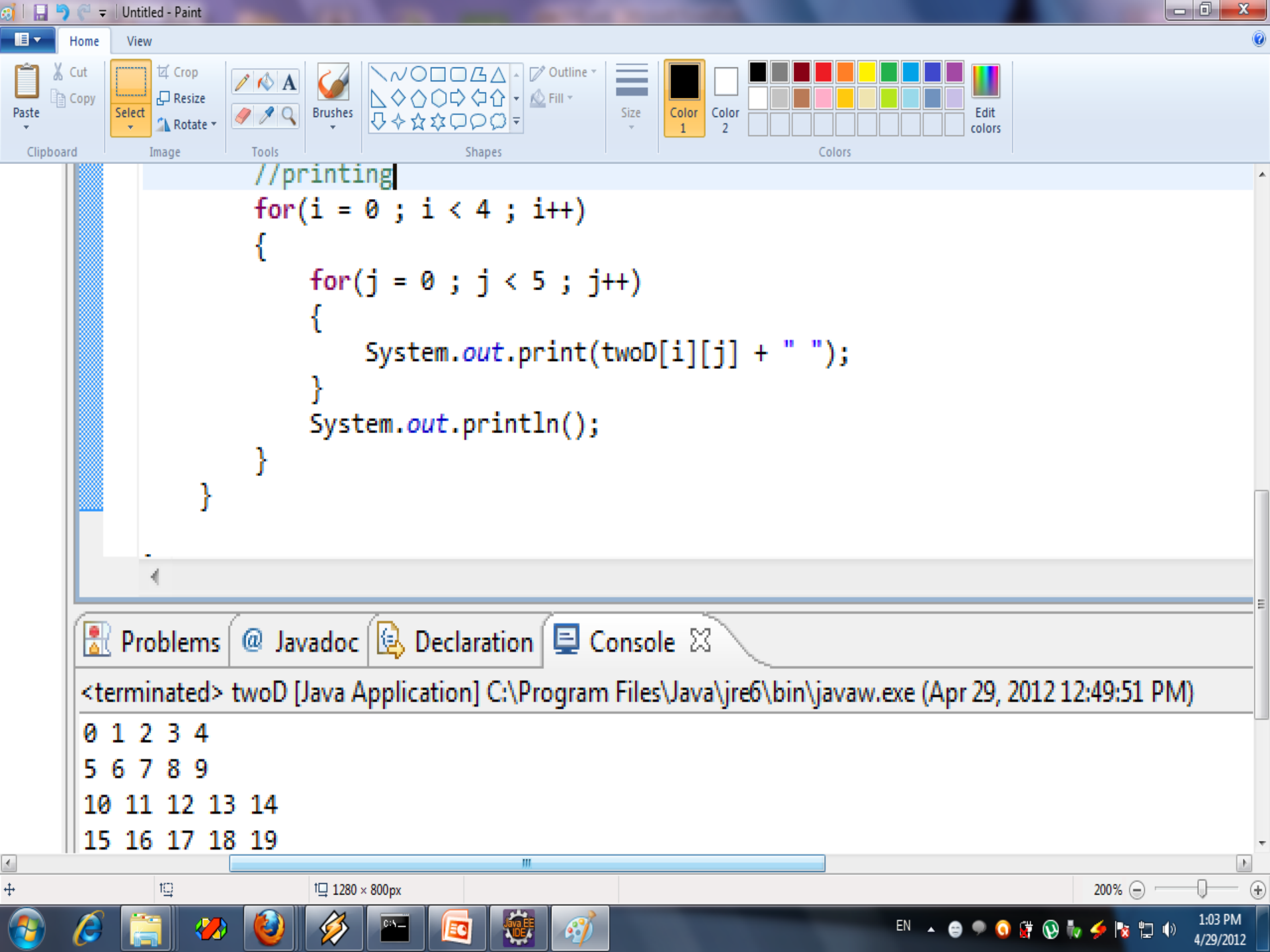
Untitled - Paint
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Brushes
Outline
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Size
Color 1
Color 2
Edit colors
Clipboard
Image
Tools
Shapes
Colors
//printing
for(i = 0 ; i < 4 ; i++)
{
for(j = 0 ; j < 5 ; j++)
{
System.out.print(twoD[i][j] + " ");
}
System.out.println();
}
}
Problems
Javadoc
Declaration
Console
<terminated> twoD [Java Application] C:\Program Files\Java\jre6\bin\javaw.exe (Apr 29, 2012 12:49:51 PM)
0 1 2 3 4
5 6 7 8 9
10 11 12 13 14
15 16 17 18 19
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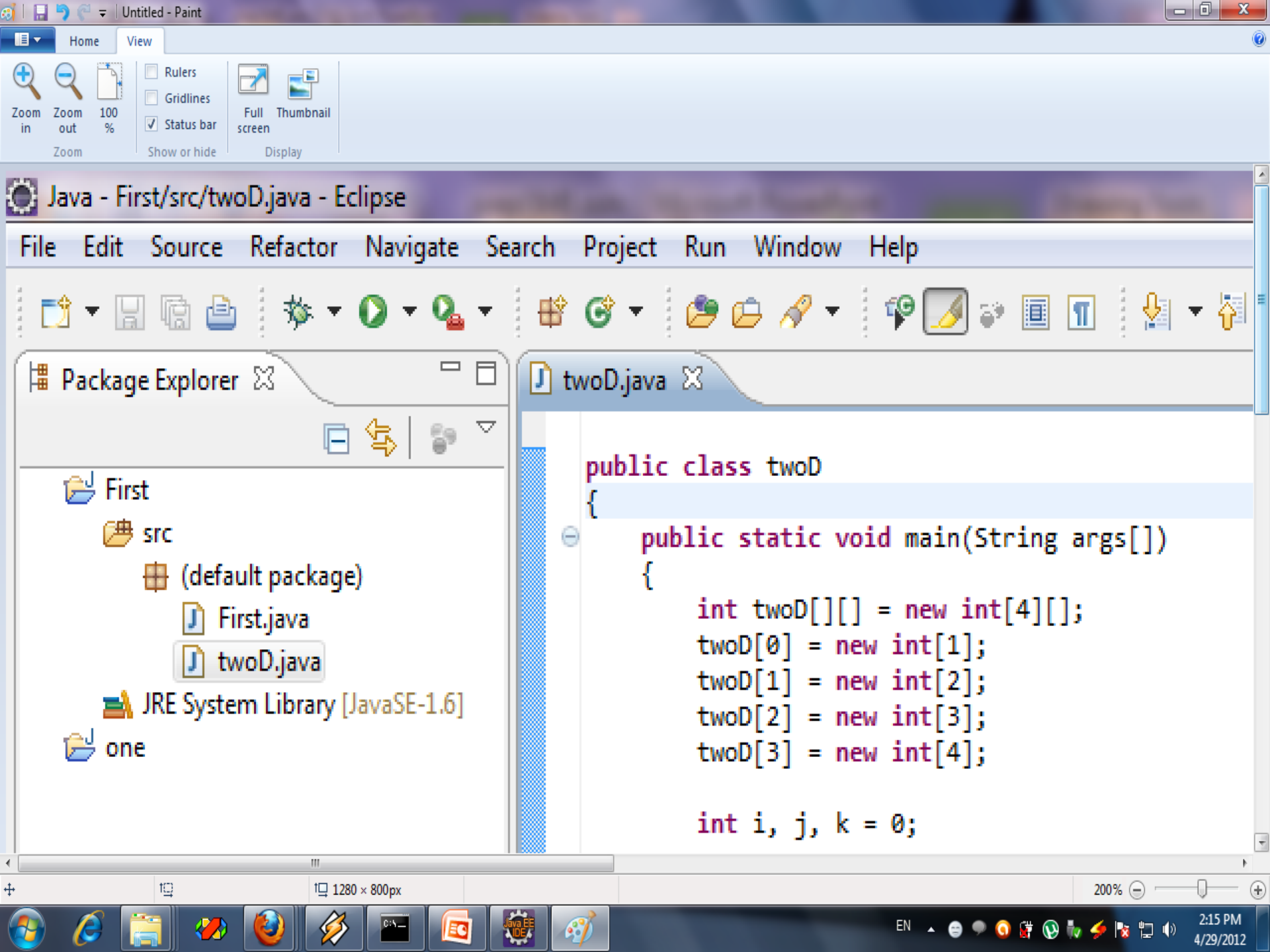
4/29/2012

Multidimensional arrays

- Another method of declaring two-dimensional array:
  - We can take the size of arrays under the upper level array in our control.
  - int twoD[ ][ ] = new int[4][ ];
  - A two-dimensional array is created here, where, there are 4 rows, but the number of columns in each row is variable.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Zoom out
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Rulers
Gridlines
Status bar
Show or hide
Full screen
Thumbnail
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Java - First/src/twoD.java - Eclipse
File Edit Source Refactor Navigate Search Project Run Window Help
Package Explorer
First
src
(default package)
First.java
twoD.java
JRE System Library [JavaSE-1.6]
one
twoD.java
public class twoD
{
public static void main(String args[])
{
int twoD[][] = new int[4][];
twoD[0] = new int[1];
twoD[1] = new int[2];
twoD[2] = new int[3];
twoD[3] = new int[4];
int i, j, k = 0;
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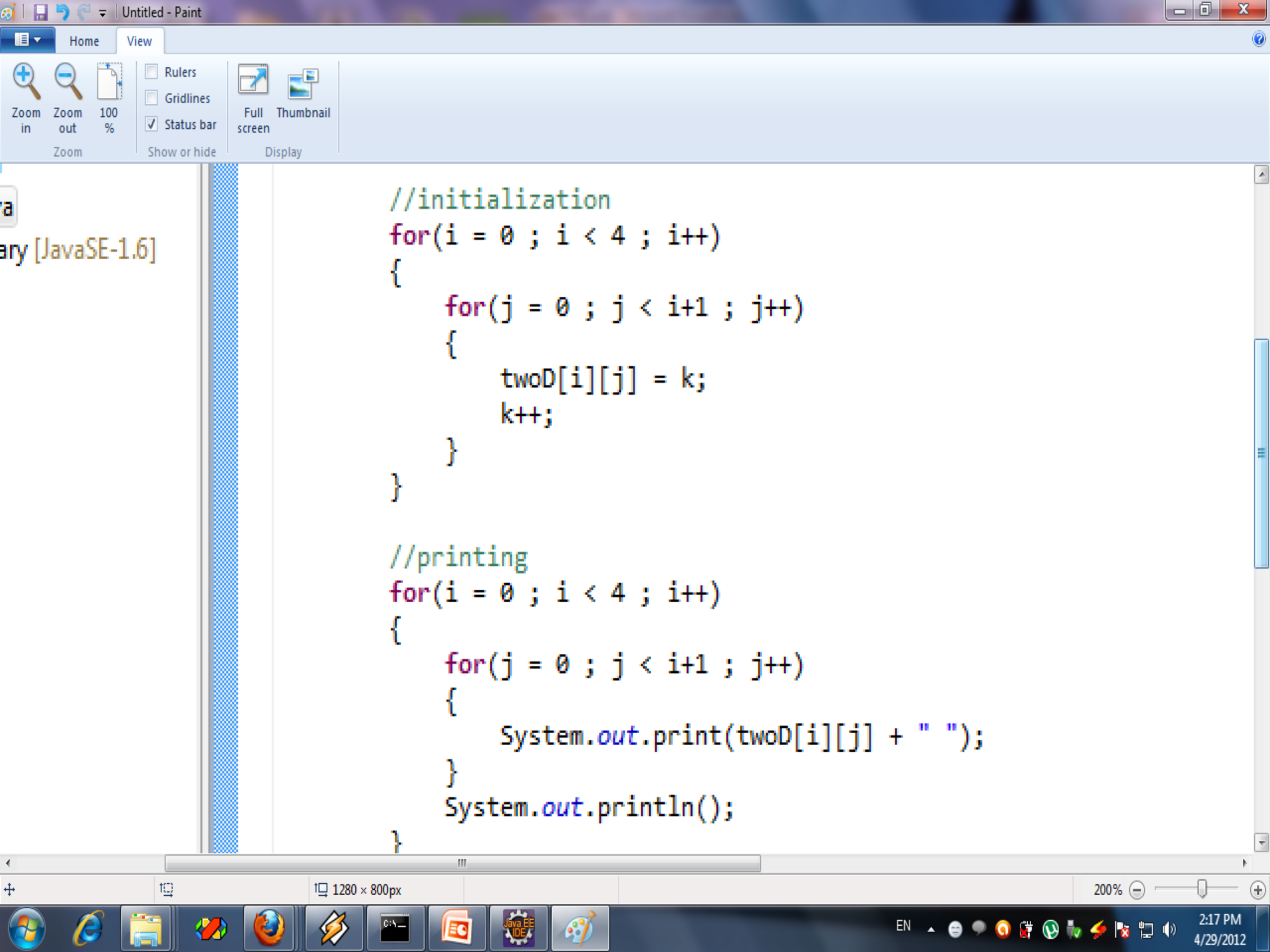
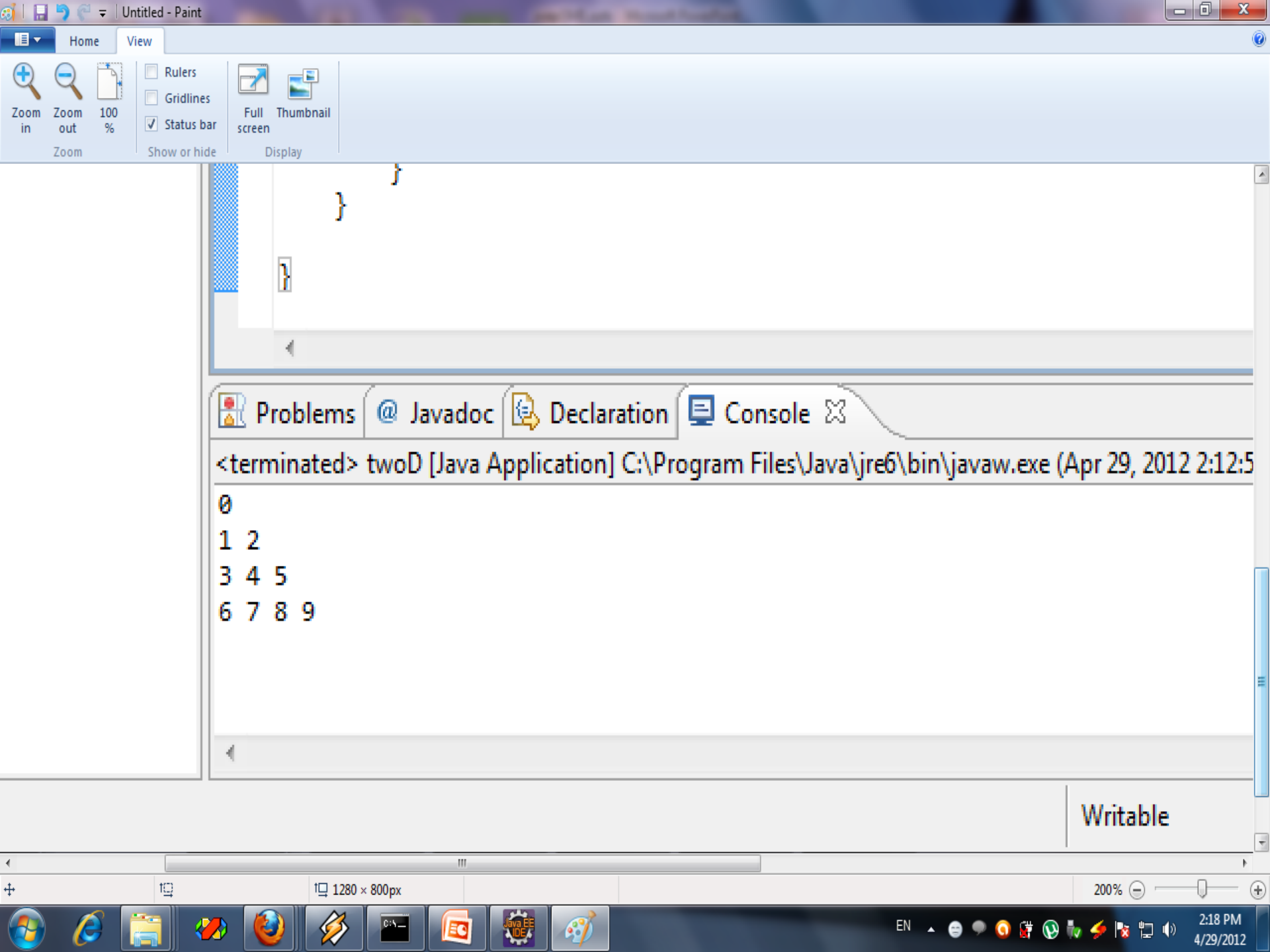

Untitled - Paint
Home
View
Zoom in
Zoom out
100 %
Zoom
Rulers
Gridlines
Status bar
Show or hide
Full screen
Thumbnail
Display
ary [JavaSE-1.6]
//initialization
for(i = 0 ; i < 4 ; i++)
{
for(j = 0 ; j < i+1 ; j++)
{
twoD[i][j] = k;
k++;
}
}
//printing
for(i = 0 ; i < 4 ; i++)
{
for(j = 0 ; j < i+1 ; j++)
{
System.out.print(twoD[i][j] + " ");
}
System.out.println();
}
1280 × 800px
200%
EN
2:17 PM
4/29/2012


Untitled - Paint
Home
View
Zoom in
Zoom out
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Zoom
Rulers
Gridlines
Status bar
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Full screen
Thumbnail
Display
}
}
}
Problems
Javadoc
Declaration
Console
<terminated> twoD [Java Application] C:\Program Files\Java\jre6\bin\javaw.exe (Apr 29, 2012 2:12:5
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3 4 5
6 7 8 9
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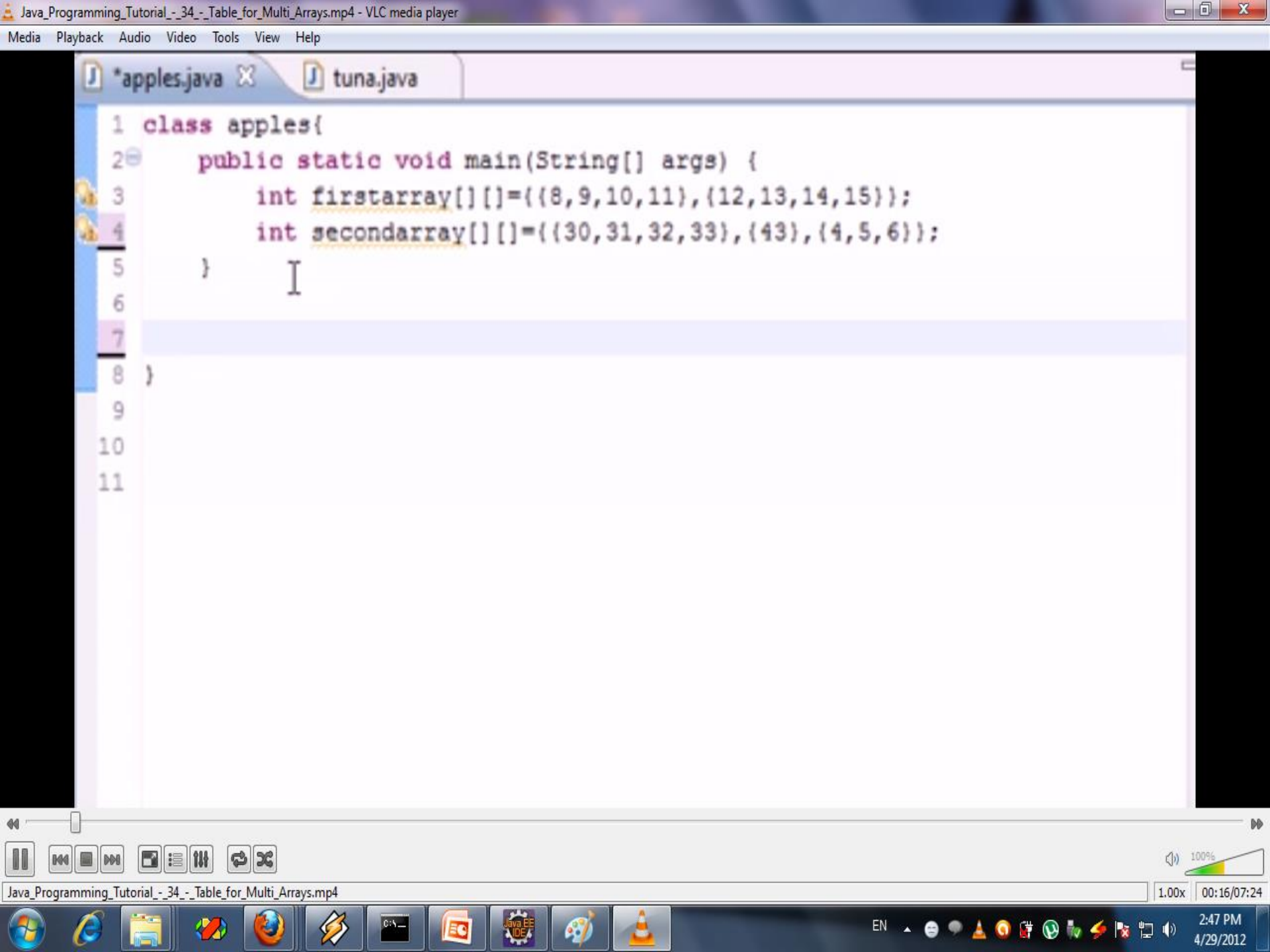
Two-dimensional arrays in method

- This is the last example that we will study about arrays.
- Here, we will see couple of new things:
  - Another way of initialization of two-dimensional array
  - Passing two dimensional array as argument while calling another method.


