**Recap:**

1. Multiplication Table with Functions
2. Arithmetic Progression (increasing) with Functions
3. For Loops
4. Print first before assignment

**Learning Outcomes:**

1. Arithmetic Progression (decreasing) with Functions
2. Printing Characters in Special Order

**Explanation Points:**

* Explain why we should use negative numbers in d, rather than changing the function
  + Ideally the function should not change, so it is “universal”
  + Having a negative number for d makes more sense for the reader, so they know it should be decreasing.
* Get the students to think of how the Characters should be displayed.

**Breakdown of Lesson Plan:**

|  |  |
| --- | --- |
| Recap Lesson 4 Quiz  (explanation) | 15 minutes  5 minutes |
| Lesson 5.1 (Arithmetic Progression (decreasing) with functions) | 25 min |
| Lesson 5.2 (Printing Characters in certain order) | 25 min |
| Lesson 5 Quiz | 20 min |

*\*Note: There is a high chance of student not being able to complete on time.*

**Recap Lesson 4**

Task 1:

Marvin is tracking the number of fallen leaves in his garden. He notices that the number of fallen leaves follows an Arithmetic Progression, as shown below. Write a function that will print the number of fallen leaves over 30 days. Your answer should be in the format:  
“On day \_\_\_ there were \_\_\_ fallen leaves.”

|  |  |
| --- | --- |
| **Day** | **Number of Fallen Leaves** |
| 1 | 3 |
| 2 | 7 |
| 3 | 11 |

Marvin is interested to know how many fallen leaves there are IN TOTAL after 30 days. Edit your function to find the total number of fallen leaves after 30 days. Print your answer in the format:

“After 30 days, there were a total of \_\_\_ fallen leaves.”

HINT: Global Variables

Task 2:

Amelia is tracking the power output of a novel power plant. She knows that it takes some time for the power plant to reach optimal power output. Hence, she tracks the power output of the plant over 3 hours. She notices that the power output of the power plant follows an Arithmetic Progression, as shown below. Write a function to print the power output over 10 hours. Your answer should be in the format:

“At \_\_\_ hours, the power plant produced \_\_\_ Mega Watts of energy.”

(Watts is a unit of energy)

|  |  |
| --- | --- |
| **Hours** | **Energy Output (Mega Watts)** |
| 1 | 1 |
| 2 | 3 |
| 3 | 5 |
| . |  |
| . |  |
| 10 | 19 |

Amelia wants to know the average energy output over the 10 hours. Edit your function to reflect the average energy output after 10 hours. Print your answer as shown:

“In 10 hours, the power plant produced an average of \_\_\_ Mega Watts of energy.”

**Recap Lesson 4**

Task 3

Jason wants to find the 12th even number, starting from 0. Write a function to find the answer of 22.

Task 4:

Write a function that prints the first 5 terms of the 12 times table.

Task 5:

Patricia is interested in finding the 5th to 10rth term of the 10 times table. Write a function to show the answer.

**Lesson 5.1**

**We have seen a few simple cases of Arithmetic Progression that increases. However, what happens if the equation is decreasing? Let us take a look at an example.**

**21, 19, 17, 15, …**

|  |  |
| --- | --- |
| **Term** | **Value** |
| **1** | **21+(-2)x0 = 21** |
| **2** | **21+(-2)x1 = 19** |
| **3** | **21+(-2)x2 = 17** |
| **4** | **21+(-2)x3 = 15** |
| **5** | **21+(-2)x4 = 13** |

**In the sequence above, we have a first term (21), and a common difference of -2. This means our sequence begins with 21, and decreases by 2 for each subsequent term. We can, of course, use the original concept of Arithmetic Progression to predict the subsequent terms.**

**From the table above, we can find a nth term by using the formula 21 + (-2) x (n-1). Notice that we used (-2) as the common difference, as compared to changing the formula to 21 -2 x (n-1).**

**Why is that so?**

**We can therefore use the same function as shown below.**

|  |  |
| --- | --- |
| ***1*** | **def A\_P(a,d,n):** |
| ***2*** | **first = a** |
| ***3*** | **for num in range(n-1):** |
| ***4*** | **print(first)** |
| ***5*** | **first+=d** |
| ***6*** |  |
| ***7*** | **A\_P(21,-2,5)** |

**Lesson 5.1**

Task 1:

James is given $300 a month for pocket money. He spends $3 a day over a period of 30 days. His remaining money therefore follows an Arithmetic Progression. Explain to your teacher what you think the starting value, the common difference and the number of terms should be. Write a function to reflect the amount of pocket money James will have in each day. Your answer should be in the format:

“After \_\_\_ days, James will have $\_\_\_ left.”

BONUS:

Print your answer in this format instead:

“After \_\_\_ days, James will have spent $\_\_\_ in total, and will have $\_\_\_ left.”

Task 2:

Jamie is observing the rate of evaporation of water. She knows the evaporation rate is dependent on the surrounding temperature. She conducts a test with 100 ml of water and measures the amount of water remaining after 5 minutes against the change in temperature, which she records below. Explain to your teacher where the Arithmetic Progression exists in this question, as well as what the starting value and common difference is.

|  |  |
| --- | --- |
| Change in Temperature (K) | Remaining Water (ml) |
| 1 | 97 |
| 2 | 94 |
| 3 | 91 |

Write the function that will show the remaining water for a change in temperature over 20 degrees. Your answer should be in the format shown below:

“When the temperature is increased by \_\_\_ K, the remaining water is \_\_\_ ml.”

