Batch: E2	**Roll No.: 16010123325**
Experiment / assignment / tutorial No. 9	
Grade: AA / AB / BB / BC / CC / CD /DD	
Signature of the Staff In-charge with date	

TITLE :Java Packages

AIM: Create a package 'myPackage' which contains a class myMath. The class contains following static methods.

i) power (x, y) – to compute xy

ii) fact (x) – to compute x!

Write a program to find the following series.

cos (x) = 1 – (x2/2!) + (x4/4!) – (x6/6!) + … upto n terms (n given by user).

(Do not make use of inbuilt functions. Use the functions of user defined class MyMath by importing mypackage.)

Expected OUTCOME of Experiment:

CO4: Explore the interface, exceptions, multithreading, packages.

Books/ Journals/ Websites referred:

1. Ralph Bravaco , Shai Simoson , "Java Programming From the Group Up" Tata McGraw-Hill.

2.Grady Booch, Object Oriented Analysis and Design .

Pre Lab/ Prior Concepts:

Java Packages:

A package in Java is a group of similar types of classes, interfaces, and sub-packages. They can be categorized into two categories, the built-in package (java, lang, util, awt, javax, swing, net, io, sql et), and user-defined package.

They are used for the following tasks –

- To prevent the naming conflicts which can occur between the classes.
- Make the searching and locating of classes or enumerations or annotations much easier.
- Provide access control to the classes.
- Used for data encapsulation.

Advantages of Java Package:

- A Java package is mainly used for the categorization of classes and interfaces so that we can maintain them easily.
- They always provide access protection
- Used to bundle classes and interfaces.
- With the help of packages, we can reuse the existing code
- By using the package, we can easily locate the classes related to it.
- Also, remove the naming collision.

Built-in Packages in Java

Built-in is a part of Java API and it offers a variety of packages are –

lang – Automatically imported and it contains language support classes.
io – Contains classes for input and output operations.
util – Contains utility classes for implementing data structures.
applet – This package contains classes that create applets.
awt – Contain classes that implement compounds for GUI.
net – This package contains classes that support networking operations.

User-defined Packages in Java

```
package First;

public class MyClass
{
public void getNames(String name)
{
System.out.println(name);
}

}
```

```
package First;
import First.MyClass;
public class MyClass1 {
public static void main(String args[])
{
// Initializing the String variable with a value
String name = "Welcome";
// Creating an instance of class MyClass in the package.
MyClass obj = new MyClass();
obj.getNames(name);
}
}
```

.

Class Diagram:

Class Name	Parameters	Return Type
mymath	x: int, y: int	int
	x: int	int
Mainclass	x: double, n: int	double
	argos:String[]	void

Algorithm:

Package Declaration:

- Create a package `Mypackage` with two classes: `Mainclass` and `mymath`.

Import Statements:

- Import `Mypackage.mymath` and `java.util.Scanner` for input.

cosSeries Method:

- Takes input `x` (value for cosine) and `n` (number of terms).
- Start with `result = 1.0` (first term of cos series).
- Alternate signs using `sign = -1`.
- Loop through even powers (2, 4, 6, ...) up to `2*n`:
  - Use `mymath.power(x, i)` and `mymath.fact(i)` to calculate terms.
  - Add/subtract each term from `result` based on the sign.
- Return the final result.

Main Method:

