Overview

A Scientific Calculator is a very powerful and general purpose calculator. In addition to basic arithmetic functions, it provides trigonometric functions, logarithms, powers, roots etc. Therefore, these calculators are widely used in any situation where quick access to certain mathematical functions is needed. Here we are going to create a scientific calculator using java swing.

Language used: JAVA PROGRAMMING LANGUAGE

Front End: Visual Studio Code

Visual Studio Code features a lightning fast source code editor, perfect for day-to-day use. With support for hundreds of languages, VS Code helps you be instantly productive with syntax highlighting, bracket-matching, auto-indentation, box-selection, snippets, and more. Intuitive keyboard shortcuts, easy customization and community-contributed keyboard shortcut mappings let you navigate your code with ease.

For serious coding, you'll often benefit from tools with more code understanding than just blocks of text. Visual Studio Code includes built-in support for IntelliSense code completion, rich semantic code understanding and navigation, and code refactoring.

And when the coding gets tough, the tough get debugging. Debugging is often the one feature that developers miss most in a leaner coding experience, so we made it happen.

Visual Studio Code includes an interactive debugger, so you can step through source code, inspect variables, view call stacks, and execute commands in the console.

It consists of the following features:

Code editor:

- Like any other IDE, it includes a code editor that supports syntax highlighting and code completion.
- The Visual Studio code editor also supports setting bookmarks in code for quick navigation
- Visual Studio features background compilation.

Debugger:

- Visual Studio includes a debugger that works both as a source-level debugger and as a machine-level debugger.

Designer:

- Visual Studio includes a host of visual designers to aid in the development of applications.

Software Requirements:

JDK 8 or above.

Future Scope of this Project:

- Reduction of paperwork.
- Human initiative or Manual Labour may be significantly minimized.
- Large operations that are conducted manually can be completed in a matter of seconds

Feature of Java Scientific Calculator:

- **Arithmetic Functions:**
  Whether we need to calculate the annual budget or distribute something equally to a number of people, for every such aspect of our life, we use arithmetic operations.
  This includes the following functional operators:

  1. Addition +
  2. Subtraction –
  3. Multiplication *
  4. Division /
  5. Percentage %
  6. Square Root √
  7. Square ^{2}
  8. Cube Root $\sqrt[3]{}$
  9. Cube ^{3}

- **Trigonometric Functions:**
  There are an enormous number of uses of trigonometry and its formulae. For example, the technique of triangulation is used in Geography to measure the distance between

landmarks; in Astronomy, to measure the distance to nearby stars and also in satellite navigation systems.

Following functions formulas are used for solving trigonometric problems:

Basic Trigonometric Functions Formulae:

1. sin θ = Opposite Side/Hypotenuse
2. cos θ = Adjacent Side/Hypotenuse
3. tan θ = Opposite Side/Adjacent Side
4. Degree °
5. Radian (180° / π or 157.29577951°)
6. Pi π

GUI Programming using Java Swing

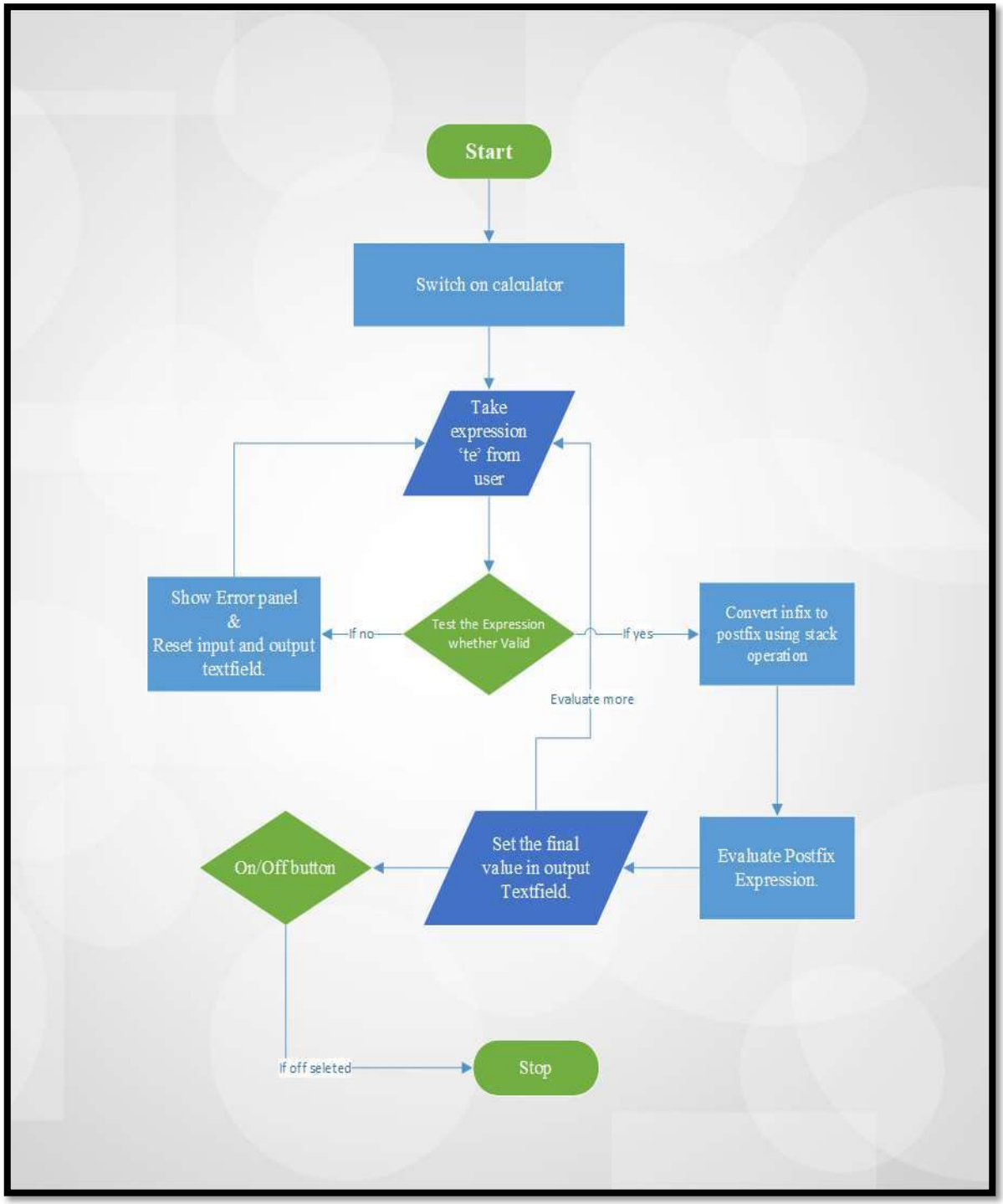
Design a GUI (Graphical User Interface) using swing in java. Swing provides a rich set of widgets and packages to make sophisticated GUI components for Java applications. Swing is a part of Java Foundation Classes (JFC), which is an API for Java programs that provide GUI.

