Day1

Very Easy

1) Sum of Natural Numbers up to N

Calculate the sum of all natural numbers from 1 to n, where n is a positive integer. Use the formula:
Sum=n×(n+1)/2 .
Take n as input and output the sum of natural numbers from 1 to n .

Task

Given an integer n, print the sum of all natural numbers from 1 to n.

Input Format

One integer n, the upper limit for calculating the sum.

Constraints

- $1 \leq n \leq 10^4$.

Output Format

Print the sum of all natural numbers from 1 to n.

Test Cases:

Example 1

Input:

```
5
```

Output:

```
15
```

Explanation:
Using the formula, Sum=5×(5+1)/2=15 .

Example 2

Input:

```
100
```

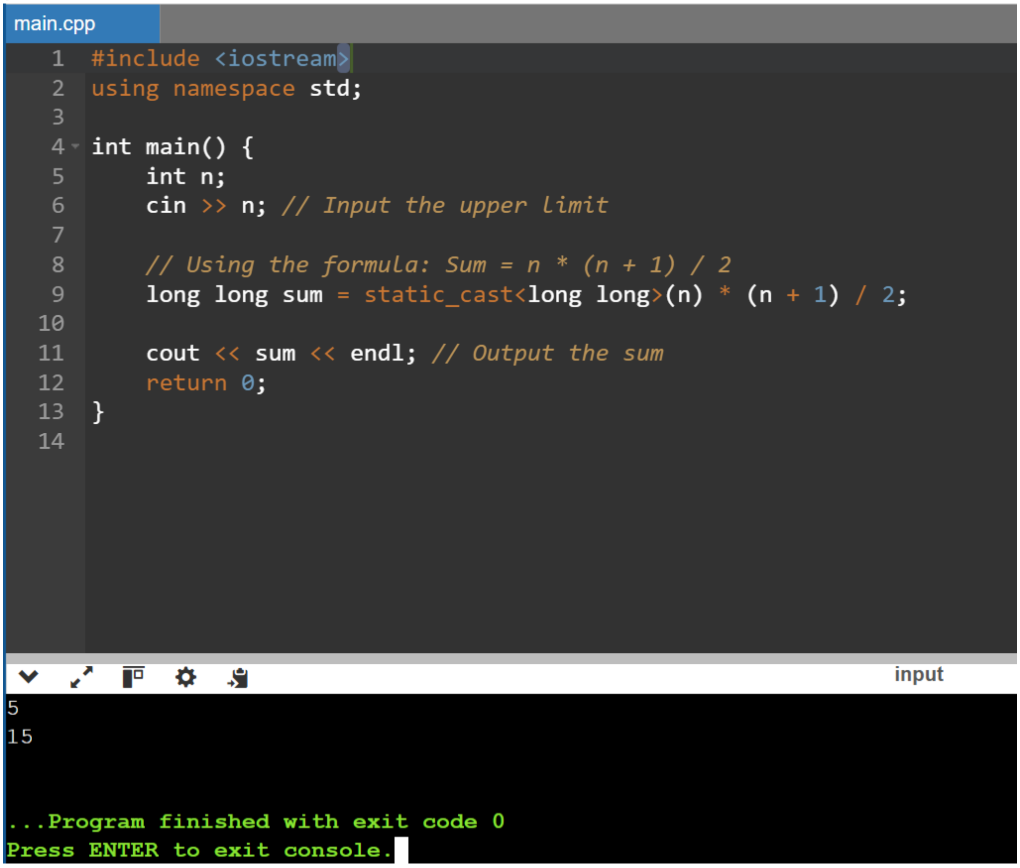
Output:

```
5050
```

Explanation:
Using the formula, Sum=100×(100+1)/2=5050 .

Code:

```
#include <iostream>
using namespace std;

int main() {
    int n;
    cin >> n;
    long long sum = static_cast<long long>(n) * (n + 1) / 2;
    cout << sum << endl;
}
```



```
#include <iostream>
using namespace std;

int main() {
    int n;
    cin >> n; // Input the upper limit

    // Using the formula: Sum = n * (n + 1) / 2
    long long sum = static_cast<long long>(n) * (n + 1) / 2;

    cout << sum << endl; // Output the sum
    return 0;
}
```

```
5
15


...Program finished with exit code 0
Press ENTER to exit console.
```

2) Check if a Number is Prime

Objective

Check if a given number n is a prime number. A prime number is a natural number greater than 1 that has no positive divisors other than 1 and itself.

To determine if a number is prime, iterate from 2 to √n and check if n is divisible by any number in this range. If it is divisible, it is not a prime number; otherwise, it is a prime.

Task

Given an integer n, print "Prime" if the number is prime, or "Not Prime" if it is not.

Input Format

One integer n.

Constraints

- $2 \leq n \leq 10^5$

Output Format

Print "Prime" if n is prime, otherwise print "Not Prime".

<u>Test Cases:</u>

Example 1

Input:

```
7
```

Output:

```
Prime
```

Explanation:
7 has no divisors other than 1 and itself, so it is a prime number.

Example 2

Input:

```
9
```

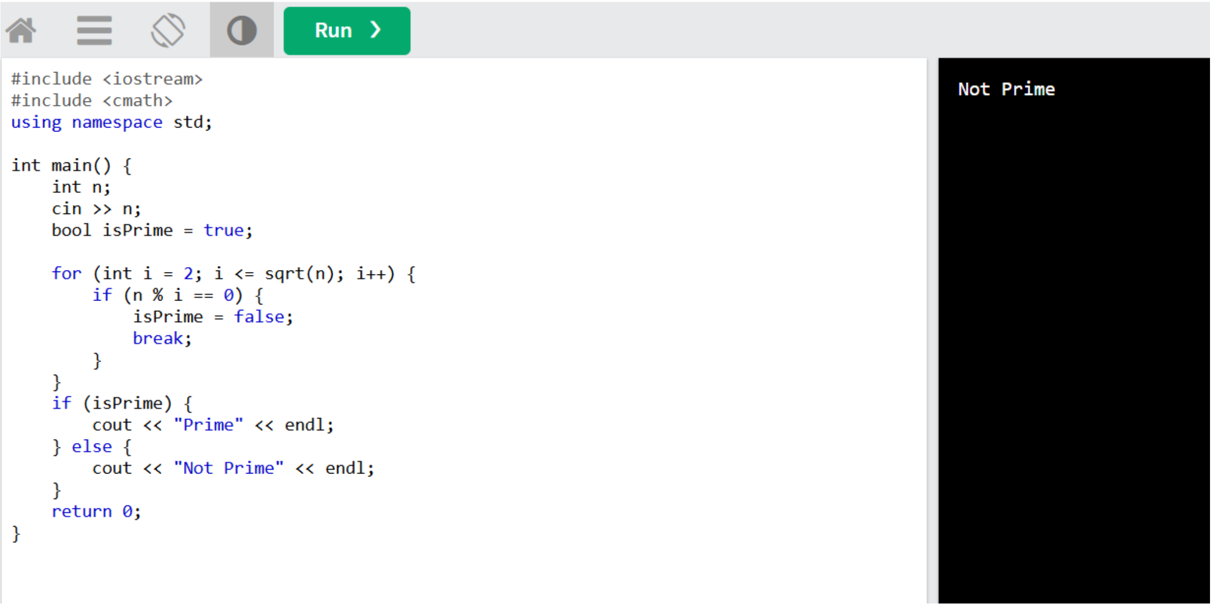
Output:

```
Not Prime
```

Explanation:
9 is divisible by 3, so it is not a prime number.