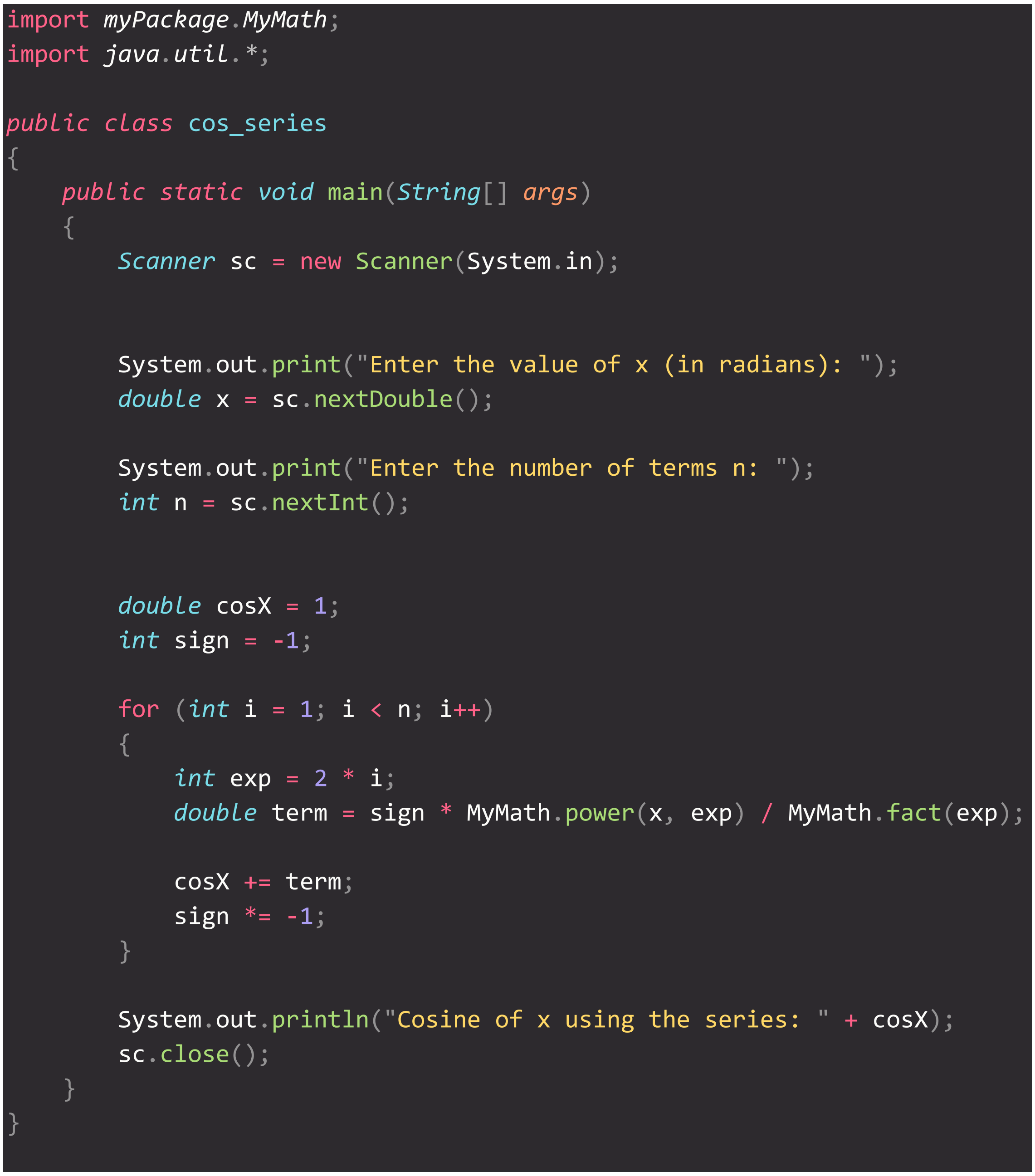
- Ask the user to input `x` and `n`.
- Call `cosSeries(x, n)` to calculate the cosine series.
- Print the result.

mymath Class:

- `power(x, y)` calculates `x^y` using a loop.
- `fact(x)` calculates factorial of `x` using a loop.

