
1- Trace the following program and predict the output.

```cpp
// www.gammal.tech

// main.cpp
#include <iostream>
#include "constants.h"

int main() {
    std::cout << "Value of PI: " << PI << "\n";
    return 0;
}
```

```cpp
// www.gammal.tech

// constants.h
const double PI = 3.14159;
```

Solution

```
Value of PI: 3.14159
```

2- Trace the following program and predict the output.

```cpp
// www.gammal.tech

// main.cpp
#include <iostream>
#include "person.h"

int main() {
    Person myPerson;
    myPerson.name = "John";
    myPerson.age = 25;

    std::cout << "Name: " << myPerson.name << "\n";
    std::cout << "Age: " << myPerson.age << "\n";

    return 0;
}
```

```cpp
// www.gammal.tech

// person.h
struct Person {
    std::string name;
    int age;
};
```

Solution

```
Name: John
Age: 25
```

3- Trace the following program and predict the output.

```cpp
// www.gammal.tech
// main.cpp
#include <iostream>
#include "functions.h"

int main() {
    printMessage();
    return 0;
}
```

```cpp
// www.gammal.tech

#include <iostream>

void printMessage() {
    std::cout << "Hello, welcome to the program!\n";
}
```

Solution

```
Hello, welcome to the program!
```

4- Trace the following program and predict the output.

```cpp
// www.gammal.tech

// main.cpp
#include <iostream>
#include "functions.h"

int main() {
    printMessage();
    int sumResult = addNumbers(5, 7);
    std::cout << "Sum: " << sumResult << "\n";

    double squareResult = calculateSquare(4.5);
    std::cout << "Square: " << squareResult << "\n";

    return 0;
}
```

```cpp
// www.gammal.tech


#include <iostream>

void printMessage() {
    std::cout << "Hello, welcome to the program!\n";
}

int addNumbers(int a, int b) {
    return a + b;
}

double calculateSquare(double x) {
    return x * x;
}
```

Solution

```
Hello, welcome to the program!
Sum: 12
Square: 20.25
```

5- Trace the following program and predict the output.

```cpp
// www.gammal.tech

// main.cpp
#include <iostream>
#include "functions.h"

int main() {
    printMessage();
    int sumResult = addNumbers(5, 7);
    std::cout << "Sum: " << sumResult << "\n";

    double squareResult = calculateSquare(4.5);
    std::cout << "Square: " << squareResult << "\n";

    double circleAreaResult = calculateCircleArea(3.0);
    std::cout << "Circle Area: " << circleAreaResult << "\n";

    return 0;
}
```

```cpp
// www.gammal.tech


#include <iostream>
#include <cmath>

void printMessage() {
    std::cout << "Hello, welcome to the program!\n";
}

int addNumbers(int a, int b) {
    return a + b;
}

double calculateSquare(double x) {
    return x * x;
}

double calculateCircleArea(double radius) {
    return M_PI * radius * radius;
}
```

Solution

```
Hello, welcome to the program!
Sum: 12
Square: 20.25
Circle Area: 28.2743
```

6- Trace the following program and predict the output.

```cpp
// www.gammal.tech

// main.cpp
#include <iostream>
#include "functions.h"

int main() {
    printMessage();

    int differenceResult = subtractNumbers(8, 3);
    std::cout << "Difference: " << differenceResult << "\n";

    double cubeResult = calculateCube(3.0);
    std::cout << "Cube: " << cubeResult << "\n";

    return 0;
}
```

```cpp
// www.gammal.tech


#include <iostream>

void printMessage() {
    std::cout << "Hello, welcome to the program!\n";
}

int subtractNumbers(int a, int b) {
    return a - b;
}

double calculateCube(double x) {
    return x * x * x;
}
```

Solution

```
Hello, welcome to the program!
Difference: 5
Cube: 27
```

7- Trace the following program and predict the output.

```cpp
// www.gammal.tech


// main.cpp
#include <iostream>
#include "functions.h"

int main() {
    printMessage();

    int quotientResult = divideNumbers(10, 2);
    std::cout << "Quotient: " << quotientResult << "\n";

    double absoluteResult = calculateAbsolute(-7.5);
    std::cout << "Absolute Value: " << absoluteResult << "\n";

    return 0;
}
```

```cpp
// www.gammal.tech


#include <iostream>

void printMessage() {
    std::cout << "Hello, welcome to the program!\n";
}

int divideNumbers(int a, int b) {
    if (b != 0) {
        return a / b;
    } else {
        std::cerr << "Error: Division by zero\n";
        return 0;
    }
}

double calculateAbsolute(double x) {
    return std::abs(x);
}
```

Solution

```
Hello, welcome to the program!
Quotient: 5
Absolute Value: 7.5
```

8- Trace the following program and predict the output.

```cpp
// www.gammal.tech


// main.cpp
#include <iostream>
#include "functions.h"

int main() {
    printMessage();

    int remainderResult = calculateRemainder(10, 3);
    std::cout << "Remainder: " << remainderResult << "\n";

    double averageResult = calculateAverage(15, 20, 25);
    std::cout << "Average: " << averageResult << "\n";

    return 0;
}
```

```cpp
// www.gammal.tech


#include <iostream>

void printMessage() {
    std::cout << "Hello, welcome to the program!\n";
}

int calculateRemainder(int a, int b) {
    if (b != 0) {
        return a % b;
    } else {
        std::cerr << "Error: Division by zero\n";
        return 0;
    }
}

double calculateAverage(int x, int y, int z) {
    return static_cast<double>(x + y + z) / 3.0;
}
```

Solution

```
Hello, welcome to the program!
Remainder: 1
Average: 20
```

9- Trace the following program and predict the output.

```cpp
// www.gammal.tech

// main.cpp
#include <iostream>
#include "functions.h"

int main() {
    printMessage();

    bool isEvenResult = isEven(14);
    std::cout << "Is Even? " << std::boolalpha << isEvenResult << "\n";

    bool isPrimeResult = isPrime(13);
    std::cout << "Is Prime? " << std::boolalpha << isPrimeResult << "\n";

    return 0;
}
```

```cpp
// www.gammal.tech


#include <iostream>

void printMessage() {
    std::cout << "Hello, welcome to the program!\n";
}

bool isEven(int number) {
    return (number % 2 == 0);
}

bool isPrime(int number) {
    if (number < 2) {
        return false;
    }
    for (int i = 2; i * i <= number; ++i) {
        if (number % i == 0) {
            return false;
        }
    }
    return true;
}
```

Solution

```
Hello, welcome to the program!
Is Even? true
Is Prime? true
```

10- Trace the following program and predict the output.

```cpp
// www.gammal.tech

// main.cpp
#include <iostream>
#include "functions.h"

int main() {
    printMessage();

    int maxResult = findMax(8, 12);
    std::cout << "Max: " << maxResult << "\n";

    int minResult = findMin(25, 17);
    std::cout << "Min: " << minResult << "\n";

    return 0;
}
```

```cpp
// www.gammal.tech


#include <iostream>

void printMessage() {
    std::cout << "Hello, welcome to the program!\n";
}

int findMax(int a, int b) {
    return (a > b) ? a : b;
}

int findMin(int a, int b) {
    return (a < b) ? a : b;
}
```

Solution

```
Hello, welcome to the program!
Max: 12
Min: 17
```