Code:

```
#include <iostream>
#include <cmath>
using namespace std;

int main() {
    int n;
    cin >> n;
    bool isPrime = true;
    for (int i = 2; i <= sqrt(n); i++) {
        if (n % i == 0) {
            isPrime = false;
            break;
        }
    }
    if (isPrime) {
        cout << "Prime" << endl;
    } else {
        cout << "Not Prime" << endl;
    }

    return 0;
}
```



```
#include <iostream>
#include <cmath>
using namespace std;

int main() {
    int n;
    cin >> n;
    bool isPrime = true;

    for (int i = 2; i <= sqrt(n); i++) {
        if (n % i == 0) {
            isPrime = false;
            break;
        }
    }
    if (isPrime) {
        cout << "Prime" << endl;
    } else {
        cout << "Not Prime" << endl;
    }
    return 0;
}
```

```
Not Prime
```

3) Print Odd Numbers up to N

Objective

Print all odd numbers between 1 and n, inclusive. Odd numbers are integers that are not divisible by 2. These numbers should be printed in ascending order, separated by spaces.

This problem is a simple introduction to loops and conditional checks. The goal is to use a loop to iterate over the numbers and check if they are odd using the condition $i\%2\neq0$.

Task

Given an integer n, print all odd numbers from 1 to n, inclusive.

Input Format

One integer n, the upper limit of the range.

Constraints

- $1 \leq n \leq 10^4$

Output Format

A single line containing all odd numbers from 1 to n, separated by spaces.

Test Cases:

Example 1

Input:

```
10
```

Output:

```
1 3 5 7 9
```

Example 2

Input:

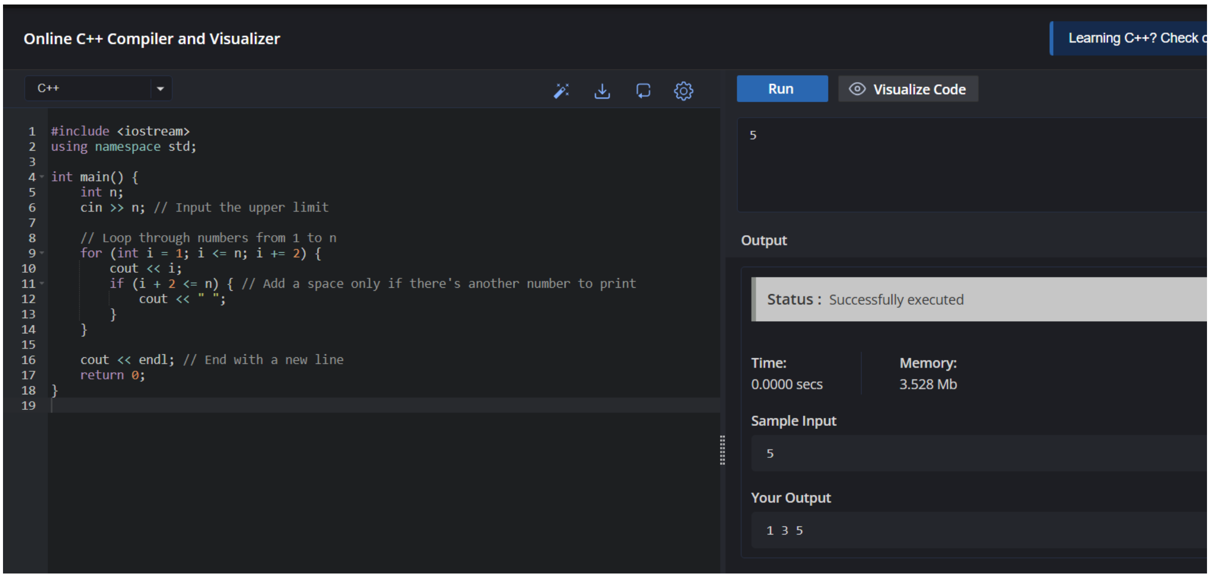
```
7
```

Output:

```
1 3 5 7
```

Code:-

```
#include <iostream>
using namespace std;
int main() {
    int n;
    cin >> n;
    for (int i = 1; i <= n; i += 2) {
        cout << i;
        if (i + 2 <= n) {
            cout << " ";
        }
    }
    cout << endl;
    return 0;
}
```



```
#include <iostream>
using namespace std;

int main() {
    int n;
    cin >> n; // Input the upper limit

    // Loop through numbers from 1 to n
    for (int i = 1; i <= n; i += 2) {
        cout << i;
        if (i + 2 <= n) { // Add a space only if there's another number to print
            cout << " ";
        }
    }

    cout << endl; // End with a new line
    return 0;
}
```

```
5
```

Output

Status : Successfully executed

Time: 0.0000 secs

Memory: 3.528 Mb

Sample Input

```
5
```

Your Output

```
1 3 5
```

Easy:

1) Count Digits in a Number

Objective

Count the total number of digits in a given number n. The number can be a positive integer. For example, for the number 12345, the count of digits is 5. For a number like 900000, the count of digits is 6.

Given an integer n, your task is to determine how many digits are present in n. This task will help you practice working with loops, number manipulation, and conditional logic.

Task

Given an integer n, print the total number of digits in n.

Input Format

One integer n.

Constraints

- $1 \le n \le 10^9$

Output Format

Print the number of digits in n.

Test Cases

Example 1:
Input:
12345

Output:

5

Explanation:
The number 12345 has 5 digits: 1, 2, 3, 4, 5.

Example 2:
Input:

900000

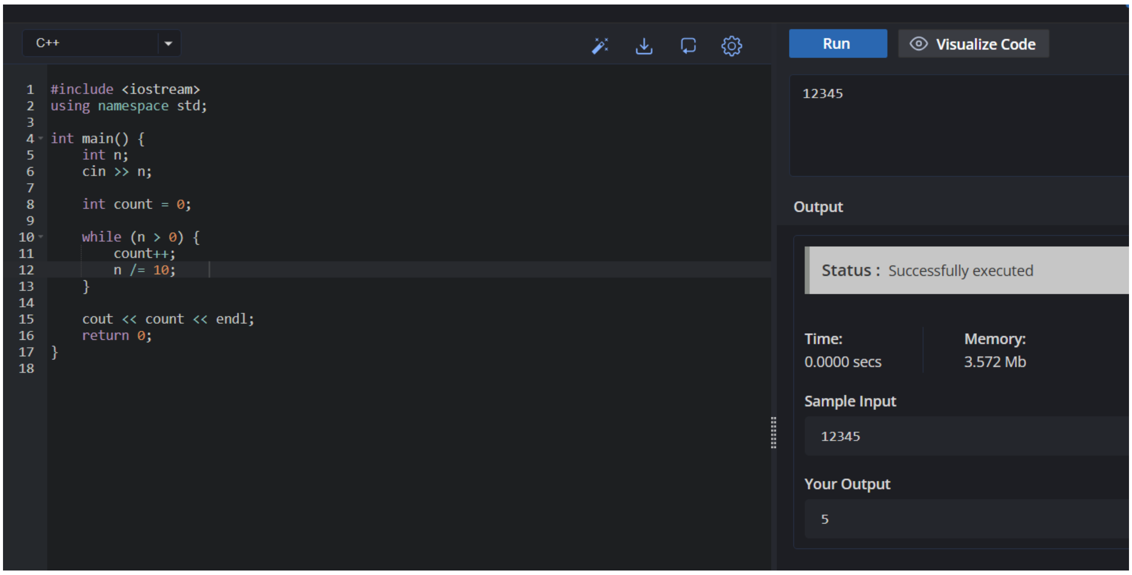
Output:

6

Explanation:
The number 900000 has 6 digits: 9, 0, 0, 0, 0, 0.

Code:

```
#include <iostream>
using namespace std;

int main() {

    int n;
    cin >> n;
    int count = 0;
    while (n > 0) {
        count++;
        n /= 10;
    }
    cout << count << endl;
    return 0;
}
```



```
#include <iostream>
using namespace std;

int main() {
    int n;
    cin >> n;

    int count = 0;

    while (n > 0) {
        count++;
        n /= 10;
    }

    cout << count << endl;
    return 0;
}

```

```
12345
```

Output

Status : Successfully executed

Time: 0.0000 secs

Memory: 3.572 Mb

Sample Input

```
12345
```

Your Output

```
5
```

2) Reverse a Number

Objective

Reverse the digits of a given number n. For example, if the input number is 12345, the output should be 54321. The task involves using loops and modulus operators to extract the digits and construct the reversed number.

Task

Given an integer n, print the number with its digits in reverse order.

Input Format

One integer n.

Constraints

- $1 \leq n \leq 10^9$

Output Format

Print the number with its digits in reverse order.

Test Cases

Example 1:
Input:
12345

Output:

54321

Explanation:
The digits of 12345 in reverse order are 54321.

Example 2:
Input:

9876

Output:

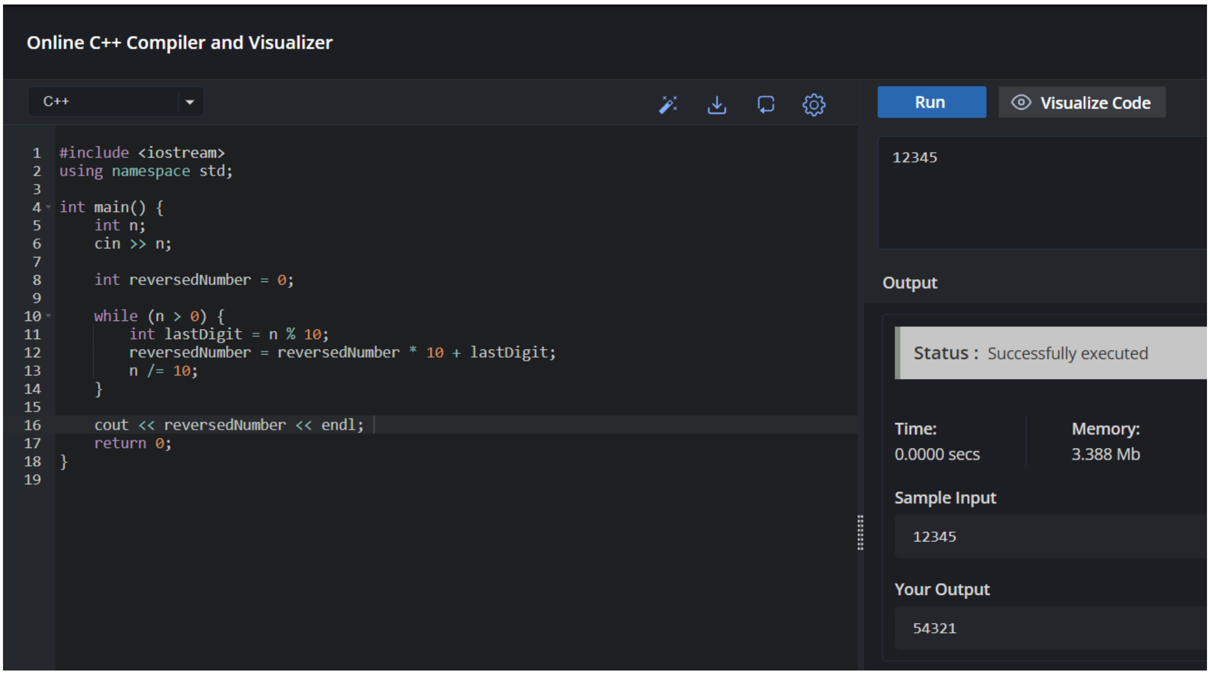
6789

Explanation:
The digits of 9876 in reverse order are 6789.

Code:

```
#include <iostream>
using namespace std;

int main() {

    int n;
    cin >> n;

    int reversedNumber = 0;

    while (n > 0) {
        int lastDigit = n % 10;
        reversedNumber = reversedNumber * 10 + lastDigit;
        n /= 10;
    }

    cout << reversedNumber << endl;

    return 0;
}
```

Output:



```
#include <iostream>
using namespace std;

int main() {
    int n;
    cin >> n;

    int reversedNumber = 0;

    while (n > 0) {
        int lastDigit = n % 10;
        reversedNumber = reversedNumber * 10 + lastDigit;
        n /= 10;
    }

    cout << reversedNumber << endl;
    return 0;
}
```

```
12345
```

Output

Status : Successfully executed

Time: 0.0000 secs

Memory: 3.388 Mb

Sample Input

```
12345
```

Your Output

```
54321
```

3) Find the Largest Digit in a Number

Objective

Find the largest digit in a given number n. For example, for the number 2734, the largest digit is 7. You need to extract each digit from the number and determine the largest one. The task will involve using loops and modulus operations to isolate the digits.

Task

Given an integer n, find and print the largest digit in n.

Input Format

One integer n.

Constraints

- $1 \le n \le 10^9$

Output Format

Print the largest digit in the number n.

Test Cases

Example 1:
Input:
2734

Output:

7

Explanation:
The digits of 2734 are 2, 7, 3, and 4. The largest digit is 7.