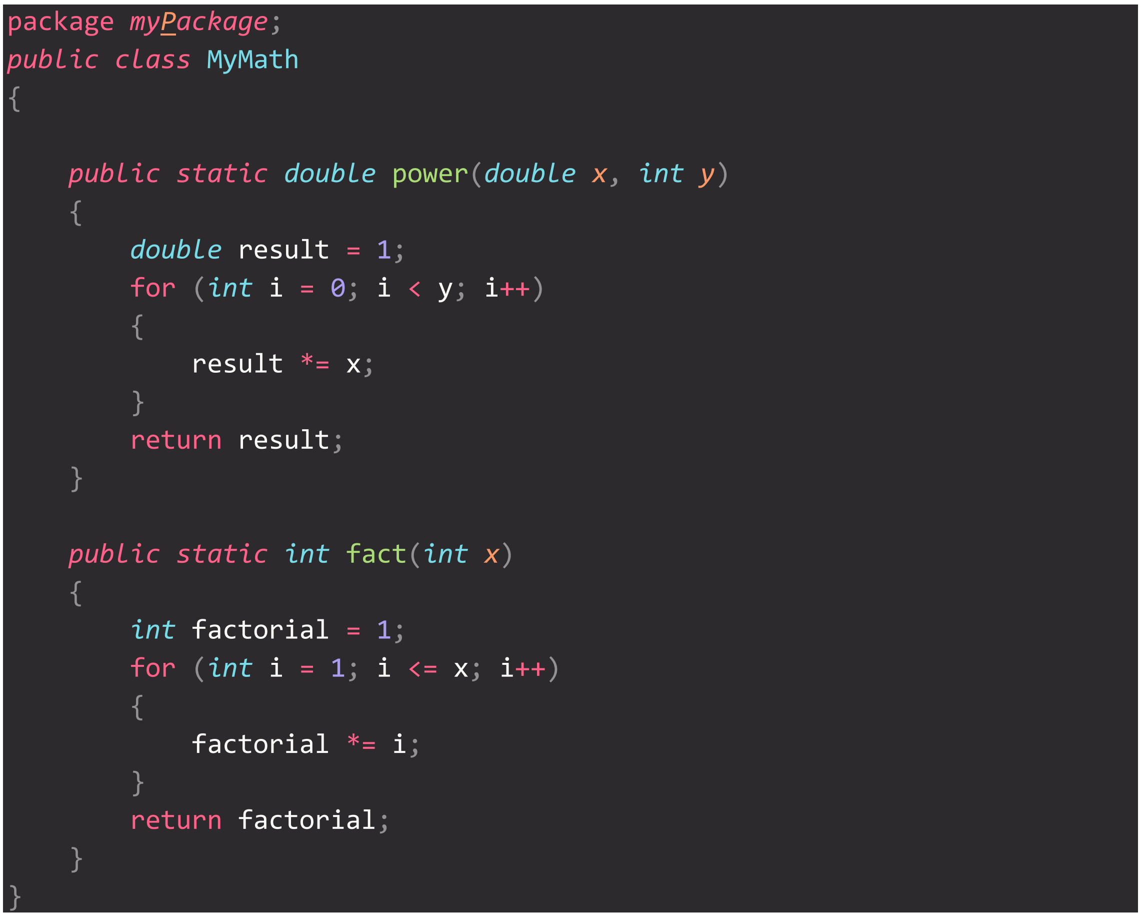
Implementation details:

Cos_series.java



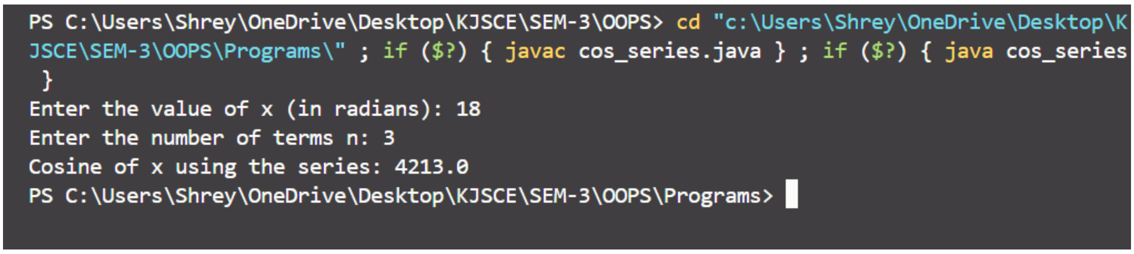
```
import myPackage.MyMath;
import java.util.*;

public class cos_series
{
    public static void main(String[] args)
    {
        Scanner sc = new Scanner(System.in);


        System.out.print("Enter the value of x (in radians): ");
        double x = sc.nextDouble();

        System.out.print("Enter the number of terms n: ");
        int n = sc.nextInt();


        double cosX = 1;
        int sign = -1;

        for (int i = 1; i < n; i++)
        {
            int exp = 2 * i;
            double term = sign * MyMath.power(x, exp) / MyMath.fact(exp);

            cosX += term;
            sign *= -1;
        }

        System.out.println("Cosine of x using the series: " + cosX);
        sc.close();
    }
}
```

