

Name: _____ **SOLUTION** _____ CM: _____ Section: _____ Grade: _____ of 10

- In the table below, read the code in the *first* column. Then write in the *second* column what it prints when it runs.
- In the table below, read the code in the *third* column. Then write in the *fourth* column what it prints when it runs.

For problem 1		For problem 2	
<pre>for j in range(4): for k in range(2): print(j, k)</pre> <p>Grader: 2 points for problem 1 (in the second column) and 2 points for problem 2 (in the fourth column).</p> <p>3 points for problem 3.</p> <p>1 point for each of the three answers in problem 4 (so 3 points total for problem 4).</p>	<p><u>Output:</u></p> <pre>0 0 0 1 1 0 1 1 2 0 2 1 3 0 3 1</pre>	<pre>for j in range(4): for k in range(j): print(j, k)</pre> <p>I have put extra spaces in the answers to make them easier to read.</p>	<p><u>Output:</u></p> <pre>1 0 2 0 2 1 3 0 3 1 3 2</pre>

- In problems where we are trying to write code to print patterns (like triangular or rectangular in shape) to the console, we try to “separate concerns” into 3 parts and address them one at a time. Number the first concern we address with a 1, second with a 2, etc. Leave blank the one that isn’t a concern.

3 Get the values that are printed correct ___ Get the *return* statement correct

1 Get the number of rows correct 2 Get the number of columns correct

- You learned in a video that the code in the *first* column below prints a triangle of stars with *n* rows and *n* columns, as shown in the picture in the *second* column for *n=4*. For each of the remaining three columns, indicate **what expression involving *j* and/or *k* should be in the *print* statement instead of the * to produce the output for that column.** Write your answer inside the column, below the output.

<pre>for j in range(n): for k in range(j + 1): print("*", end="") print()</pre>	<pre>* ** *** ****</pre>	<pre>1 12 123 1234</pre> <p><i>k + 1</i></p>	<pre>1 22 333 4444</pre> <p><i>j + 1</i></p>	<pre>0 12 234 3456</pre> <p><i>j + k</i></p>
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Students: see the explanation on the next page.

Here is the thought-process to figure out the above answers:

[Same as previous page, repeated for your convenience]

<pre>for j in range(n): for k in range(j + 1): print("*", end="") print()</pre>	<pre>* ** *** ****</pre>	<pre>1 12 123 1234</pre> <p>$k + 1$</p>	<pre>1 22 333 4444</pre> <p>$j + 1$</p>	<pre>0 12 234 3456</pre> <p>$j + k$</p>
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Step 1: Start by going DOWN the *first* COLUMN.

- For the third box above (whose answer is $k + 1$), we see when going DOWN that the number does not change. That means that the function for what to print will NOT include the OUTER variable, j .
- For the fourth box above (whose answer is $j + 1$), we see when going DOWN that the number INCREASES by 1. That means that the function for what to print will be a POSITIVE function of the outer variable, j .
 - If we were to see when going DOWN that the number DECREASES by 1, then the function for what to print would have a $-j$ as part of it.
 - If we were to see when going DOWN that the number INCREASES by (say) 4, then the function for what to print would have a $4j$ as part of it.
 - And so forth.
- For the fifth box above (whose answer is $j + k$), we see when going DOWN that the number INCREASES by 1. That means that the function for what to print will be a POSITIVE function of the outer variable, j .

Step 2: Now go ACROSS (left to right) the *first* ROW.

- For the third box above (whose answer is $k + 1$), we see when going ACROSS that the number INCREASES by 1. That means that the function for what to print will be a POSITIVE function of the INNER variable, k .
- For the fourth box above (whose answer is $j + 1$), we see when going ACROSS that the number does not change. That means that the function for what to print will NOT include the inner variable, k .
- For the fifth box above (whose answer is $j + k$), we see when going ACROSS that the number INCREASES by 1. That means that the function for what to print will be a POSITIVE function of the inner variable, k .

[continues on the next page]

[Same as a previous page, repeated for your convenience]

<pre>for j in range(n): for k in range(j + 1): print("*", end="") print()</pre>	<pre>* ** *** ****</pre>	<pre>1 12 123 1234</pre> <p>$k + 1$</p>	<pre>1 22 333 4444</pre> <p>$j + 1$</p>	<pre>0 12 234 3456</pre> <p>$j + k$</p>
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Step 3: Include the constant that works when both variables (j and k) are ZERO, that is, for the number in the FIRST COLUMN and FIRST ROW (that is, the upper-left number)

- For the third box above (whose answer is $k + 1$), the upper-left number is 1. So the constant in the formula for what to print will be 1. Combining this with the results from Steps 1 and 2 implies that the formula for what to print is $k + 1$.
- For the fourth box above (whose answer is $j + 1$), the upper-left number is 1. So the constant in the formula for what to print will be 1. Combining this with the results from Steps 1 and 2 implies that the formula for what to print is $j + 1$.
- For the fifth box above (whose answer is $j + k$), the upper-left number is 0. So the constant in the formula for what to print will be 0. Combining this with the results from Steps 1 and 2 implies that the formula for what to print is $j + k + 0$, i.e., $j + k$.