Example 2:
Input:

9450

Output:

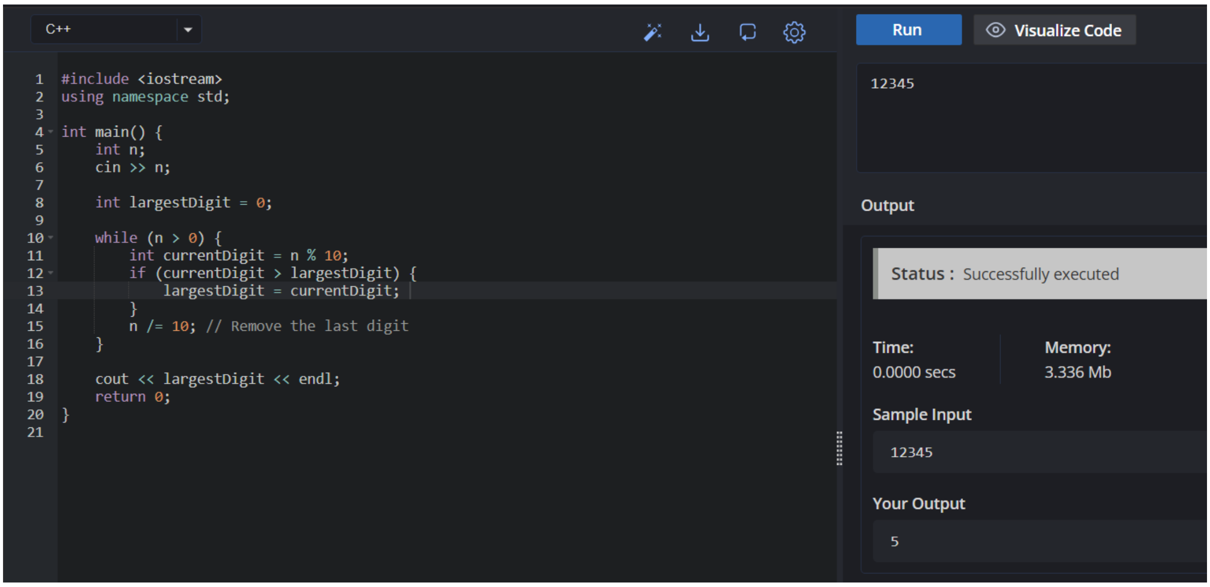
9

Explanation:
The digits of 9450 are 9, 4, 5, and 0. The largest digit is 9.

Code:

```
#include <iostream>
using namespace std;

int main() {

    int n;
    cin >> n;

    int largestDigit = 0;

    while (n > 0) {
        int currentDigit = n % 10;
        if (currentDigit > largestDigit) {
            largestDigit = currentDigit;
        }
        n /= 10;
    }

    cout << largestDigit << endl;

    return 0;
}
```

Output:



```
#include <iostream>
using namespace std;

int main() {
    int n;
    cin >> n;

    int largestDigit = 0;

    while (n > 0) {
        int currentDigit = n % 10;
        if (currentDigit > largestDigit) {
            largestDigit = currentDigit;
        }
        n /= 10; // Remove the last digit
    }

    cout << largestDigit << endl;
    return 0;
}
```

```
12345
```

Output

Status : Successfully executed

Time: 0.0000 secs

Memory: 3.336 Mb

Sample Input

```
12345
```

Your Output

```
5
```

Medium:

1) Function Overloading for Calculating Area.

Objective

Write a program to calculate the area of different shapes using function overloading. Implement overloaded functions to compute the area of a circle, a rectangle, and a triangle.

Input Format
The program should accept:
1. Radius of the circle for the first function.
2. Length and breadth of the rectangle for the second function.
3. Base and height of the triangle for the third function.

Constraints
$1 \leq \text{radius, length, breadth, base, height} \leq 10^3$
Use 3.14159 for the value of π.

Output Format
Print the computed area of each shape in a new line.

Test Cases:

Example 1

Input:

Radius = 5
Length = 4, breadth = 6
Base = 3, height = 7

Output:
78.53975
24
10.5

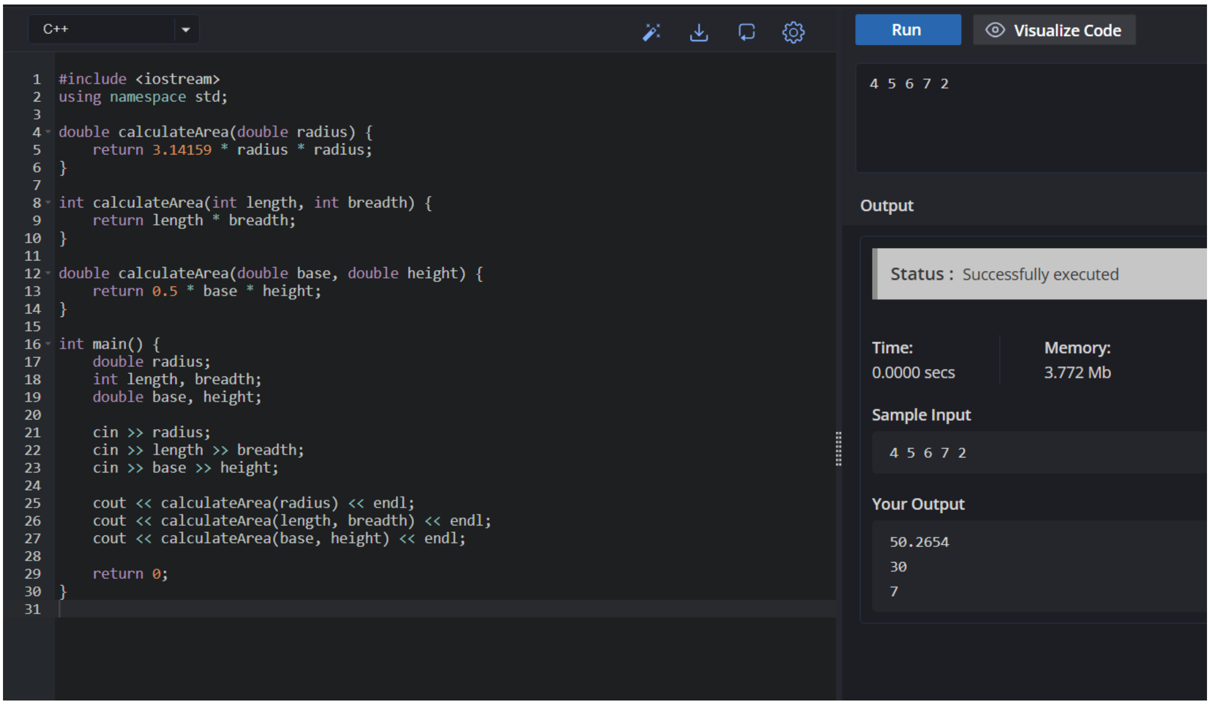
Explanation:

- The area of the circle with radius 5 is 3.14159* 5^2 = 78.53975.
- The area of the rectangle with length 4 and breadth 6 is 4* 6 = 24.
- The area of the triangle with base 3 and height 7 is 0.5*3*7 = 10.5.

