**Recap:**

1. Multiplication Table
2. Functions with 2 or more arguments
3. Append
4. Pattern and Open-ended Questions, and the Data Flow

**Learning Outcomes:**

1. Pattern Sequence/Multiplication Table with Functions
2. Arithmetic Progression (Increasing) with Functions

**Explanation Points:**

* Explain the concept of common difference (d), number of terms (n) and the first term (a) of an Arithmetic Progression.
* Explain when we should print, and when we should add the common difference.

**Breakdown of Lesson Plan:**

|  |  |
| --- | --- |
| Recap Lesson 3 Quiz | 15 minutes |
| Lesson 4.1 (Number Pattern Sequences/Multiplication Table with Functions) | 25 min |
| Lesson 4.2 (Arithmetic Progression (Increasing) with Functions) | 25 min |
| Lesson 4 Quiz | 25 min |

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

**Recap Lesson 3**

Question 1:

Alfred is playing a MOBA (Multiplayer Online Battle Arena). He knows that after every cycle, he gets a certain number of gold bars. Write a function to help him calculate how much he will get after a certain number of cycles. After every cycle, print the number of gold bars Alfred has in the following format:

“After \_\_\_ cycles, Alfred will have \_\_\_ gold bars.”

**Given the following inputs:**

|  |  |  |
| --- | --- | --- |
| **Challenge** | **Gold bars after Every Cycle** | **Number of Cycles** |
| A | 100 | 15 |
| B | 50 | 20 |
| C | 120 | 16 |

Question 2:

Liam is a painter who has to cover the outer faces of a dice with oil.

The dice has a height of h meters, length of l meters and breath of b meters.

Liam also needs 1 litre of oil for every 5 square meters that needs to be covered.

1. Define a function to calculate the total wall area that has to be oiled for the dice
2. Calculate the number of litres of oil Liam needs using your function and for loops

Dice 1 (Length 10m x Breath 20m x Height 4m)

Dice 2 (Length 5m x Breath 5m x Height 5m)

Dice 3 (Length 15m x Breath 10m x Height 5m)

Question 3

Josh is a teacher with a class of 5 students who had just taken a physical education test. The scores from the school's computer system is given as:

Data = ['Bolt 85','Ash 70','Jones 57','James 61','Sesh 23']

Create a function that returns the score of the student in intergers.

Using for loops, append and slicing, create 2 lists, one with the students names, and the other with their scores.

Print both lists.

**Recap Lesson 3**

Question 4

CakeShop sells square shaped cakes of 3 different sizes of length at different prices.

Cake A = 30cm with price $30

Cake B = 35cm with price $40

Cake C = 40cm with price $50

Jane wants to order a cake for her parent's birthday party, however she is unable to decide on which size is most worth her money

Use for loops, append and index to help Jane calculate the price per square cm in order to help her in her decision.

Print your answers in a list.

Question 5

Joan has a group of students who took an exam with a total score of 12. The students raw scores are given in the following list:

rawscore = [2,1,10,7,6]

Use for loops and append, calculate each students’ percentage score and store the percentage scores in a list.

Formula for percentage score = (rawscore/total score)\* 100

Question 6

Given the number sequence: 1,2,3,4,...100, create a list of numbers containing the 1st, 2nd, 4th, 7th, 11th, 16th... terms of the given number sequence.

Question 7

Create a list of 20 elements with the numbers 2,3,4,5,6,2,3,4,5,6... repeating using for loops, append and indexing. The answer will be 2,3,4,5,6,2,3,4,5,6,2,3,4,5,6,2,3,4,5,6

**Recap Lesson 3**

Question 8

John just opened a new account with 1 dollar

At the end of every month, he deposits 2 times the amount in his bank dollars.