The Java Swing library is built on top of the Java Abstract Widget Toolkit (AWT), an older platform dependent GUI toolkit. You can use the Java GUI programming components like Jbutton, Jtextfield etc. from the libraryand do not have to create the components from scratch.

CALCULATOR ALGORITHM

Step 1 Start
Step 2 Switch on calculator
Step 3 Take expression from the user
Step 4 Test the expression whether it is valid or not
Step 5
CASE 1 If Yes: Convert infix to postfix using stack operation
CASE 2 If No: Show Error Panel & Reset Input & Output Textfield
Step 6
CASE 1 Evaluate postfix expression
Step 7 Set the final value in the output Textfield
Step 8 ON/OFF Button
Step 8 Stop

CALCULATOR FLOW CHART



Source Code Explanation:

PACKAGE

Following are the imported packages. These packages help you to reserve the class namespace and create a maintainable code.

```
import java.awt.*;
import javax.swing.*;
import java.awt.event.*;
import java.math.*;
import java.util.*;
import java.util.Stack;
import java.lang.String;
import javax.swing.border.*;
```

JFRAME

```
class sincalculator extends JFrame
```

The new class called sincalculator is based on JFrame (by the method of inheritances)

JPANEL

```
JPanel p1,p2,p3,p4;
```

JPanel is a simplest container class. It provides space in which an application can attach any other component. It inherits the JComponents class. is a simplest container class. It provides space in which an application can attach any other component. It inherits the JComponents class.

JTOGGLE BUTTON

```
JToggleButton tb;
```

JToggleButton is used to create toggle button, it is two-states button to switch on or off.

JBUTTON

```
JButton num[],ab,fun[];
```

JButton class is used to create a labeled button that has platform independent implementation. The application result in some action when the button is pushed. It inherits AbstractButton class.

JTEXTFIELD

```
JTextField in,out;
```

The object of a JTextField class is a text component that allows the editing of a single line text. It inherits JTextComponent class.

METHOD

setBackground()

Sets the background color of this component. The background color is used only if the component is opaque, and only by subclasses of JComponent or ComponentUI implementations. Direct subclasses of JComponent must override paintComponent to honor this property.

setForeground()

Set the foreground colour of the components. It is up to the look and feel to honour this property; some may choose to ignore it.

setFocusedPaint()

Sets the paintFocus property, which must be true for the focus state to be painted. The default value for the paintFocus property is true. Some look and feels might not paint focus state; they will ignore this property.

setBorderPaint()

Sets the borderPainted property. If true and the button has a border, the border is painted. The default value for the borderPainted property is true.

setFont()

Set the font style for the particular components

setHorizontalAlignment()

Sets the horizontal alignment of the text. Valid keys are:

- JTextField.LEFT
- JTextField.CENTER
- JTextField.RIGHT
- JTextField.LEADING
- JTextField.TRAILING

invalidate and repaint are called when the alignment is set, and a PropertyChange event ("horizontalAlignment") is fired.

setVerticalAlignment()

Sets the horizontal alignment of the text. Valid keys are:

- JTextField.LEFT
- JTextField.CENTER
- JTextField.RIGHT
- JTextField.LEADING
- JTextField.TRAILING
-

invalidate and repaint are called when the alignment is set, and a PropertyChange event ("horizontalAlignment") is fired.

setToolTipText()

Registers the text to display in a tool tip. The text displays when the cursor lingers over the component.

setEditable()

Sets the specified boolean to indicate whether or not this TextComponent should be editable. A PropertyChange event ("editable") is fired when the state is changed.

setVisible()

Shows or hides this Window depending on the value of parameter b.
If the method shows the window then the window is also made focused under the following conditions:
The Window meets the requirements outlined in the isFocusableWindow method.
The Window's autoRequestFocus property is of the true value.
Native windowing system allows the Window to get focused.
There is an exception for the second condition (the value of the autoRequestFocus property). The property is not taken into account if the window is a modal dialog, which blocks the currently focused window.
Developers must never assume that the window is the focused or active window until it receives a WINDOW_GAINED_FOCUS or WINDOW_ACTIVATED event

setEnable()

Enable (or disable) the Button.

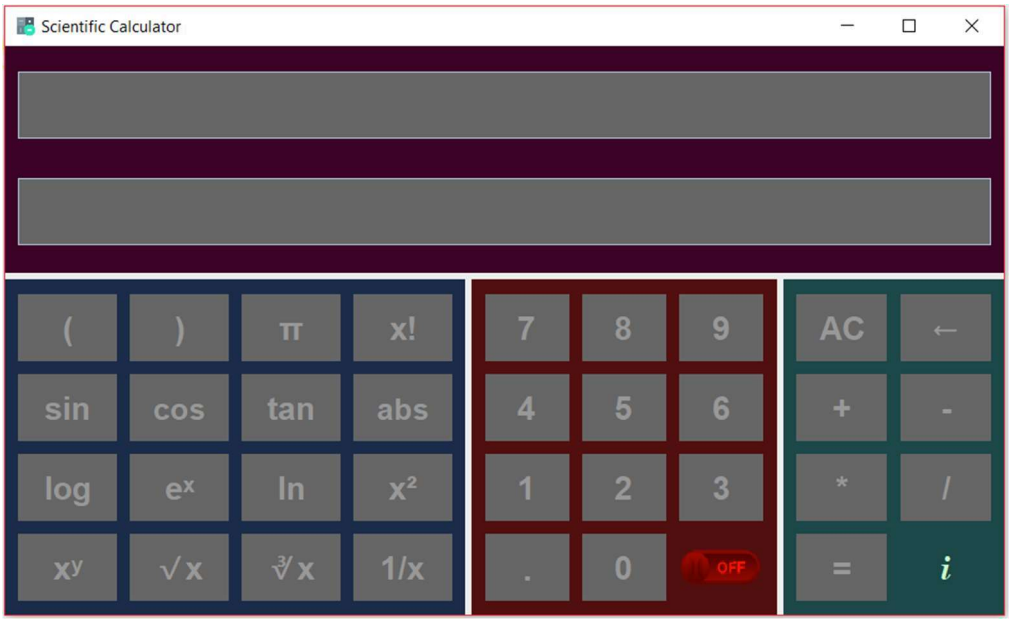
getDefaultToolkit ()

Toolkit class is the abstract superclass of every implementation in the Abstract Window Toolkit. Subclasses of Toolkit are used to bind various components. It inherits Object class.

