CS240 Fundamentals

Complete the following problems without a calculator. You will need to know all these concepts for this class!

1. Functions

Given this function: $T(n) = 5 + n^2$

(a) What are the values of: *T(0) =*_____ *T(1) =*_____ *T(2) =*_____

(b) Consider an arbitrary value, c. What is: *T(c) =*_____ *T(c + 1) =*_____

2. Algebra

(a) Simplify the following: $\frac{n^2+3n}{n^2} =$ _____ *(from problem 1)* $\frac{T(n)}{n} =$ _____

(b) Solve the following inequalities (find the range of values of *x* that satisfies the inequality):

$x + 5 < 8$ This is true when: _____

$x^2 - 4 \geq 0$ This is true when: _____

3. Powers of 2

(a) Write the powers of 2 starting from 2^0 to 2^{10}. The first three have been completed for you. (You can use a calculator here.)

2^0	2^1	2^2	2^3	2^4	2^5	2^6	2^7	2^8	2^9	2^{10}
1	*2*	*4*								

(b) Solve the following: $\log_2 8 =$ _____ $\log_2 512 =$ _____ $\log_2 2^{100} =$ _____

(c) Now solve these: $2^{\log_2 1701} =$ _____ $2^{\log_2 x} =$ _____

4. Graphs

Fill in the blanks to match each function to the line that best represents its growth (graph is not shown exactly to scale):

Possible functions:

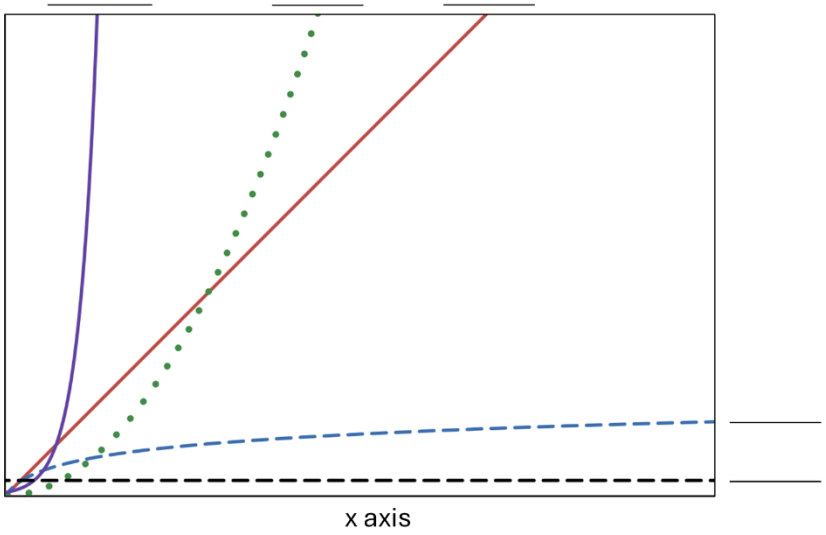
A(x) = x

B(x) = $\log_2 x$

C(x) = x^2

D(x) = 4

E(x) = 2^x



5. Code Tracing and Counting

Consider the following code, which prints out a number of A's.

```
public static void printAs(int n) {
    for (int i = 0; i < n; i++) {
        System.out.print("A");
        System.out.print("A");
    }
}
```

(a) Trace through the code for `printAs(5)`. How many A's get printed? _____

(b) Let's say that *A(n)* is a function that represents the number of A's that gets printed for a given input, *n*.

Trace through the code for the following inputs and determine:

A(1) = _____ *A(2)* = _____ *A(3)* = _____ *A(4)* = _____

(c) Generalize. Write a function *A(n)* with respect to <u>any value of *n*</u> that properly represents the number of A's that gets printed when calling `printAs`:

A(n) = _____

6. More Counting

Consider the following code, which prints out a number of B's.

```
public static void printBs(int n) {
    for (int i = 0; i < n; i++) {
        for (int j = 0; j < n; j++) {
            System.out.print("B");
        }
    }
}
```

(a) Trace through the code for `printBs(2)`. How many B's get printed? _____

(b) Write a function that represents the number of B's printed for a given input:

B(n) = _____

7. Even More Counting (yes this is a fundamental part of the class)

Consider the following code, which prints out a number of C's.

```
public static void printCs(int n) {
    System.out.print("C");

    for (int i = 0; i < n; i++) {
        System.out.print("C");
    }
}
```

Write a function that represents the number of C's printed for a given input:

C(n) = _____