Java_Programming_Tutorial_-_34_-_Table_for_Multi_Arrays.mp4 - VLC media player
Media Playback Audio Video Tools View Help
*apples.java
tuna.java
1 class apples{
2 public static void main(String[] args) {
3 int firstarray[][]={{8,9,10,11},{12,13,14,15}};
4 int secondarray[][]={{30,31,32,33},{43},{4,5,6}};
5 }
6
7
8 }
9
10
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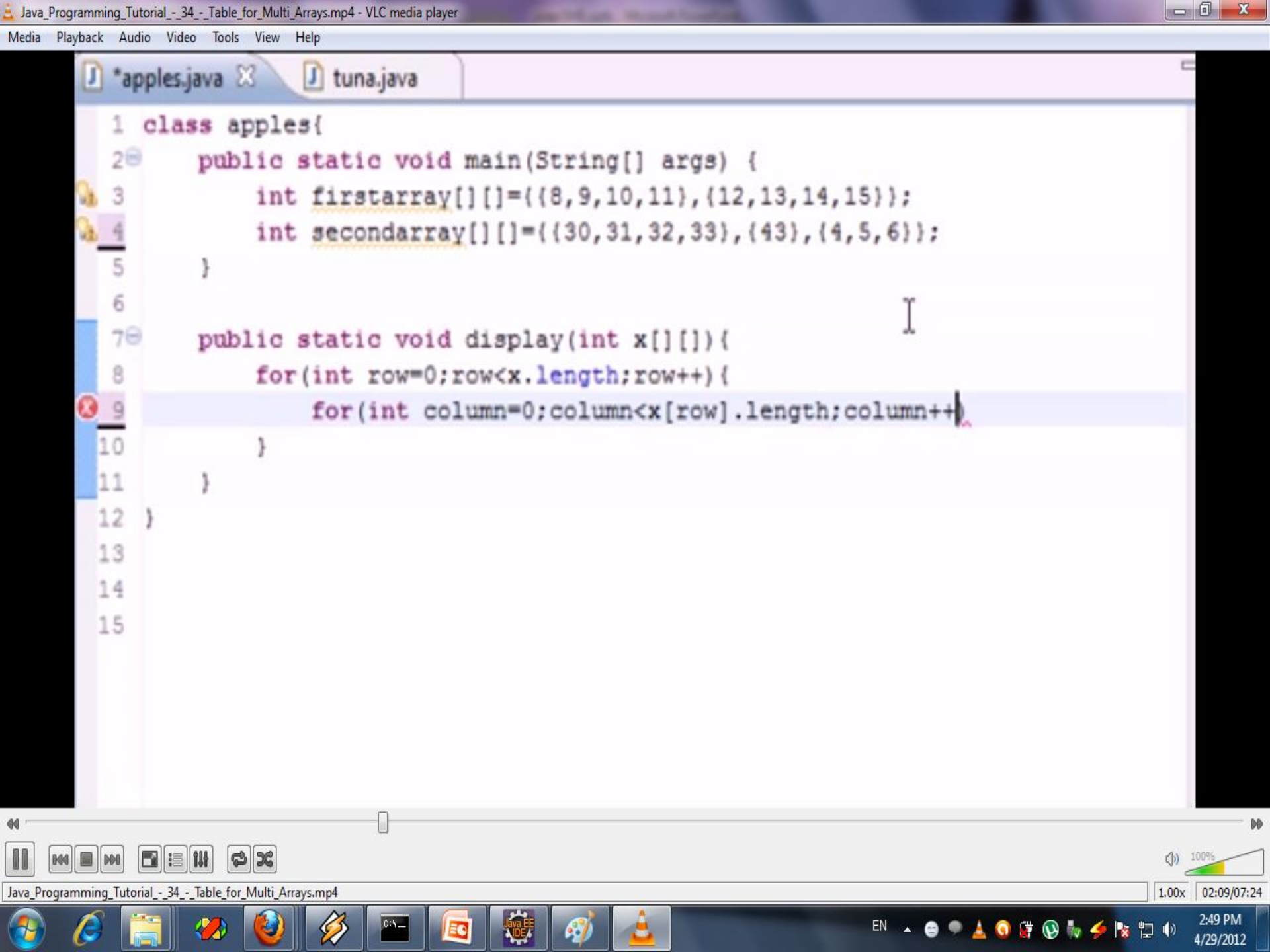
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*apples.java
tuna.java
1 class apples{
2 public static void main(String[] args) {
3 int firstarray[][]={{8,9,10,11},{12,13,14,15}};
4 int secondarray[][]={{30,31,32,33},{43},{4,5,6}};
5 }
6
7 public static void display(int x[][]){
8 for(int row=0;row<x.length;row++){
9 for(int column=0;column<x[row].length;column++)
10 }
11 }
12 }
13
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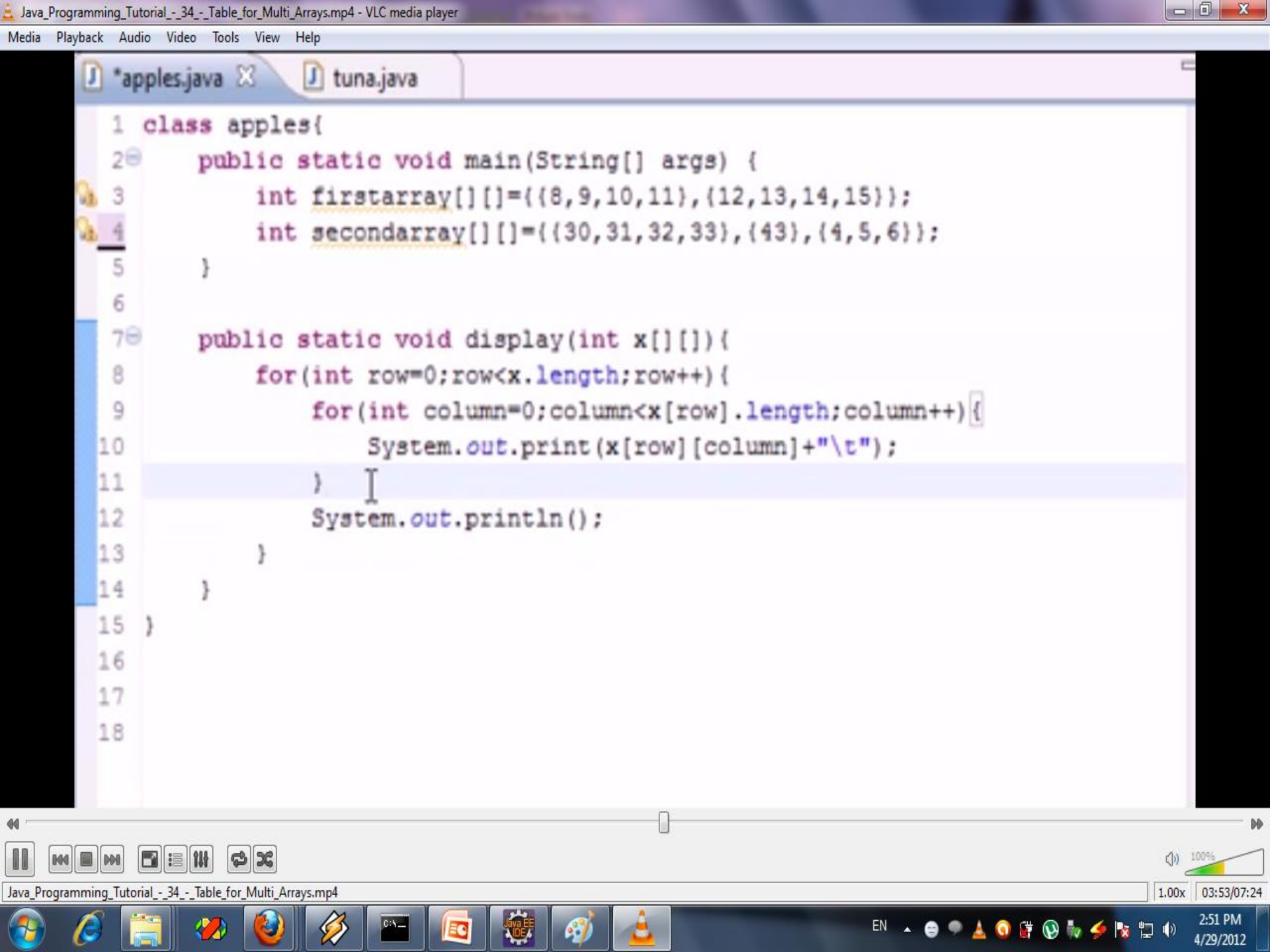
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Media Playback Audio Video Tools View Help
*apples.java
tuna.java
1 class apples{
2 public static void main(String[] args) {
3 int firstarray[][]={{8,9,10,11},{12,13,14,15}};
4 int secondarray[][]={{30,31,32,33},{43},{4,5,6}};
5 }
6
7 public static void display(int x[][]){
8 for(int row=0;row<x.length;row++){
9 for(int column=0;column<x[row].length;column++){
10 System.out.print(x[row][column]+"\t");
11 }
12 System.out.println();
13 }
14 }
15 }
16
17
18
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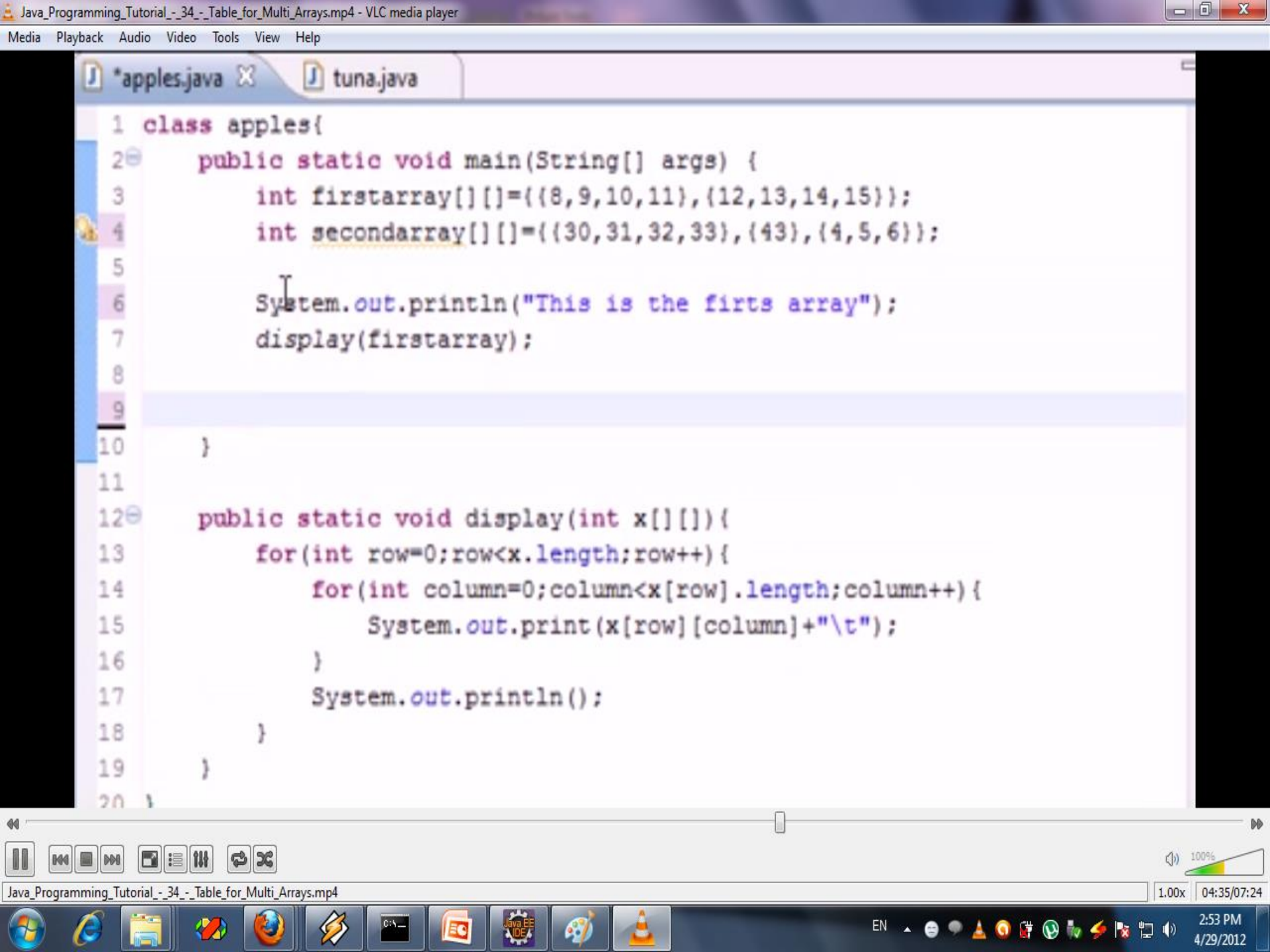
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*apples.java
tuna.java
class apples{
public static void main(String[] args) {
int firstarray[][]={{8,9,10,11},{12,13,14,15}};
int secondarray[][]={{30,31,32,33},{43},{4,5,6}};
System.out.println("This is the firts array");
display(firstarray);
}
public static void display(int x[][]){
for(int row=0;row<x.length;row++){
for(int column=0;column<x[row].length;column++){
System.out.print(x[row][column]+"\t");
}
System.out.println();
}
}
}
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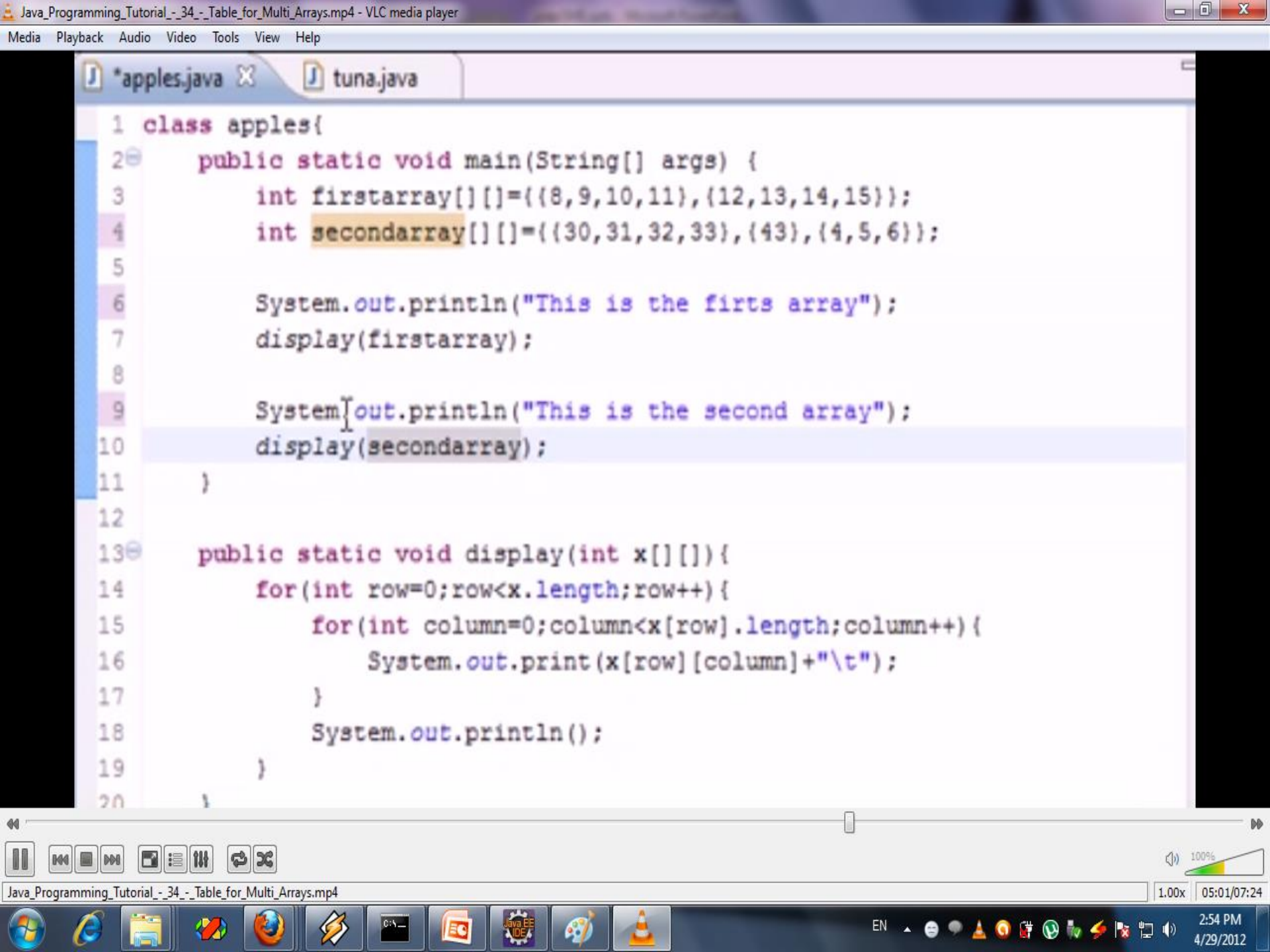
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*apples.java
tuna.java
1 class apples{
2 public static void main(String[] args) {
3 int firstarray[][]={{8,9,10,11},{12,13,14,15}};
4 int secondarray[][]={{30,31,32,33},{43},{4,5,6}};
5
6 System.out.println("This is the firts array");
7 display(firstarray);
8
9 System.out.println("This is the second array");
10 display(secondarray);
11 }
12
13 public static void display(int x[][]){
14 for(int row=0;row<x.length;row++){
15 for(int column=0;column<x[row].length;column++){
16 System.out.print(x[row][column]+"\t");
17 }
18 System.out.println();
19 }
20 }
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```
20      }
21  }
22
23
24
```

Problems | Javadoc | Declaration | Console

<terminated> apples [Java Application] C:\Program Files\Java\jre6\bin\javaw.exe (May 16, 2009 11:12:46 AM)

```
This is the fifts array
8       9       10      11
12      13      14      15
This is the second array
30      31      32      33
43
```

Inheritance

Inheritance

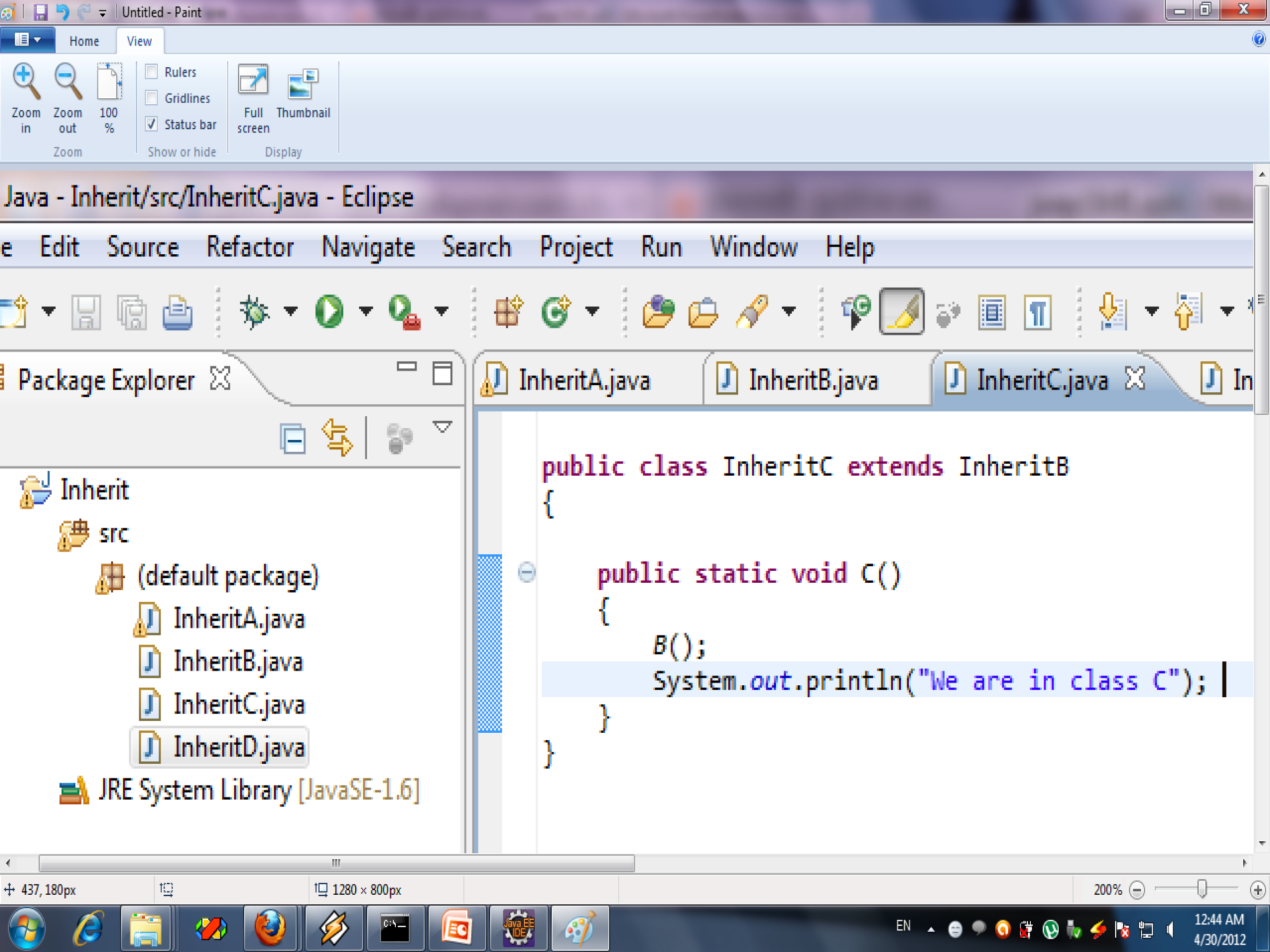
- Inheritance can be defined as the process where one object acquires the properties of another.
- With the use of inheritance, the information is made manageable in a hierarchical order.
- A class that is inherited is called a ***superclass***.
- The class that does the inheriting is called a ***subclass***.

Inheritance

- A subclass is a specialized version of a superclass.
- The subclass inherits all of the instance variables and methods defined by the superclass and add with its own.
- To inherit a class, simply incorporate the definition of one class into another by using the **extends** keyword.

Inheritance

- The first and simple example of inheritance:
  - There four classes(A,B,C,D) in the example.
  - Class A contains the main function
  - Class C and D both inherits Class B
  - So, here the “superclass B” has two “subclasses C and D”.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InheritA.java
InheritB.java
InheritC.java
InheritD.java
JRE System Library [JavaSE-1.6]
InheritA.java
InheritB.java
InheritC.java
public class InheritC extends InheritB
{
public static void C()
{
B();
System.out.println("We are in class C");
}
}
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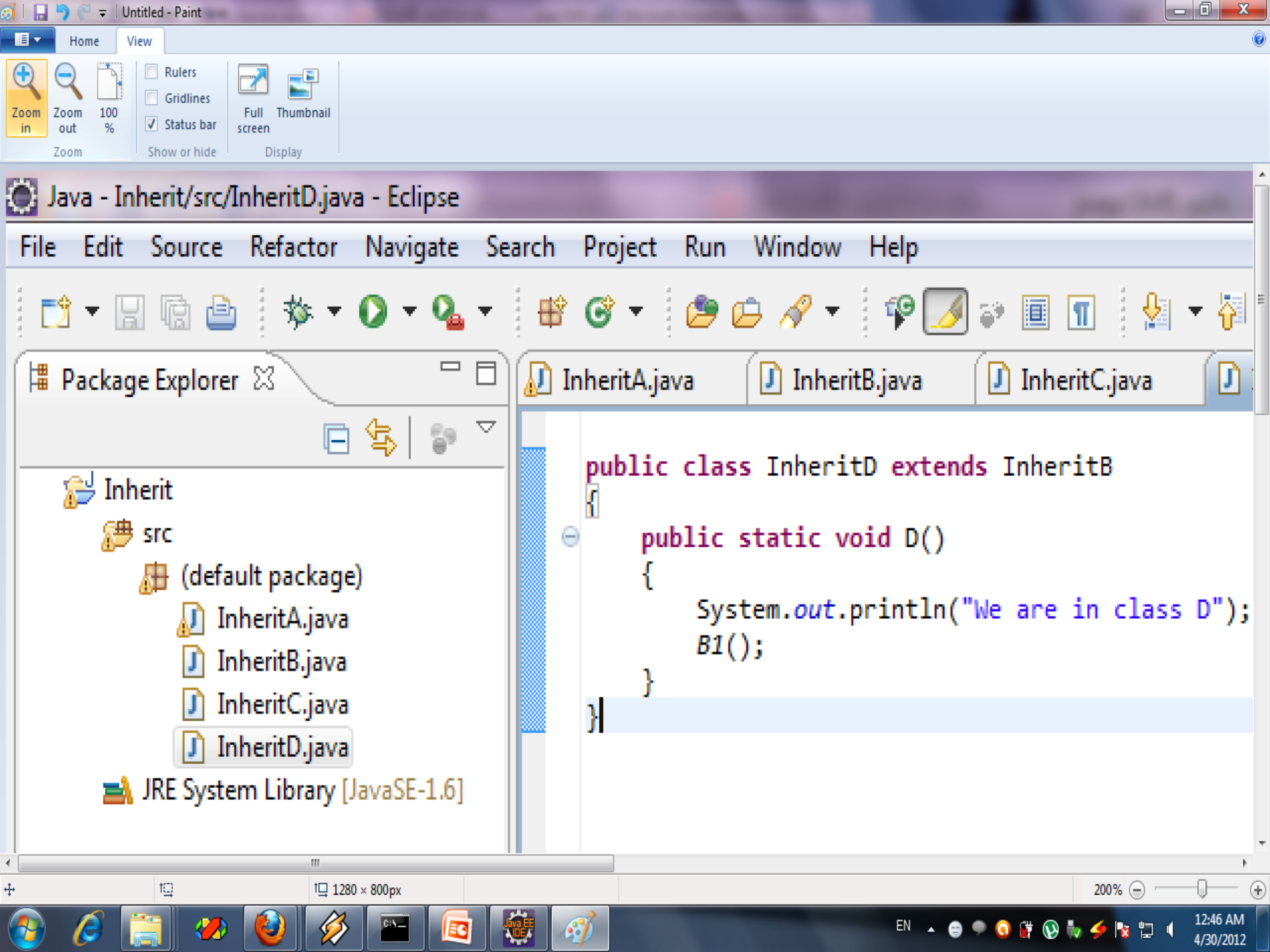
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InheritC.java
InheritD.java
JRE System Library [JavaSE-1.6]
InheritA.java
InheritB.java
InheritC.java
public class InheritD extends InheritB
{
public static void D()
{
System.out.println("We are in class D");
B1();
}
}
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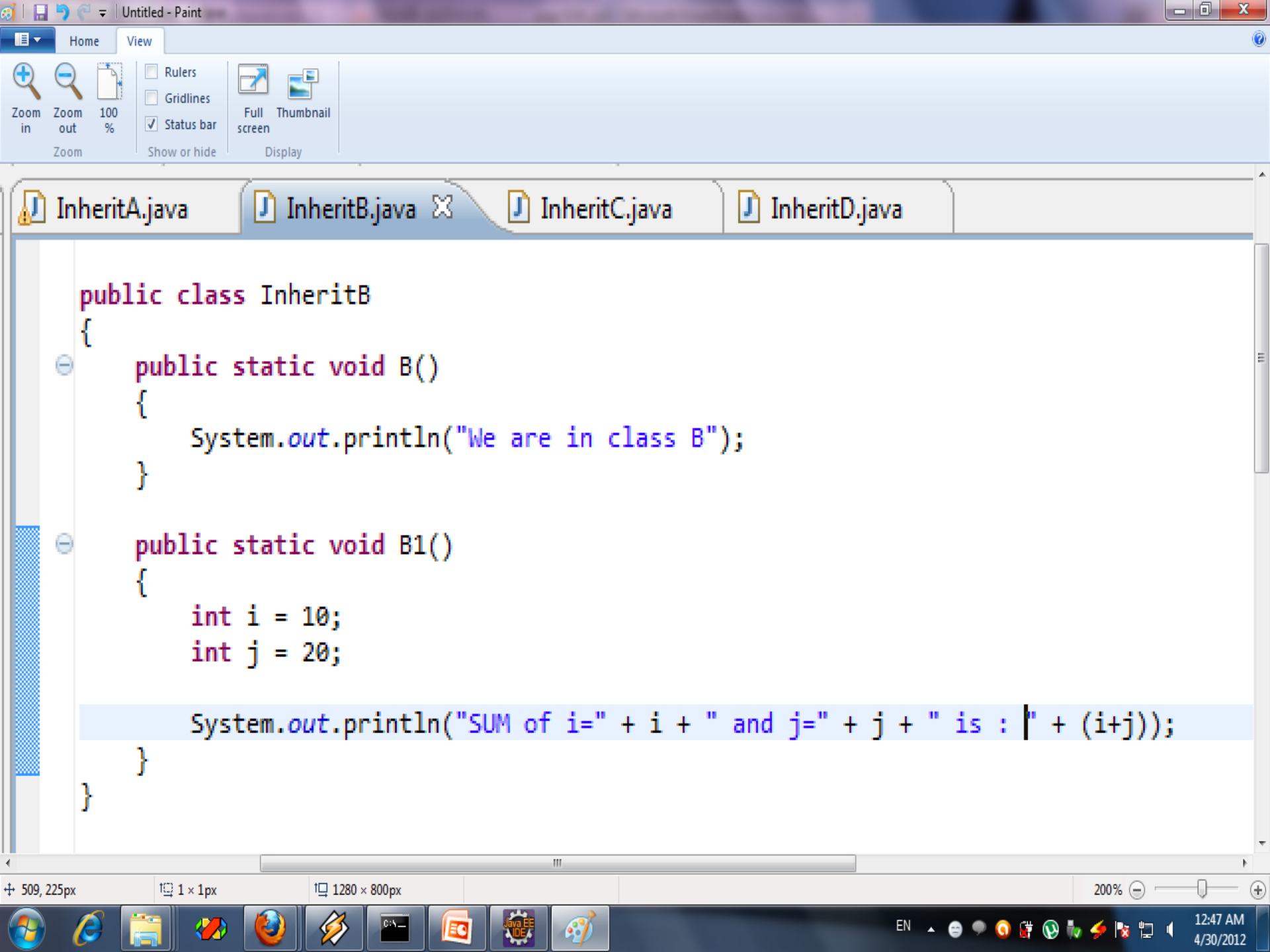
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InheritB.java
InheritC.java
InheritD.java
public class InheritB
{
public static void B()
{
System.out.println("We are in class B");
}
public static void B1()
{
int i = 10;
int j = 20;
System.out.println("SUM of i=" + i + " and j=" + j + " is : " + (i+j));
}
}
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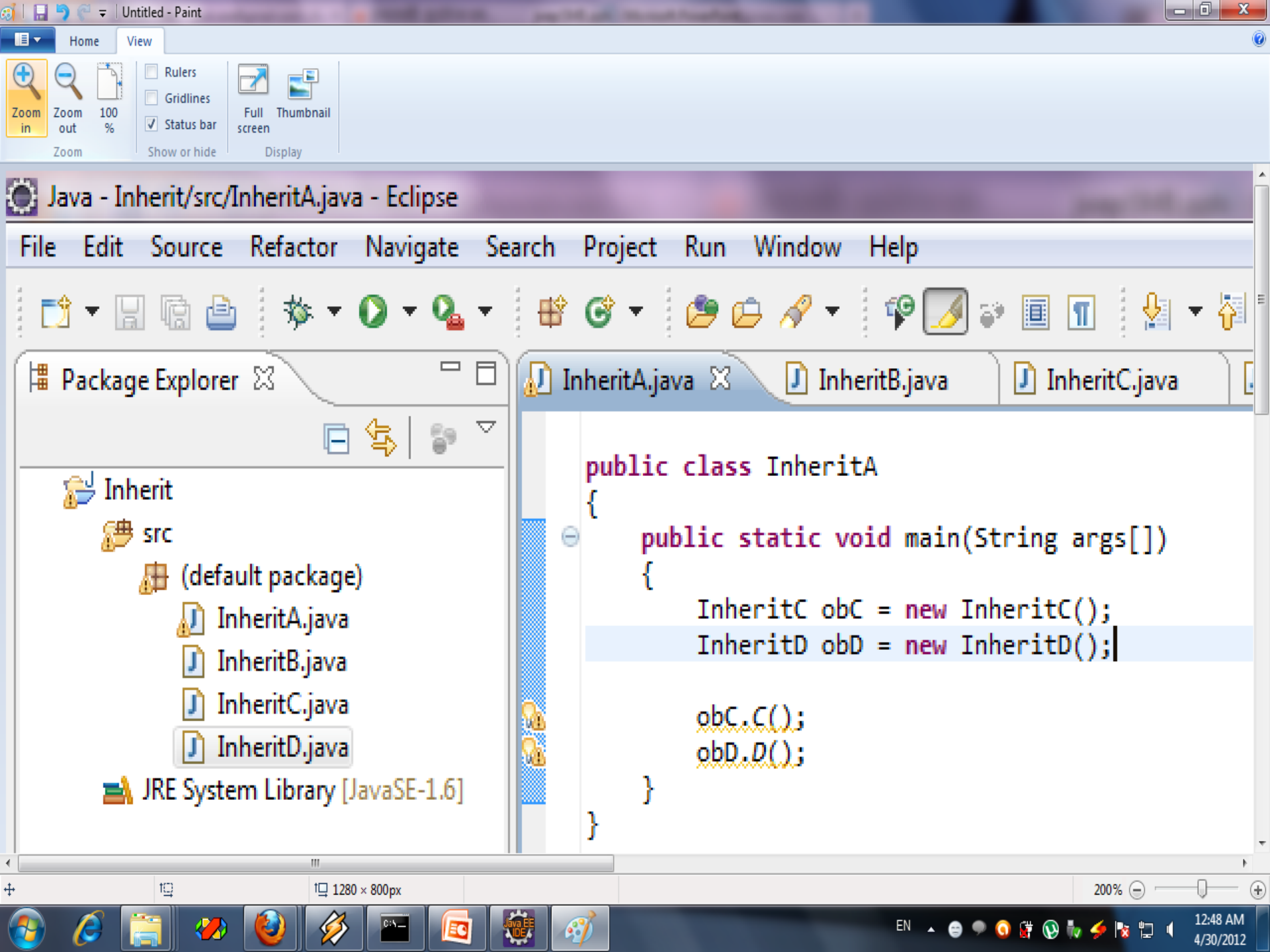
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InheritC.java
InheritD.java
JRE System Library [JavaSE-1.6]
InheritA.java
InheritB.java
InheritC.java
public class InheritA
{
public static void main(String args[])
{
InheritC obC = new InheritC();
InheritD obD = new InheritD();
obC.C();
obD.D();
}
}
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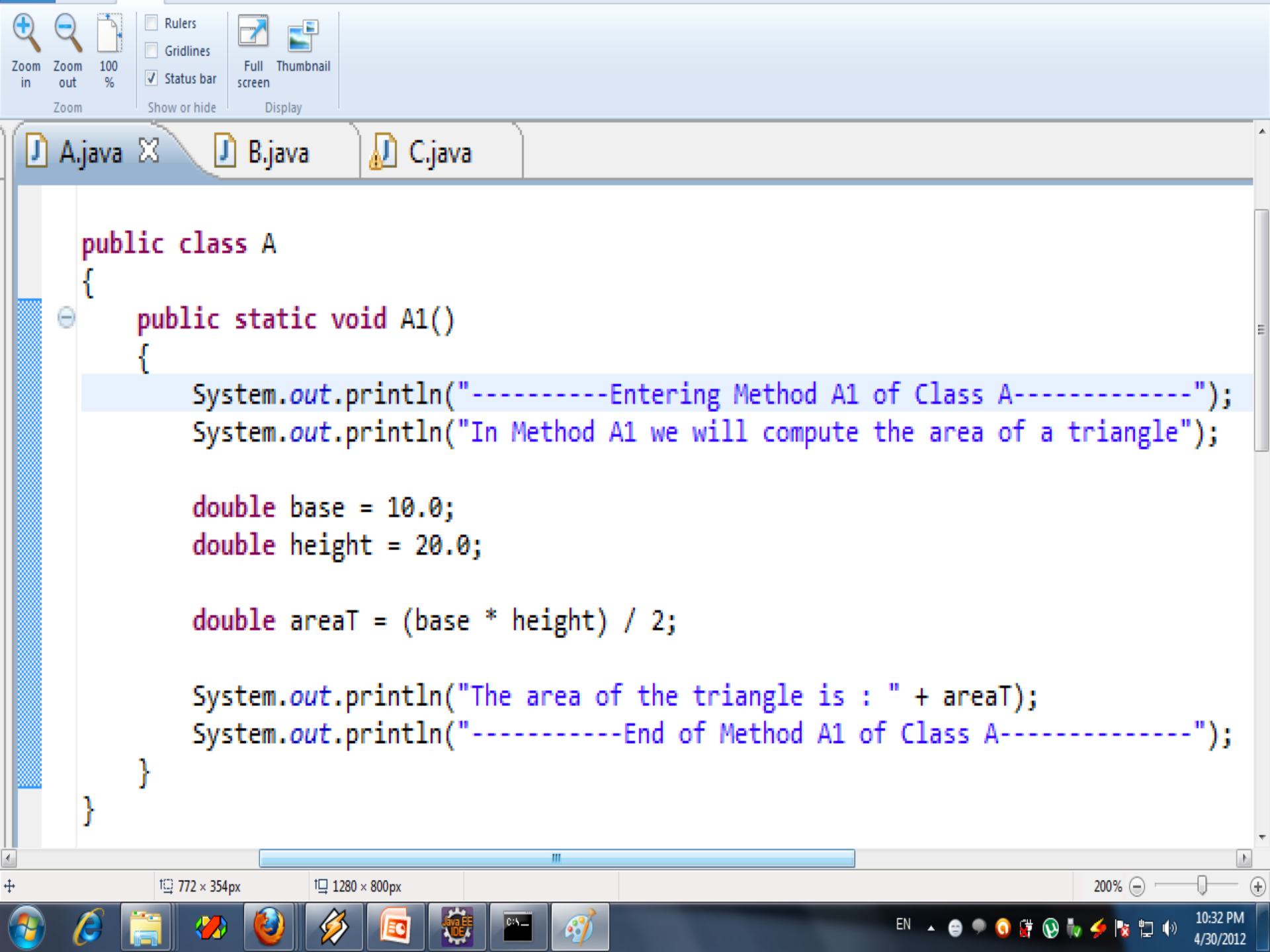
Multilevel Hierarchy of Inheritance

- In the previous example, there was one superclass and multiple(two) subclasses.
- It is also perfectly acceptable to use a subclass as a superclass of another.
- Let, there are 3 classes, A, B and C. B can inherit A and C can inherit B.
- After that, class C inherits both the properties of A and B.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A.java
B.java
C.java
public class A
{
public static void A1()
{
System.out.println("----------Entering Method A1 of Class A-------------");
System.out.println("In Method A1 we will compute the area of a triangle");
double base = 10.0;
double height = 20.0;
double areaT = (base * height) / 2;
System.out.println("The area of the triangle is : " + areaT);
System.out.println("----------End of Method A1 of Class A-------------");
}
}
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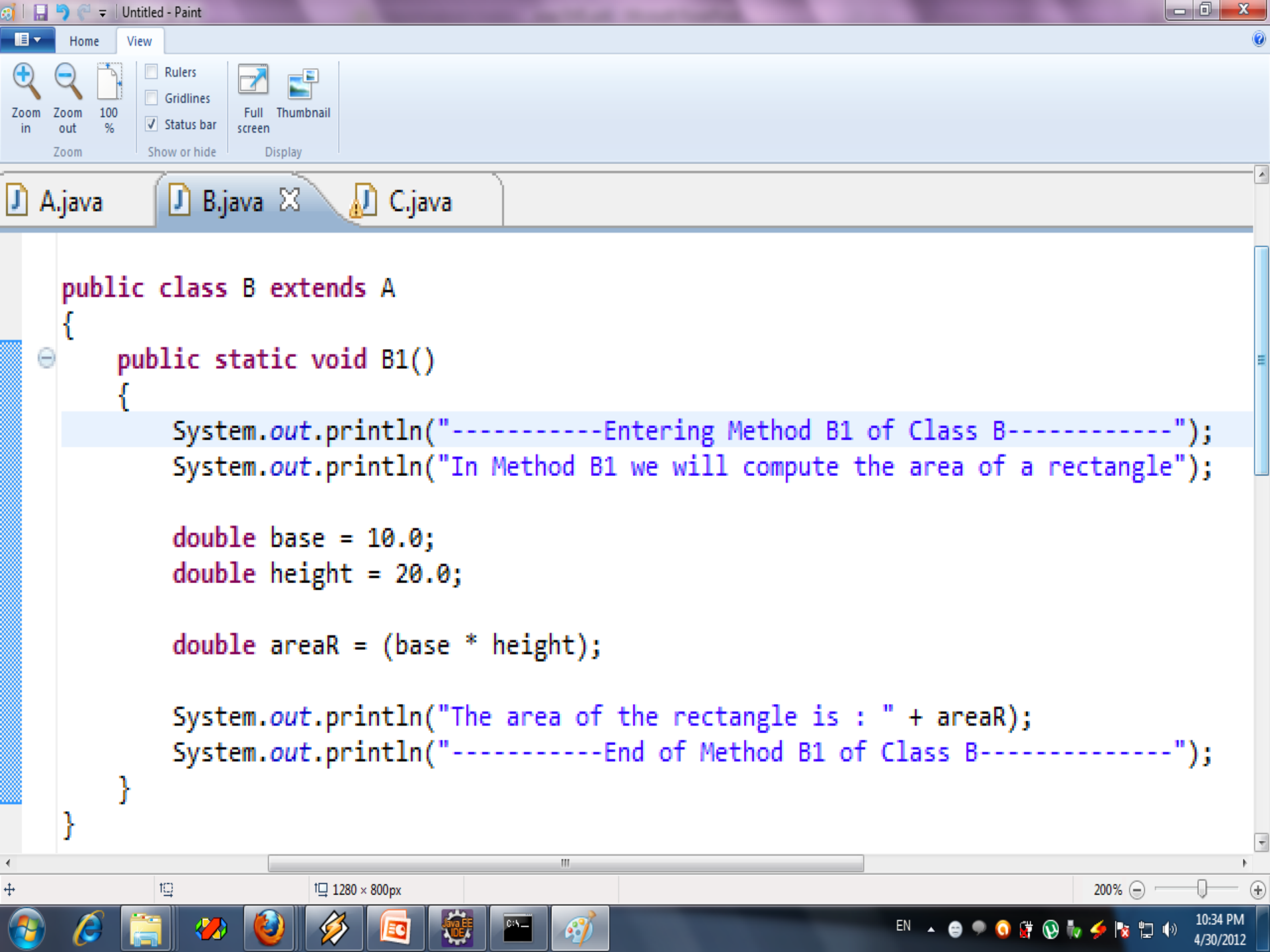
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A.java
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C.java
public class B extends A
{
public static void B1()
{
System.out.println("----------Entering Method B1 of Class B----------");
System.out.println("In Method B1 we will compute the area of a rectangle");
double base = 10.0;
double height = 20.0;
double areaR = (base * height);
System.out.println("The area of the rectangle is : " + areaR);
System.out.println("----------End of Method B1 of Class B----------");
}
}
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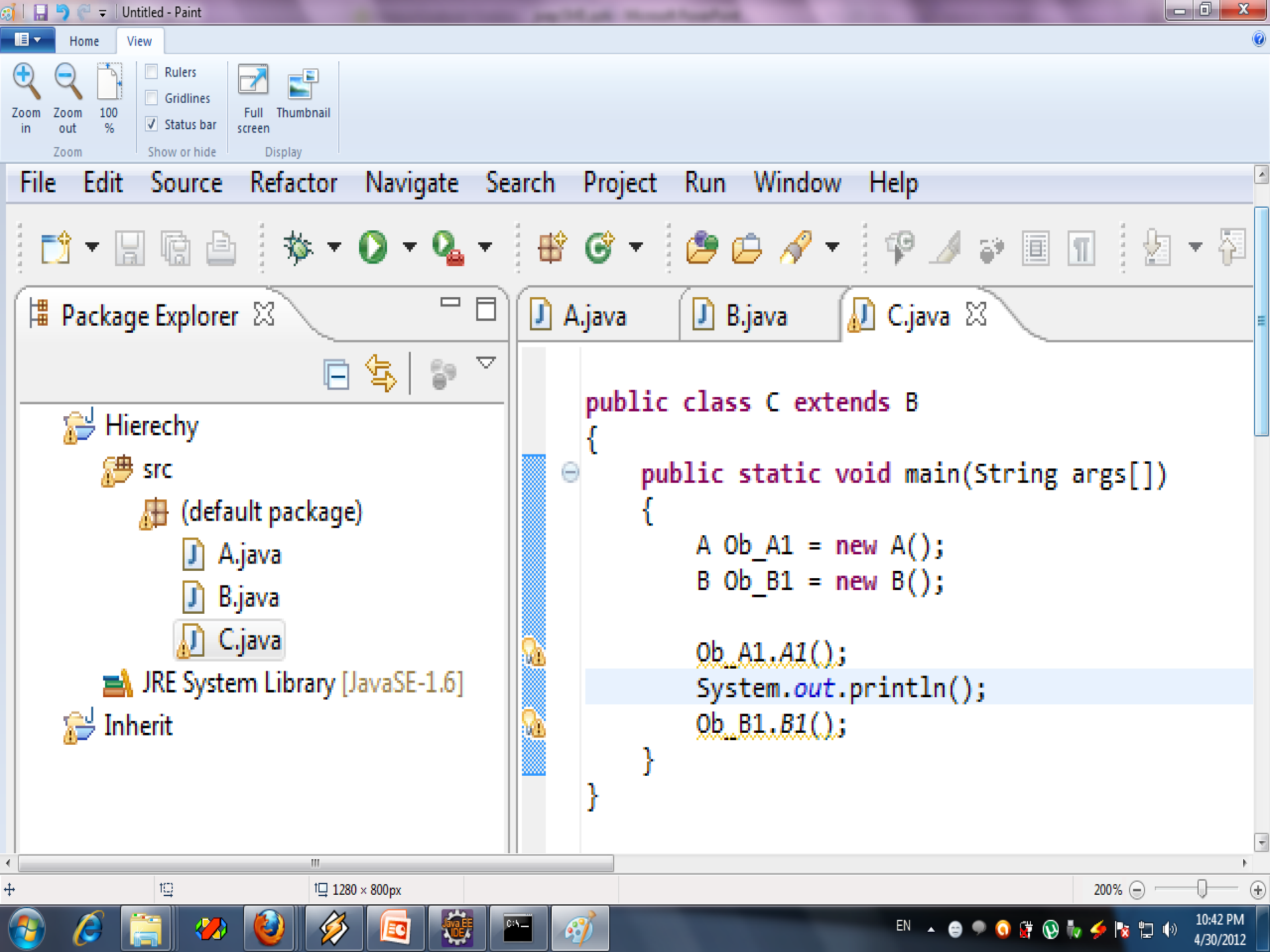
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C.java
JRE System Library [JavaSE-1.6]
Inherit
A.java
B.java
C.java
public class C extends B
{
public static void main(String args[])
{
A Ob_A1 = new A();
B Ob_B1 = new B();
Ob_A1.A1();
System.out.println();
Ob_B1.B1();
}
}
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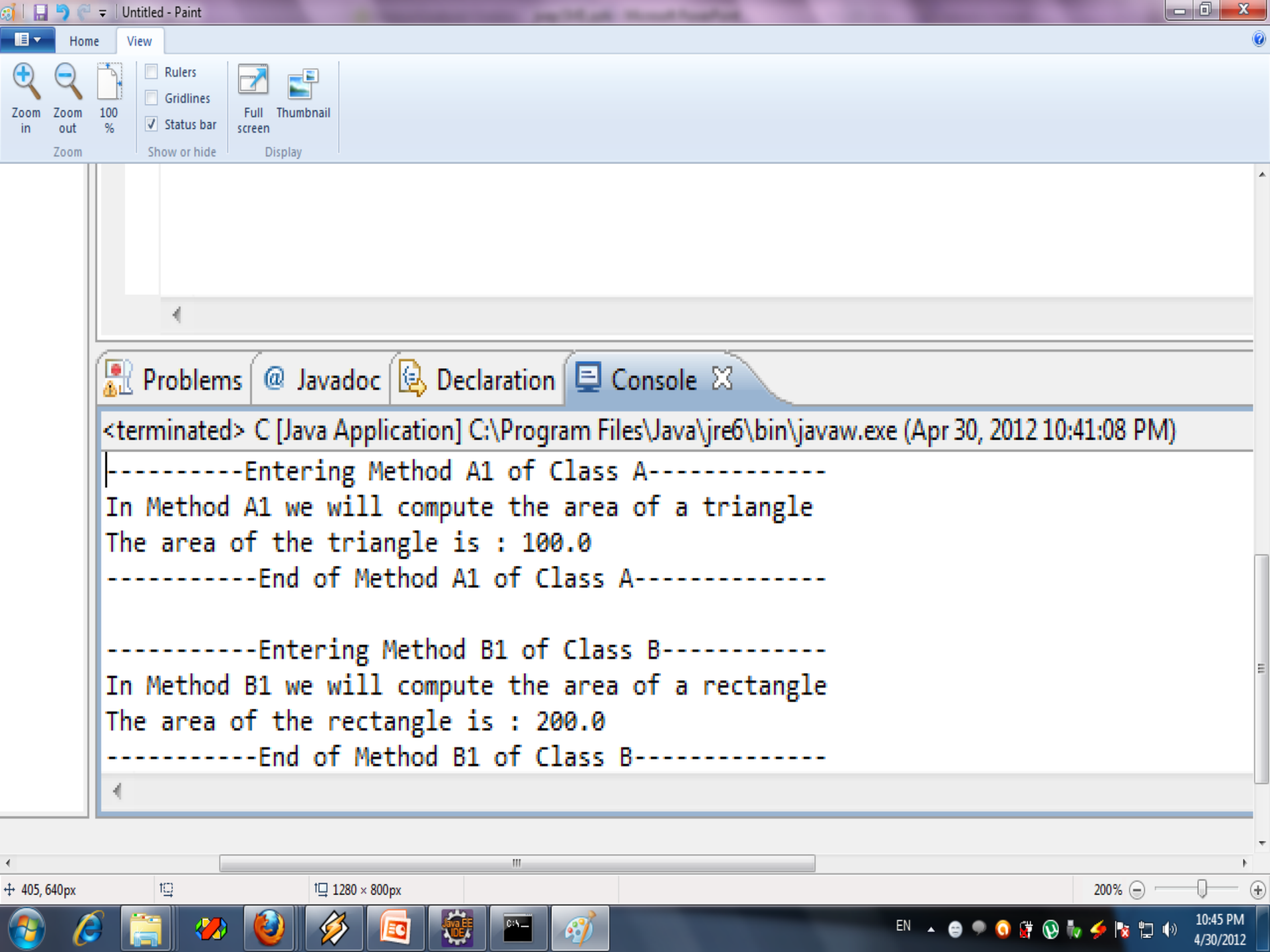
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<terminated> C [Java Application] C:\Program Files\Java\jre6\bin\javaw.exe (Apr 30, 2012 10:41:08 PM)
----------Entering Method A1 of Class A----------
In Method A1 we will compute the area of a triangle
The area of the triangle is : 100.0
----------End of Method A1 of Class A----------
----------Entering Method B1 of Class B----------
In Method B1 we will compute the area of a rectangle
The area of the rectangle is : 200.0
----------End of Method B1 of Class B----------
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Inheritance

- An important note to remember while doing work with inheritance:
  1. Although a subclass includes all the members of its superclass in one level hierarchy and also includes all the members of the superclass of which its superclass is a subclass. (following is an example)
  2. One subclass cannot have multiple superclass, but a superclass can have multiple subclass. (already shown in the first example)

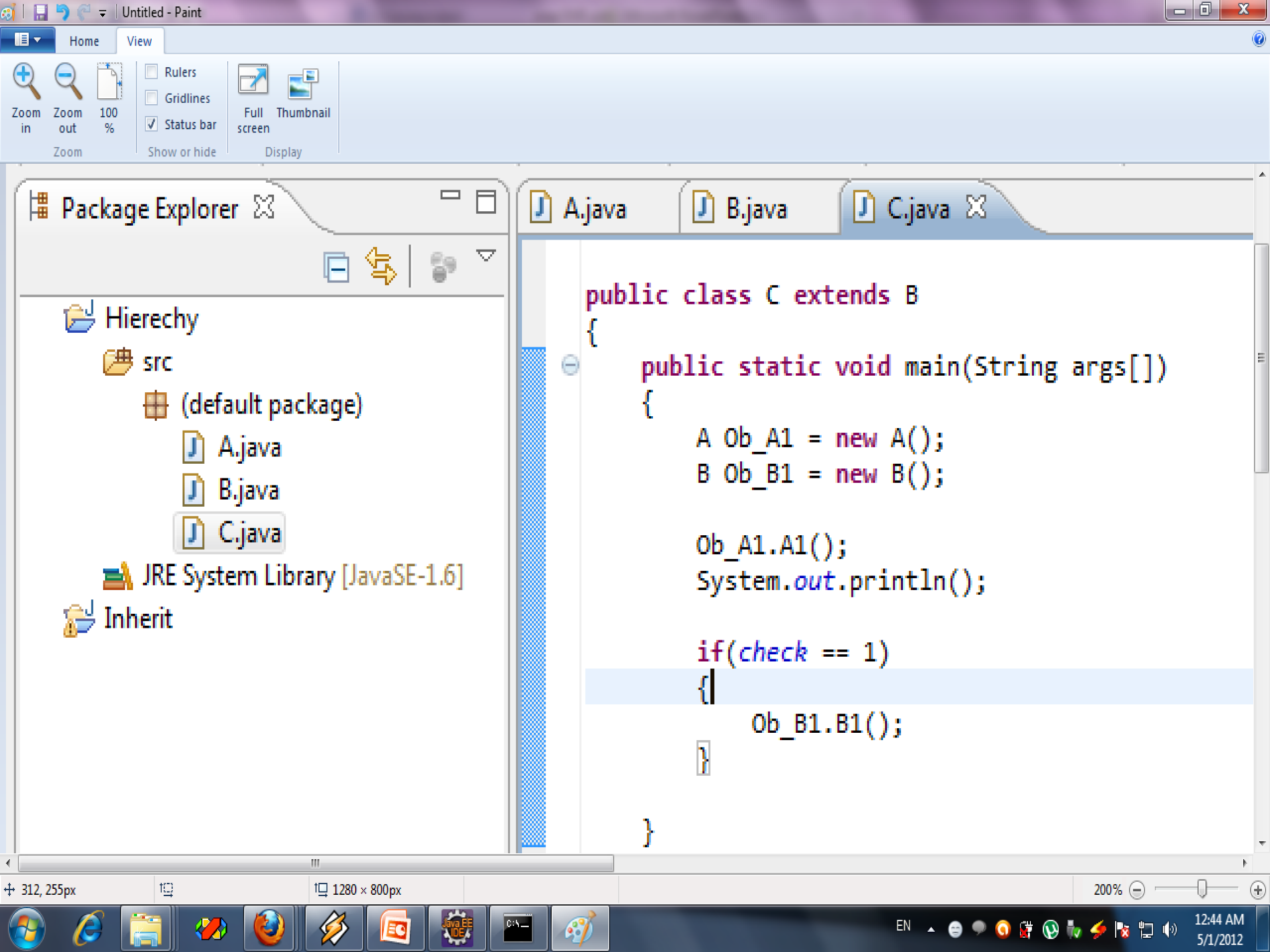
```
public class B extends A
{
    double base = 10.0;
    double height = 20.0;
    double areaR;