MyMath.java

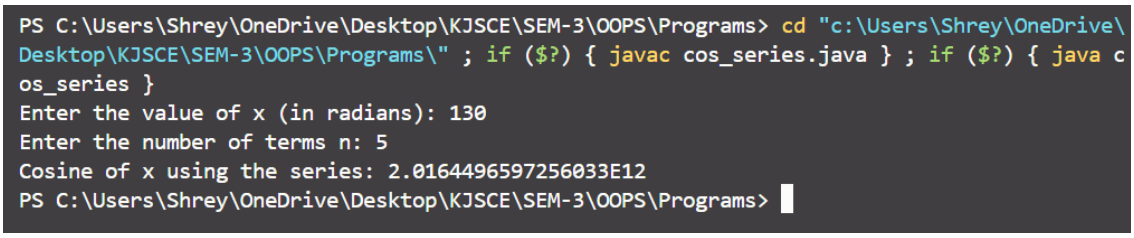


```java
package myPackage;
public class MyMath
{

    public static double power(double x, int y)
    {
        double result = 1;
        for (int i = 0; i < y; i++)
        {
            result *= x;
        }
        return result;
    }

    public static int fact(int x)
    {
        int factorial = 1;
        for (int i = 1; i <= x; i++)
        {
            factorial *= i;
        }
        return factorial;
    }
}
```

Output:



```
PS C:\Users\Shrey\OneDrive\Desktop\KJSCE\SEM-3\OOPS> cd "c:\Users\Shrey\OneDrive\Desktop\K
JSCE\SEM-3\OOPS\Programs\" ; if ($?) { javac cos_series.java } ; if ($?) { java cos_series
 }
Enter the value of x (in radians): 18
Enter the number of terms n: 3
Cosine of x using the series: 4213.0
PS C:\Users\Shrey\OneDrive\Desktop\KJSCE\SEM-3\OOPS\Programs> 
```



```
PS C:\Users\Shrey\OneDrive\Desktop\KJSCE\SEM-3\OOPS\Programs> cd "c:\Users\Shrey\OneDrive\
Desktop\KJSCE\SEM-3\OOPS\Programs\" ; if ($?) { javac cos_series.java } ; if ($?) { java c
os_series }
Enter the value of x (in radians): 130
Enter the number of terms n: 5
Cosine of x using the series: 2.0164496597256033E12
PS C:\Users\Shrey\OneDrive\Desktop\KJSCE\SEM-3\OOPS\Programs>
```

Conclusion:

In this experiment, we created a custom package `myPackage` with a class `mymath` to compute powers and factorials, using it to calculate the cosine series without built-in functions. This enhanced our understanding of packages and static methods in Java.

Date: 11/10/24 **Signature of faculty in-charge**

Post Lab Descriptive Questions

Q.1 What are Java Packages? What's the significance of packages?

Java packages are a way to organize and group related classes, interfaces, and sub-packages together. They help in managing large codebases by preventing naming conflicts and improving code organization.

