Please provide brief (common sense) justifications with your answers below.

1. What is the type (and value) of this expression:
   \[ 5 \times (7 + 4 / 2) \]

2. What is the type (and value) of this expression:
   \[ 1 \neq 1 \]

3. What is the type (and value) of this expression:
   \[ 'C' - 'A' \]

4. What is the type (and value) of this expression:
   \[ \text{Math.sqrt}(3) \]

5. What is the value of this expression:
   \[ (9 / 4) \times 4 + 9 \% 4 \]

6. What is the value of this expression:
   \[ 9 \% 4 == 7 \% 2 \]

7. What is the type (and value) of this expression:
   \[ \text{false} || (\text{true} \&\& ! \text{true}) \]

8. What is the type (and value) value of this expression:
   \[ 1 + 2 + "3" + 4 + 5 \]

9. What is the type (and value) of this expression:
   \[ \text{"automaton".length()} \]

10. What is the type (and value) of this expression:
    \[ \text{"automaton".charAt(5)} \]
11. What is the type (and value) of this expression:

"automaton".substring(2, "automaton".length() - 1)

12. Write the following Java expression in mathematical notation:

Math.sqrt(a + Math.sqrt(b))

13. Write the following mathematical expression in Java notation:

$$\sqrt{\left(\sqrt{2}\right)^{2}}$$

14. What is the value of the following expression:

\[2 \times 3 / 2 \times 3\]

15. Write the following mathematical expression in Java:

\[s = s_0 + v_0t + \frac{1}{2}gt^2\]

16. Write the following Java expression in mathematical notation:

\[dm = m \times ((Math.sqrt(1 + v / c) / Math.sqrt(1 - v / c)) - 1);\]

17. What is the type (and value) of the following Java expression:

\[1 / 2 \times 3.0\]

18. What is the type (and value) of the following Java expression:

\[1 / 2.0 \times 3\]

19. What is the type (and value) of the following Java expression:

\[(int) Math.sqrt(15);\]

20. What is the output of the following line of code:

System.out.println("\\\n");
21. Write a Java statement that prints the following:

```

```

22. What is the output produced by the following code when embedded in a complete program? Please explain.

```java
boolean x;
if (true)
    System.out.print(0);
else
    System.out.print(1);
x = (1 < 2) && (4 < 3);
if (x)
    System.out.print(2);
else
    System.out.print(3);
```

23. What is the output produced by the following code when embedded in a complete program? Please explain.

```java
boolean x;
if (true)
    System.out.print(3);
else
    System.out.print(2);
x = (1 < 2) || (4 < 3);
if (x)
    System.out.print(1);
else
    System.out.print(0);
```

**What if you erased the second `else` keyword?**

```java
boolean x;
if (true)
    System.out.print(3);
else
    System.out.print(2);
x = (1 < 2) || (4 < 3);
if (x)
    System.out.print(1);
    System.out.print(0);
```

**What if you erased them both? Please explain.**
24. What is the output produced by the following code when embedded in a complete program? Please explain.

```java
boolean x = false;
if (true)
    System.out.print(0);
else
    System.out.print(1);

x = x || !x;
if (x)
    System.out.print(2);
else
    System.out.print(3);
```

25. What is the output produced by the following code when embedded in a complete program? Please explain.

```java
if (false && false || true) {
    System.out.print(false);
} else {
    System.out.print(true);
}
```

26. What is the output produced by the following code when embedded in a complete program? Please explain.

```java
if (false && (false || true)) {
    System.out.print(false);
} else {
    System.out.print(true);
}
```

27. What does the following Java statement print? Why?

```java
System.out.println( 1 > 2 ? "what" : false );
```

28. Assume two integer variables n and m.

Write a boolean expression that reads like this:

```
m is greater than n or (m + n) is divisible by 19
```

29. Assume that x is an integer variable.

Simplify the following boolean expression:

```java
(x < 5) && (x < 25)
```
30. Assume that \( x \) is an integer variable.

Simplify the following boolean expression:

\[
(x < 5) \; || \; (x < 25)
\]

31. Assume that \( x \) is an integer variable.

Simplify the following boolean expression.

Explain your simplification.

\[
(x > 3) \; || \; (x < 5)
\]

32. Assume that \( x \) is an integer variable.

Simplify the following boolean expression.

Explain your simplification.

\[
(x > 3) \; && \; (x < 5)
\]

33. Consider the following code fragment when embedded in a complete program:

```java
if (x > 3) {
    if (x <= 5)
        y = 1;
    else if (x != 6)
        y = 2;
} else
    y = 3;
```

Assume that \( x \) has a value of 6 at the beginning of the fragment.

What value does the variable \( y \) hold after the fragment gets executed? Why?

34. Assume \( \text{int } j = 3; \).

What happens when the following expression is executed?

\[
j = ++j + j++;
\]

35. What is wrong with the following \textit{for} loop? Why?

```java
for (int i = 0; i < 10; i = i++) {
    System.out.println( "Hi there." );
}
```
36. Write the following as a for loop:

```java
int count = 0;
count = count + 1;
while (!(count > 0)) {
    System.out.println(count);
count = count - 1;
}
```

37. What is the output of the following program? Explain.

```java
class One {
    public static void main(String[] args) {
        int x = 3, y = 5;
        int b = x++ + y++ - ++y - ++x;
        System.out.println(x + " " + y + " " + b);
    }
}
```

38. What's wrong with the following code? Explain your answer:

```java
if (2 < 1) {
    System.out.println("Oops.");
}
```

39. What's wrong with the following code? Explain your answer:

```java
int i = 0;
while (i < 10) {
    i = i + 1;
}
System.out.println(i);
```

40. Write a loop that computes:

   The sum of all even numbers between 2 and 100 (inclusive).

41. Write a loop that computes:

   The sum of all odd numbers between a and b (inclusive).
42. Rewrite the following do loop into a while loop. Explain your answer.

```java
int n = 1;
double x = 0;
double s;
do {
    s = 1.0 / (n * n);
    x = x + s;
    n++;
} while (s > 0.01);
```

43. What does the following code print? Why?

```java
for (int i = 0; i < 3; i++) {
    for (int j = 0; j < 3; j++)
        System.out.print(i * j % 3);
    System.out.println();
}
```

44. Rewrite the following for loop into a while loop.

```java
int s = 0;
for (int i = 1; i <= 10; i++) s = s + 1;
```

45. What is the output produced by the following code when embedded in a complete program? Why?

```java
int x = 10, y = 3;
while (x > 0 && y > 0) {
    x = x - y;
}
System.out.print(x);
```
46. What gets printed when you compile and run the following program? Why? (You could try rewriting the line marked // [1] using just the operator – and the numbers 1, 2, 3, 4 and 5.)

```java
public class A {
    public static void main(String[] args) {
        System.out.println(nuf(fun(5, nuf(fun(4, 3), 2)), 1)); // [1]
    }
    public static int fun(int a, int b) {
        return a - b;
    }
    public static int nuf(int b, int a) {
        return a - b;
    }
}
```

47. What is the output produced by the following code when embedded in a complete program? Why?

```java
int x = 10, y = 3;
while (x > 0 && y > 0) {
    x = x - y;
    y = y + 1;
}
System.out.print(x);
```

48. What happens when you try to compile and run this code? Why?

```java
class One {
    public static void main(String[] args) {
        { int i = 5, j = 2;
            System.out.println( i + j );
        }
        { String i = "5";
            char j = '2';
            System.out.println( i + j );
        }
    }
}
```