    public static int check = 1;

    public void B1()
    {
        if(check == 1)
        {
            System.out.println("----------Entering Method B1 of Class B----------");
            System.out.println("In Method B1 we will compute the area of a rectangle");

            areaR = (base * height);

            System.out.println("The area of the rectangle is : " + areaR);
            System.out.println("----------End of Method B1 of Class B----------");
        }
```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A.java
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C.java
JRE System Library [JavaSE-1.6]
Inherit
A.java
B.java
C.java
public class C extends B
{
public static void main(String args[])
{
A Ob_A1 = new A();
B Ob_B1 = new B();
Ob_A1.A1();
System.out.println();
if(check == 1)
{
Ob_B1.B1();
}
}
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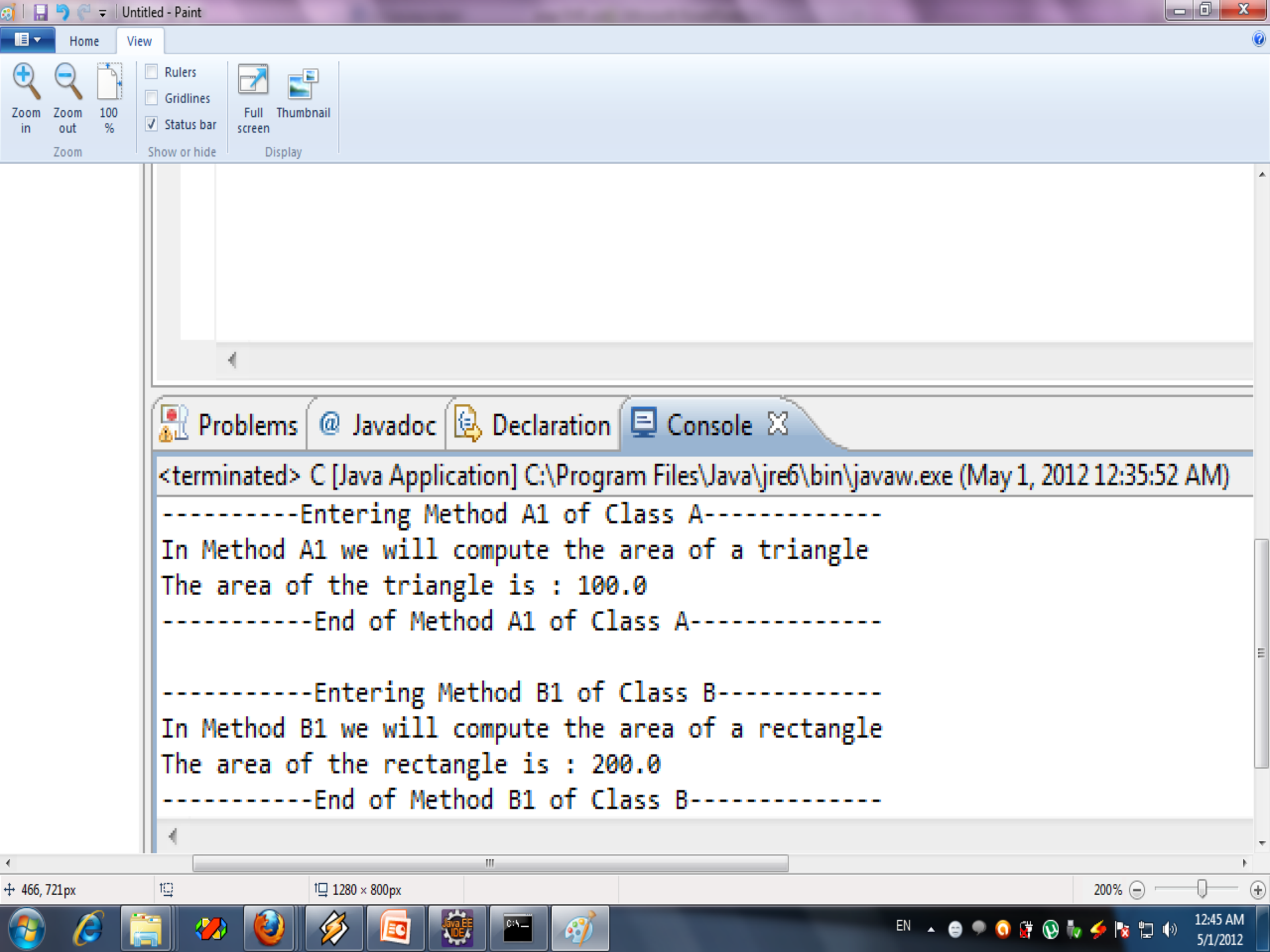
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Declaration
Console
<terminated> C [Java Application] C:\Program Files\Java\jre6\bin\javaw.exe (May 1, 2012 12:35:52 AM)
----------Entering Method A1 of Class A----------
In Method A1 we will compute the area of a triangle
The area of the triangle is : 100.0
----------End of Method A1 of Class A----------
----------Entering Method B1 of Class B----------
In Method B1 we will compute the area of a rectangle
The area of the rectangle is : 200.0
----------End of Method B1 of Class B----------
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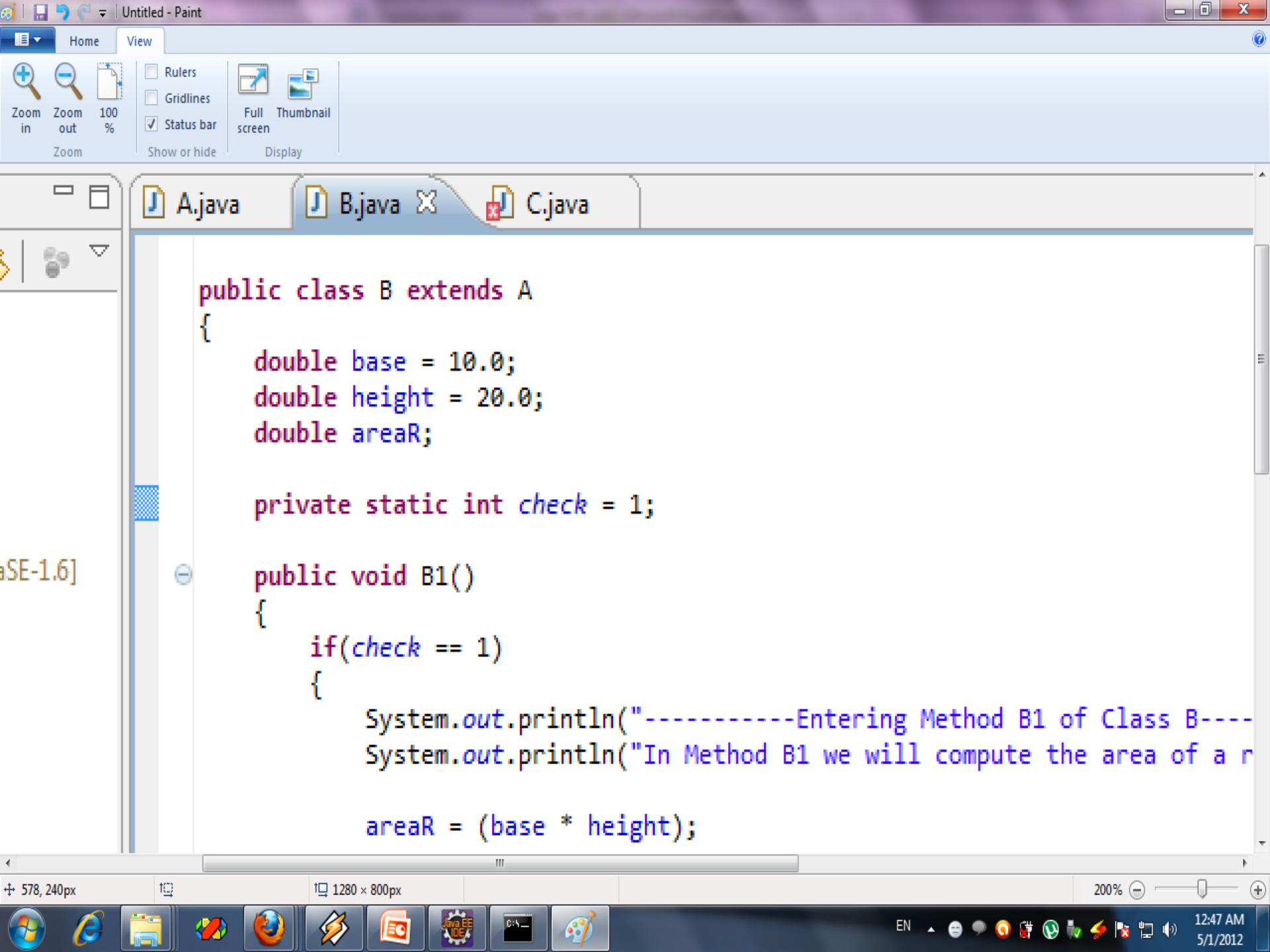
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Full screen
Thumbnail
Display
A.java
B.java
C.java
public class B extends A
{
double base = 10.0;
double height = 20.0;
double areaR;
private static int check = 1;
public void B1()
{
if(check == 1)
{
System.out.println("----------Entering Method B1 of Class B----
System.out.println("In Method B1 we will compute the area of a r
areaR = (base * height);
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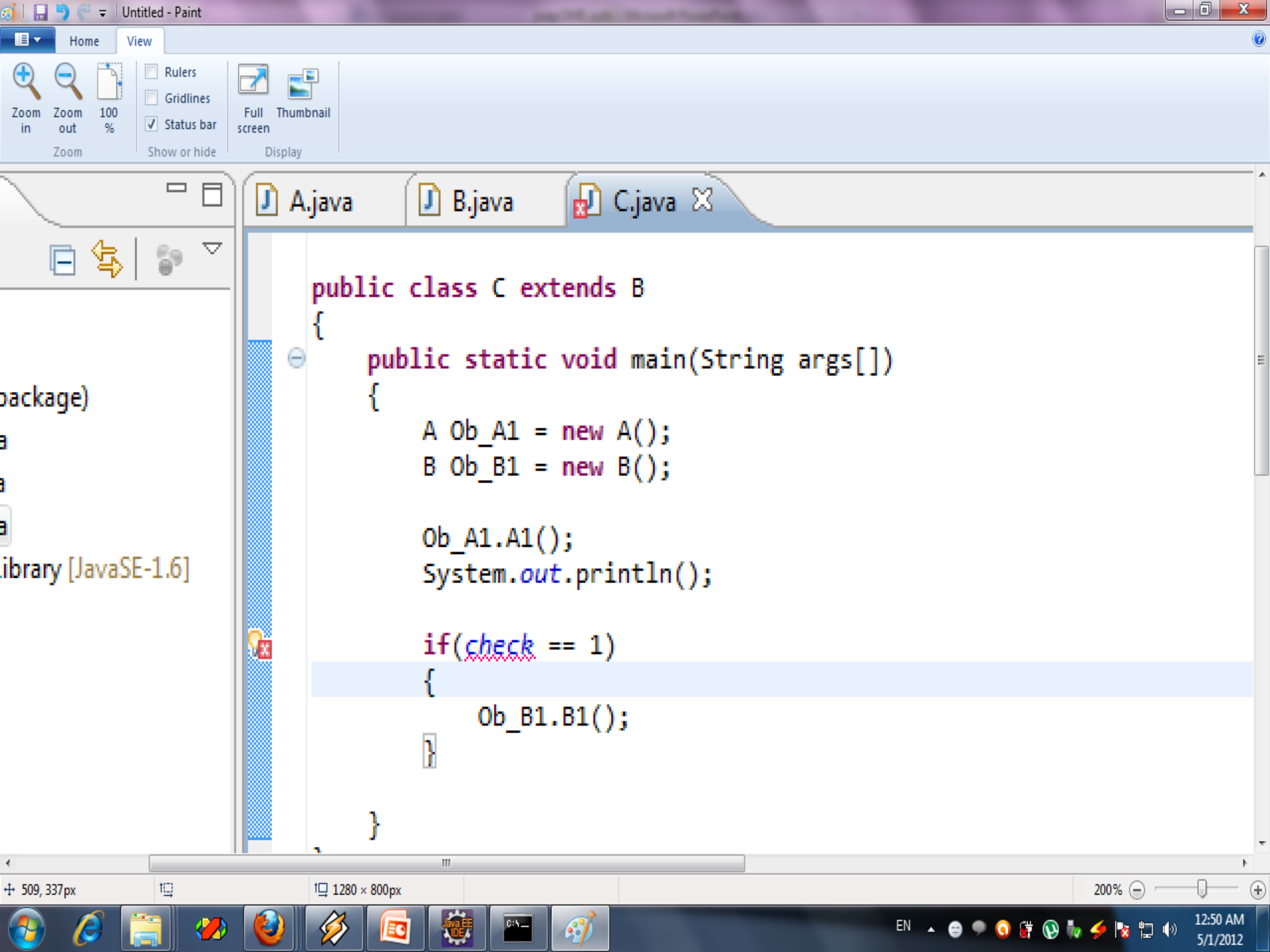
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A.java
B.java
C.java
public class C extends B
{
public static void main(String args[])
{
A Ob_A1 = new A();
B Ob_B1 = new B();
Ob_A1.A1();
System.out.println();
if(check == 1)
{
Ob_B1.B1();
}
}
package)
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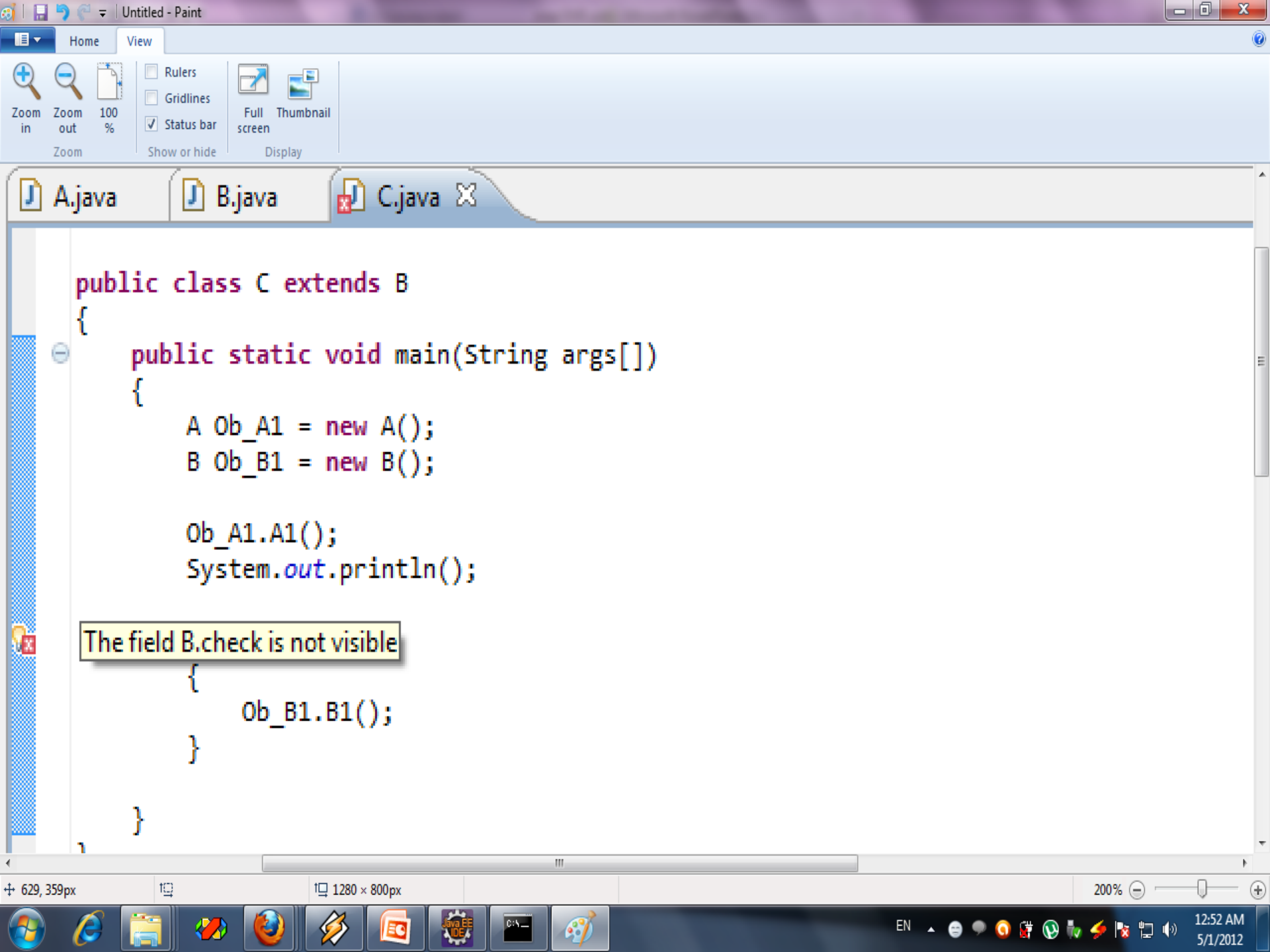
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A.java
B.java
C.java
public class C extends B
{
public static void main(String args[])
{
A Ob_A1 = new A();
B Ob_B1 = new B();
Ob_A1.A1();
System.out.println();
The field B.check is not visible
{
Ob_B1.B1();
}
}
}
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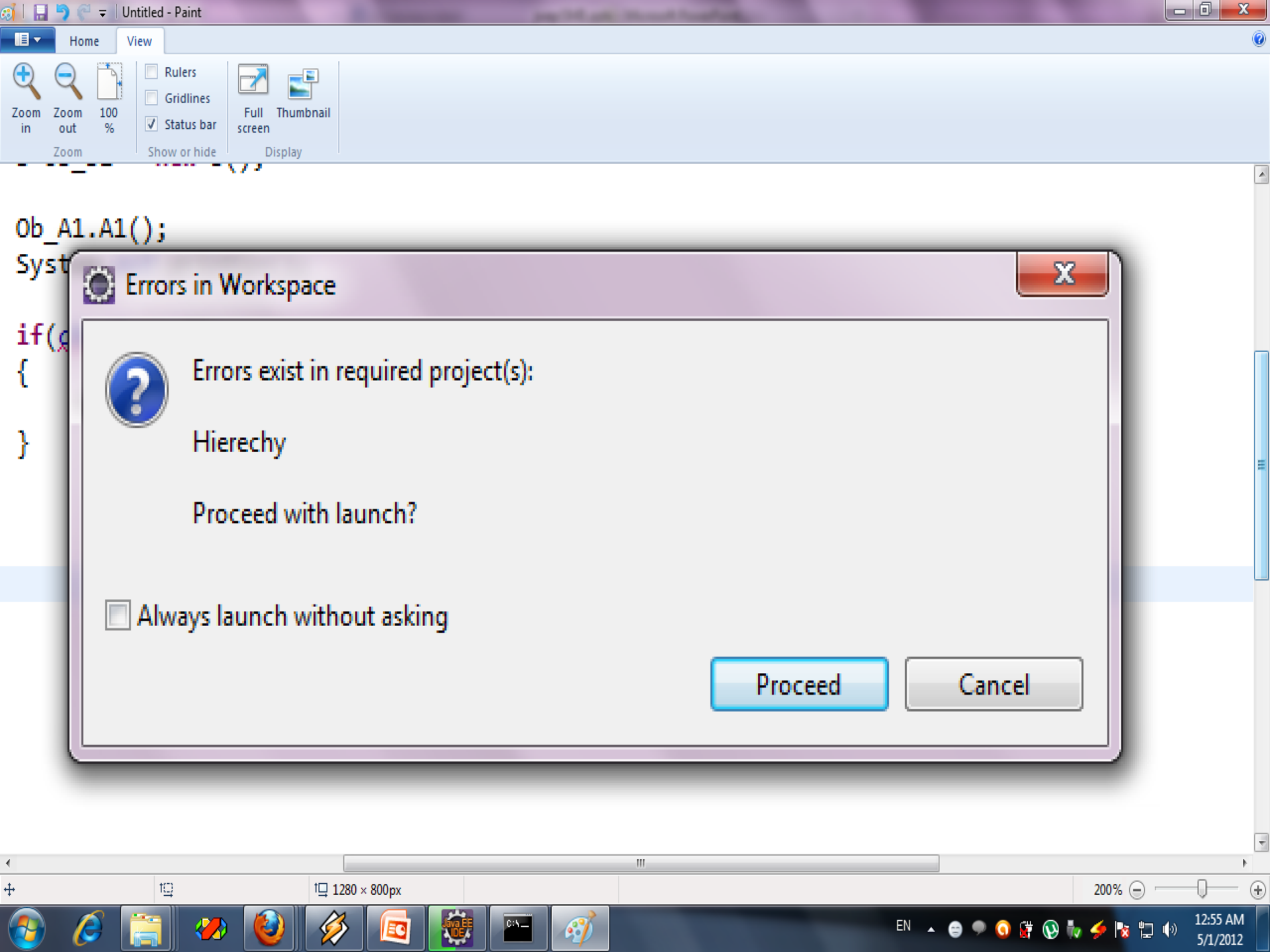
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Ob_A1.A1();
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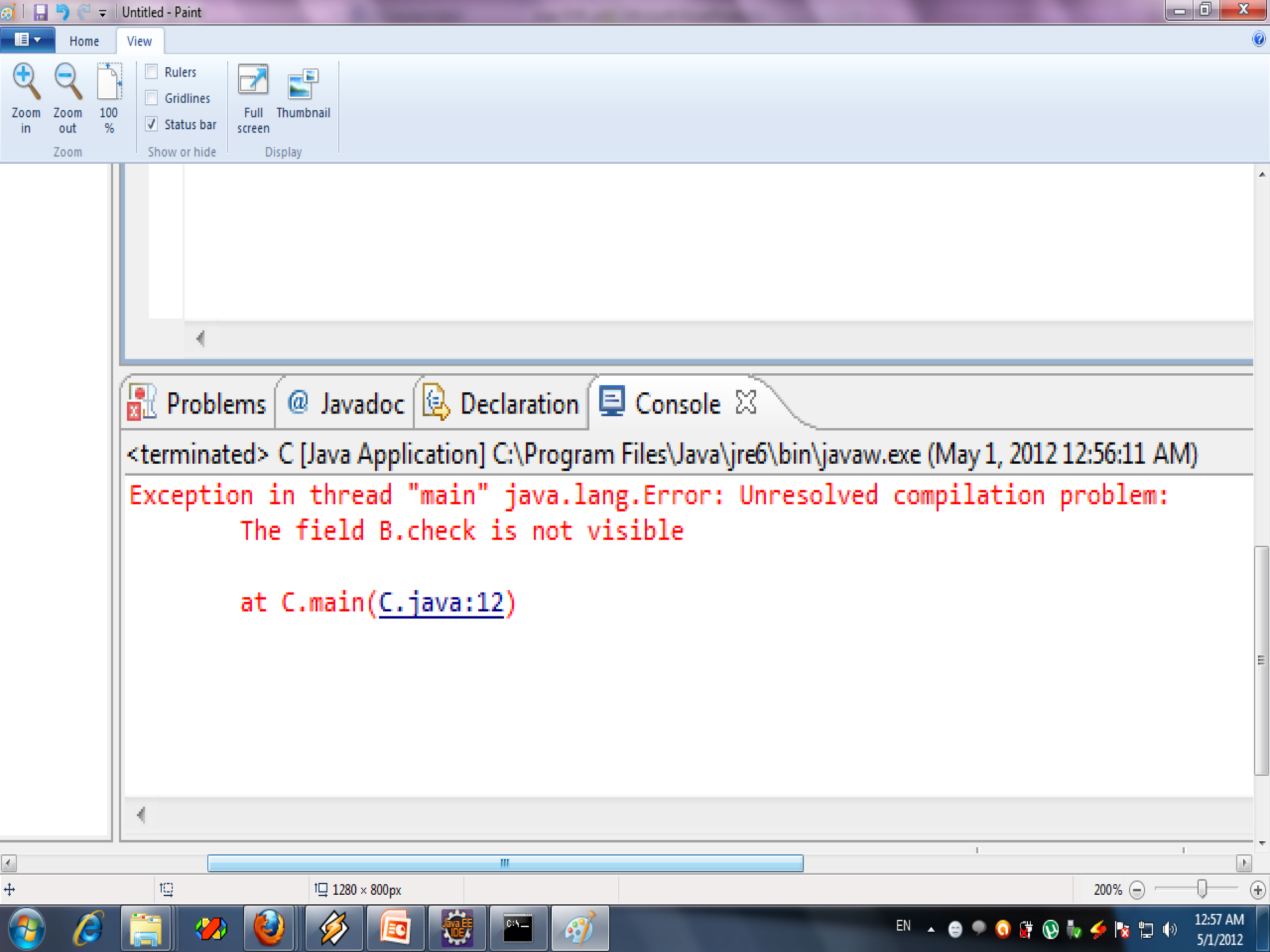
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The field B.check is not visible
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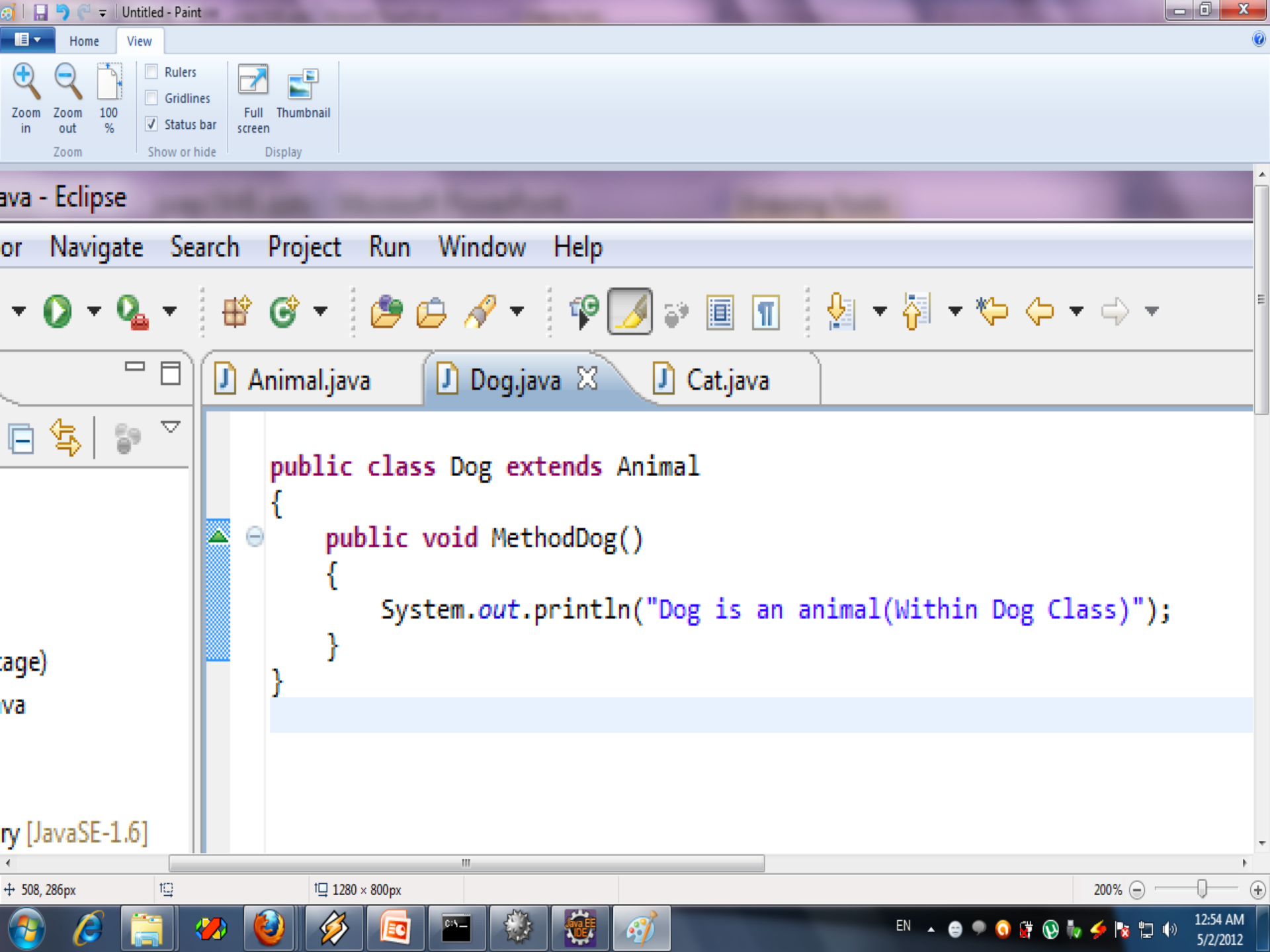
Method Overriding

- In a class hierarchy, when a method in a subclass has the same name and type signature as a method in its superclass,
  - Then ***the method in the subclass is said to override the method in the superclass.***
- When *an overridden method is called from within a subclass*,
  - It will always ***refer to the version of that method defined by the subclass***.
  - The version of the method defined by the superclass will be ***hidden***.

Method Overriding

- Following are two examples :
  1. Shows that how a method in a subclass with same signature that of superclass overrides the method of superclass.
  2. When overriding gives error.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or Navigate Search Project Run Window Help
Animal.java
Dog.java
Cat.java
public class Dog extends Animal