Use for loops, append and indexing, create a list of John's bank balance at the end of every month till the end of the 6th month. The answer will be [1,3,9,27,81,243]

End of 1st month: 1

End of 2nd month: (1 x 2) +1 = 3

End of 3rd month: (3 x 2) +3 = 9

End of 4th month: (9 x 2) +9 = 27

End of 5th month: (27 x 2) +27 = 81

End of 6th month: (27 x 2) +81 = 243

Question 9

Peter has 15 days daily of data for stock price in the market. The maximum stock price is 200.

Use for loops and append, calculate the stock price percentage and store the percentage in a list.

Formula = (dailystockprice/maximum stock price) \* 100

DailyStockprice = [5,4,2,3,5,8,3,6,5,8,10,13,10,12,14]

Question 10

John has 1,000 dollars in his bank account.

He performs the following transactions as recorded.

Transactions = [-59, -29, 39,90,50,90,50,30,12,58, -600,150,350].

Positive numbers represent deposits of money into his account while negative numbers represent spending.

Use loops, indexing and append to create a list of John's bank balance after each transaction.

Your answer will be [1000, 941, 912, 951, 1041, 991, 1081, 1131, 1161, 1173, 1231, 631, 781, 1131]

**Lesson 4.1**

**Recap in Lesson 1 the 2 ways of coming out with the multiplication table**

***Output***

|  |  |
| --- | --- |
| **1** | **for i in range (1,5,1):** |
| **2** | **result = i \* 3** |
| **3** | **print( i, “x”, “3” , “=”, result)** |

|  |  |
| --- | --- |
| 1 | 1 x 3=3 |
| 2 | 2 x 3=6 |
| 3 | 3 x 3=9 |
| 4 | 4 x 3=12 |

***Output***

|  |  |
| --- | --- |
| **1** | **Ans = 0** |
| **2** | **for i in range (1,5,1):** |
| **3** | **Ans = Ans + 3** |
| **4** | **print( i, “x”, “3” , “=”, Ans)** |

|  |  |
| --- | --- |
| 1 | 1 x 3=3 |
| 2 | 2 x 3=6 |
| 3 | 3 x 3=9 |
| 4 | 4 x 3=12 |

Task 1a:

Using loops and range(), find the output for the 5 times table. The output will be as follows:

(Do not use start, stop, step)

Output

|  |  |
| --- | --- |
| 1 | for i in range (6): |
| 2 | result = i \* 5 |
| 3 | print(result) |

|  |  |
| --- | --- |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |
| 6 |  |

Output

|  |  |
| --- | --- |
| 1 | for i in range ( 6): |
| 2 | result = (i+1) \* 5 |
| 3 | print(result) |

|  |  |
| --- | --- |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |
| 6 |  |

**Task 1a: Explain the difference and code sequence between the above 2**

|  |
| --- |
|  |

**Lesson 4.1**

Using loops and range(), find the output for the 5 times table. The output will be as follows:

(Fill in line 2. Do not use start, stop, step)

Task 1b:

Output

|  |  |
| --- | --- |
| 1 | answer=0 |
| 2 | for i in range ( ): |
| 3 | answer = answer + 5 |
| 4 | print(answer) |

|  |  |
| --- | --- |
| 1 | 5 |
| 2 | 10 |
| 3 | 15 |
| 4 | 20 |
| 5 | 25 |
| 6 | 30 |

**Lesson 4.1**

**In Mathematics, sequences are common occurrences. In lesson 2, we had seen different number pattern sequences and used loops to determine the answers. In this lesson, we will be looking at number pattern sequence/multiplication number patterns and using functions with loops to determine the answers.**

**5, 10, 15, 20, 25, 30, 35, …**

**From the numbers above, we notice that we can simply add 5 to get the next number in line. This is also your multiplication table of 5. Therefore, we can simply compile this number pattern as a function, which is shown below.**