Code:

```
#include <iostream>
using namespace std;

double calculateArea(double radius) {
   return 3.14159 * radius * radius;
}

int calculateArea(int length, int breadth) {
    return length * breadth;
}

double calculateArea(double base, double height) {
    return 0.5 * base * height;
}

int main() {
    double radius;
    int length, breadth;
    double base, height;

    cin >> radius;
    cin >> length >> breadth;
    cin >> base >> height;

    cout << calculateArea(radius) << endl;
    cout << calculateArea(length, breadth) << endl;
    cout << calculateArea(base, height) << endl;

    return 0;
}
```

Output:-



```
#include <iostream>
using namespace std;

double calculateArea(double radius) {
    return 3.14159 * radius * radius;
}

int calculateArea(int length, int breadth) {
    return length * breadth;
}

double calculateArea(double base, double height) {
    return 0.5 * base * height;
}

int main() {
    double radius;
    int length, breadth;
    double base, height;

    cin >> radius;
    cin >> length >> breadth;
    cin >> base >> height;

    cout << calculateArea(radius) << endl;
    cout << calculateArea(length, breadth) << endl;
    cout << calculateArea(base, height) << endl;

    return 0;
}
```

```
4 5 6 7 2
```

Status : Successfully executed

Time: 0.0000 secs

Memory: 3.772 Mb

Sample Input

```
4 5 6 7 2
```

Your Output

```
50.2654
30
7
```

2) Function Overloading with Hierarchical Structure.

Objective

Write a program that demonstrates function overloading to calculate the salary of employees at different levels in a company hierarchy. Implement overloaded functions to compute salary for:

- Intern (basic stipend).
- Regular employee (base salary + bonuses).
- Manager (base salary + bonuses + performance incentives).

Input Format:

The program should accept:

1. Intern: Basic stipend.
2. Regular employee: Base salary and bonuses.
3. Manager: Base salary, bonuses, and performance incentives.

Constraints

- 1 ≤ stipend, base salary, bonuses, incentives≤ 10^6.

Output Format

Print the calculated salary for each level of the hierarchy on a new line.

Test Cases:

Example 1

Input:

Stipend = 10000
base salary = 50000, bonuses = 20000
base salary = 80000, bonuses = 30000, incentives = 20000

Output:

Intern Salary: 10000
Employee Salary: 70000
Manager Salary: 130000

Explanation:

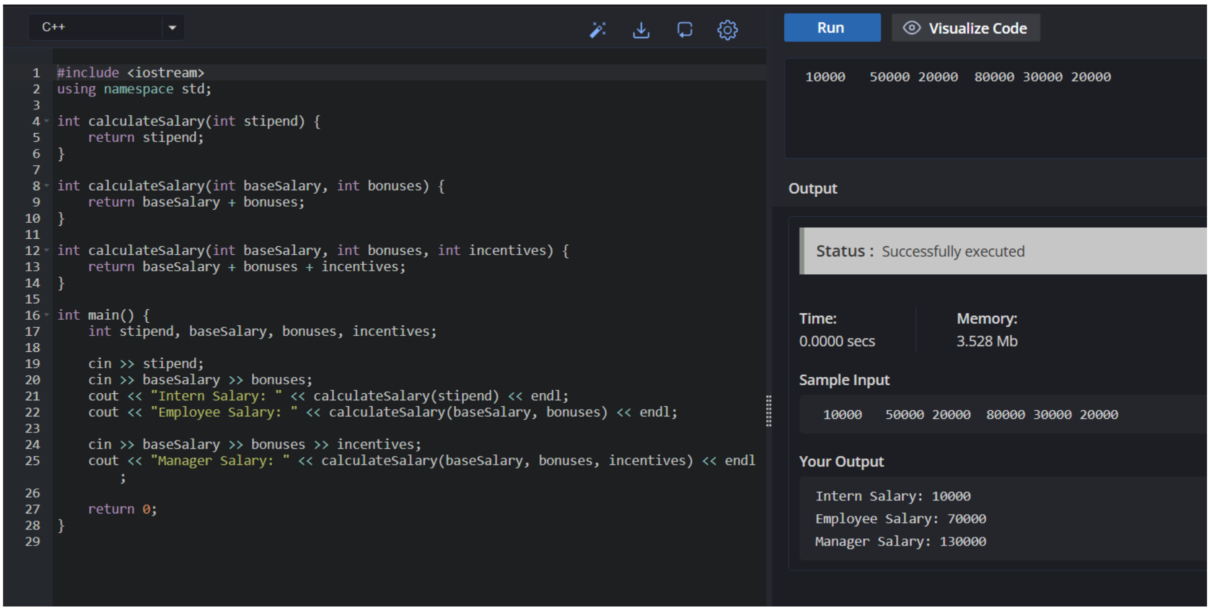
- Intern receives only the stipend: 10000.
- Regular employee salary is calculated as 50000+20000=70000.
- Manager's salary includes all components: 80000+30000+20000=

Code:

```
#include <iostream>
using namespace std;

int calculateSalary(int stipend) {
   return stipend;
}
```

```
int calculateSalary(int baseSalary, int bonuses) {
    return baseSalary + bonuses;
}

int calculateSalary(int baseSalary, int bonuses, int incentives) {
    return baseSalary + bonuses + incentives;
}

int main() {
    int stipend, baseSalary, bonuses, incentives;

    cin >> stipend;
    cin >> baseSalary >> bonuses;
    cout << "Intern Salary: " << calculateSalary(stipend) << endl;
    cout << "Employee Salary: " << calculateSalary(baseSalary, bonuses) << endl;

    cin >> baseSalary >> bonuses >> incentives;
    cout << "Manager Salary: " << calculateSalary(baseSalary, bonuses, incentives) << endl;

    return 0;
}
```

Output:



```
#include <iostream>
using namespace std;

int calculateSalary(int stipend) {
    return stipend;
}

int calculateSalary(int baseSalary, int bonuses) {
    return baseSalary + bonuses;
}

int calculateSalary(int baseSalary, int bonuses, int incentives) {
    return baseSalary + bonuses + incentives;
}

int main() {
    int stipend, baseSalary, bonuses, incentives;

    cin >> stipend;
    cin >> baseSalary >> bonuses;
    cout << "Intern Salary: " << calculateSalary(stipend) << endl;
    cout << "Employee Salary: " << calculateSalary(baseSalary, bonuses) << endl;

    cin >> baseSalary >> bonuses >> incentives;
    cout << "Manager Salary: " << calculateSalary(baseSalary, bonuses, incentives) << endl;

    return 0;
}
```

```
10000   50000 20000  80000 30000 20000
```

Output

Status : Successfully executed

Time: 0.0000 secs

Memory: 3.528 Mb

Sample Input

```
10000   50000 20000  80000 30000 20000
```

Your Output

```
Intern Salary: 10000
Employee Salary: 70000
Manager Salary: 130000
```

3) Encapsulation with Employee Details

Objective

Write a program that demonstrates encapsulation by creating a class Employee. The class should have private attributes to store:

Employee ID.

Employee Name.

Employee Salary.

Provide public methods to set and get these attributes, and a method to display all details of the employee.