Significance of Packages:

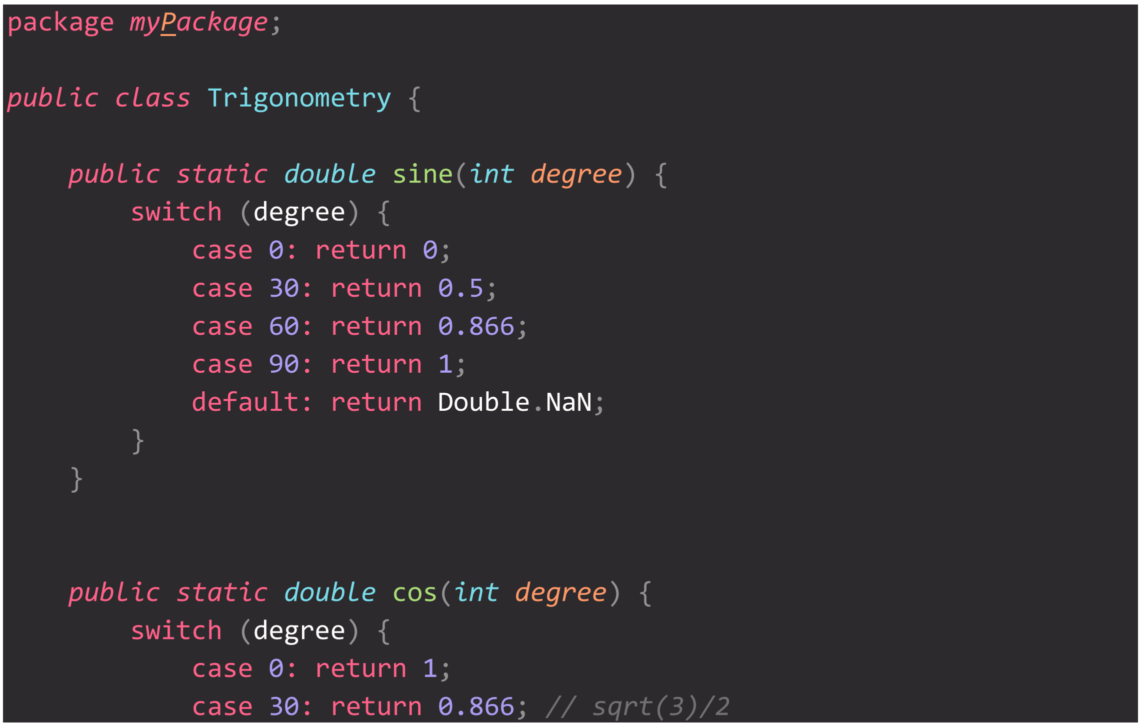
- **Modularity:** Makes code easier to manage and maintain.
- **Reusability:** Classes can be reused in different projects.
- **Namespace Control:** Avoids class name conflicts by grouping them in namespaces.
- **Access Control:** Controls visibility of classes and methods (e.g., `public`, `protected`, `private`).

Q.2 Does Importing a package imports its sub-packages as well in Java?