{
public void MethodDog()
{
System.out.println("Dog is an animal(Within Dog Class)");
}
}
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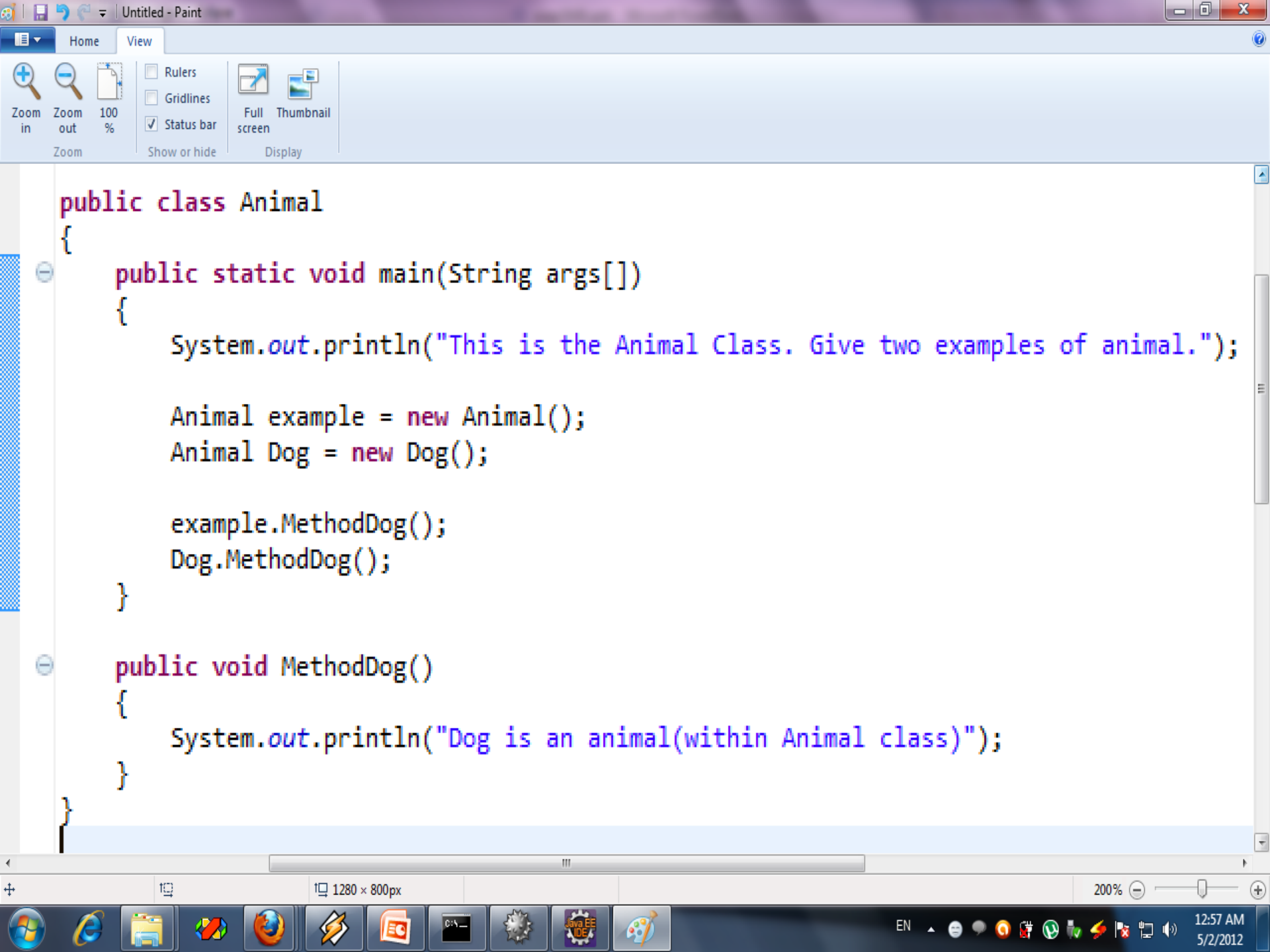
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public class Animal
{
public static void main(String args[])
{
System.out.println("This is the Animal Class. Give two examples of animal.");
Animal example = new Animal();
Animal Dog = new Dog();
example.MethodDog();
Dog.MethodDog();
}
public void MethodDog()
{
System.out.println("Dog is an animal(within Animal class)");
}
}
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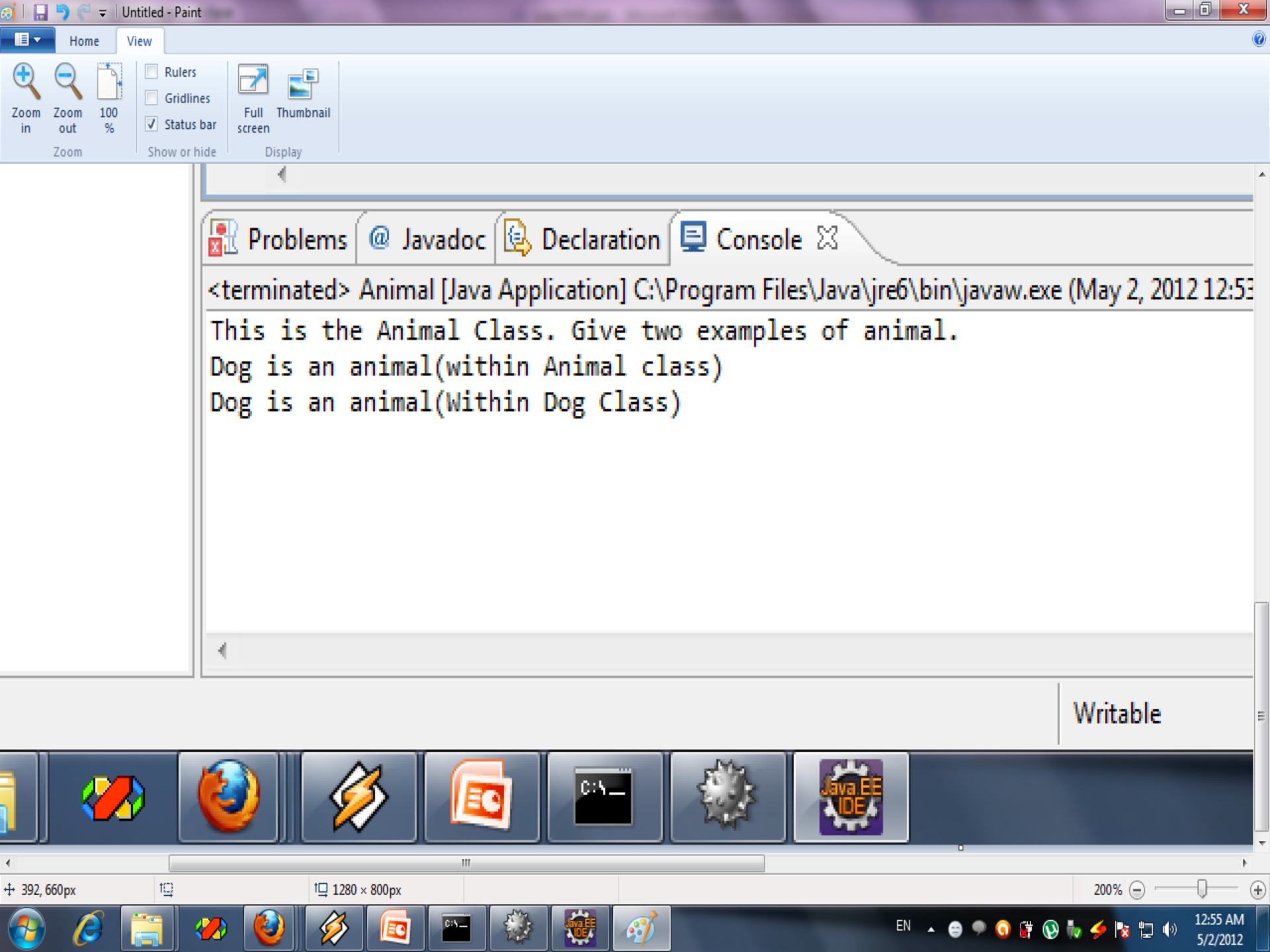
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This is the Animal Class. Give two examples of animal.
Dog is an animal(within Animal class)
Dog is an animal(Within Dog Class)
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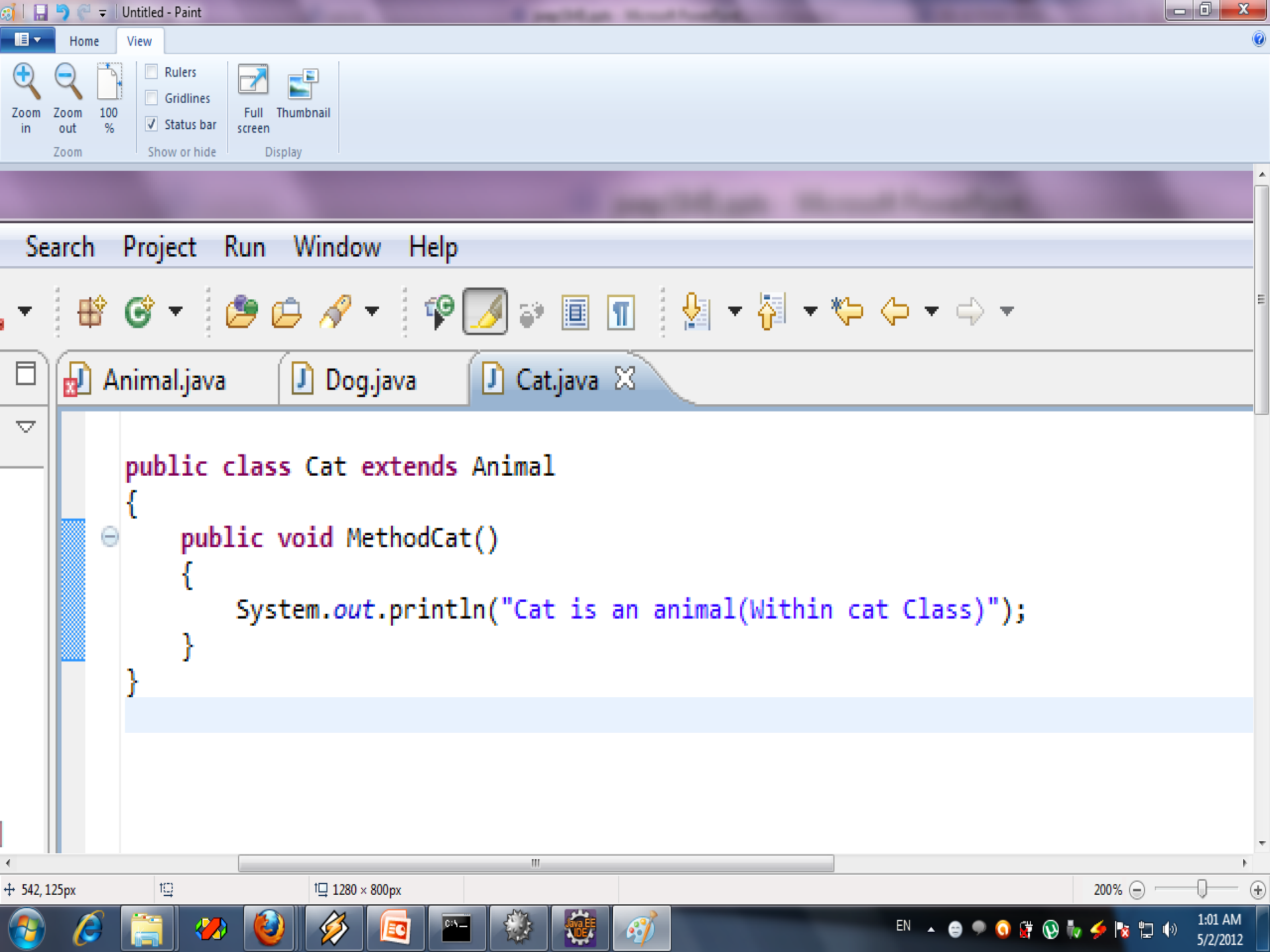
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Animal.java
Dog.java
Cat.java
public class Cat extends Animal
{
public void MethodCat()
{
System.out.println("Cat is an animal(Within cat Class)");
}
}
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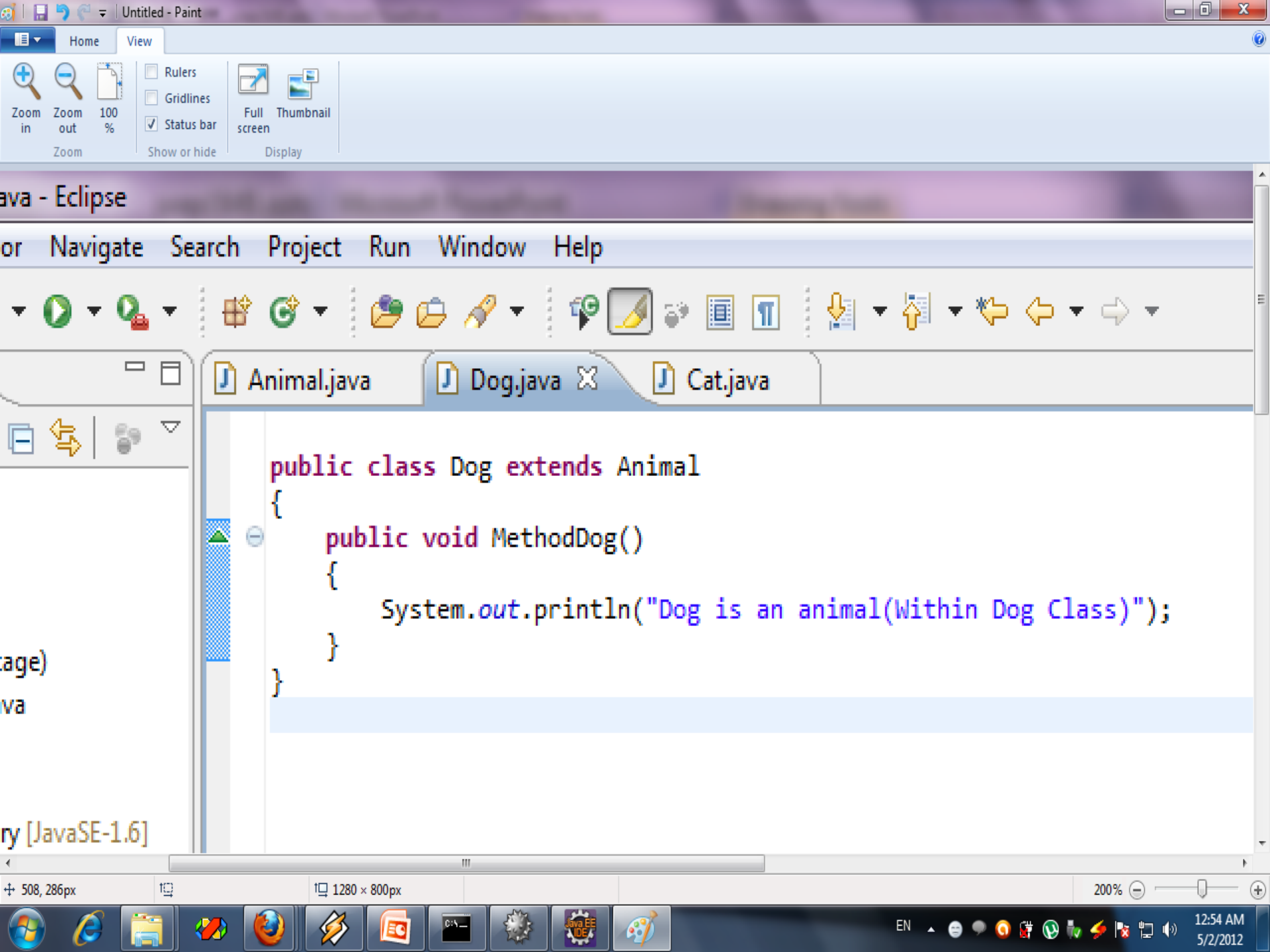
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public class Dog extends Animal
{
public void MethodDog()
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System.out.println("Dog is an animal(Within Dog Class)");
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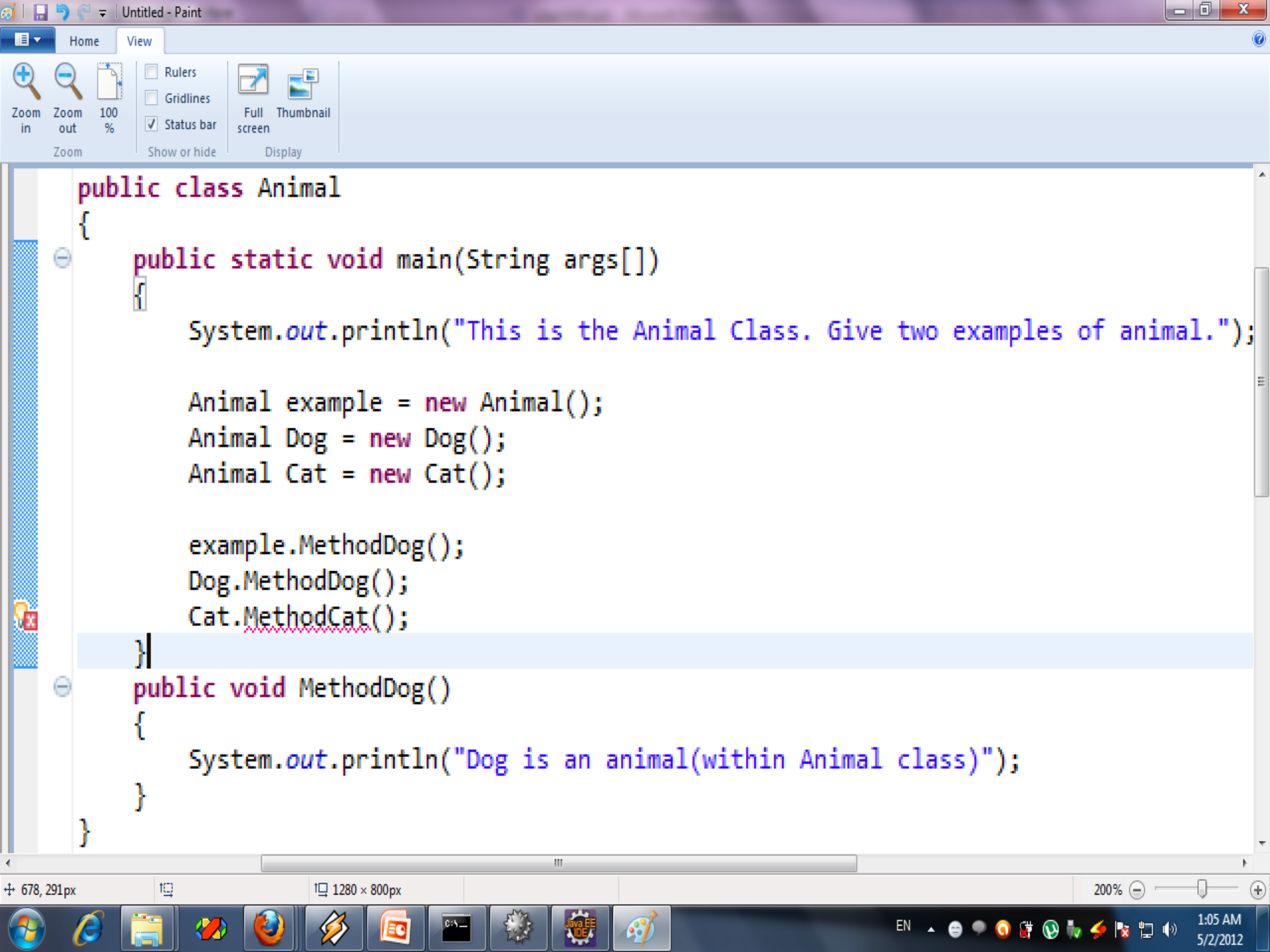
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public class Animal
{
public static void main(String args[])
{
System.out.println("This is the Animal Class. Give two examples of animal.");
Animal example = new Animal();
Animal Dog = new Dog();
Animal Cat = new Cat();
example.MethodDog();
Dog.MethodDog();
Cat.MethodCat();
}
public void MethodDog()
{
System.out.println("Dog is an animal(within Animal class)");
}
}
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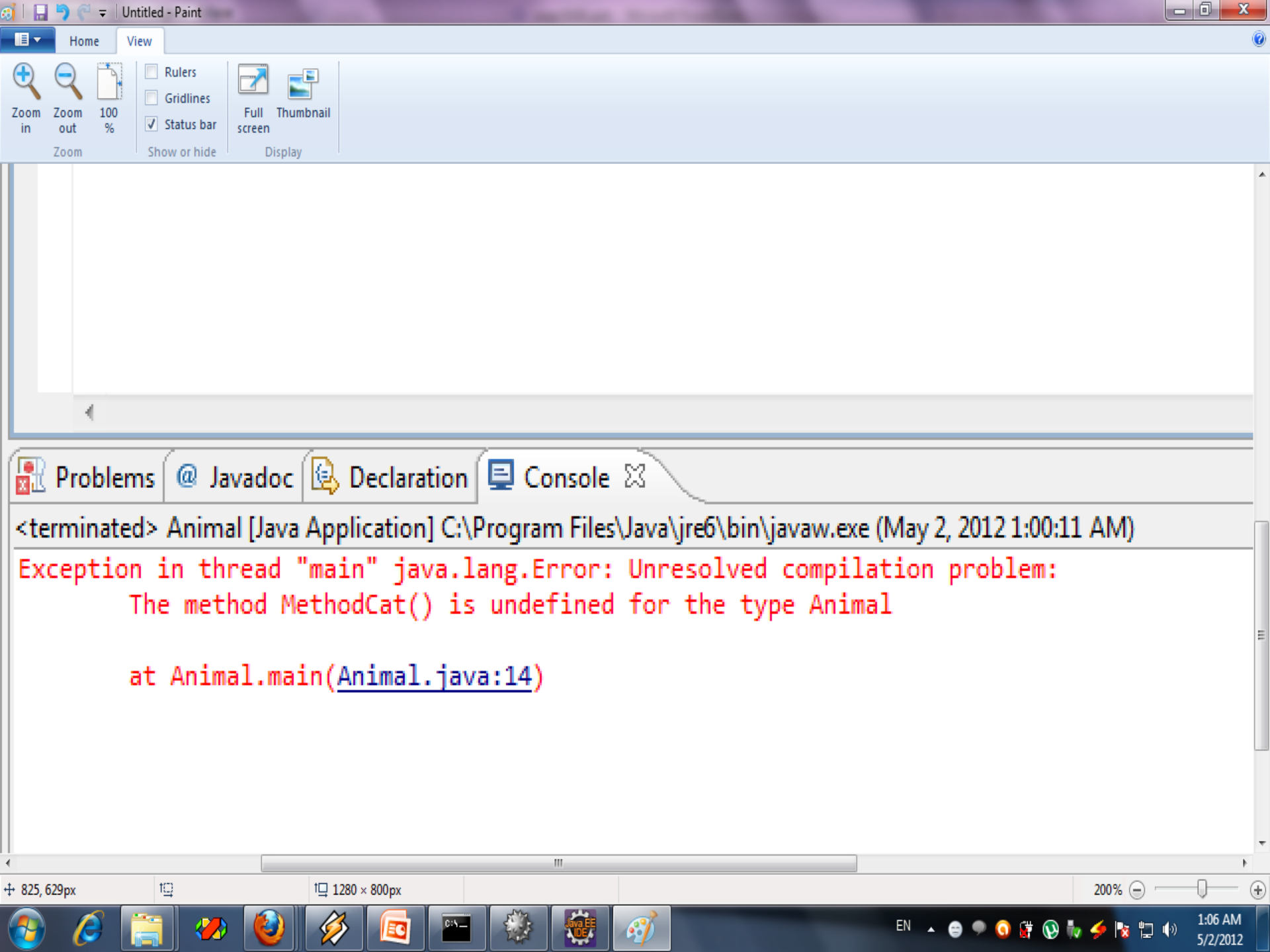
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Javadoc
Declaration
Console
<terminated> Animal [Java Application] C:\Program Files\Java\jre6\bin\javaw.exe (May 2, 2012 1:00:11 AM)
Exception in thread "main" java.lang.Error: Unresolved compilation problem:
The method MethodCat() is undefined for the type Animal
at Animal.main(Animal.java:14)
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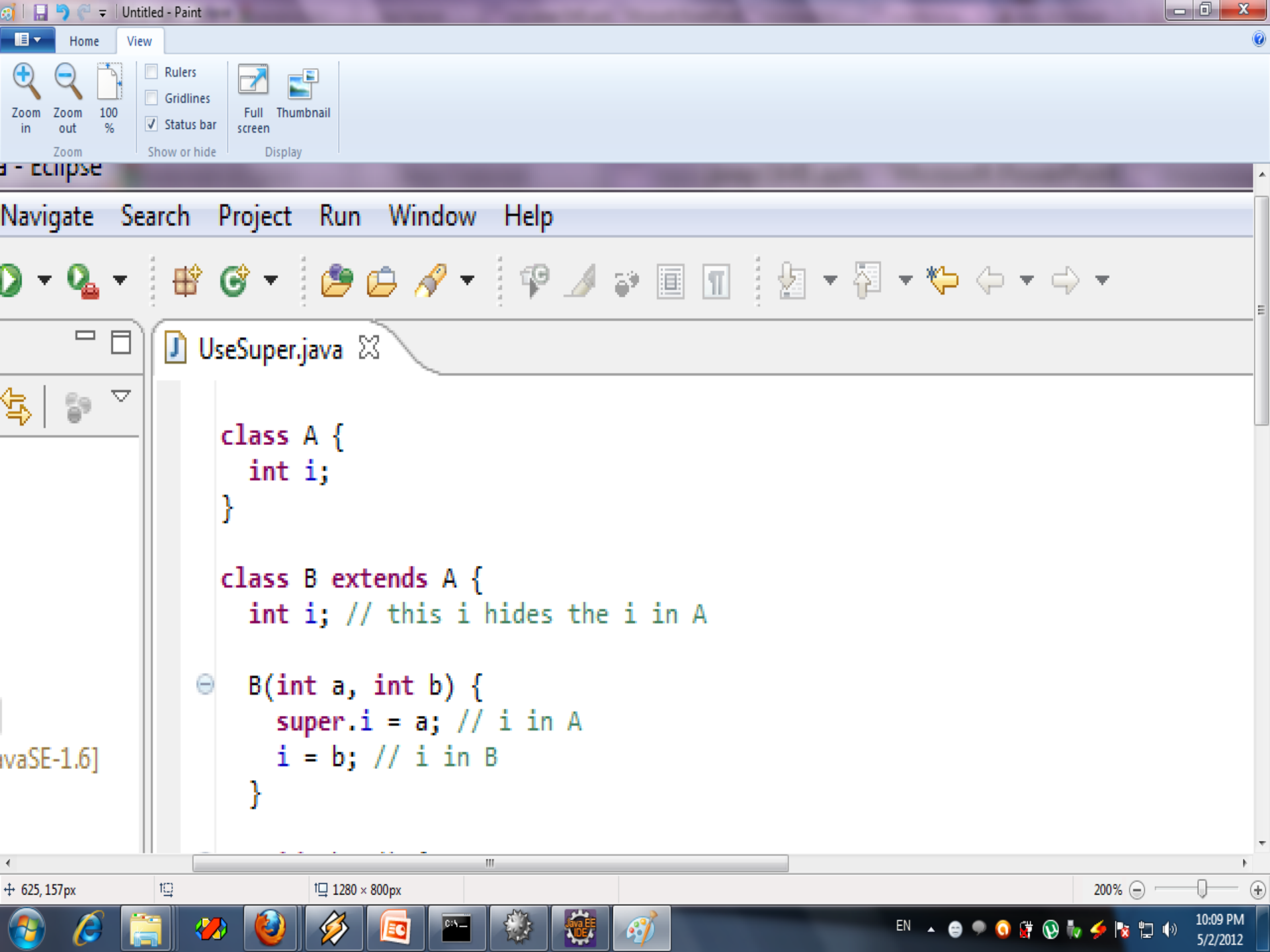
Using Super

- Whenever a subclass needs to refer to its immediate superclass, it can do so by use of the ***keyword super***.
- Super has two general forms:
  1. The first ***calls the superclass' constructor***.
  2. The second is ***used to access a member of the superclass*** that has been hidden by a member of a subclass.
- Following is an example of using super: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UseSuper.java
class A {
int i;
}
class B extends A {
int i; // this i hides the i in A
B(int a, int b) {
super.i = a; // i in A
i = b; // i in B
}
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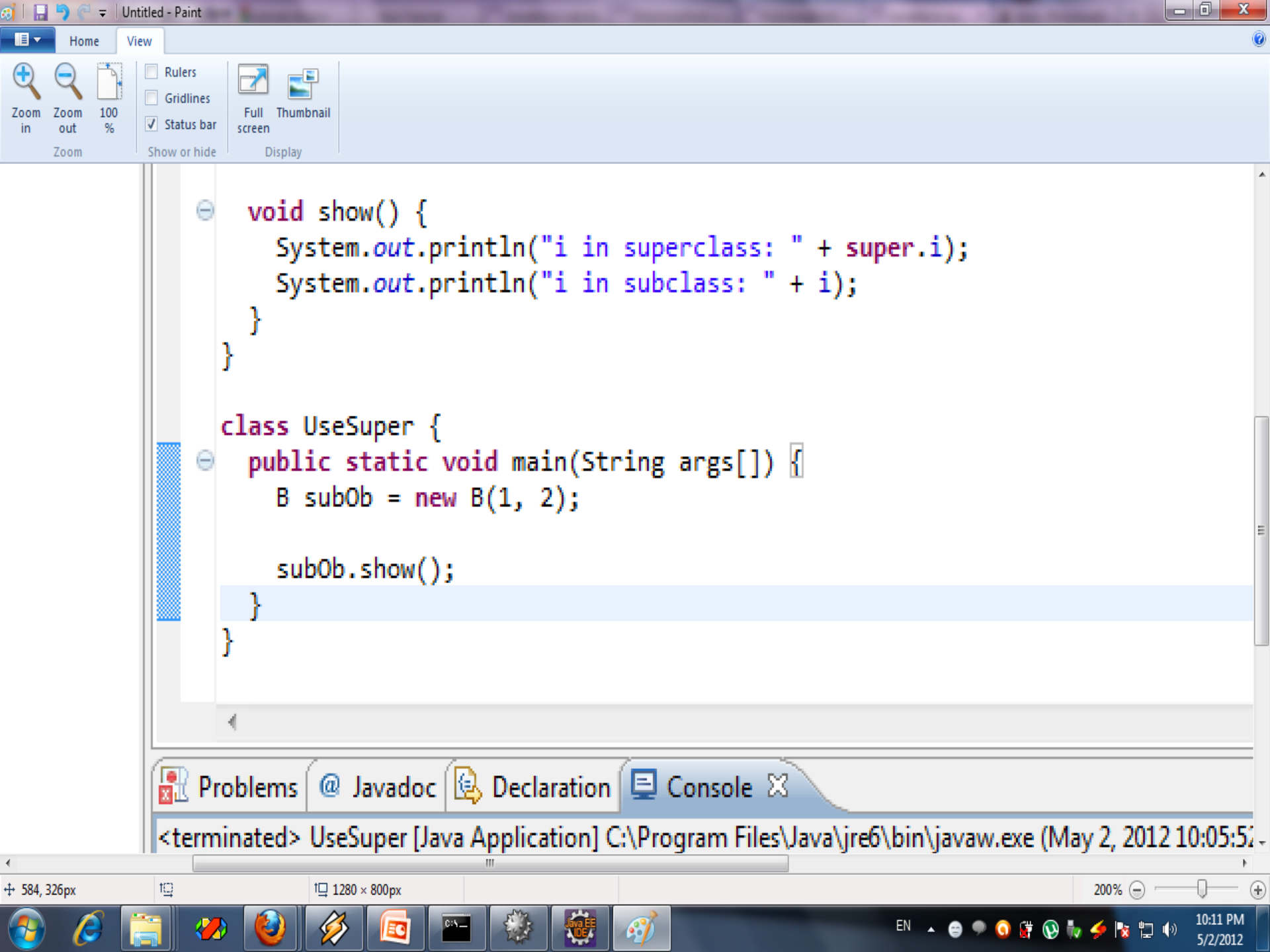
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void show() {
System.out.println("i in superclass: " + super.i);
System.out.println("i in subclass: " + i);
}
}
class UseSuper {
public static void main(String args[]) {
B subOb = new B(1, 2);
subOb.show();
}
}
Problems
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<terminated> UseSuper [Java Application] C:\Program Files\Java\jre6\bin\javaw.exe (May 2, 2012 10:05:5
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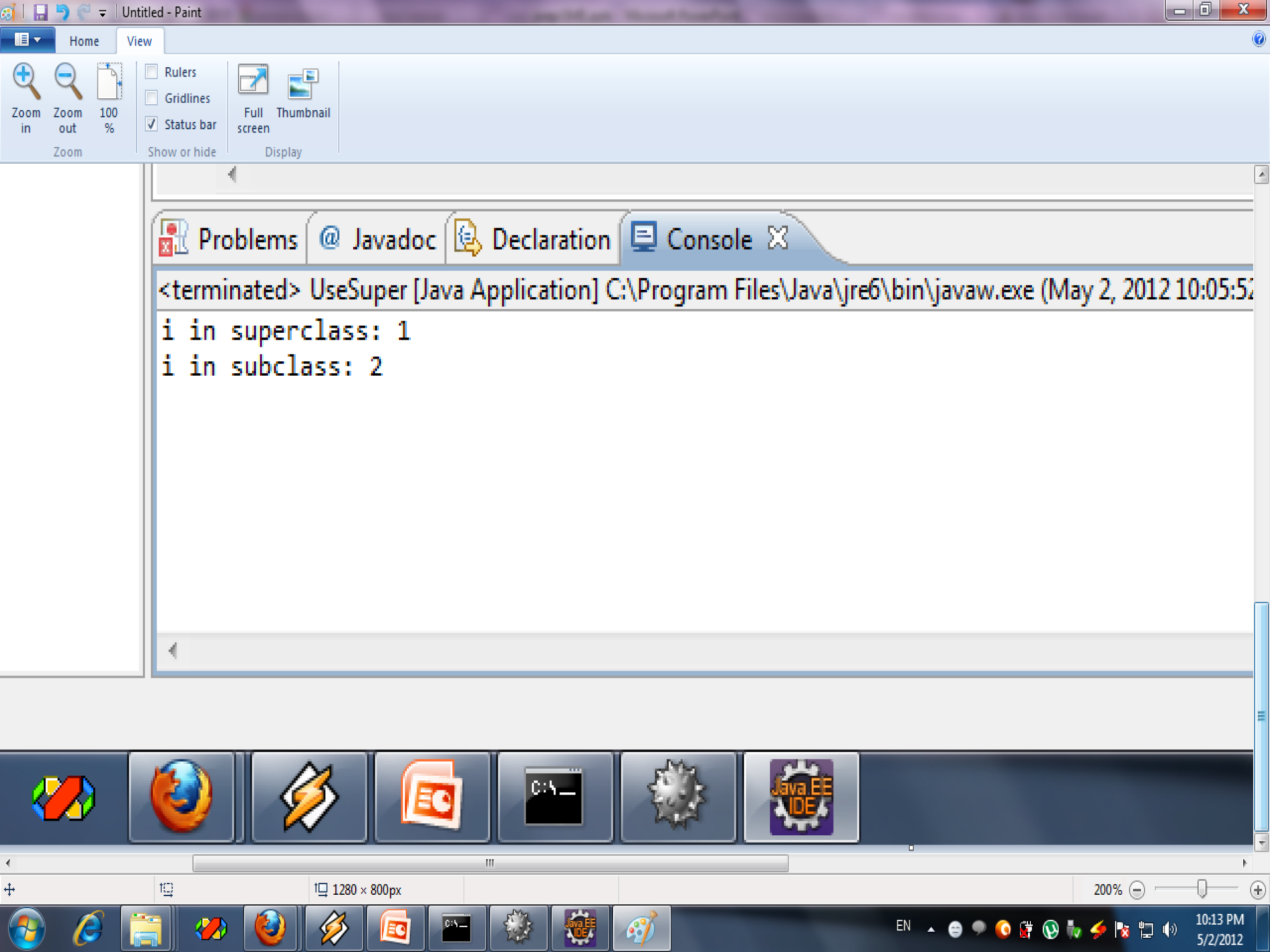
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Console
<terminated> UseSuper [Java Application] C:\Program Files\Java\jre6\bin\javaw.exe (May 2, 2012 10:05:52
i in superclass: 1
i in subclass: 2