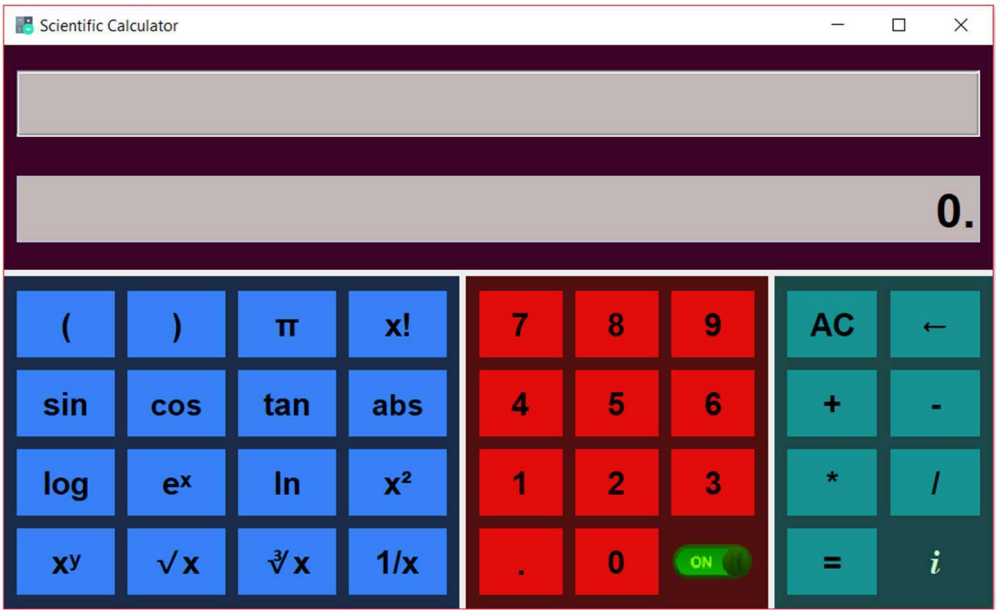
FUNCTIONALITY

Sum or any aspect of what a product, such as a software application or computing device, can do for a user**.**

Switch Button:

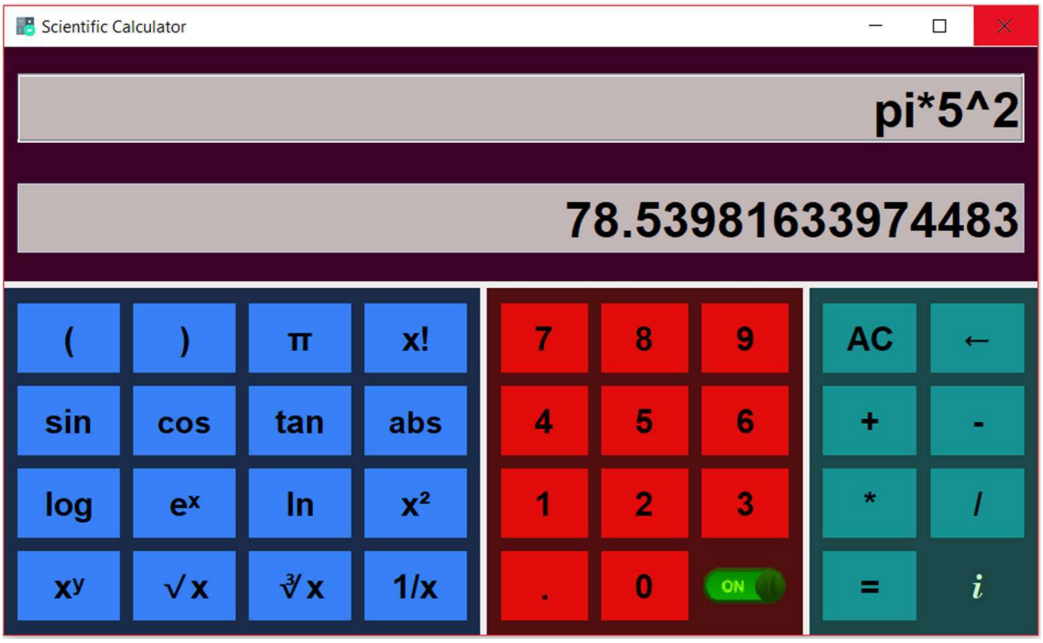


OFF MODE



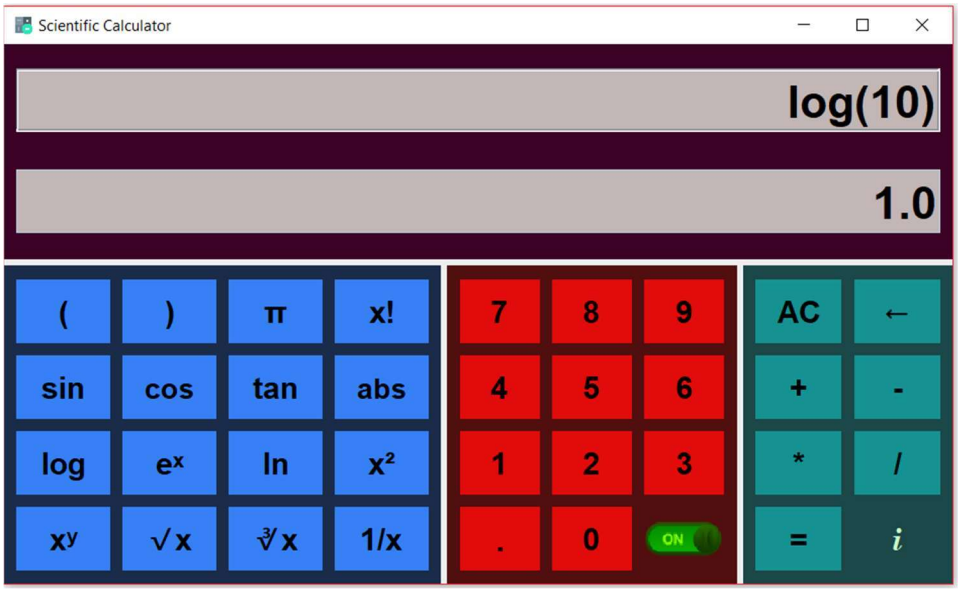
ON MODE

View of the interface when it is turned on. Using **Jtoggle Button** we have created switch button for turning on and off.