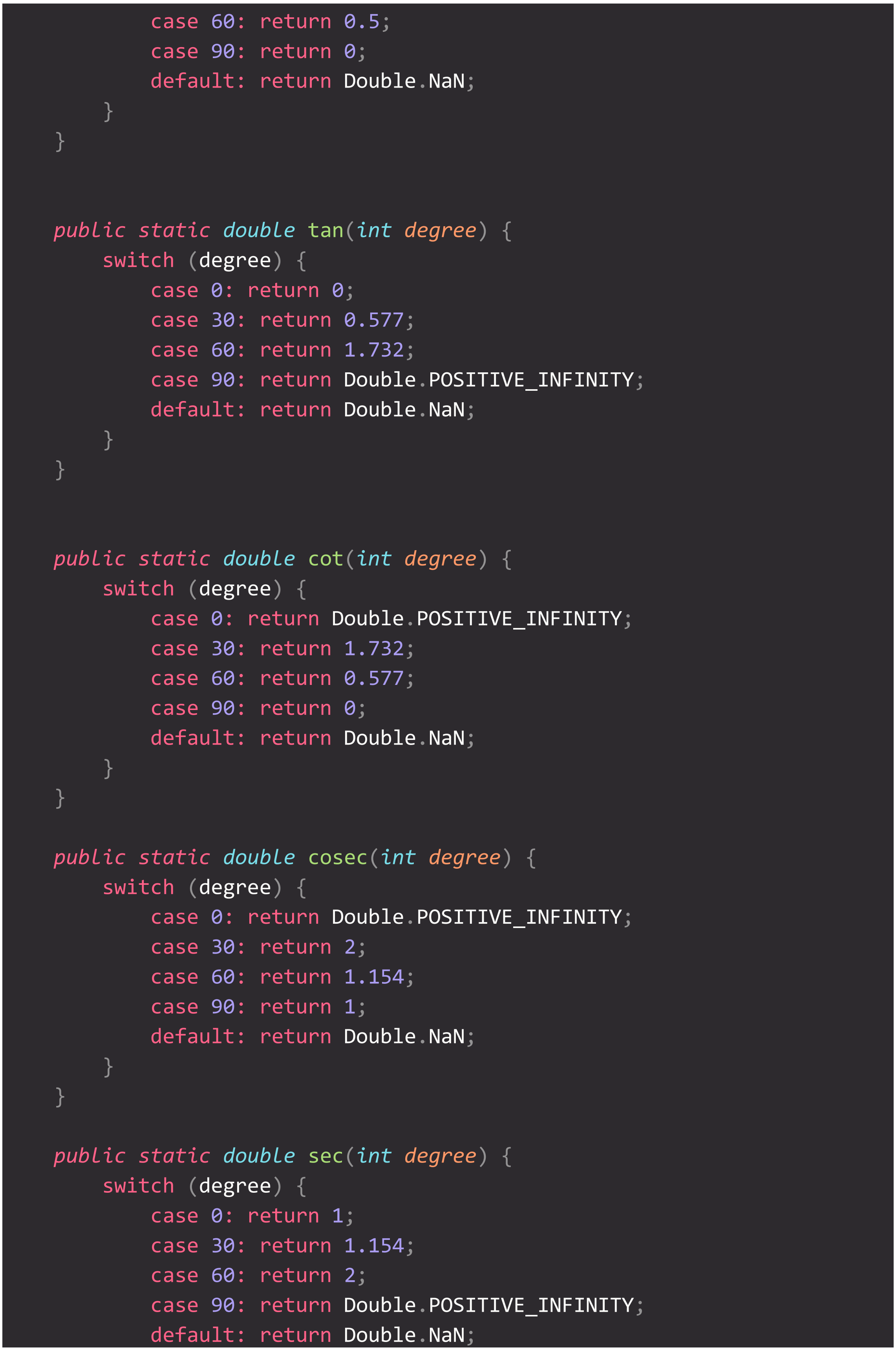
No, importing a package in Java **does not** automatically import its sub-packages. Each package and sub-package must be imported separately. For example, importing `java.util` does not import `java.util.regex`. You need to import sub-packages explicitly if you want to use their classes.

Q.3 Write a program to create a package ‘myPack’ which contains a class Trigonometry. The
class contains following static methods.
i) sine() –accepts degree (0,30,60,90)
ii) cos() - accepts degree (0,30,60,90)
iii)tan()- accepts degree (0,30,60,90)
iv)cot()-- accepts degree (0,30,60,90)
v)cosec()-- accepts degree (0,30,60,90)
vi)sec()-- accepts degree (0,30,60,90)
(Do not make use of inbuilt functions. Use the functions of user defined class Trigonometry by
importing mypack.)