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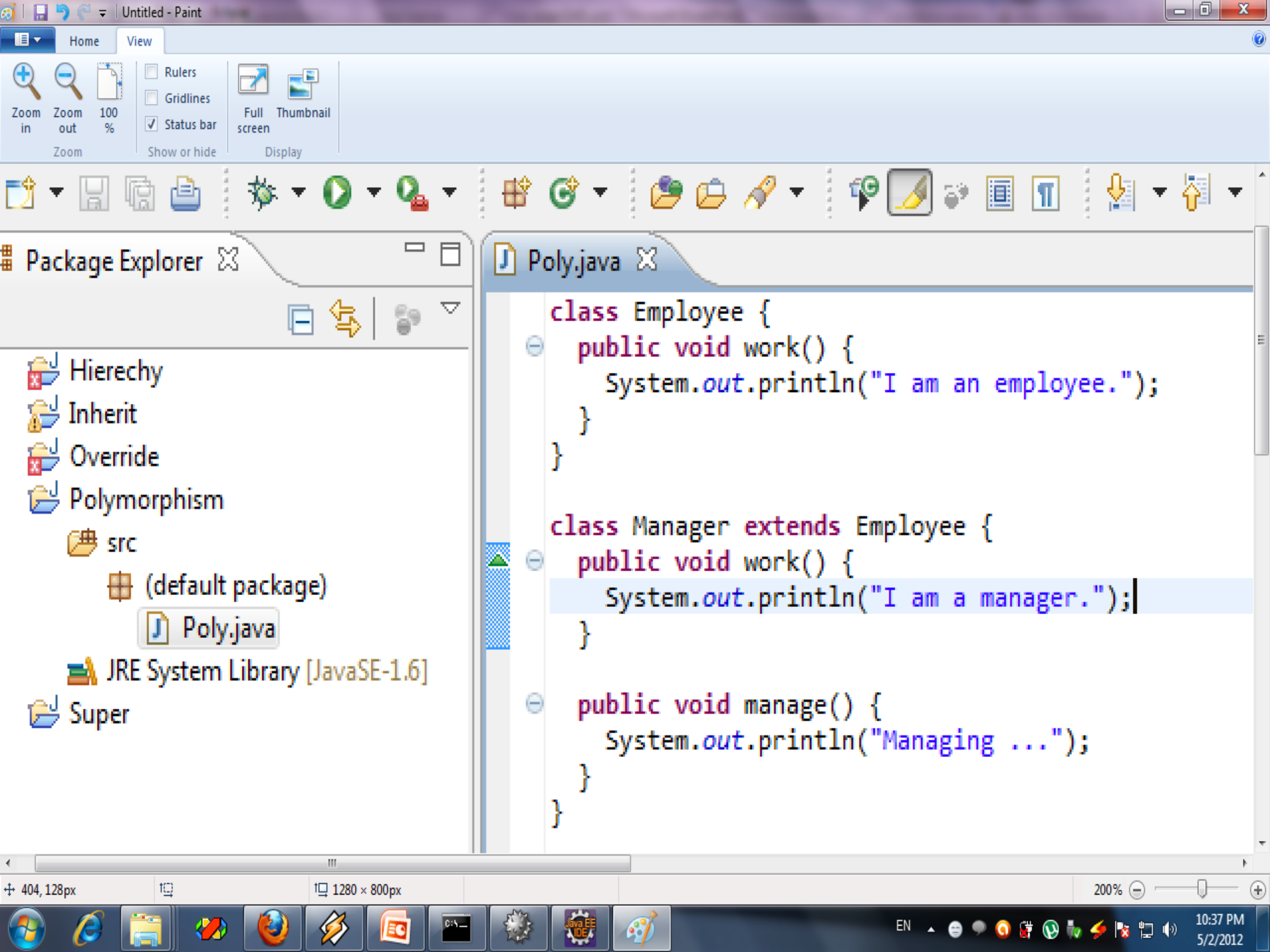
Polymorphism

Polymorphism

- Polymorphism is the ***ability of an object to take on many forms***.
- The ***most common use*** of polymorphism in OOP occurs when ***a parent class reference is used to refer to a child class object***.
- It means the ability of ***a single variable of a given type*** to be used ***to reference objects of different types and to automatically call the method that is specific to the type*** of object the variable references.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Poly.java
class Employee {
public void work() {
System.out.println("I am an employee.");
}
}
class Manager extends Employee {
public void work() {
System.out.println("I am a manager.");
}
public void manage() {
System.out.println("Managing ...");
}
}
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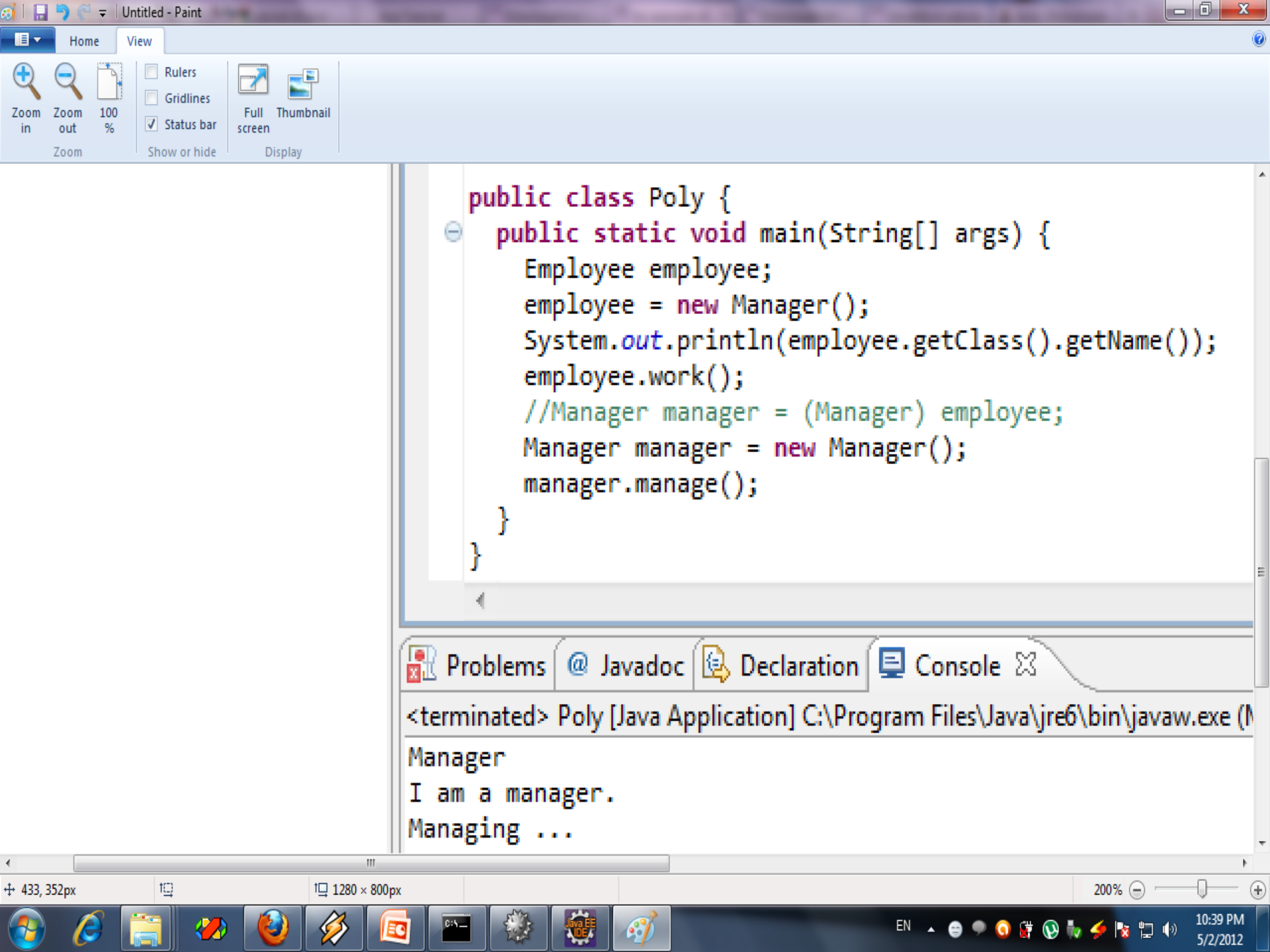
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public class Poly {
public static void main(String[] args) {
Employee employee;
employee = new Manager();
System.out.println(employee.getClass().getName());
employee.work();
//Manager manager = (Manager) employee;
Manager manager = new Manager();
manager.manage();
}
}
Problems
Javadoc
Declaration
Console
<terminated> Poly [Java Application] C:\Program Files\Java\jre6\bin\javaw.exe (
Manager
I am a manager.
Managing ...
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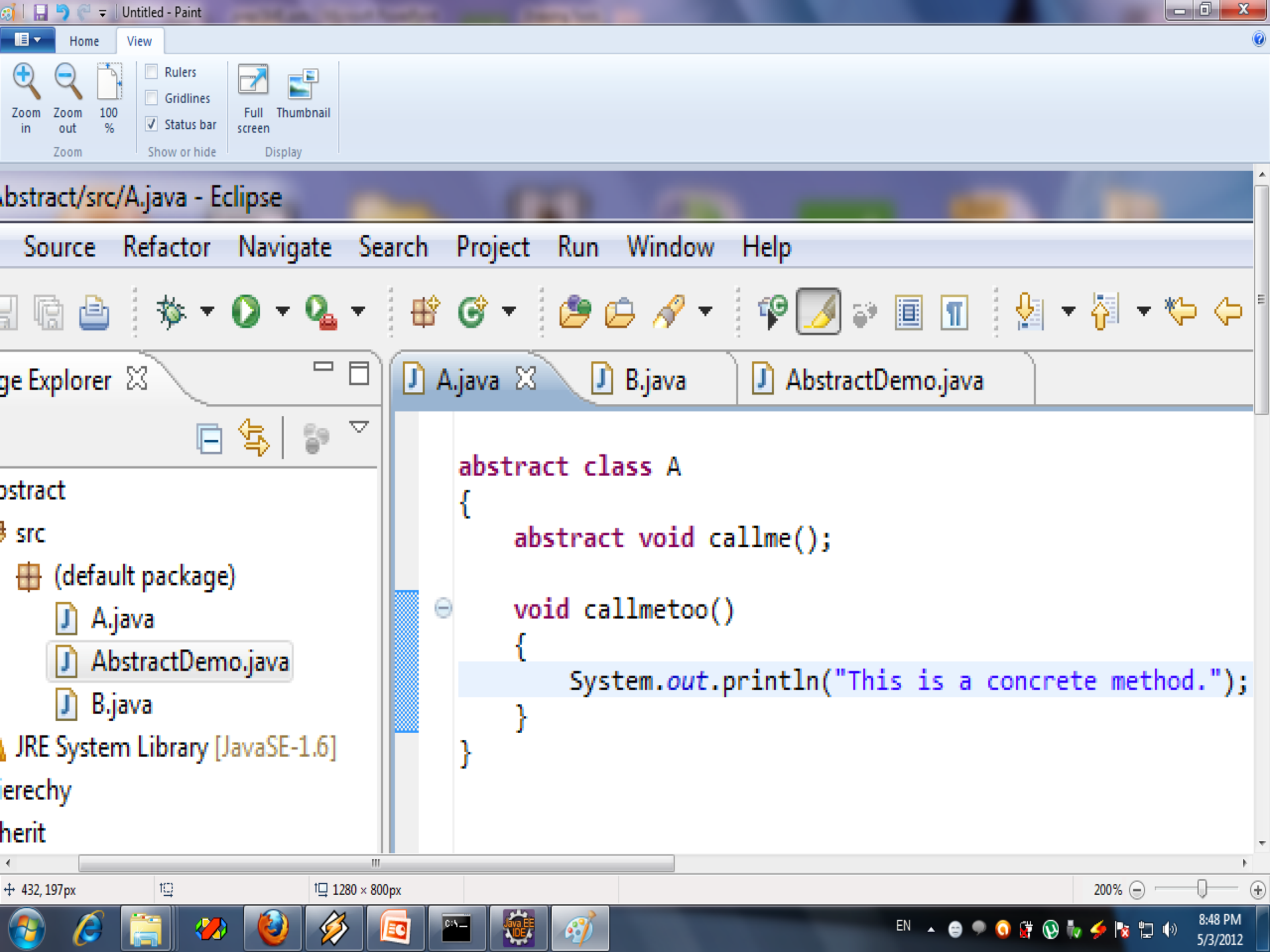
Using Abstract Classes

- Sometimes it is required that certain methods be overridden by subclasses by specifying the ***abstract*** type.
- These methods are sometimes called ***subclasser responsibility*** because they have no implementation specified in the superclass.
- ***To declare a class abstract***, you simple ***use the abstract keyword in front of the class*** keyword at the beginning of the class declaration.

Using Abstract Classes

- There can be ***no objects*** of an abstract class.
- An abstract class ***cannot be directly instantiated*** with the new operator.
- Such ***objects would be useless***, because an ***abstract class is not fully defined.***
- Since class of superclass is overridden, so its implementation is not necessary.(advantage)
- Following is an example :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AbstractDemo.java
abstract class A
{
abstract void callme();
void callmetoo()
{
System.out.println("This is a concrete method.");
}
}
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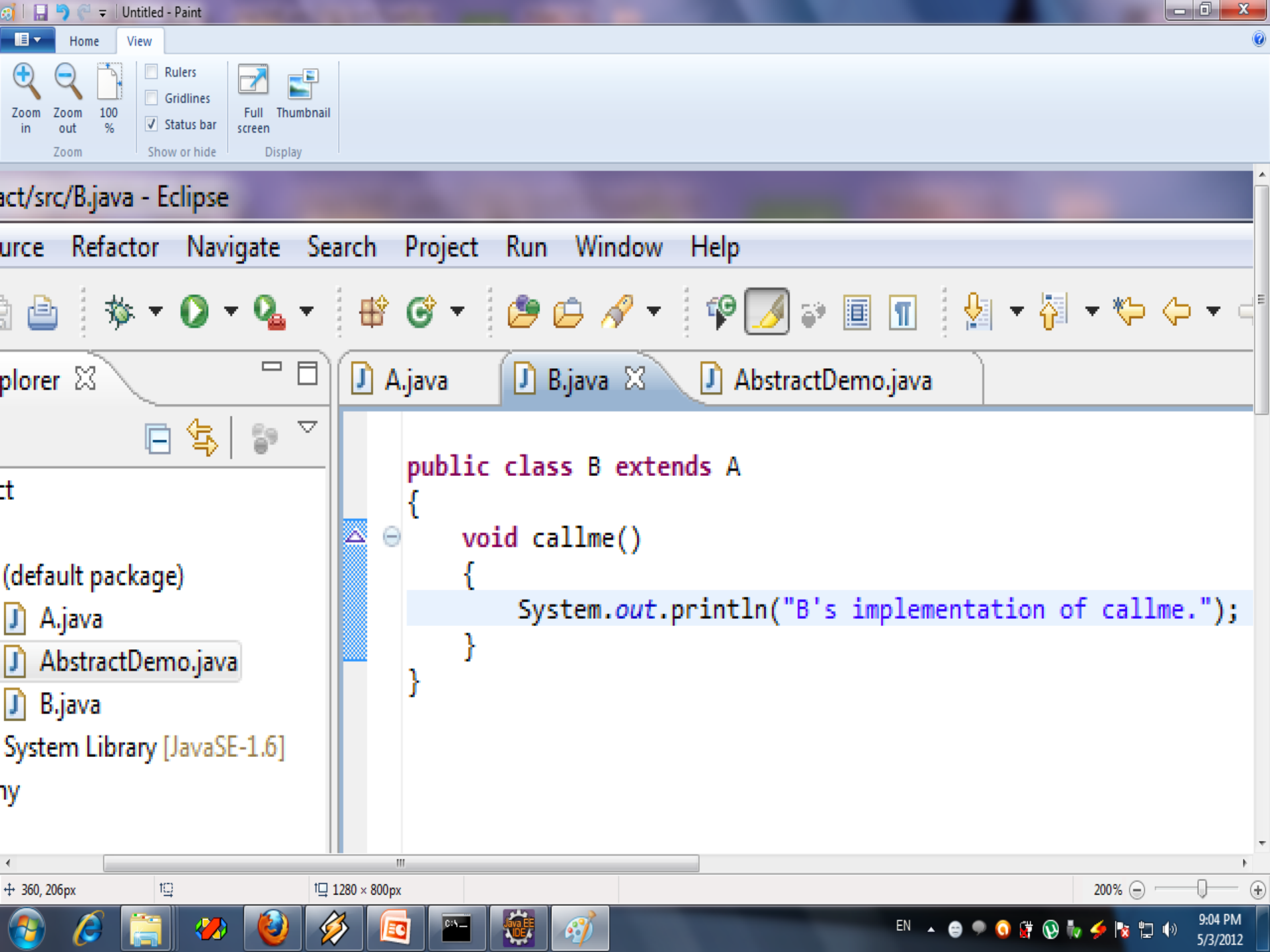
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B.java
AbstractDemo.java
public class B extends A
{
void callme()
{
System.out.println("B's implementation of callme.");
}
}
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System Library [JavaSE-1.6]
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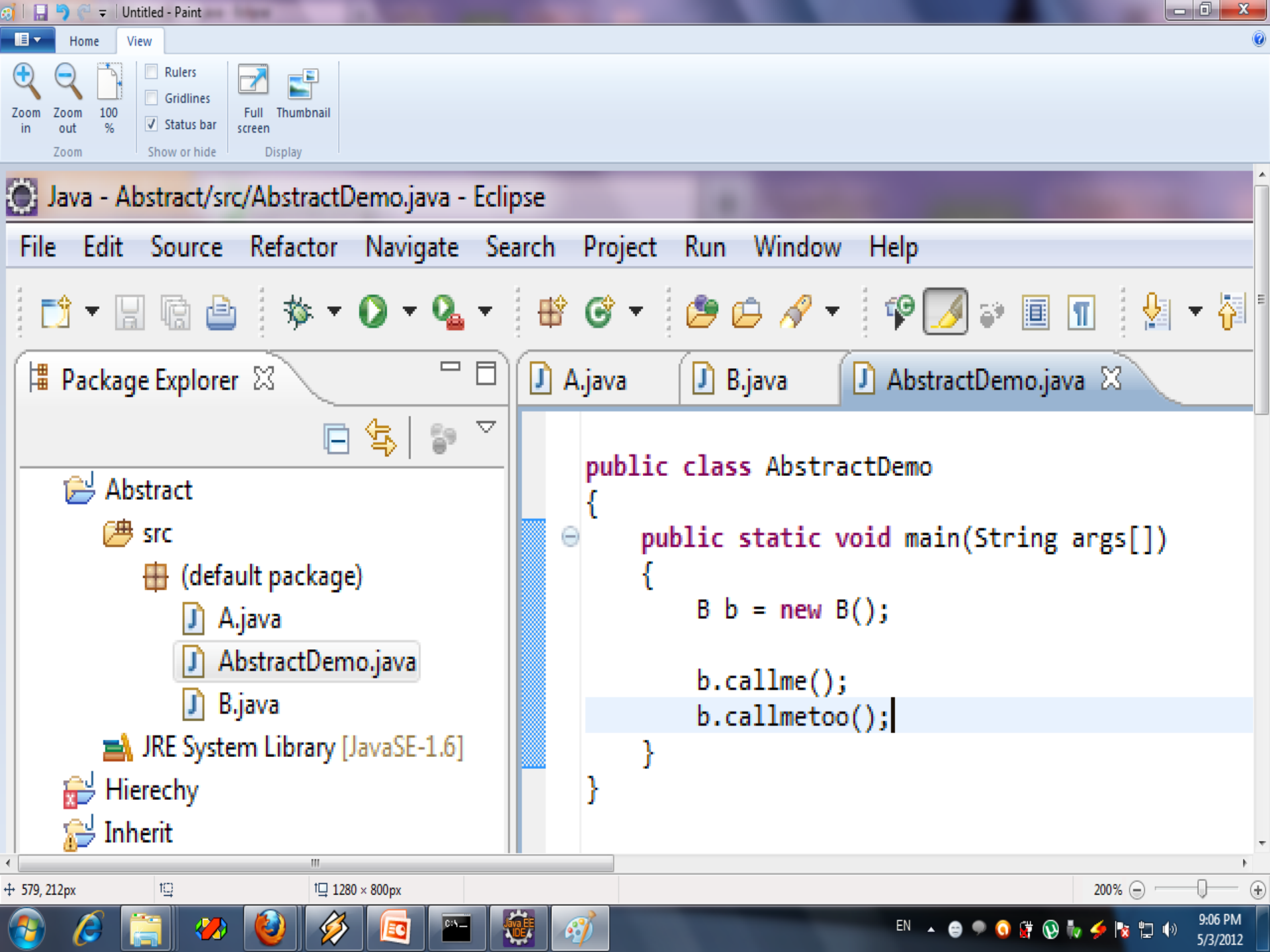
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B.java
JRE System Library [JavaSE-1.6]
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A.java
B.java
AbstractDemo.java
public class AbstractDemo
{
public static void main(String args[])
{
B b = new B();
b.callme();
b.callmetoo();
}
}
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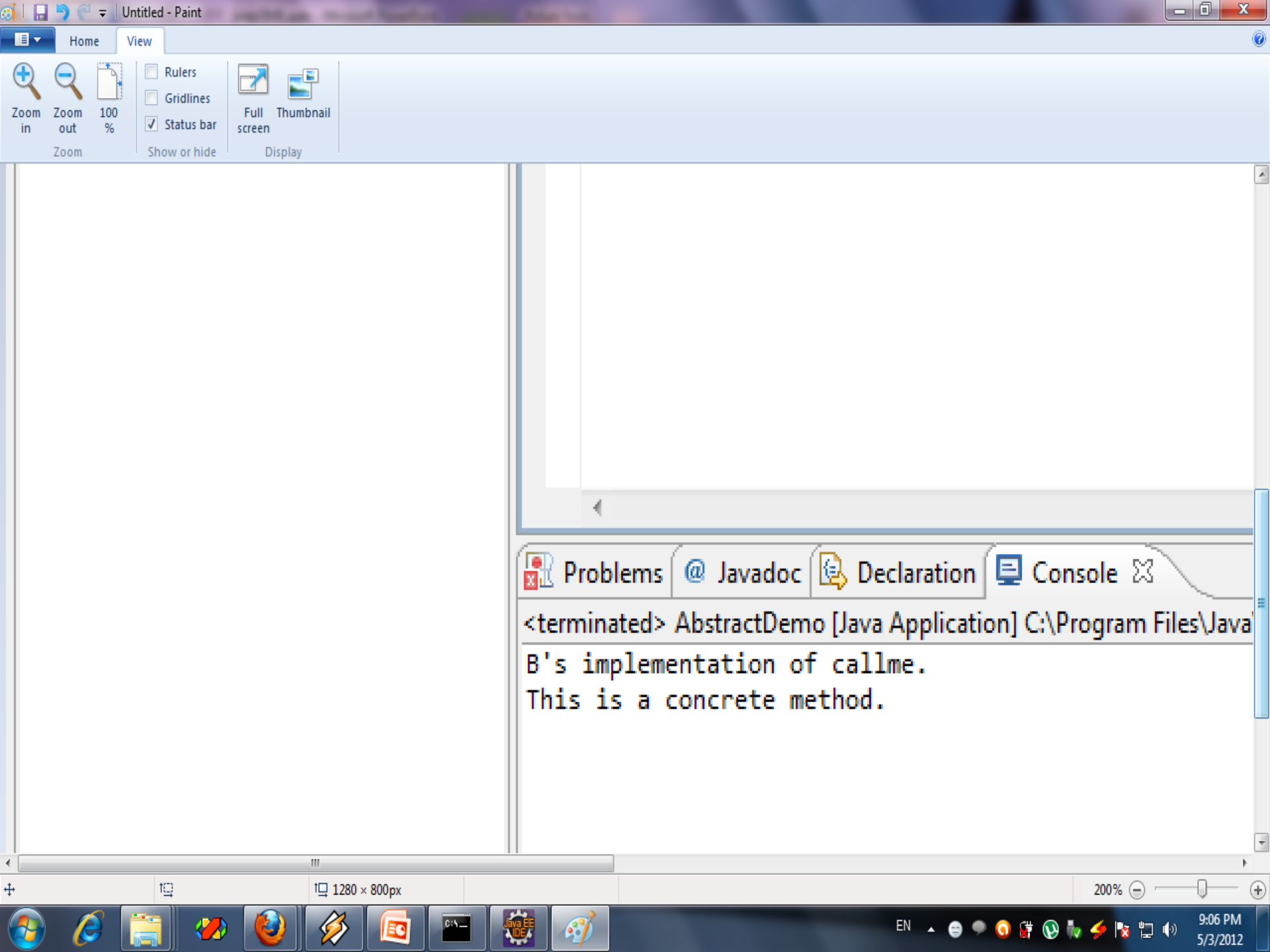
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<terminated> AbstractDemo [Java Application] C:\Program Files\Java
B's implementation of callme.
This is a concrete method.
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Using Final

- Using final to prevent overriding:
  - While method overriding in one of the JAVA's most powerful features, there will be times when we do not want overriding.
  - We can do this by using ***final*** keyword.
  - With final we can ***prevent a method to be overridden*** as well as we can ***prevent a class to be extended, that is prevent Inheritance***.

Using final to prevent Overriding