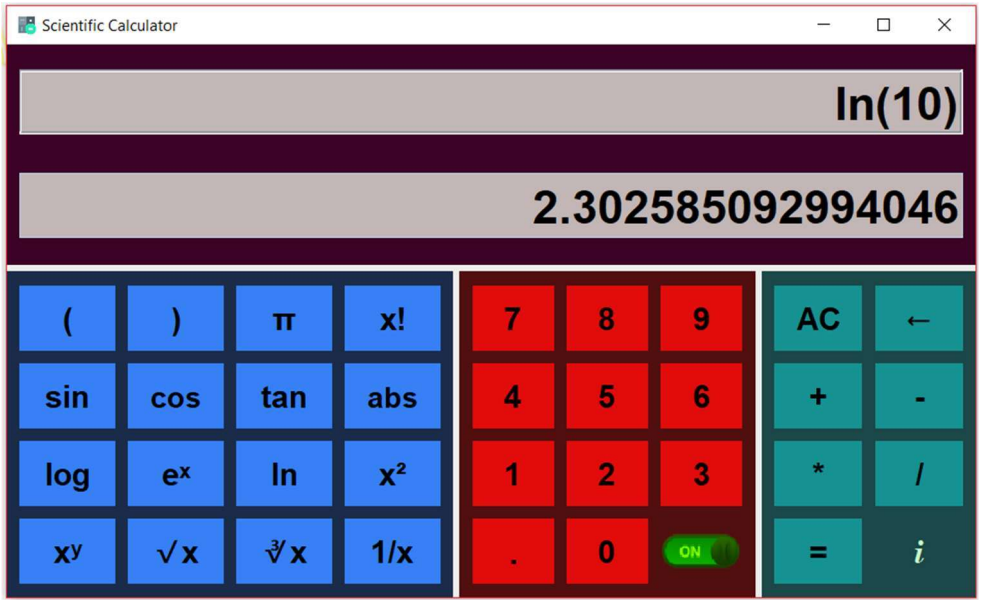
PI π

pi is used to **find the area and circumference of a circle**. Pi is used to find area by multiplying the radius squared times pi. So, in trying to find the area of a circle with a radius of 3 centimeters, π32 = 28.27 cm.



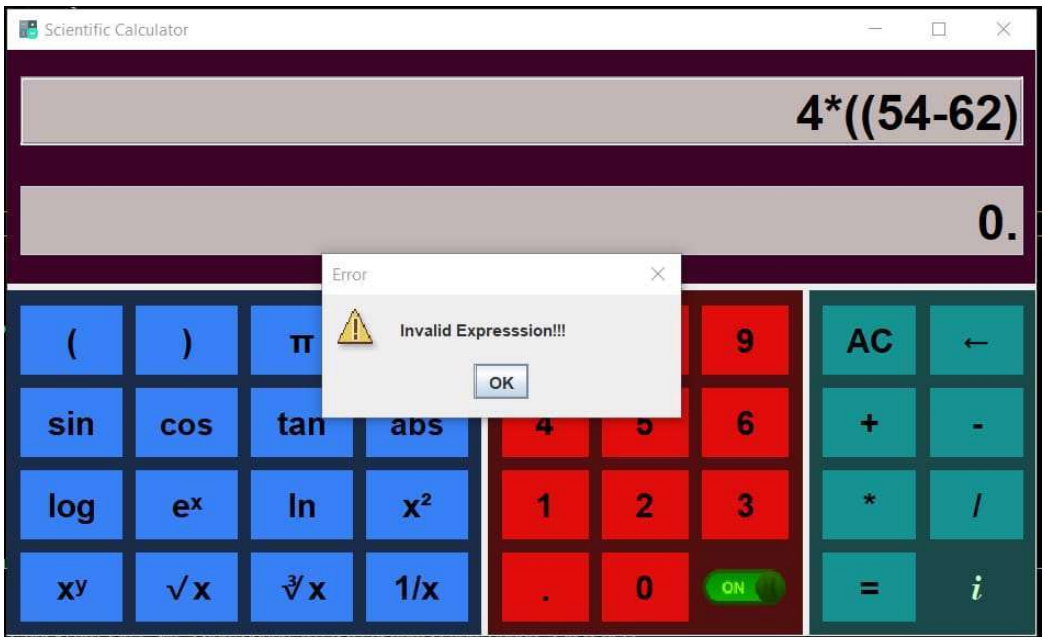
LOG FUNCTION

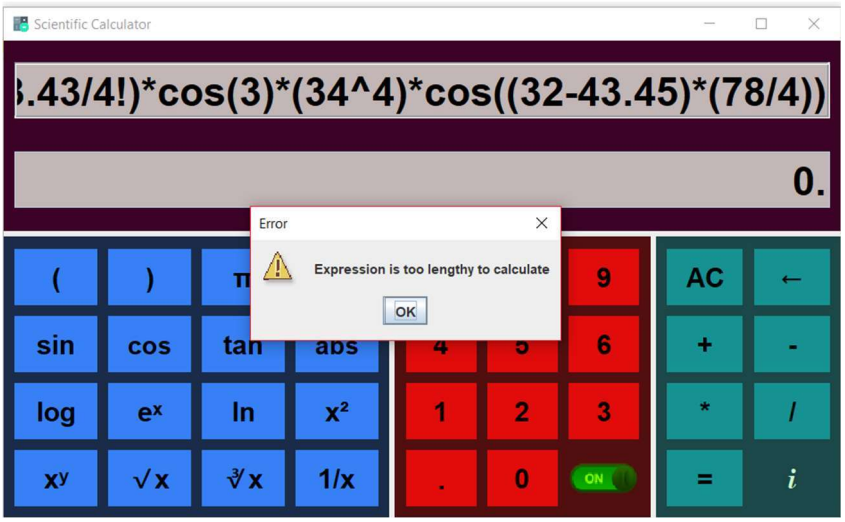
The LOG () function returns the natural logarithm of a specified number, or the logarithm of the number to the specified base.