1. Trigonometry.java



```
package myPackage;

public class Trigonometry {

    public static double sine(int degree) {
        switch (degree) {
            case 0: return 0;
            case 30: return 0.5;
            case 60: return 0.866;
            case 90: return 1;
            default: return Double.NaN;
        }
    }


    public static double cos(int degree) {
        switch (degree) {
            case 0: return 1;
            case 30: return 0.866; // sqrt(3)/2
```

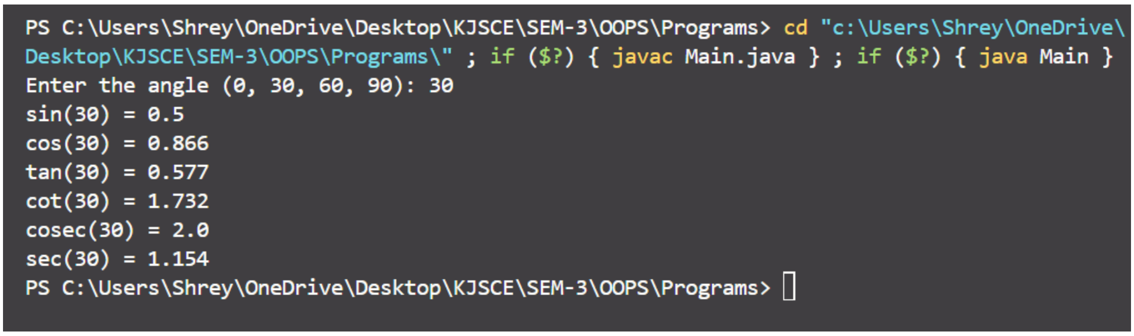


```
            case 60: return 0.5;
            case 90: return 0;
            default: return Double.NaN;
        }
    }


    public static double tan(int degree) {
        switch (degree) {
            case 0: return 0;
            case 30: return 0.577;
            case 60: return 1.732;
            case 90: return Double.POSITIVE_INFINITY;
            default: return Double.NaN;
        }
    }


    public static double cot(int degree) {
        switch (degree) {
            case 0: return Double.POSITIVE_INFINITY;
            case 30: return 1.732;
            case 60: return 0.577;
            case 90: return 0;
            default: return Double.NaN;
        }
    }

    public static double cosec(int degree) {
        switch (degree) {
            case 0: return Double.POSITIVE_INFINITY;
            case 30: return 2;
            case 60: return 1.154;
            case 90: return 1;
            default: return Double.NaN;
        }
    }

    public static double sec(int degree) {
        switch (degree) {
            case 0: return 1;
            case 30: return 1.154;
            case 60: return 2;
            case 90: return Double.POSITIVE_INFINITY;
            default: return Double.NaN;
        }
    }
}
```

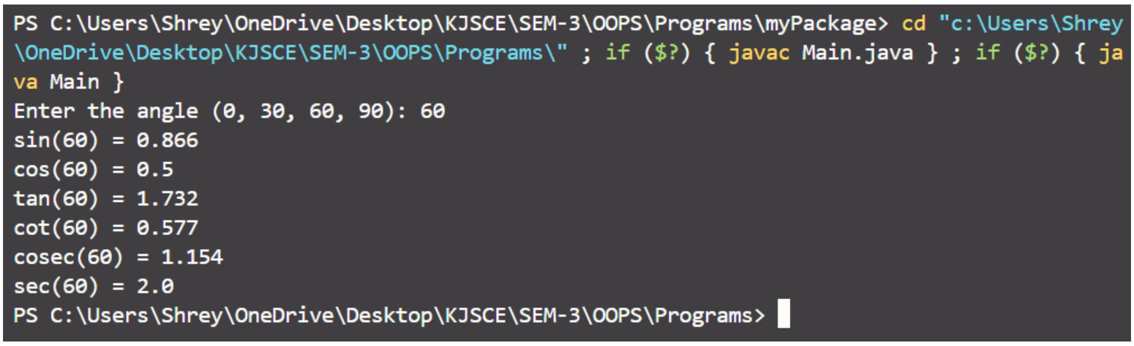
2. MainClass.java

```
import myPackage.Trigonometry;
import java.util.Scanner;

public class Main
{
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);

        System.out.print("Enter the angle (0, 30, 60, 90): ");
        int degree = sc.nextInt();

        System.out.println("sin(" + degree + ") = " +
Trigonometry.sine(degree));
        System.out.println("cos(" + degree + ") = " +
Trigonometry.cos(degree));
        System.out.println("tan(" + degree + ") = " +
Trigonometry.tan(degree));
        System.out.println("cot(" + degree + ") = " +
Trigonometry.cot(degree));
        System.out.println("cosec(" + degree + ") = " +
Trigonometry.cosec(degree));
        System.out.println("sec(" + degree + ") = " +
Trigonometry.sec(degree));

        sc.close();
    }
}
```

