You have 50 minutes. You may use one prepared 8.5 × 11 sheet of paper. All questions concern the C++ programming language. For the multiple choice questions, marked [MC], circle the letter of the best answer, even if no answer is ideal. For the other questions, write the answer after the question in a clear and readable way. **Check your answers.**

1. [MC] What is the value of C++ expression 9 − 5 − 3 * 3?
   (a) −5
   (b) −3
   (c) 0
   (d) 3
   (e) 13

2. [MC] What is the value of C++ expression 15/4 + 3/4?
   (a) 6
   (b) 4.5
   (c) 4
   (d) 3.5
   (e) 3

3. [MC] What is the value of C++ expression (20 % 3 + 1)?
   (a) 2
   (b) 3
   (c) 3.33333. . .
   (d) 7
   (e) 7.33333. . .

4. [MC] What is the type of expression 3.0*5.0 + 1.0?
   (a) int
   (b) long
   (c) bool
   (d) double
   (e) real
5. [MC] When you create a variable $x$ using statement

```c
double x;
```

(a) $x$ will have an initial value, but you have no way of knowing what that value will be when the program runs.

(b) $x$ has no initial value, and using $x$ before you initialize $x$ will lead to a run-time error.

(c) $x$ has no initial value, and using $x$ before you initialize $x$ will lead to a compile error.

(d) $x$ has an initial value of 0.

6. What is the value of variable $x$ after the following statements?

```c
int y = 50;
int x = y;
y = 18;
x++; y++; y++;
```

Answer: ______________________

7. Function $f(n)$ is defined below in C++. What is the value of C++ expression $f(f(3))$?

```c
int f(const int n)
{
    int m = (n-1)*(n+1);
    return m + 1;
}
```

Answer: ______________________
8. Suppose that \( R \) is a rectangle with horizontal and vertical sides. One of the vertices is point \((x_1, y_1)\) and the opposite vertex is \((x_2, y_2)\). The area of \( R \) is \(|x_1 - x_2| \cdot |y_1 - y_2|\). Write a C++ definition of function \( \text{rectangleArea}(x_1, y_1, x_2, y_2) \), which returns the area of rectangle \( R \). You can use function \text{abs} from the library. Do not use sqrt.

Make this function do exactly its job and nothing more. It must not read or write anything. A heading is given.

\[
\text{int rectangleArea(int x1, int y1, int x2, int y2)}
\]

9. Now suppose that point \((x_3, y_3)\) is in the interior of rectangle \( R \) described in the preceding problem. Rectangle \( S \) has horizontal and vertical sides. One of its vertices is \((x_1, y_1)\) and the opposite vertex is \((x_3, y_3)\). So rectangle \( S \) is inside rectangle \( R \). Write a C++ definition of function \( \text{partialArea}(x_1, y_1, x_2, y_2, x_3, y_3) \), which returns the area of rectangle \( R \), but excluding rectangle \( S \). Use the function from the preceding question. Do not use abs or sqrt for this function definition.

Make this function do exactly its job and nothing more. It must not read or write anything. A heading is given.

\[
\text{int partialArea(int x1, int y1, int x2, int y2, int x3, int y3)}
\]

10. Write a C++ definition of function \( \text{celsiusToFahrenheit}(t) \), which returns the Fahrenheit equivalent of Celsius temperature \( t \). Using common mathematical notation, the result is \((9/5)(t) + 32\). Be sure to write your definition in correct C++ notation. Make this function do exactly its job and nothing more. It must not read or write anything. A heading is given.

\[
\text{double FahrenheitToCelsius(const double t)}
\]