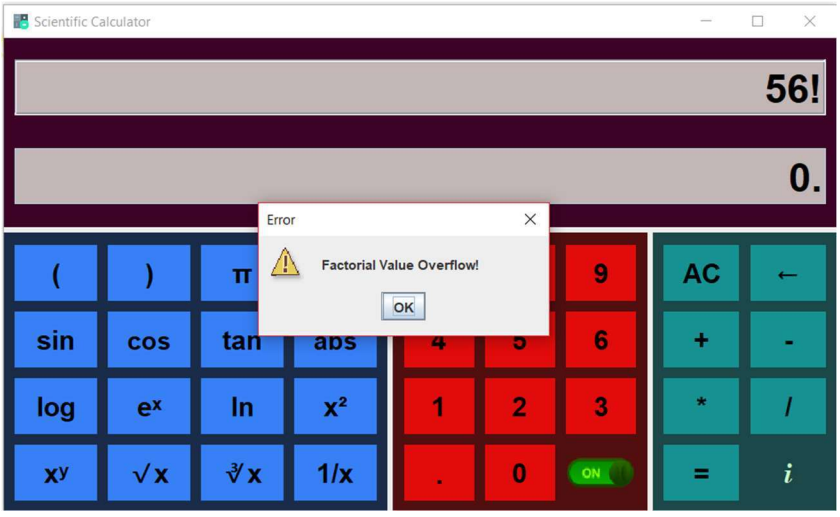


Ln FUNCTION

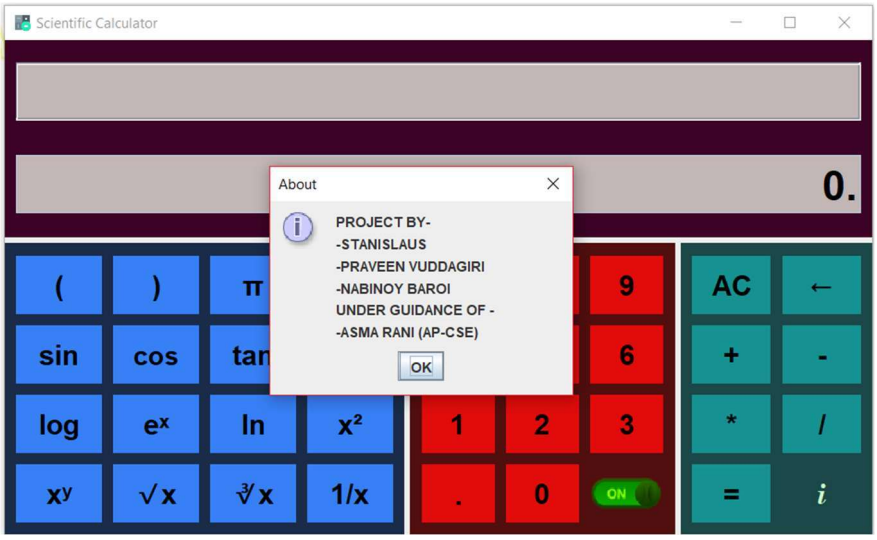
LN functioN is the mathematical trigonometry function that is used for **calculating the natural logarithm of a number**. Where LN denotes the logarithm statement and as per the syntax we just need to put any number who logarithm value we need to find.