Input Format

The program should accept:

1. Employee ID as an integer.
2. Employee Name as a string.
3. Employee Salary as a floating-point number.

Constraints

- $1 \leq$ Employee ID $\leq 10^{6.}$
- Name can have up to 50 characters.
- $1.0 \leq$Salary $\leq 10^{7}$.

Output Format

Print the employee details, including ID, Name, and Salary, on separate lines.

<u>Test Cases:</u>

Example 1

Input:

ID = 101
Name = John Doe
Salary = 75000.5

Output:

Employee ID: 101
Employee Name: John Doe
Employee Salary: 75000.5

Explanation:

Encapsulation ensures that employee details are accessed and modified only through public methods.

Example 2

Input:

ID = 202
Name = Jane Smith
Salary = 85000.75

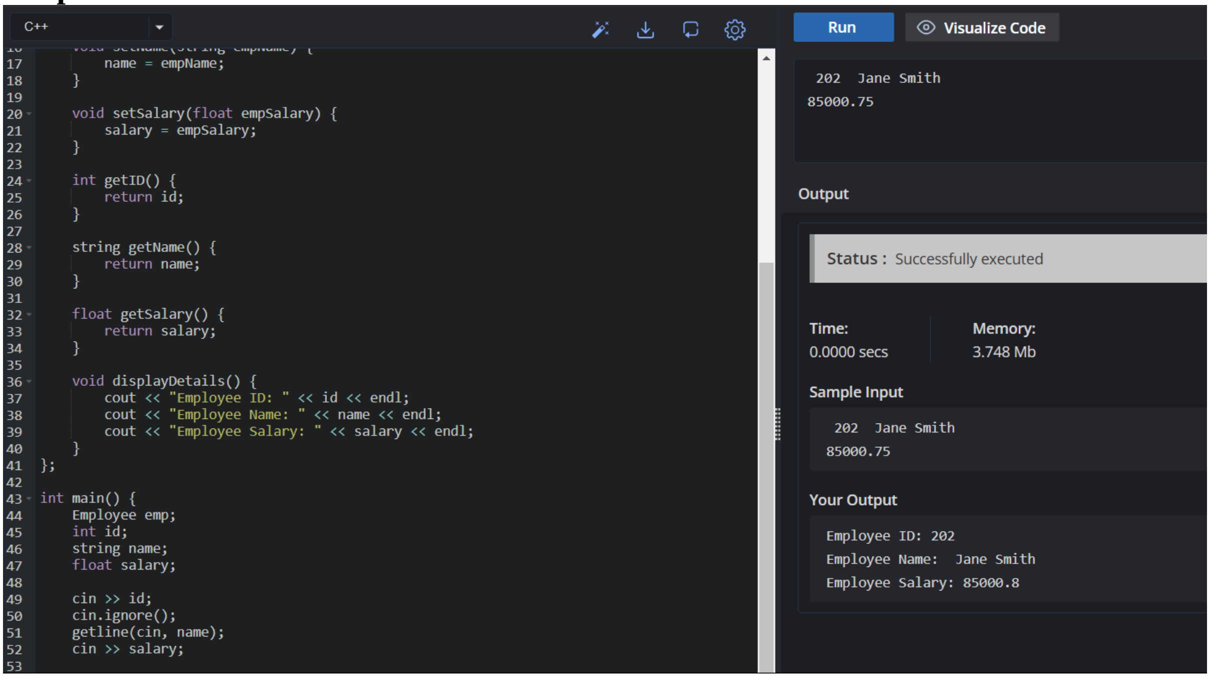
Output:

```
Employee ID: 202
Employee Name: Jane Smith
Employee Salary: 85000.75
```

Code:

```
#include <iostream>
#include <string>
using namespace std;

class Employee {
private:
    int id;
    string name;
    float salary;

public:
    void setID(int empID) {
        id = empID;
    }

    void setName(string empName) {
        name = empName;
    }

    void setSalary(float empSalary) {
        salary = empSalary;
    }

    int getID() {
        return id;
    }

    string getName() {
        return name;
    }

    float getSalary() {
        return salary;
    }

    void displayDetails() {
        cout << "Employee ID: " << id << endl;
        cout << "Employee Name: " << name << endl;
        cout << "Employee Salary: " << salary << endl;
    }
};

int main() {
    Employee emp;
    int id;
    string name;
    float salary;

    cin >> id;
    cin.ignore();
    getline(cin, name);
    cin >> salary;

    emp.setID(id);
    emp.setName(name);
    emp.setSalary(salary);

    emp.displayDetails();

    return 0;
}
```

Output:



```
    void setName(string empName) {
        name = empName;
    }

    void setSalary(float empSalary) {
        salary = empSalary;
    }

    int getID() {
        return id;
    }

    string getName() {
        return name;
    }

    float getSalary() {
        return salary;
    }

    void displayDetails() {
        cout << "Employee ID: " << id << endl;
        cout << "Employee Name: " << name << endl;
        cout << "Employee Salary: " << salary << endl;
    }
};

int main() {
    Employee emp;
    int id;
    string name;
    float salary;

    cin >> id;
    cin.ignore();
    getline(cin, name);
    cin >> salary;
```

```
 202  Jane Smith
85000.75
```

Output

Status : Successfully executed

Time: 0.0000 secs

Memory: 3.748 Mb

Sample Input

```
 202  Jane Smith
85000.75
```

Your Output

```
Employee ID: 202
Employee Name:  Jane Smith
Employee Salary: 85000.8
```

Hard:

1)Implementing Polymorphism for Shape Hierarchies.

Objective

Write a program to demonstrate runtime polymorphism in C++ using a base class Shape and derived classes Circle, Rectangle, and Triangle. The program should use virtual functions to calculate and print the area of each shape based on user input.

Input Format

The program should accept:

1. Radius of the circle for the first derived class.
2. Length and breadth of the rectangle for the second derived class.
3. Base and height of the triangle for the third derived class.

Constraints

- 1 ≤ radius, length , breadth, base, height ≤ $10^{3.}$
- Use 3.14159 for the value of π.

Output Format

Print the computed area of each shape on a new line.

Test Cases:

Example 1

Input:

Radius = 5
Length = 4, breadth = 6
Base = 3, height = 7

Output:

Area of Circle: 78.53975
Area of Rectangle: 24
Area of Triangle: 10.5

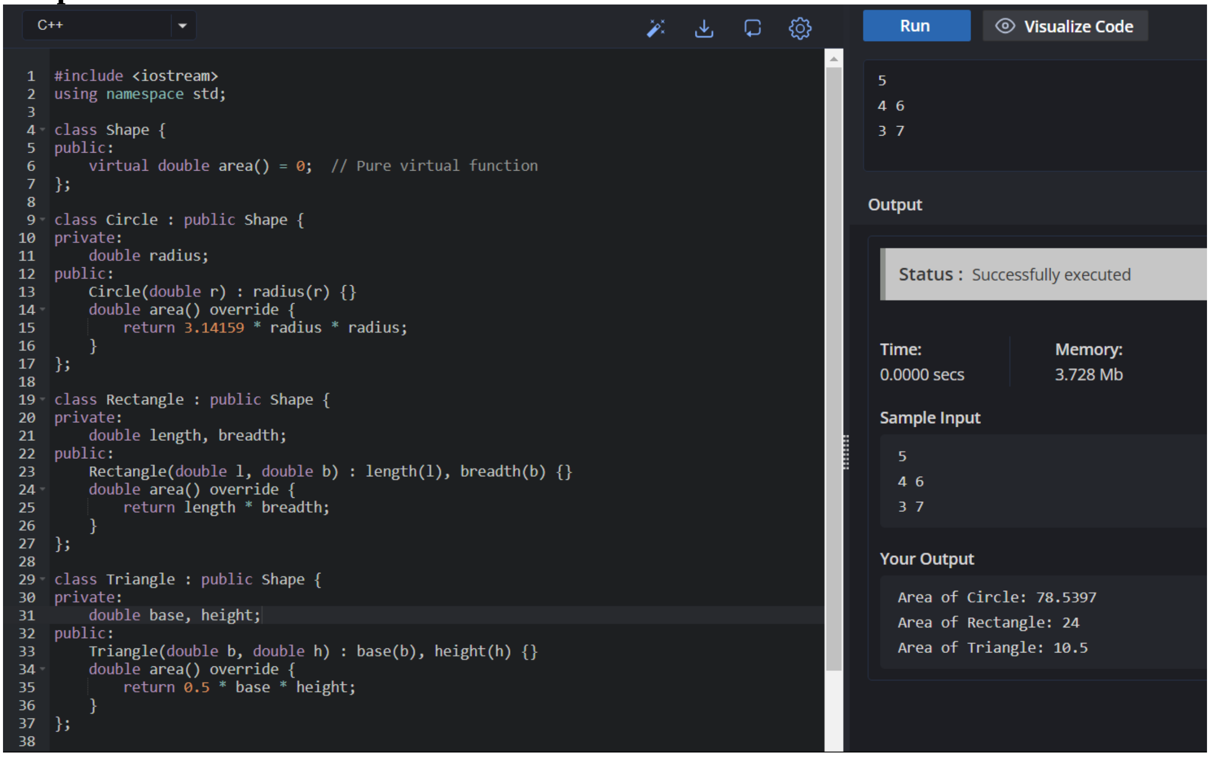
Explanation:

- The area of the circle is 3.14159×52=78.53975.
- The area of the rectangle is 4×6=24.
- The area of the triangle is 0.5×3×7=10.5.

Code:

```
#include <iostream>
#include <string>
using namespace std;

class Employee {
private:
    int id;
    string name;
    float salary;

public:
    void setID(int empID) {
        id = empID;
    }

    void setName(string empName) {
        name = empName;
    }

    void setSalary(float empSalary) {
        salary = empSalary;
    }

    int getID() {
        return id;
    }

    string getName() {
        return name;
    }

    float getSalary() {
        return salary;
    }

    void displayDetails() {
        cout << "Employee ID: " << id << endl;
        cout << "Employee Name: " << name << endl;
        cout << "Employee Salary: " << salary << endl;
    }
};

int main() {
    Employee emp;
    int id;
    string name;
    float salary;

    cin >> id;
    cin.ignore();
    getline(cin, name);
    cin >> salary;

    emp.setID(id);
    emp.setName(name);
    emp.setSalary(salary);
    emp.displayDetails();

    return 0;
}
```

Output:



```
#include <iostream>
using namespace std;

class Shape {
public:
    virtual double area() = 0;  // Pure virtual function
};

class Circle : public Shape {
private:
    double radius;
public:
    Circle(double r) : radius(r) {}
    double area() override {
        return 3.14159 * radius * radius;
    }
};

class Rectangle : public Shape {
private:
    double length, breadth;
public:
    Rectangle(double l, double b) : length(l), breadth(b) {}
    double area() override {
        return length * breadth;
    }
};

class Triangle : public Shape {
private:
    double base, height;
public:
    Triangle(double b, double h) : base(b), height(h) {}
    double area() override {
        return 0.5 * base * height;
    }
};

```

```
5
4 6
3 7
```

Output

Status : Successfully executed

Time: 0.0000 secs

Memory: 3.728 Mb

Sample Input

```
5
4 6
3 7
```

Your Output

```
Area of Circle: 78.5397
Area of Rectangle: 24
Area of Triangle: 10.5
```

2) Advanced Function Overloading for Geometric Shapes

Objective

Create a C++ program that demonstrates **function overloading** to calculate the area of different geometric shapes. Implement three overloaded functions named calculateArea that compute the area for the following shapes:

Circle: Accepts the radius.

Rectangle: Accepts the length and breadth.

Triangle: Accepts the base and height.

Additionally, use a menu-driven program to let the user choose the type of shape and input the respective parameters. Perform necessary validations on the input values.

Input Format

- An integer 1 ≤ choice ≤ 3 representing the shape type:
    1. Circle
    2. Rectangle
    3. Triangle
- For each shape:

- **Circle**: A positive floating-point number for the radius.
- **Rectangle**: Two positive floating-point numbers for length and breadth.
- **Triangle**: Two positive floating-point numbers for base and height.

Test Cases:

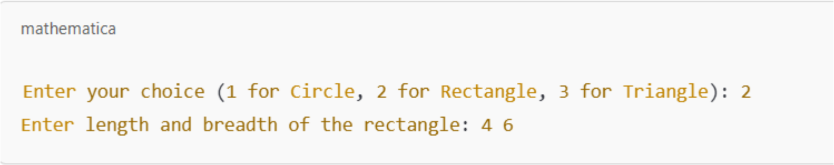
Example 1: Circle

Input:
Choice: 1
Radius: 7.5
Output:
Shape: Circle
Radius: 7.5
Area: 176.714

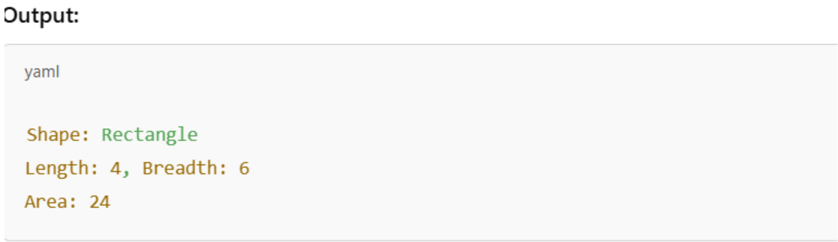
Code:

```
#include <iostream>
#include <cmath>
using namespace std;

class Shape {
public:
    void calculateArea(int choice) {
        if (choice == 1) {
            float radius;
            cout << "Enter radius of the circle: ";
            cin >> radius;
            if (radius > 0) {
                cout << "Shape: Circle" << endl;
                cout << "Radius: " << radius << endl;
                cout << "Area: " << calculateArea(radius) << endl;
            } else {
                cout << "Invalid input for radius. Must be greater than 0." << endl;
            }
        } else if (choice == 2) {
            float length, breadth;
            cout << "Enter length and breadth of the rectangle: ";
            cin >> length >> breadth;
            if (length > 0 && breadth > 0) {
                cout << "Shape: Rectangle" << endl;
                cout << "Length: " << length << ", Breadth: " << breadth << endl;
                cout << "Area: " << calculateArea(length, breadth) << endl;
            } else {
                cout << "Invalid input for length or breadth. Must be greater than 0." << endl;
            }
        } else if (choice == 3) {
            float base, height;
            cout << "Enter base and height of the triangle: ";
            cin >> base >> height;
            if (base > 0 && height > 0) {
                cout << "Shape: Triangle" << endl;
                cout << "Base: " << base << ", Height: " << height << endl;
                cout << "Area: " << calculateArea(base, height) << endl;
            } else {
                cout << "Invalid input for base or height. Must be greater than 0." << endl;
            }
        } else {
            cout << "Invalid choice." << endl;
        }
    }

private:
    float calculateArea(float radius) {
        return 3.14159 * radius * radius;
    }

    float calculateArea(float length, float breadth) {
        return length * breadth;
    }

    float calculateArea(float base, float height) {
        return 0.5 * base * height;
    }
};

int main() {
    int choice;
    cout << "Enter your choice (1 for Circle, 2 for Rectangle, 3 for Triangle): ";
    cin >> choice;

    Shape shape;
    shape.calculateArea(choice);

    return 0;
}
```