```
Class A
{
      final void meth()
      {
            System.out.println("This is a final method.");
      }
}

Class B extends A
{
      void meth()
      {
            //ERROR! Can't override the "meth" method
            System.out.println("Illegal !!!");
       }
}
```

Using final to prevent Inheritance

```
final class A
{
      void meth()
      {
            System.out.println("Method in final class.");
      }
}

//The following class is illegal.
Class B extends A
//can not be a subclass of A which is final
{


}
```

Exception Handling

Exception Handling Fundamentals

- A JAVA exception is an object that describes an exception(or, an error) condition that has occurred in a block of a code.
- When an exceptional condition arises, an object representing that exception is created and ***thrown*** in the method that caused the error.
- At some point the exception is ***caught*** and processed.

Exception Handling Fundamentals

- Java exception handling is managed via five keywords:
  - Try, catch, throw, throws, and finally
- Program statements that you want to monitor for exceptions are contained within a ***try*** block.
- If an exception occurs within the ***try*** block, it is thrown

Exception Handling Fundamentals

- Your code can ***catch*** this exception and can handle it.
- System generated exceptions are automatically thrown by the java run-time system.
- To manually throw an exception, use the keyword ***throw***.
-

Exception Handling Fundamentals

- Any exception that is thrown out of a method must be specified as such by a ***throws*** clause.
- Any code that absolutely must be executed before a method returns is put in a ***finally*** block.

Exception Types

- All exception types are subclasses of the built in class ***Throwable***.
- There are two subclasses that partitions exceptions into two distinct branches.
  1. Exception
     - This class is used for exceptional conditions that user program should catch.
     - From this class, you can create your own custom exception types.

Exception Types

- There is an important subclass of Exception, called ***RuntimeException***.
- Runtime exceptions are automatically defined.

2. Error
   - Defines exceptions that are not expected to be caught under normal circumstances by your program.
   - This is not handled by your program.
   - This type of error can crash your program.

Uncaught Exception

- Following is a program segment within which the “Divide by Zero” error is intentionally occurred.

```
class Exc0
{
     public static void main(String args[])
     {
          int d = 0;
          int a = 42 / d;
     }
}
```

Uncaught Exception

- When the JAVA run time system detects the attempt to ***divide by zero***, it constructs a new exception object and then *throws* the exception.
- This causes the execution of Exc0 to stop, now it must be caught by an exception handler.
- In this example, we have not supplied any exception handler of our own.

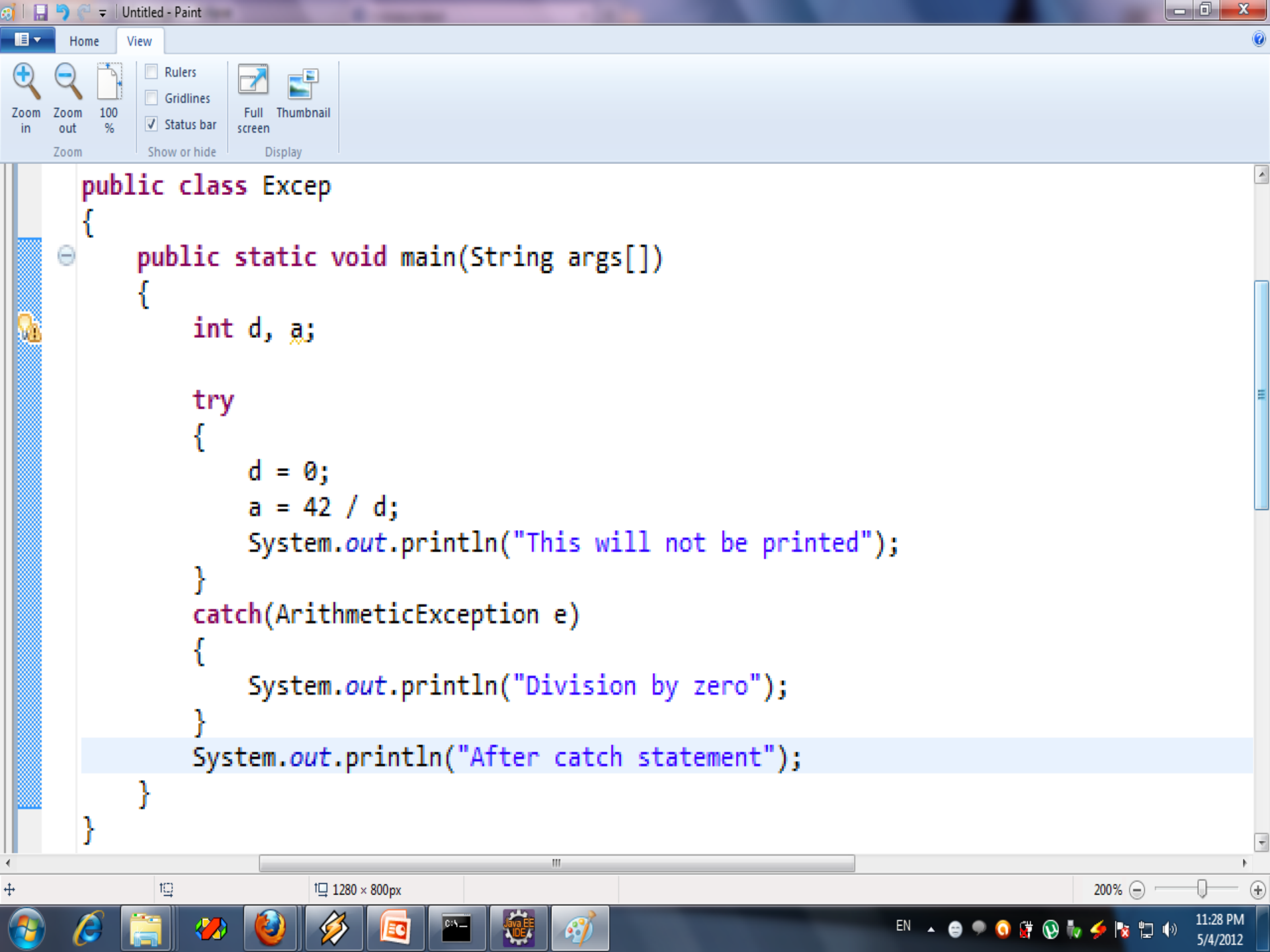
Uncaught Exception

- So it is caught by the default handler provided by the java run time system.
- The default handler
  - displays a string describing the exception
  - Prints the point at which the exception occurred
  - And, terminates the program.
- For previous exception results:

```
Java.lang.ArithmeticException: / by zero
                    at Exc0.main(Exc0.java:4)
```

Using Try-Catch()

- Now the examples
  1. ***using try-catch and our own handler***
  2. Using try-catch and printing default string corresponding to the exception.
  3. Multiple catch clauses
  4. Nested try statement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Display
public class Excep
{
public static void main(String args[])
{
int d, a;
try
{
d = 0;
a = 42 / d;
System.out.println("This will not be printed");
}
catch(ArithmeticException e)
{
System.out.println("Division by zero");
}
System.out.println("After catch statement");
}
}
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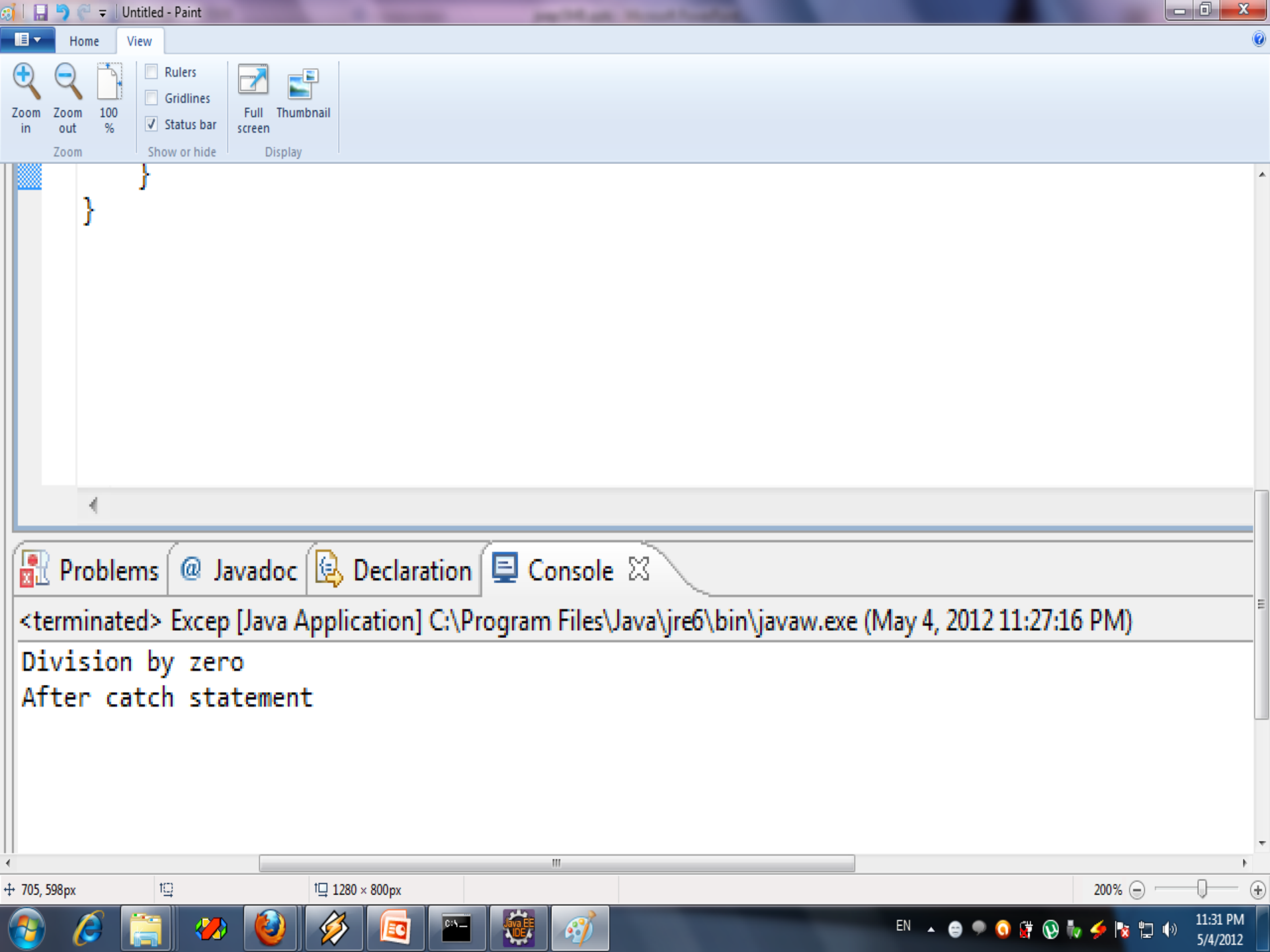
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Division by zero
After catch statement
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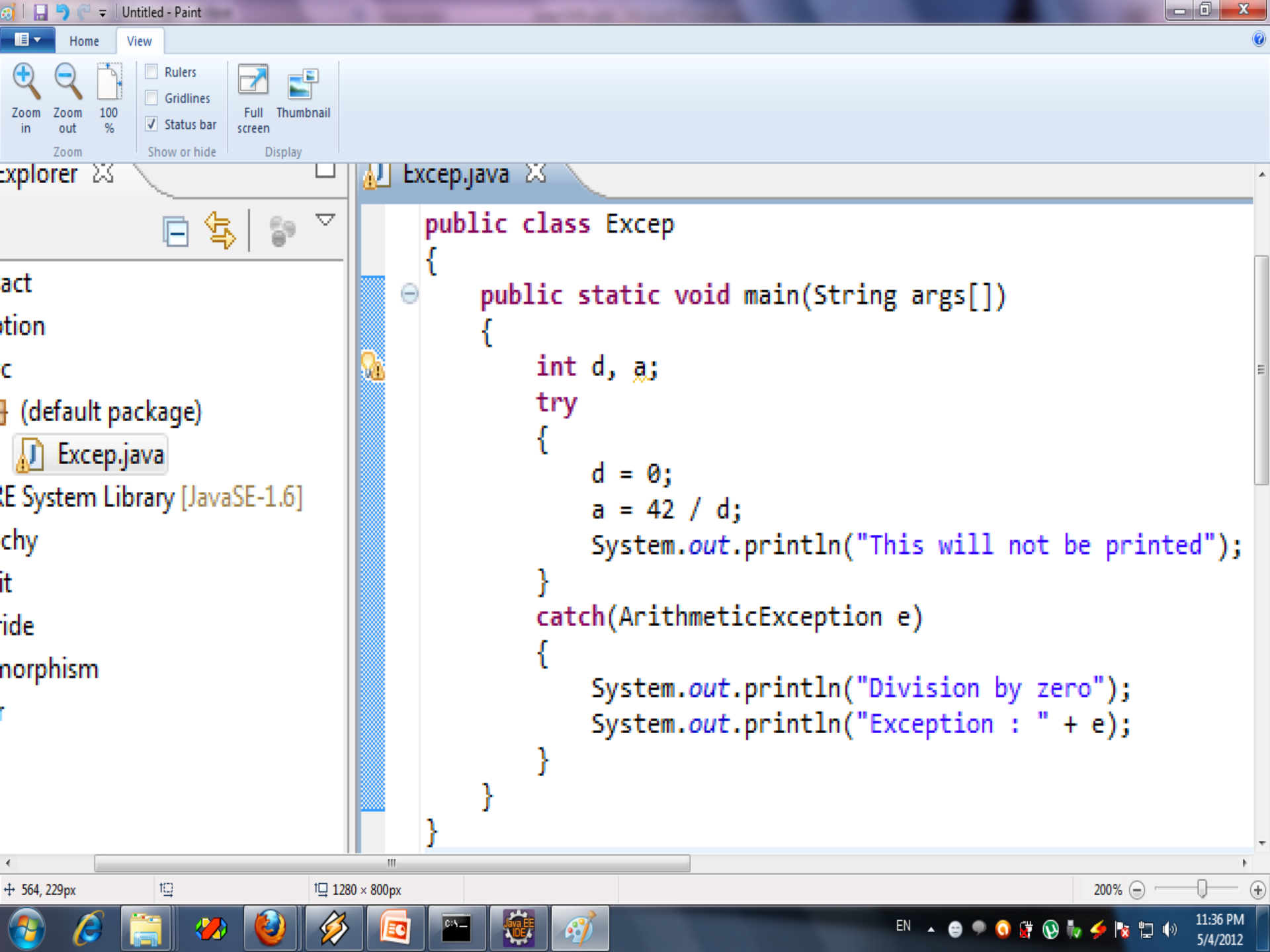
Using Try-Catch()

- Now the examples
  1. using try-catch and our own handler
  2. ***Using try-catch and printing default string corresponding to the exception.***
  3. Multiple catch clauses
  4. Nested try statement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Excep.java
public class Excep
{
public static void main(String args[])
{
int d, a;
try
{
d = 0;
a = 42 / d;
System.out.println("This will not be printed");
}
catch(ArithmeticException e)
{
System.out.println("Division by zero");
System.out.println("Exception : " + e);
}
}
}
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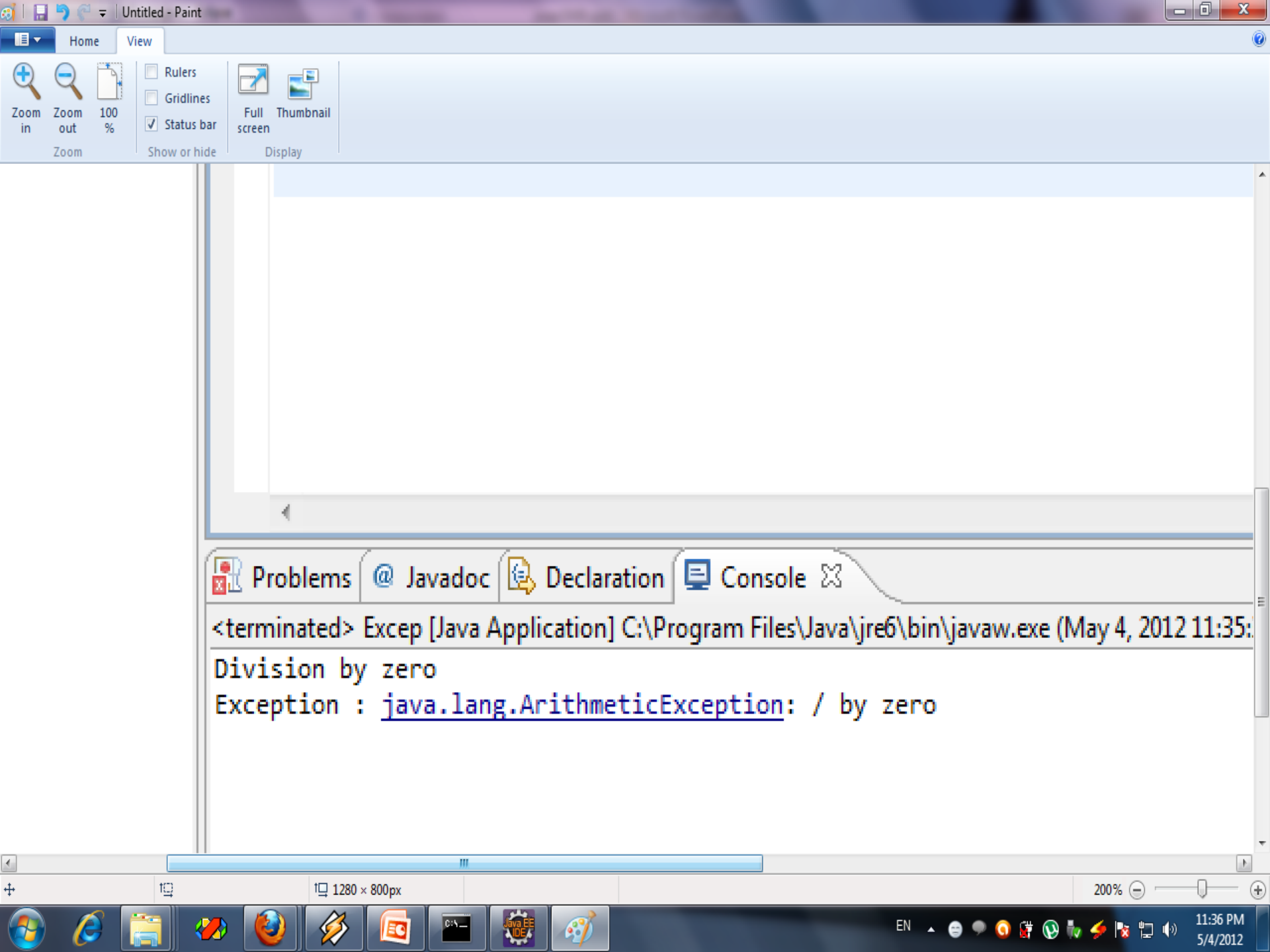
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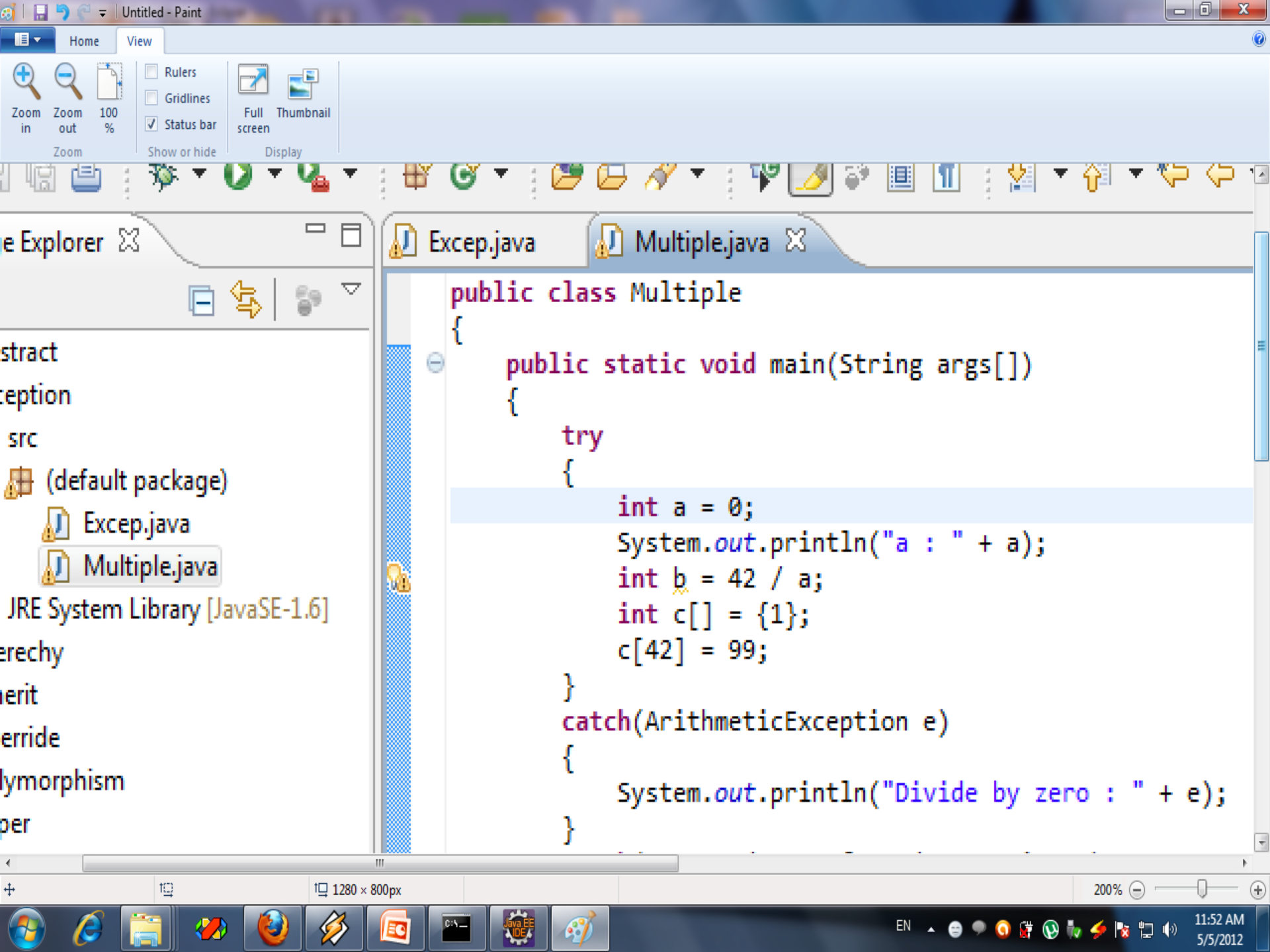
Using Try-Catch()

- Now the examples
  1. using try-catch and our own handler
  2. Using try-catch and printing default string corresponding to the exception.
  3. ***Multiple catch clauses***
  4. Nested try statement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Multiple.java
public class Multiple
{
public static void main(String args[])
{
try
{
int a = 0;
System.out.println("a : " + a);
int b = 42 / a;
int c[] = {1};
c[42] = 99;
}
catch(ArithmeticException e)
{
System.out.println("Divide by zero : " + e);
}
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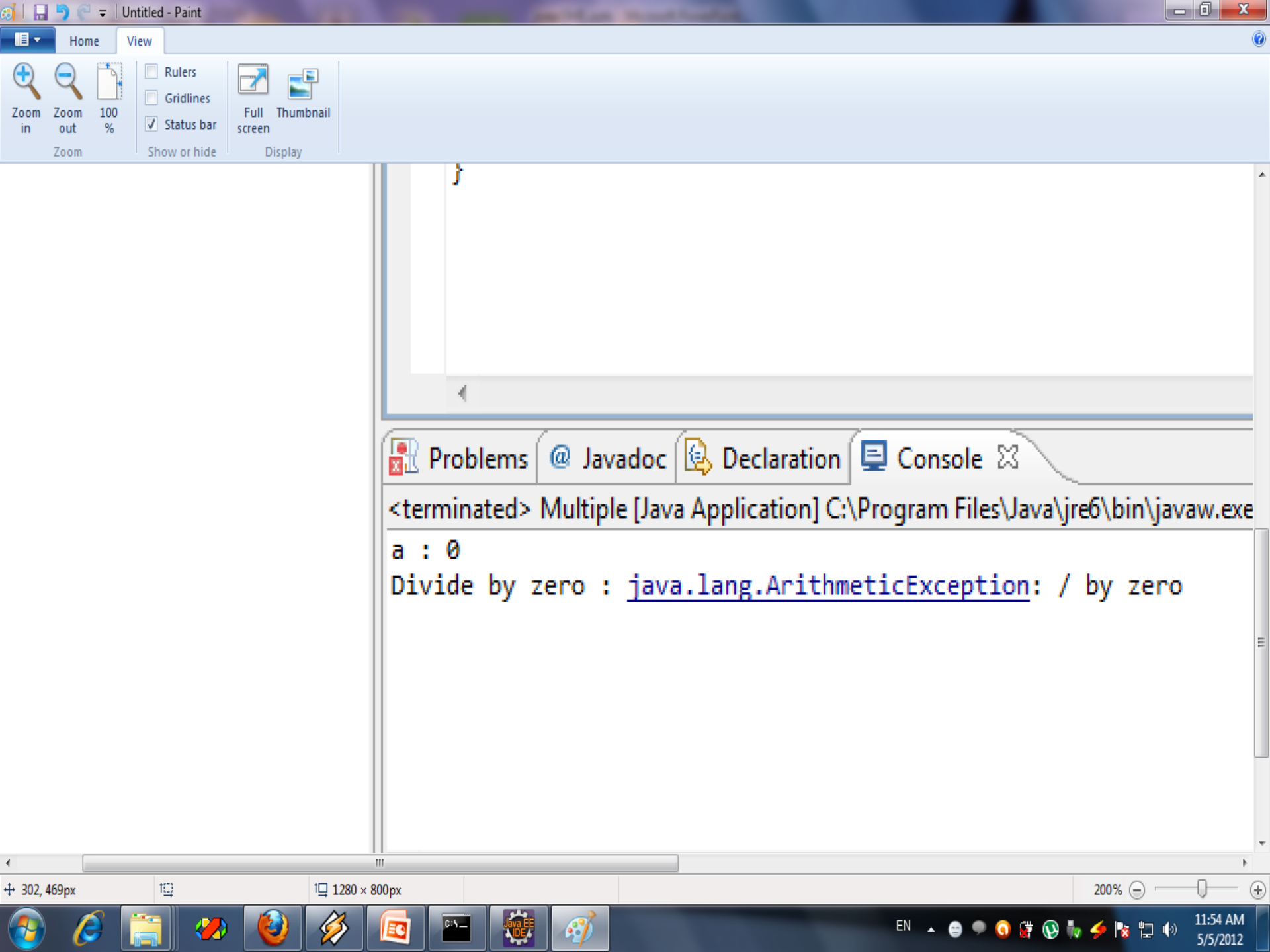
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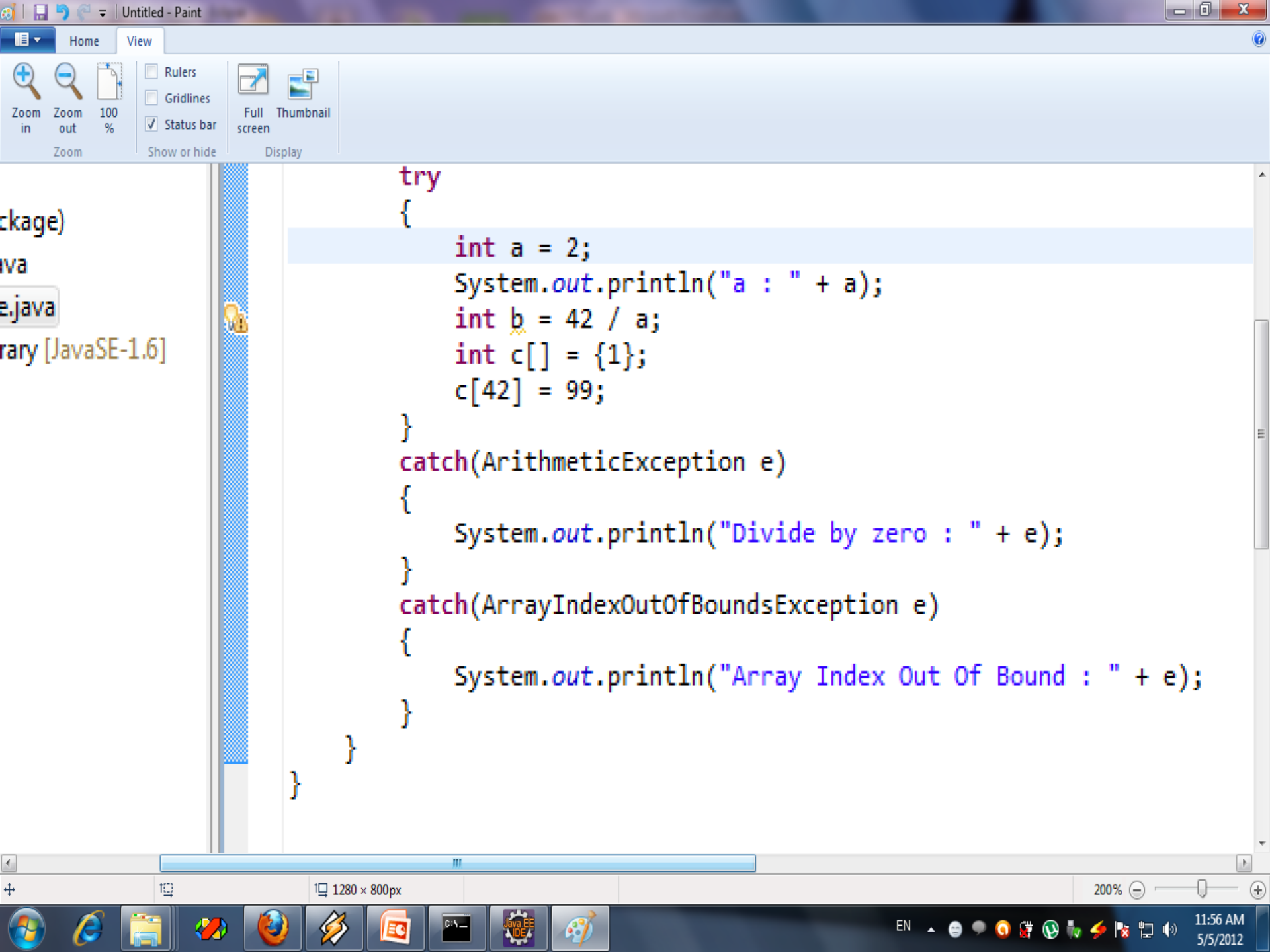
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{
int a = 2;
System.out.println("a : " + a);
int b = 42 / a;
int c[] = {1};
c[42] = 99;
}
catch(ArithmeticException e)
{
System.out.println("Divide by zero : " + e);
}
catch(ArrayIndexOutOfBoundsException e)
{
System.out.println("Array Index Out Of Bound : " + e);
}
}
}
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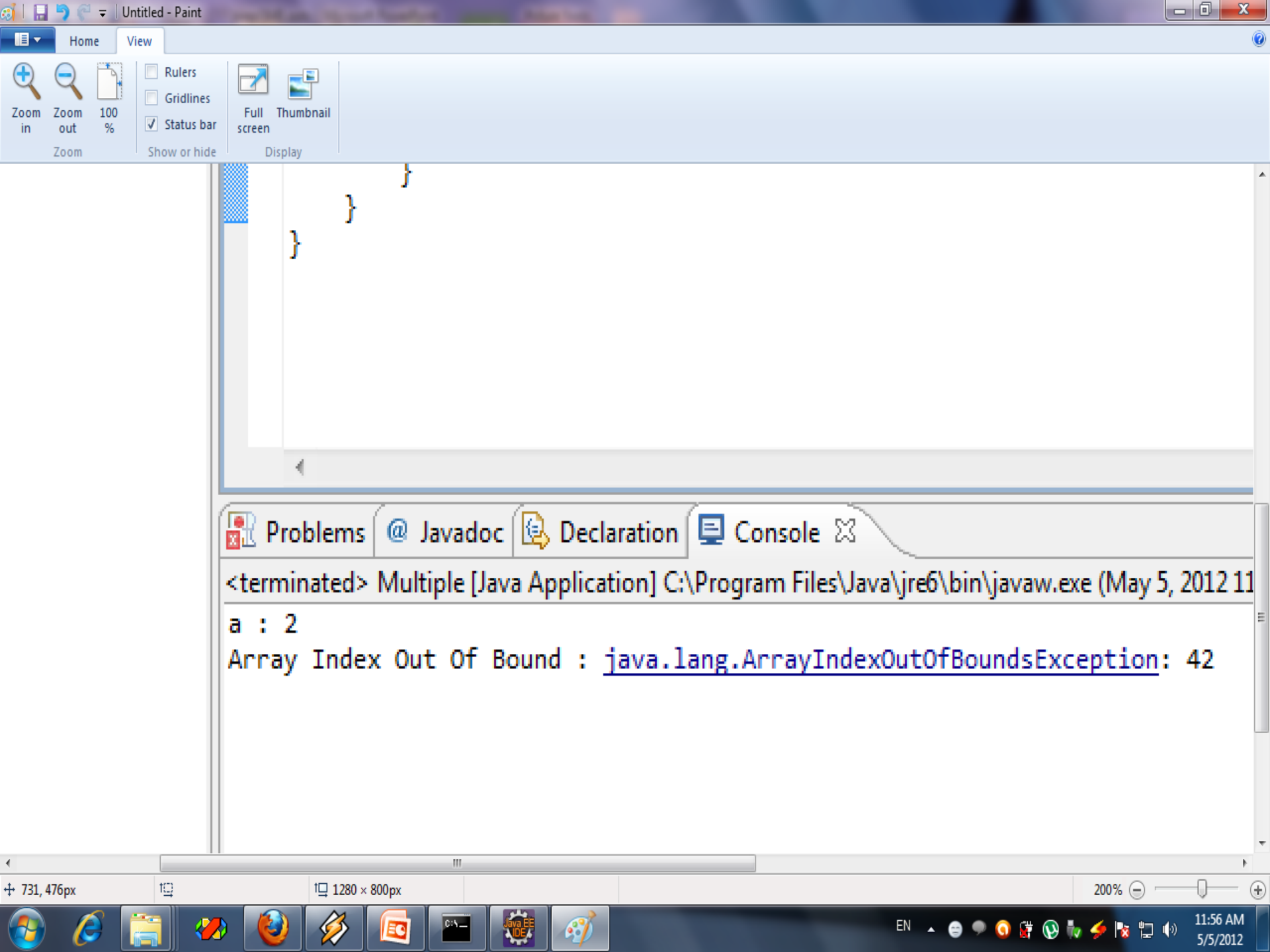
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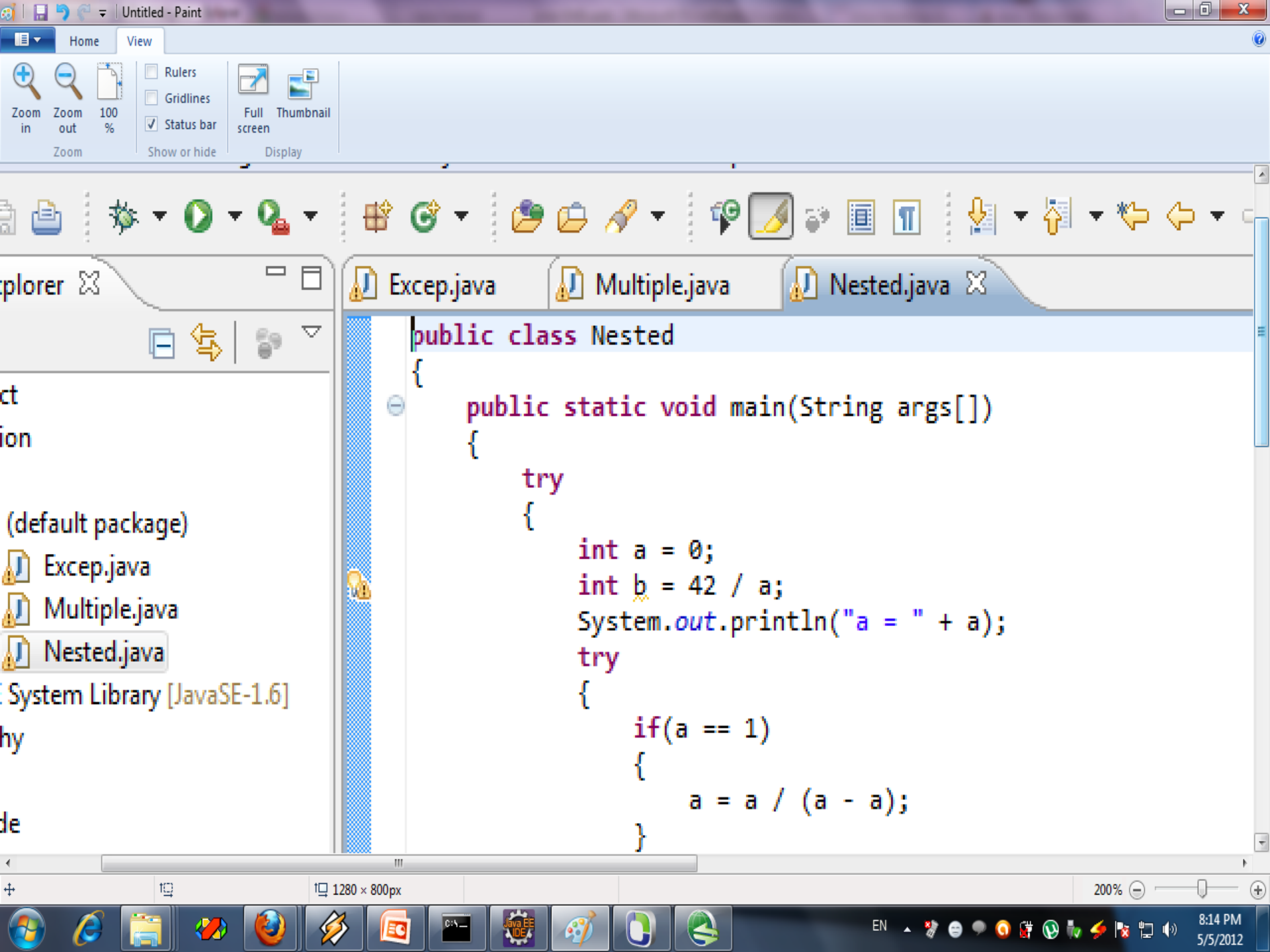
Using Try-Catch()

- Now the examples
  1. using try-catch and our own handler
  2. Using try-catch and printing default string corresponding to the exception.
  3. Multiple catch clauses
  4. ***Nested try statement***
  5. Using Throw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Nested.java
public class Nested
{
public static void main(String args[])
{
try
{
int a = 0;
int b = 42 / a;
System.out.println("a = " + a);
try
{
if(a == 1)
{
a = a / (a - a);
}
(default package)
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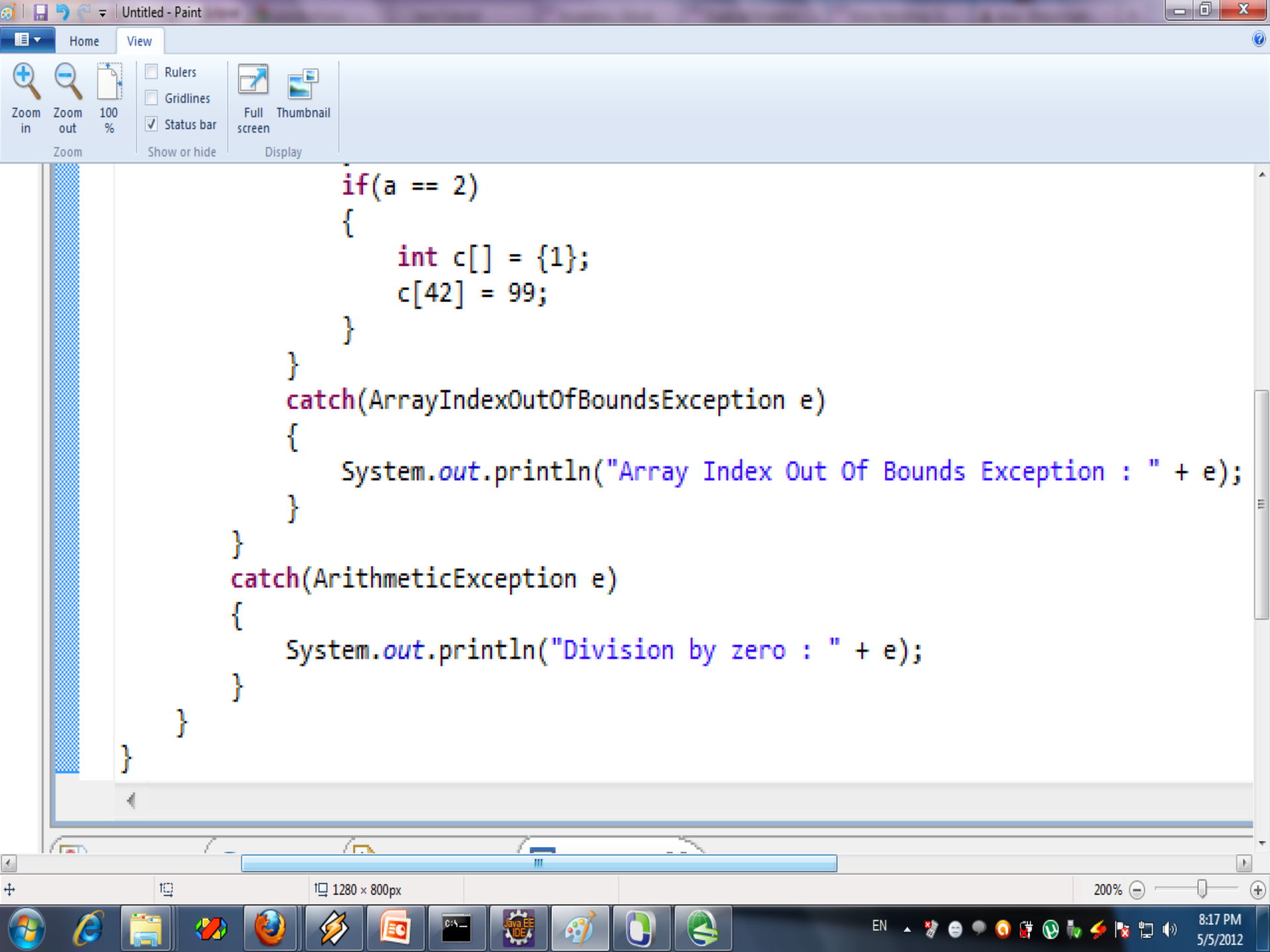
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if(a == 2)
{
int c[] = {1};
c[42] = 99;
}
}
catch(ArrayIndexOutOfBoundsException e)
{
System.out.println("Array Index Out Of Bounds Exception : " + e);
}
}
catch(ArithmeticException e)
{
System.out.println("Division by zero : " + e);
}
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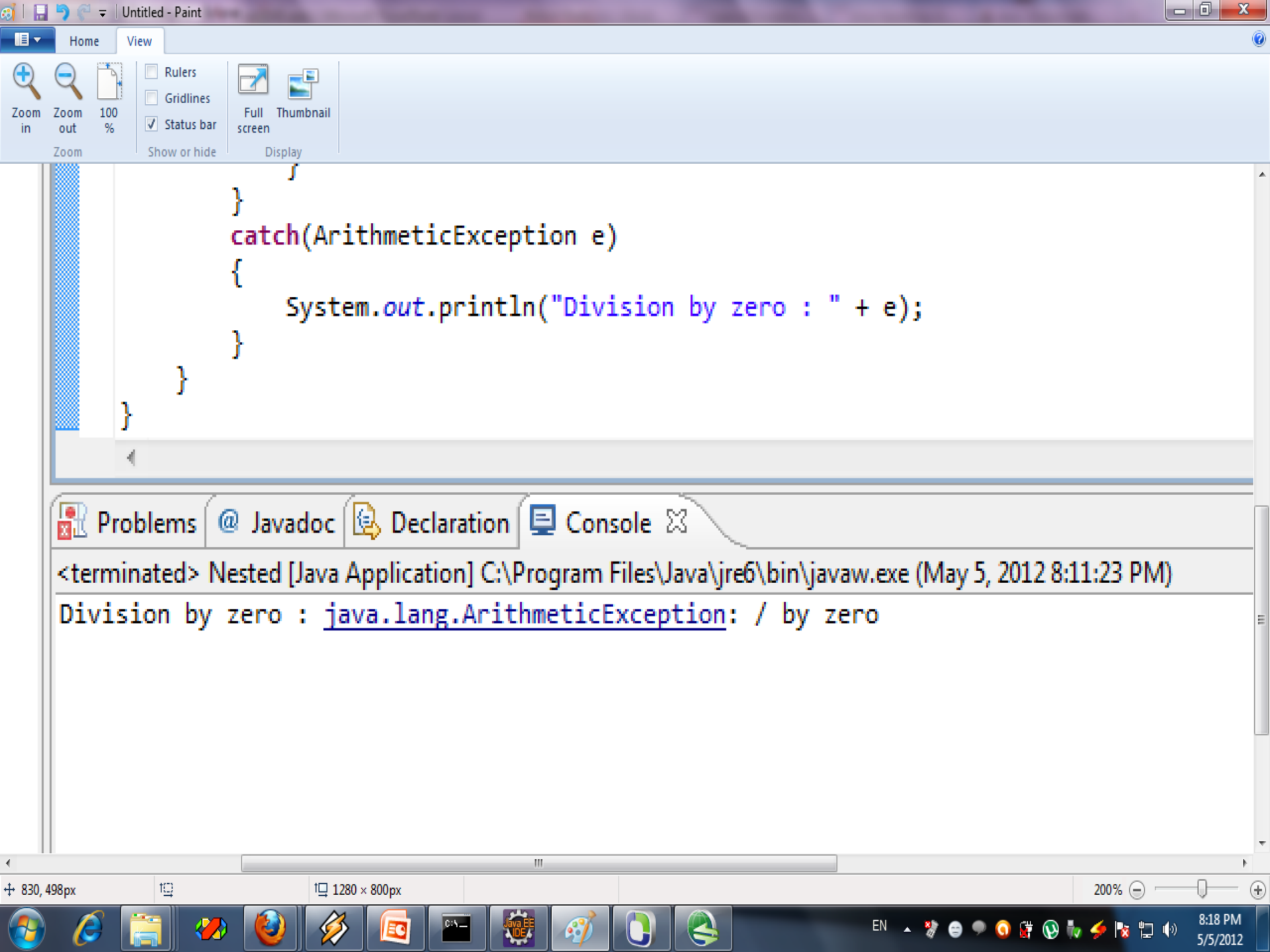
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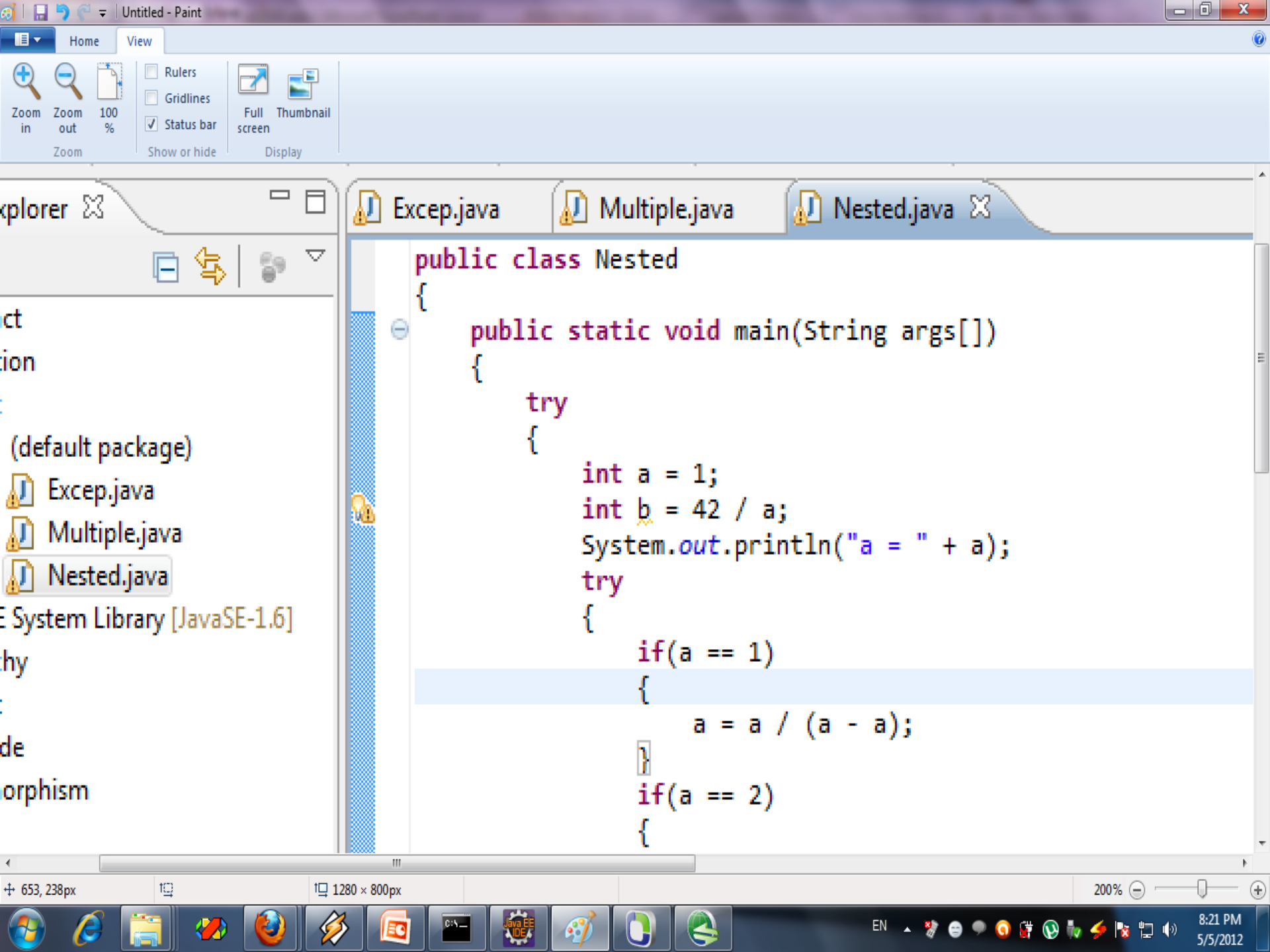
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Nested.java
public class Nested
{
public static void main(String args[])
{
try
{
int a = 1;
int b = 42 / a;
System.out.println("a = " + a);
try
{
if(a == 1)
{
a = a / (a - a);
}
if(a == 2)
{
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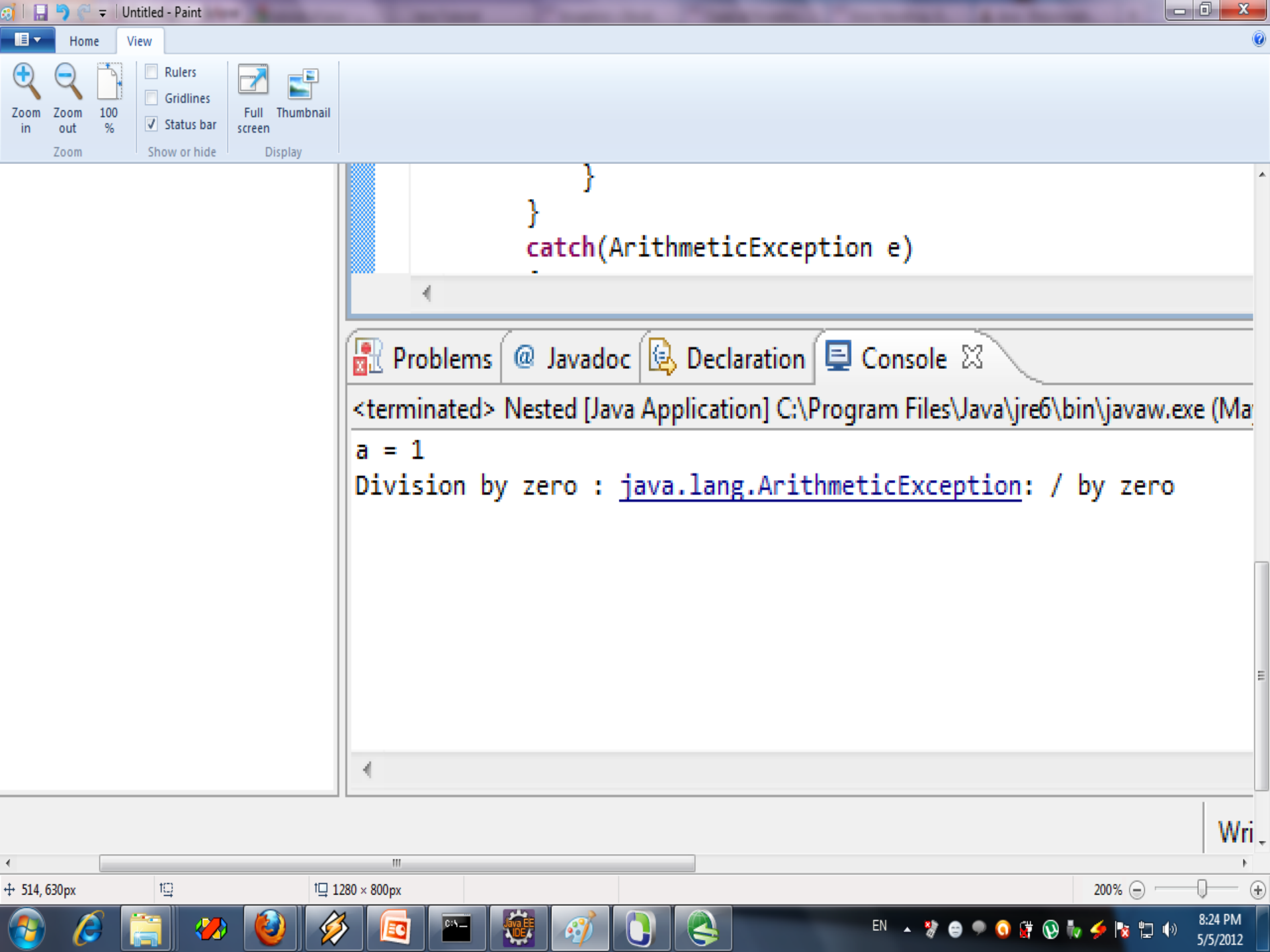
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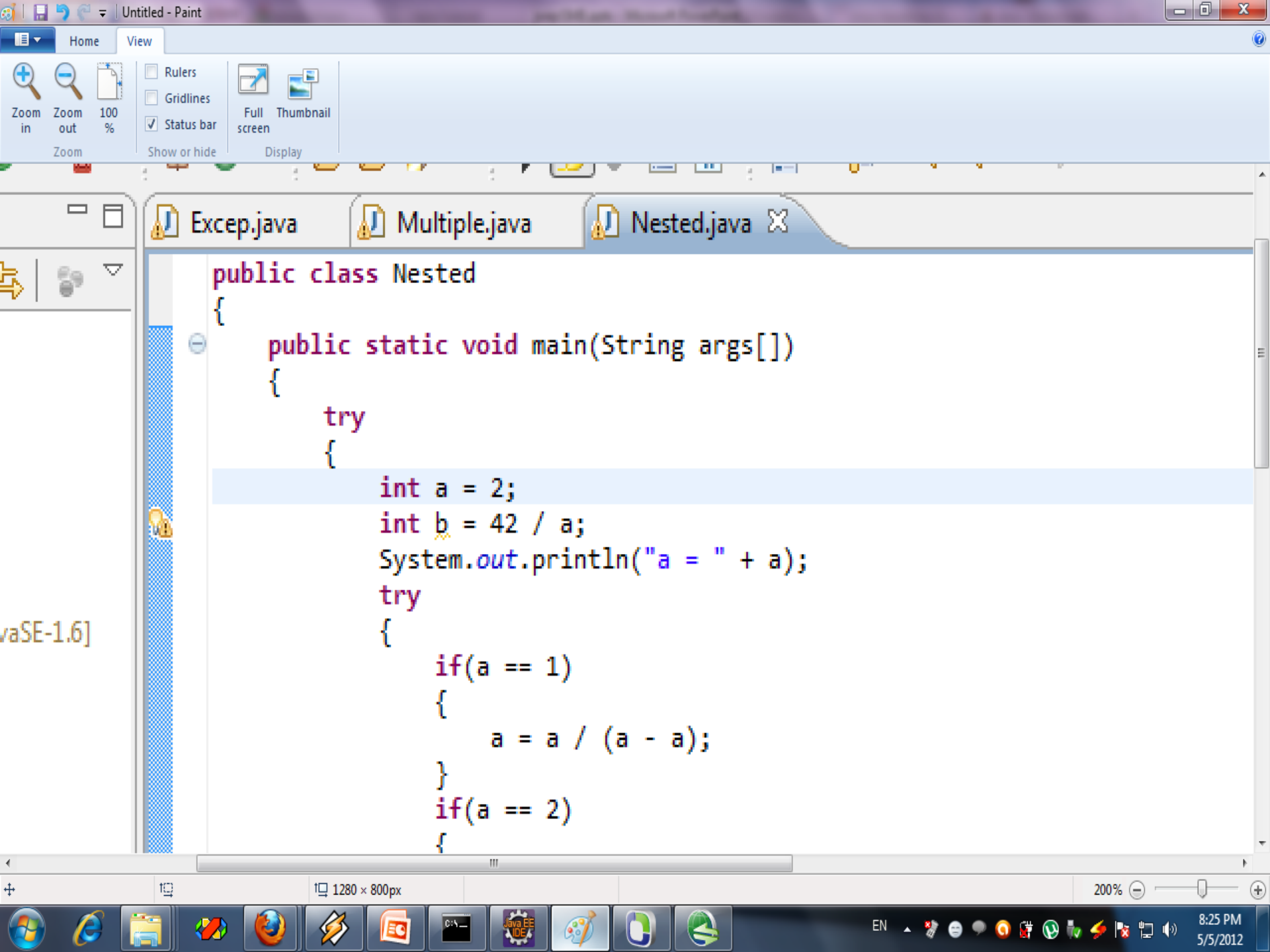
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Excep.java
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Nested.java
public class Nested
{
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{
int a = 2;
int b = 42 / a;
System.out.println("a = " + a);
try
{
if(a == 1)
{
a = a / (a - a);
}
if(a == 2)
{
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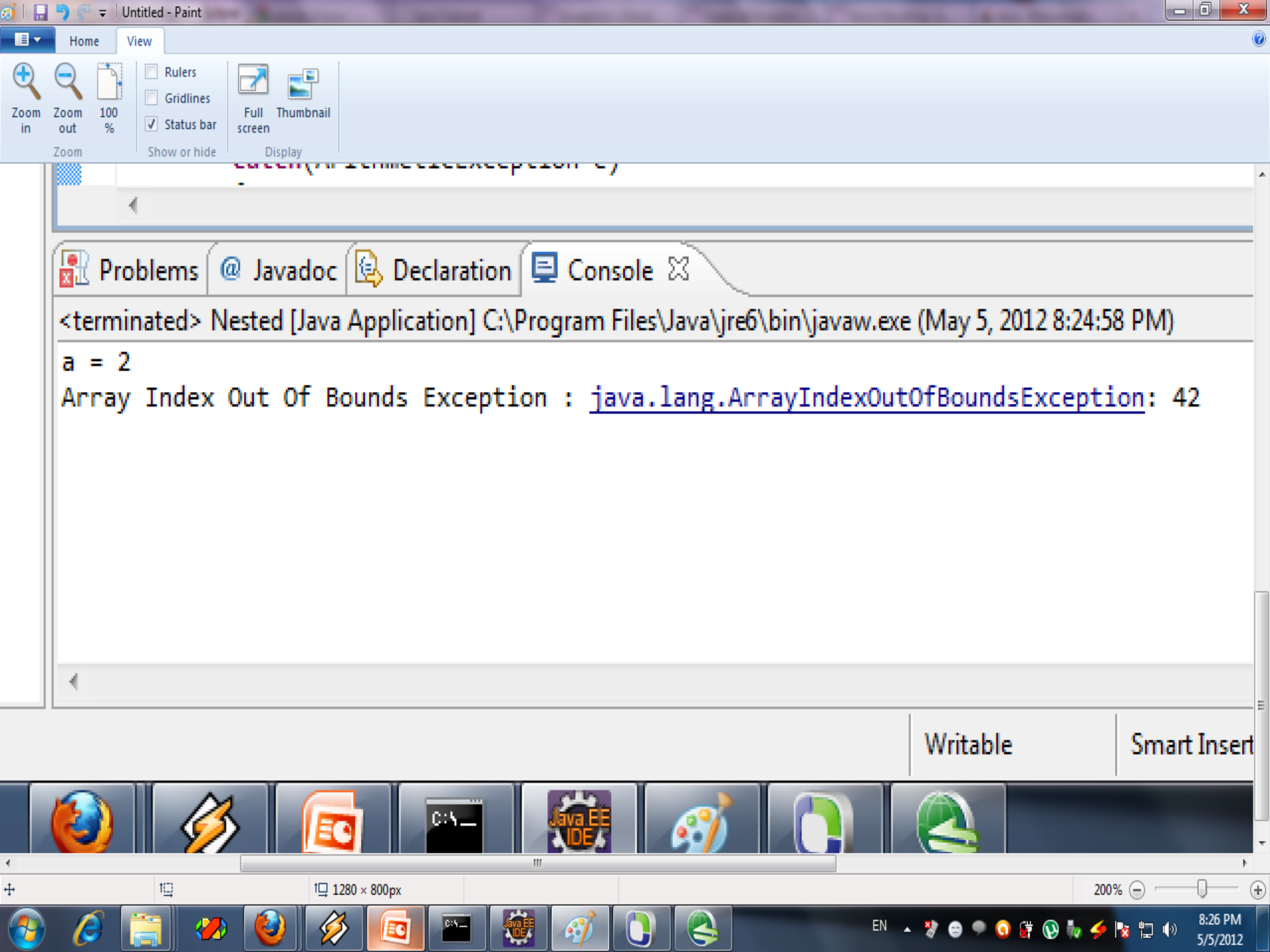
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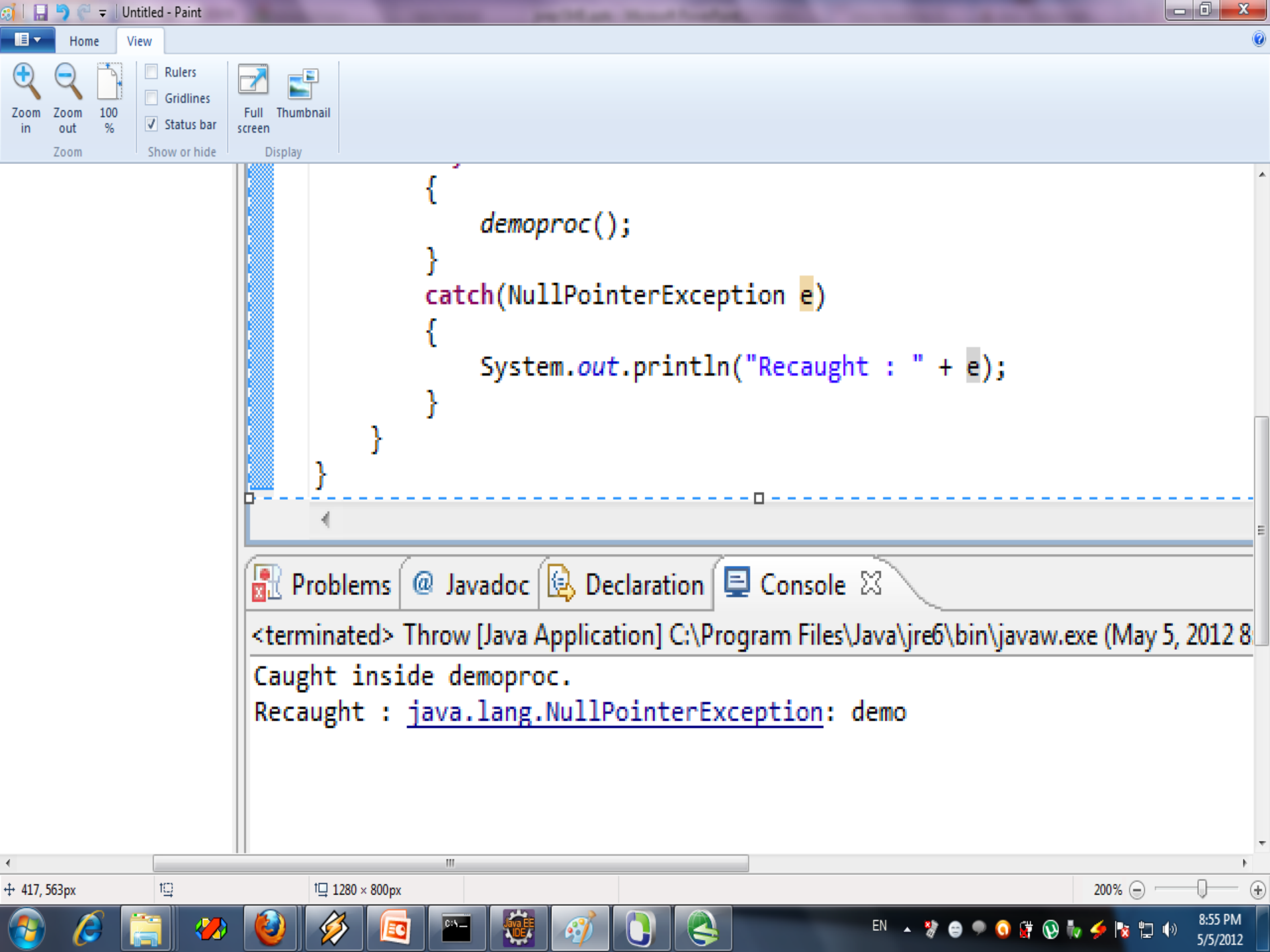
Using Try-Catch()

- Now the examples
  1. using try-catch and our own handler
  2. Using try-catch and printing default string corresponding to the exception.
  3. Multiple catch clauses
  4. Nested try statement
  5. ***Using Throw***

Excep.java | Multiple.java | Nested.java | Throw.java