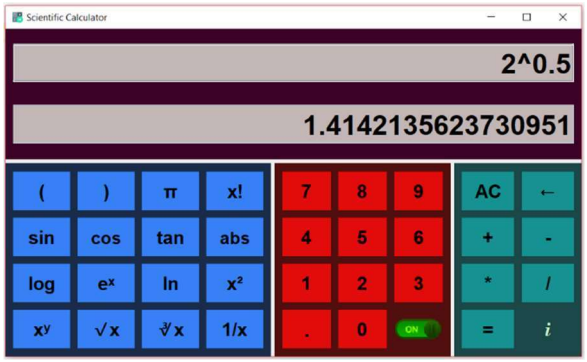


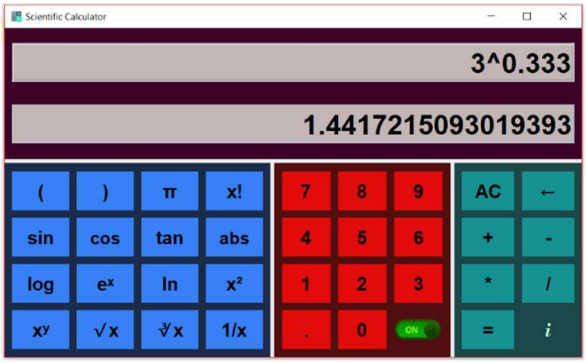


ERRORS



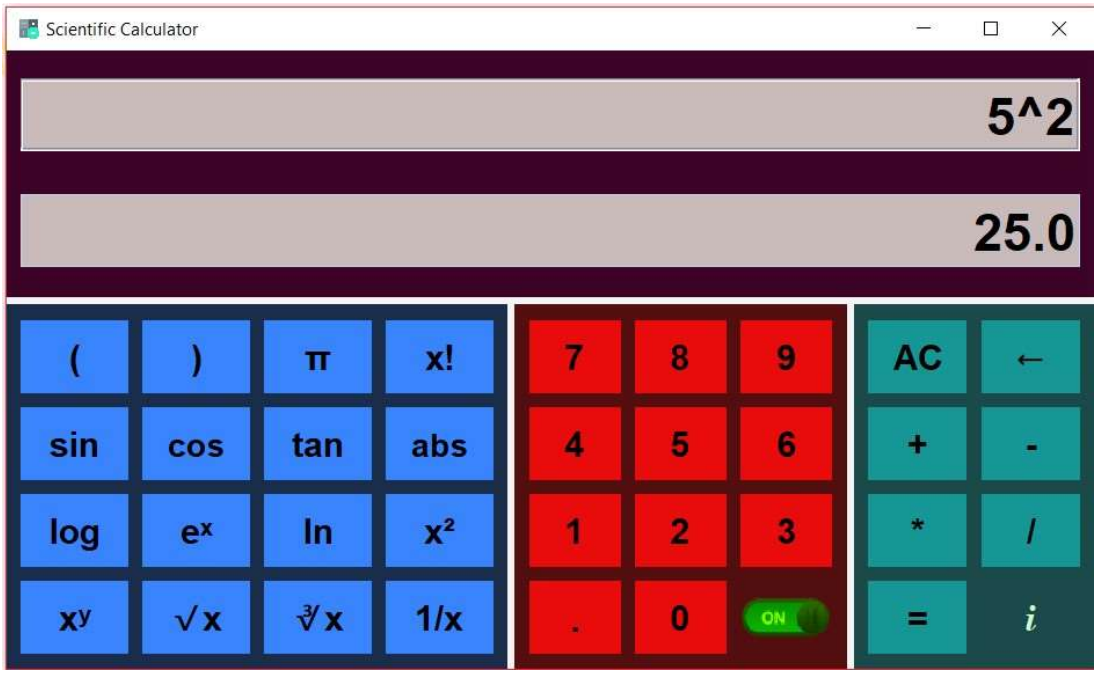
ABOUT





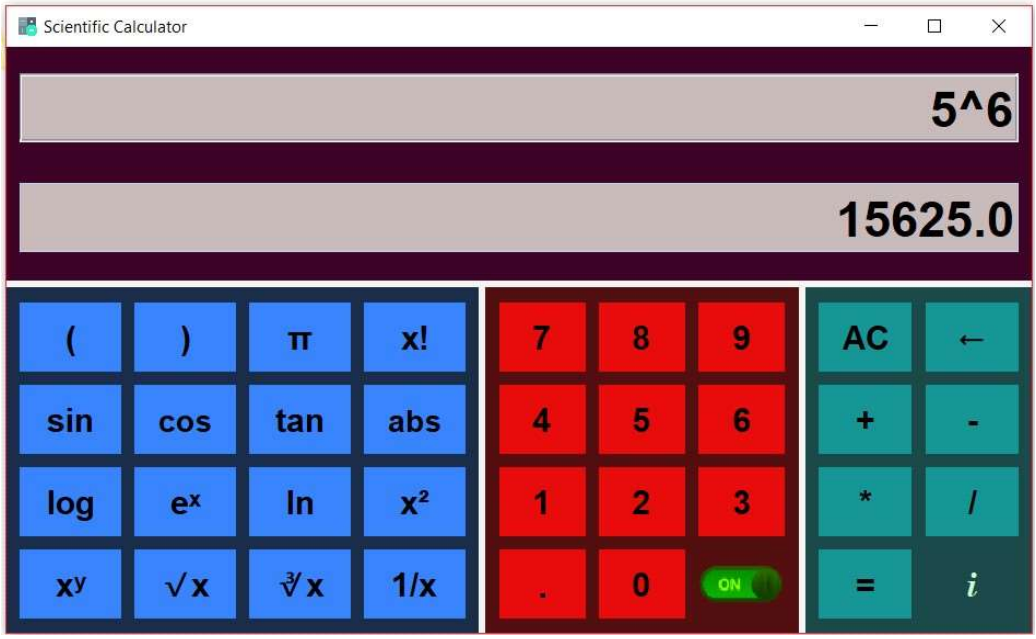
ROOT FUNCTION

In mathematics, the general root, or the nth root of a number a is another number b that when multiplied by itself n times, equals a.



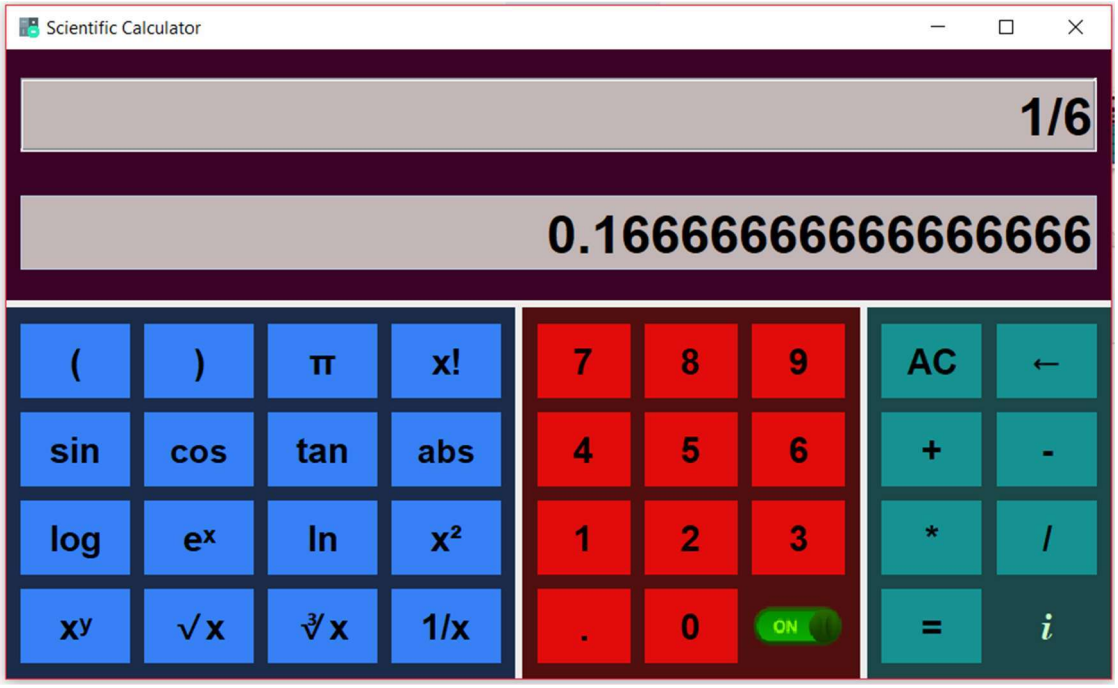
X² FUNCTION

X 2 is the same as x^2. We have five quadratic **POWER Function** equation, and we will be solving them using the formula with the help of the **POWER function** in excel to find out the roots.