Output:



```
Enter your choice (1 for Circle, 2 for Rectangle, 3 for Triangle): 2
Enter length and breadth of the rectangle: 4 6
```



Output:

```
Shape: Rectangle
Length: 4, Breadth: 6
Area: 24
```

4) Polymorphism for Shape Area Calculations

Objective

Create a C++ program that uses polymorphism to calculate the area of various shapes. Define a base class Shape with a virtual method calculateArea(). Extend this base class into the following derived classes:

Rectangle: Calculates the area based on length and width.

Circle: Calculates the area based on the radius.

Triangle: Calculates the area using base and height.

The program should use dynamic polymorphism to handle these shapes and display the area of each.

Input Format

1. Shape Type (1 for Rectangle, 2 for Circle, 3 for Triangle).
2. For Rectangle: Length and Width (float).
3. For Circle: Radius (float).
4. For Triangle: Base and Height (float).

Constraints

- Shape Type: 1 ≤ type ≤ 3 .
- Length, Width, Radius, Base, and Height: 1.0 ≤ value ≤ 10^4 .
- Use π=3.14159 for calculations.

<u>Test Cases:</u>

Example 1: Rectangle Area

Input:
Shape Type: 1
Length: 5
Width: 10
Output:
Shape: Rectangle
Area: 50.00

Example 2: Circle Area

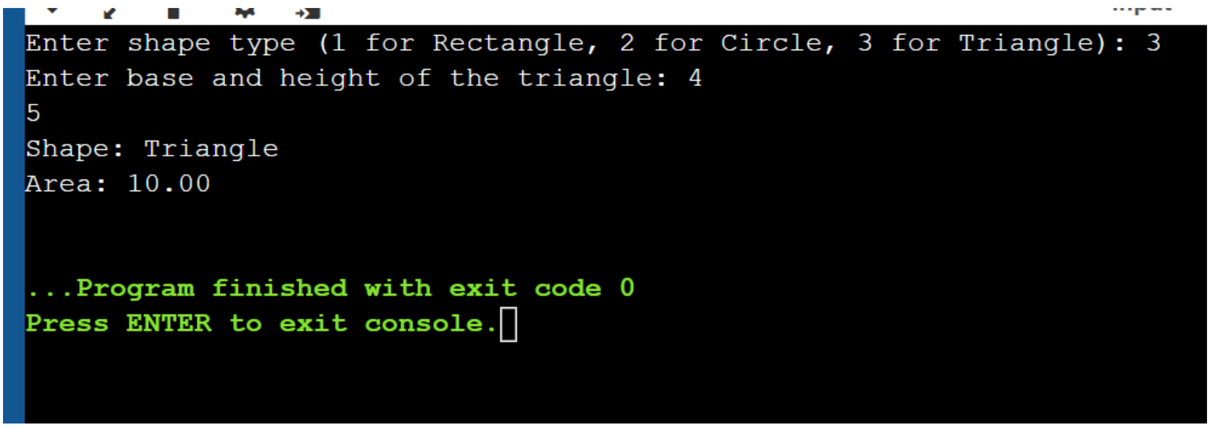
Input:
Shape Type: 2
Radius: 7
Output:
Shape: Circle
Area: 153.94

Code:

```
#include <iostream>
#include <cmath>
```

```
#include <iomanip>  // For controlling output precision
using namespace std;

class Shape {
public:
    virtual void calculateArea() = 0;  // Pure virtual function for calculating area
    virtual ~Shape() {}  // Virtual destructor to ensure proper cleanup
};

class Rectangle : public Shape {
private:
    float length, width;
public:
    void setDimensions(float l, float w) {
        length = l;
        width = w;
    }

    void calculateArea() override {
        cout << "Shape: Rectangle" << endl;
        cout << "Area: " << fixed << setprecision(2) << length * width << endl;
    }
};

class Circle : public Shape {
private:
    float radius;
public:
    void setRadius(float r) {
        radius = r;
    }

    void calculateArea() override {
        cout << "Shape: Circle" << endl;
        cout << "Area: " << fixed << setprecision(2) << 3.14159 * radius * radius << endl;
    }
};

class Triangle : public Shape {
private:
    float base, height;
public:
    void setDimensions(float b, float h) {
        base = b;
        height = h;
    }

    void calculateArea() override {
        cout << "Shape: Triangle" << endl;
        cout << "Area: " << fixed << setprecision(2) << 0.5 * base * height << endl;
    }
};

int main() {
    int shapeType;
    Shape* shape = nullptr;

    cout << "Enter shape type (1 for Rectangle, 2 for Circle, 3 for Triangle): ";
    cin >> shapeType;

    if (shapeType == 1) {
        float length, width;
        cout << "Enter length and width of the rectangle: ";
        cin >> length >> width;
        shape = new Rectangle();
        dynamic_cast<Rectangle*>(shape)->setDimensions(length, width);
    }
    else if (shapeType == 2) {
        float radius;
        cout << "Enter radius of the circle: ";
        cin >> radius;
        shape = new Circle();
        dynamic_cast<Circle*>(shape)->setRadius(radius);
    }
    else if (shapeType == 3) {
        float base, height;
        cout << "Enter base and height of the triangle: ";
        cin >> base >> height;
        shape = new Triangle();
        dynamic_cast<Triangle*>(shape)->setDimensions(base, height);
    }
    else {
        cout << "Invalid shape type!" << endl;
        return 1;
    }

    shape->calculateArea();  // Polymorphic call

    delete shape;  // Free the allocated memory
    return 0;
}
```

Output:



```
Enter shape type (1 for Rectangle, 2 for Circle, 3 for Triangle): 3
Enter base and height of the triangle: 4
5
Shape: Triangle
Area: 10.00


...Program finished with exit code 0
Press ENTER to exit console.
```