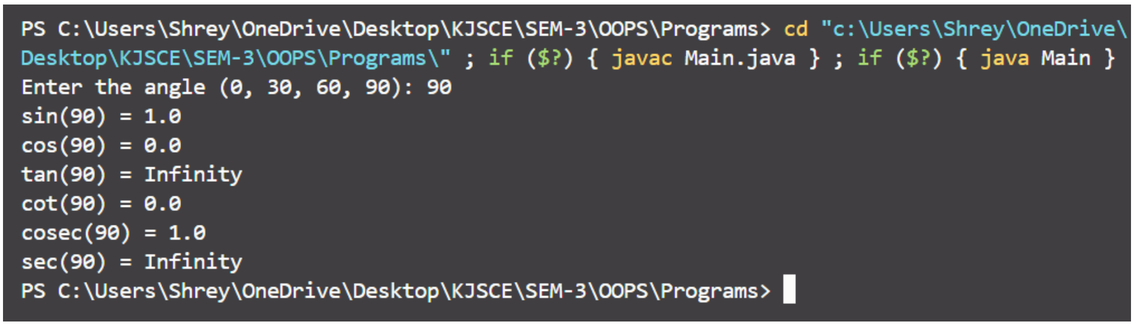
Output:



```
PS C:\Users\Shrey\OneDrive\Desktop\KJSCE\SEM-3\OOPS\Programs> cd "c:\Users\Shrey\OneDrive\
Desktop\KJSCE\SEM-3\OOPS\Programs\" ; if ($?) { javac Main.java } ; if ($?) { java Main }
Enter the angle (0, 30, 60, 90): 30
sin(30) = 0.5
cos(30) = 0.866
tan(30) = 0.577
cot(30) = 1.732
cosec(30) = 2.0
sec(30) = 1.154
PS C:\Users\Shrey\OneDrive\Desktop\KJSCE\SEM-3\OOPS\Programs>
```



```
PS C:\Users\Shrey\OneDrive\Desktop\KJSCE\SEM-3\OOPS\Programs\myPackage> cd "c:\Users\Shrey
\OneDrive\Desktop\KJSCE\SEM-3\OOPS\Programs\" ; if ($?) { javac Main.java } ; if ($?) { ja
va Main }
Enter the angle (0, 30, 60, 90): 60
sin(60) = 0.866
cos(60) = 0.5
tan(60) = 1.732
cot(60) = 0.577
cosec(60) = 1.154
sec(60) = 2.0
PS C:\Users\Shrey\OneDrive\Desktop\KJSCE\SEM-3\OOPS\Programs>
```



```
PS C:\Users\Shrey\OneDrive\Desktop\KJSCE\SEM-3\OOPS\Programs> cd "c:\Users\Shrey\OneDrive\
Desktop\KJSCE\SEM-3\OOPS\Programs\" ; if ($?) { javac Main.java } ; if ($?) { java Main }
Enter the angle (0, 30, 60, 90): 90
sin(90) = 1.0
cos(90) = 0.0
tan(90) = Infinity
cot(90) = 0.0
cosec(90) = 1.0
sec(90) = Infinity
PS C:\Users\Shrey\OneDrive\Desktop\KJSCE\SEM-3\OOPS\Programs>
```