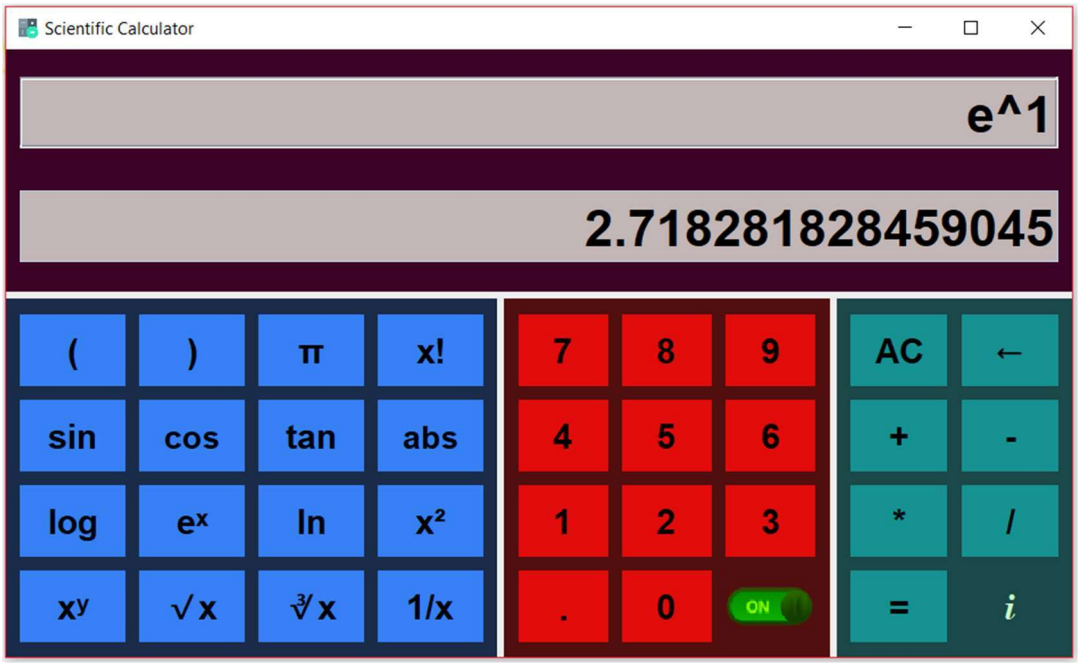
X^Y FUNCTION

Given two numbers base and exponent, pow() function finds x raised to the power of y i.e. xy. Basically value is calculated using the pow() function.



$^1/_x$ FUNCTION

The **function** f(**x**) = **1/x** is an excellent starting point from which to build an understanding of rational **functions** in general. It is a polynomial divided by a polynomial, although both are quite simple polynomials. Be sure that you understand the concept of an asymptote, especially a vertical asymptote, and then go on to the other rational **function** information

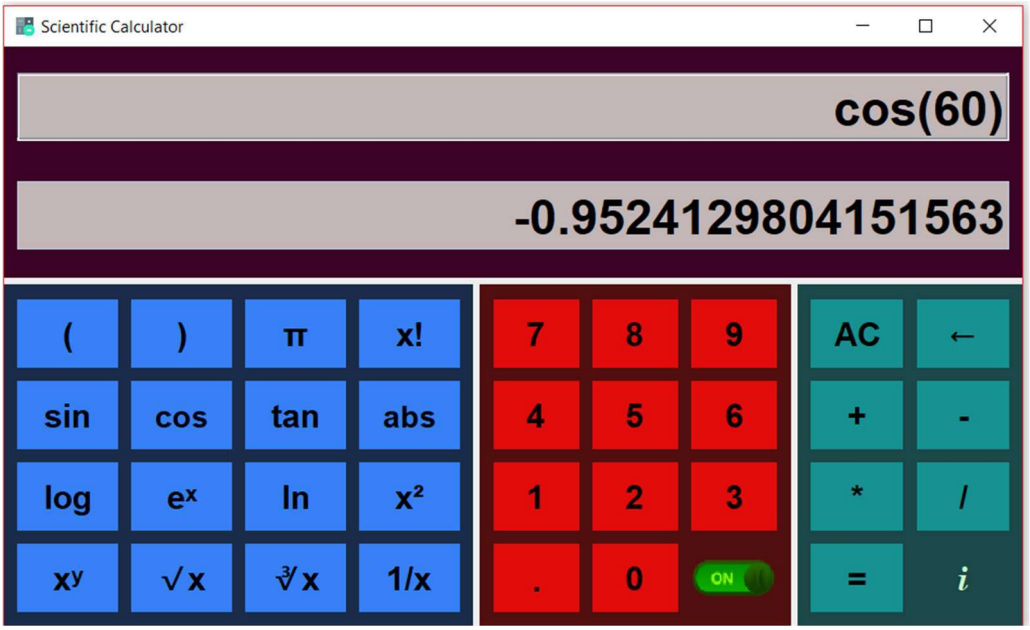


e^x FUNCTION

Enter the value of x in the input box and use the Calculate button. The exponential calculator will calculate e^x for you. e calculator takes the value of x from the user and calculates e power x instantly.