```
public class Throw
{
    static void demoproc()
    {
        try
        {
            throw new NullPointerException("demo");
        }
        catch(NullPointerException e)
        {
            System.out.println("Caught inside demoproc.");
            throw e;
        }
    }
    public static void main(String args[])
    {
        try
        {
            demoproc();
        }
        catch(NullPointerException e)
        {
            System.out.println("Recaught : " + e);
        }
    }
}
```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{
demoproc();
}
catch(NullPointerException e)
{
System.out.println("Recaught : " + e);
}
}
}
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Throws

- If a method is capable of causing an exception that it does not handle, it must specify this behavior so that callers of the method can guard themselves against that exception.
- A ***throws*** clauses lists the types of exceptions that a method might throw.
- This is necessary for all exceptions, except those of type ***error*** or ***RuntimeException***, or any of their subclasses.

Throws

- All other exceptions that a method can throw must be declared in the ***throws*** clauses.
- If they are not, a compile-time error will result.

Excep.java | Multiple.java | Nested.java | Throw.java | Throws.java

```
public class Throws
{
    static void Throws() throws IllegalAccessException
    {
        System.out.println("Inside Throws");
        throw new IllegalAccessException("demo");
    }
    public static void main(String args[])
    {
        try
        {
            Throws();
        }
        catch(IllegalAccessException e)
        {
            System.out.println("caught : " + e);
        }
    }
}
```

Problems | Javadoc | Declaration | Console

<terminated> Throw [Java Application] C:\Program Files\Java\jre6\bin\javaw.exe (May 5, 2012 8:51:09 PM)

```
Caught inside demoproc.
Recaught : java.lang.NullPointerException: demo
```

Finally

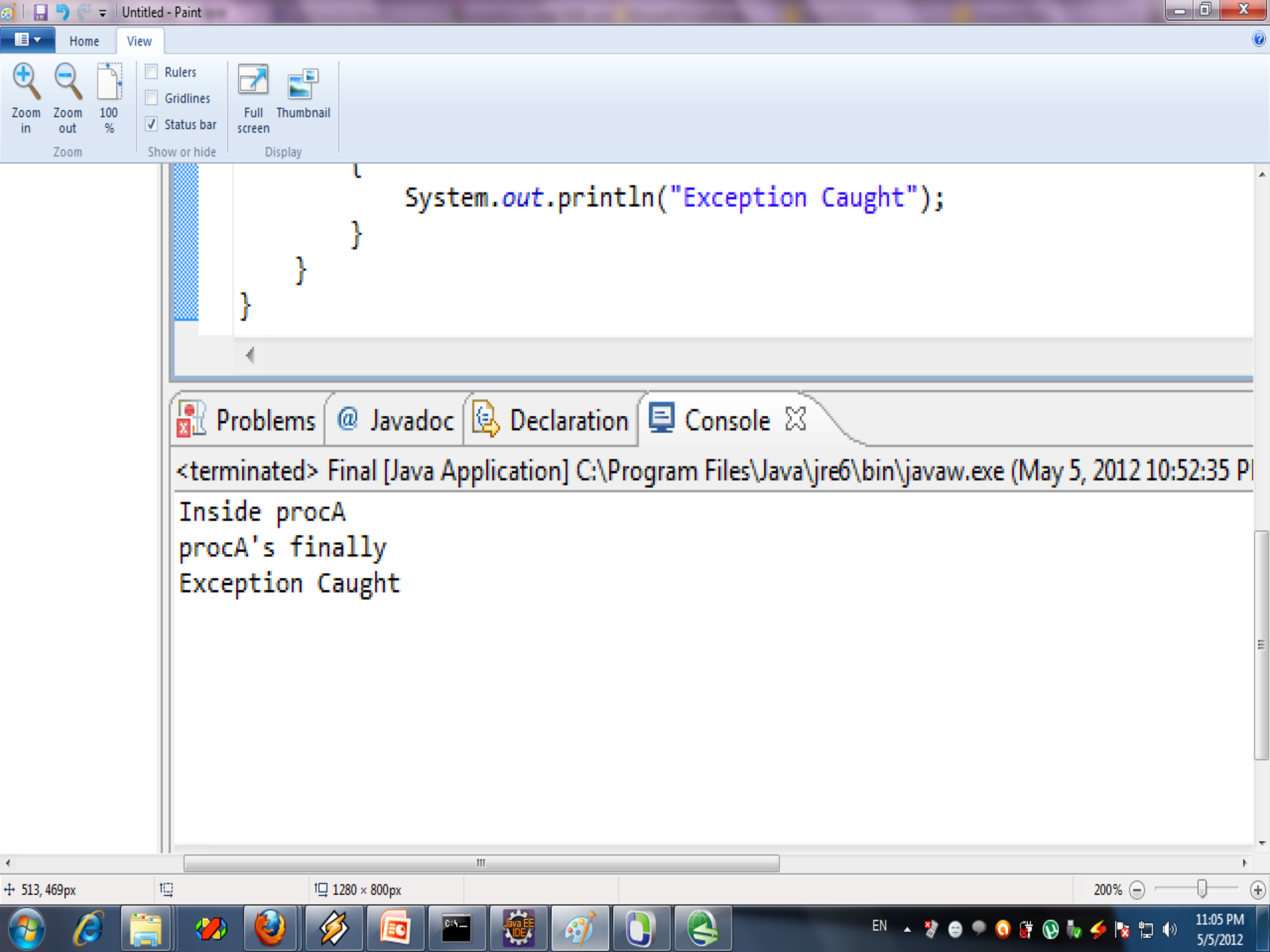
- ***Finally*** creates a block of code that will be executed after a ***try/catch*** block has completed and before the code following the ***try/catch*** block.
- The ***finally*** block will execute whether or not an exception is thrown.
- If an exception is thrown, the ***finally*** block will execute even if no ***catch*** statement matches the exception.

Finally

- The ***finally*** clause is optional.
- However, each ***try*** statement requires at least one ***catch*** or a ***finally*** clauses.

Final.java

```
public class Final
{
    static void procA()
    {
        try
        {
            System.out.println("Inside procA");
            throw new RuntimeException("demo");
        }
        finally
        {
            System.out.println("procA's finally");
        }
    }
    public static void main(String args[])
    {
        try
        {
            procA();
        }
        catch(Exception e)
        {
            System.out.println("Exception Caught");
        }
    }
}
```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