**Lesson 5.1**

Task 3:

James is studying a Mathematics Sequence. He knows the second, third and fourth terms of the sequence, which is written below. Tell your teacher what the first term is and what the common difference is.

|  |  |
| --- | --- |
| **Term Number** | **Value** |
| 2 | 473 |
| 3 | 466 |
| 4 | 459 |

Using this information, write a function that represents this Arithmetic Sequence. Print the first 20 terms of this sequence in the format shown below:

“Term number \_\_\_ of the sequence is \_\_\_.”

Task 4:

Amelia is tracking her download speed for a game. She knows the file is really large, and tracks the remaining progress at 30-minute intervals. She notes the percentage in the table shown below. She realizes that the download rate follows an Arithmetic Progression. Tell your teacher what the first term of this Arithmetic Progression is, as well as the common difference.

Write a function that will help her predict the progress every 30-minute intervals. Print your answer in the format shown below:

“After \_\_\_ 30-minute intervals, her download will be at \_\_\_%.”

Will her download be complete after 5 hours? Tell your teacher if the game would be downloaded in 5 hours based on your answer.

|  |  |
| --- | --- |
| **Intervals** | **Progress** |
| 1 | 97 |
| 2 | 94 |
| 3 | 91 |

**Lesson 5.2**

**With our understanding of how an Arithmetic Progression works, we can therefore write a simple function to print special shapes.**

**1, 3, 5, 7, 9 …**

**This sequence can be represented by the function shown below.**

|  |  |
| --- | --- |
| ***1*** | **def A\_P(a,d,n):** |
| ***2*** | **first = a** |
| ***3*** | **for num in range(n-1):** |
| ***4*** | **print(first)** |
| ***5*** | **first += d** |
| ***6*** |  |
| ***7*** | **A\_P(1,2,5)** |

**If we would like to print rings (o) following this sequence, we can edit the function to look like this:**

|  |  |
| --- | --- |
| ***1*** | **def A\_P(a,d,n):** |
| ***2*** | **first = a** |
| ***3*** | **for num in range(n-1):** |
| ***4*** | **print(‘o’\*first)** |
| ***5*** | **first += d** |
| ***6*** | **return first** |
| ***7*** |  |
| ***8*** | **A\_P(1,2,5)** |

**And your output should look something like this:**

|  |  |
| --- | --- |
| ***1*** | **o** |
| ***2*** | **ooo** |
| ***3*** | **ooooo** |
| ***4*** | **ooooooo** |

**Let us practice these sequences!**

**Lesson 5.2**

Task 1:

Write a function that will print the following:

|  |  |
| --- | --- |
| *1* | oo |
| *2* | ooo |
| *3* | oooo |
| *4* | ooooo |
| *5* | oooooo |

Task 2:

Write a function that will print the following:

|  |  |
| --- | --- |
| *1* | 1 |
| *2* | 12 |
| *3* | 123 |
| *4* | 1234 |
| *5* | 12345 |

Task 3:

Write a function that will print the following:

|  |  |
| --- | --- |
| *1* | 1 |
| *2* | 333 |
| *3* | 55555 |
| *4* | 7777777 |
| *5* | 999999999 |

Task 4:

Write a function that will print the following:

|  |  |
| --- | --- |
| *1* | 9 |
| *2* | 88 |
| *3* | 777 |
| *4* | 6666 |
| *5* | 55555 |

**Lesson 5.2**

Task 5:

Write a function that will print the following:

|  |  |
| --- | --- |
| *1* | 11111 |
| *2* | 2222 |
| *3* | 333 |
| *4* | 44 |
| *5* | 5 |

Task 6:

Using the following variable in Task 6.

name = ‘The Logic Coders’

Write a function that will print the following:

|  |  |
| --- | --- |
| *1* | The Logic Coders |
| *2* | he Logic Coders |
| *3* | e Logic Coders |
| *4* | Logic Coders |
| *5* | Logic Coders |

Task 7:

Write a function that will print the following:

|  |  |
| --- | --- |
| *1* | 0 |
| *2* | 1 |
| *3* | 2 |
| *4* | 3 |
| *5* | 4 |

**End of Lesson 5 Quiz**

Question 1:

Write a function that will give the following output:

|  |  |
| --- | --- |
| *1* | 1 |
| *2* | 33 |
| *3* | 555 |
| *4* | 7777 |
| *5* | 99999 |

Question 2:

Alfred is tracking the download progress of his game. He records the progress every 15 minutes and records it in the table shown below.

|  |  |
| --- | --- |
| **Interval** | **Progress** |
| 1 | 10 |
| 2 | 20 |
| 3 | 30 |

He notices it follows an Arithmetic Progression. Write a function to represent the download speed, and print the answer in the following format:

“At interval \_\_\_, the progress was at \_\_\_%, and Alfred had \_\_\_% remaining.”

Knowing this, edit the program to output the percentage as a bar instead! Your output should look like this:

|  |  |
| --- | --- |
| *1* | #--------- 10% |
| *2* | ##-------- 20% |
| *3* | ###------- 30% |
| *4* | ####------ 40% |
| *5* | #####----- 50% |
| *6* | ######---- 60% |