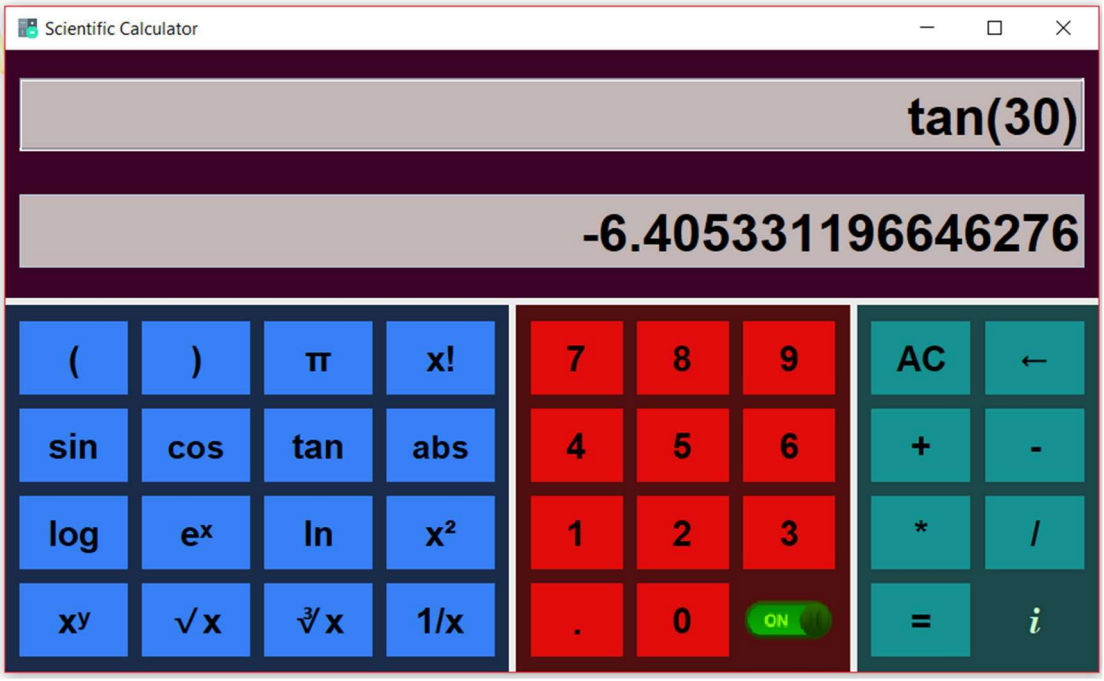
ABS FUNCTION

ABS function returns the absolute value of a number. Negative numbers are converted to positive numbers, and positive numbers are unaffected



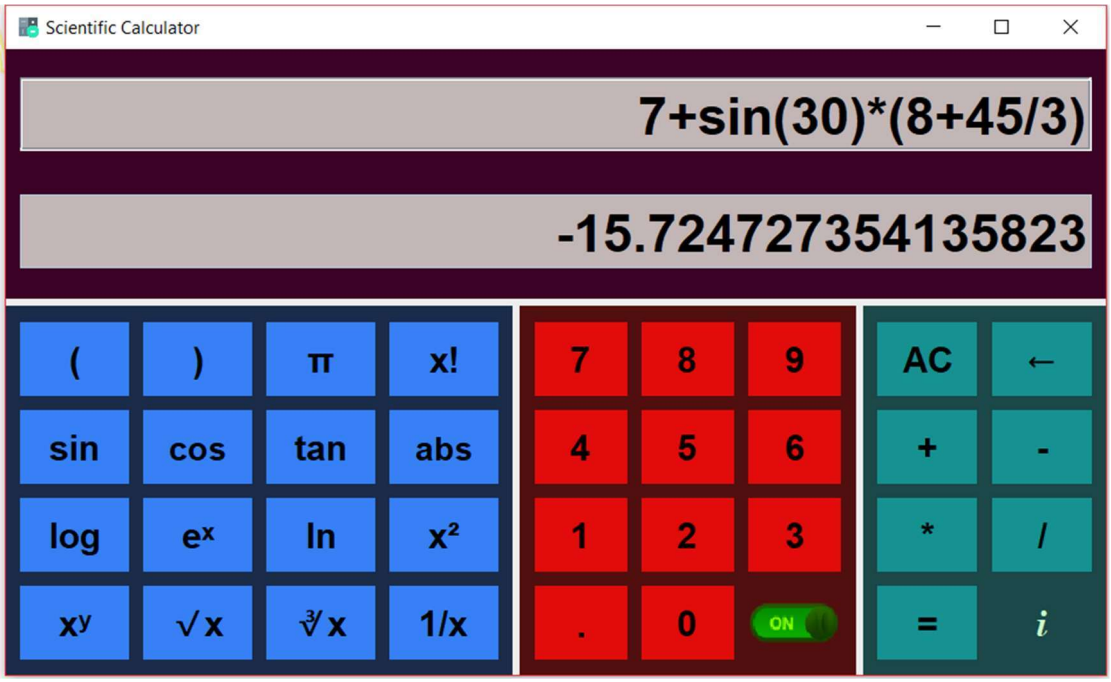
COS FUNCTION

It is **used** to calculate the cosine value of given number or in terms or trigonometry the cosine value of a given angle, here the angle is a number in excel and this **function** takes only a single argument which is the input number provided.



TAN FUNCTION

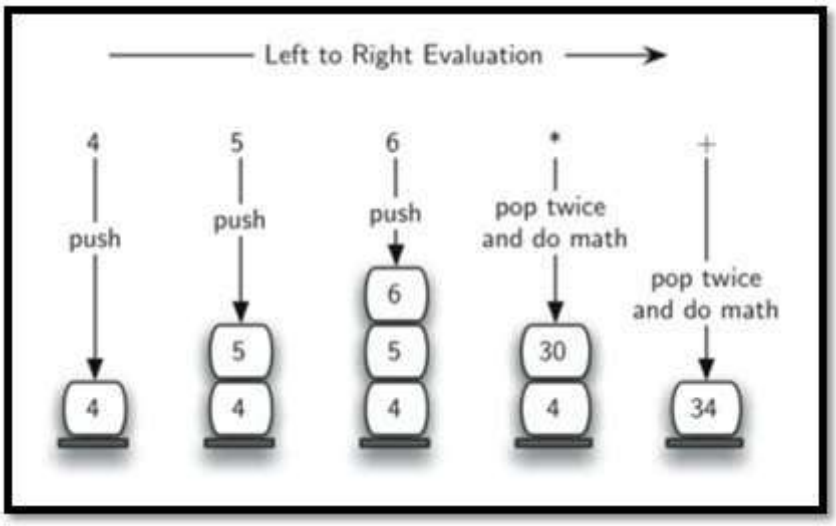
COMPLEX CALCULATIONS



USING STACK

Evaluation rule of a Postfix Expression states:

1. While reading the expression from left to right, push the element in the stack if it is an operand.
2. Pop the two operands from the stack, if the element is an operator and then evaluate it.
3. Push back the result of the evaluation. Repeat it till the end of the expression.



NOTES

- Factorial can't be evaluated above 9!
- You can't evaluate an expression having length greater than 40.
- Icon given with the file should always be present in the current working directory of Java file.
- Two operators cannot be at beside like -+, *+ etc.
- Expression for multiplication with parenthesis will not be valid. i.e., Expr(Expr)
  Only Expr*(Expr) will valid for calculations.

CONCLUSION:

It made easier to perform a variety of functions and see how they are likely to impact a carrier in the sciences or mathematics. Above Scientific Calculator for a student to perform various mathematic operation efficiently and accurately.