***Output***

|  |  |
| --- | --- |
| ***1*** | ***def seq(n):*** |
| ***2*** | ***term = 0*** |
| ***3*** | ***for i in range(n):*** |
| ***4*** | ***term += 5*** |
| ***5*** | ***print(term)*** |
| ***6*** |  |
| ***7*** | ***seq(5)*** |
| ***8*** | ***seq(210)*** |

|  |  |
| --- | --- |
| ***1*** | ***25*** |
| ***2*** | ***1050*** |

**Recap: Indentation of print**

***Output***

|  |  |
| --- | --- |
| ***1*** | ***def seq(n):*** |
| ***2*** | ***term = 0*** |
| ***3*** | ***for i in range(n):*** |
| ***4*** | ***term += 5*** |
| ***5*** | ***print(term)*** |
| ***6*** |  |
| ***7*** | ***seq(5)*** |

|  |  |
| --- | --- |
| ***1*** | ***5*** |
| ***2*** | ***10*** |
| ***3*** | ***15*** |
| ***4*** | ***20*** |
| ***5*** | ***25*** |

**Lesson 4.1**

**Let us try doing some simple sequence questions!**

Task 1a:

James wants to find the 5th even number, starting from 0. Help to edit the function below to find the answer.

Output

|  |  |
| --- | --- |
| 1 | def even(x): |
| 2 |  |
| 3 | for num in range(\_\_\_\_\_): |
| 4 |  |
| 5 | print(\_\_\_\_\_\_\_\_\_\_\_) |
| 6 |  |
| 7 | even(5) |

|  |  |
| --- | --- |
| *1* |  |

Task 1b:

Jovan wants to find the 14th even number, starting from 0. Write the function below to find the answer.

Output

|  |  |
| --- | --- |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |
| 6 |  |
| 7 |  |

|  |  |
| --- | --- |
| *1* |  |

Task 2:

Alfred is finding multiples of 3. He needs help with finding the first 50 terms that are multiples of 3. Edit the function below to help him find the answer. Show your answer to your teacher.

|  |  |
| --- | --- |
| 1 | def mult3(x): |
| 2 |  |
| 3 | for num in range(\_\_\_\_\_\_): |
| 4 |  |
| 5 | print(\_\_\_\_\_) |
| 6 |  |
| 7 | mult3(\_\_\_\_\_\_\_\_) |

**Lesson 4.1**

Task 3:

Write a function that prints the first 21 terms of the 5 times table.

Task 4:

Write a function that prints the first 5 terms of the 13 times table.

Task 5:

James is interested in finding the 5th to 23rd term of the 6 times table. Edit the code shown below to help him find his answer. Show your answer to your teacher.

(Complete line 5 and 7)

|  |  |
| --- | --- |
| 1 | def mult6(start,stop): |
| 2 | fin = (start - 1) \* 6 |
| 3 | for num in range(start,stop): |
| 4 | fin = fin + 6 |
| 5 | print(\_\_\_\_\_\_\_\_) |
| 6 |  |
| 7 | mult6(\_\_\_\_\_\_,\_\_\_\_\_\_\_) |

In Task 5, why does fin equal to (start - 1) \* 6? Explain the reasoning below.

Hint: See line 4.

**Lesson 4.1**

Task 6:

Write a function to find the 4th to 23rd term of the 7 times table.

Task 7:

Write a function to find the 21st to 52nd term of the 9 times table.

Task 8:

Jonah is studying the number of leaves on a certain species of plant. He notices the pattern over 5 days. Write a function that can help him find the expected number of leaves from the 6th day to the 30th day. Your answer should be in the format:

“On day \_7\_\_, there should be \_49\_\_ leaves expected.”

.

.

.

.

.

“On day \_30\_\_, there should be \_210\_\_ leaves expected.”

|  |  |
| --- | --- |
| **Days** | **Number of Leaves** |
| 1 | 7 |
| 2 | 14 |
| 3 | 21 |
| 4 | 28 |
| 5 | 35 |
| 6 | 42 |
| 7 | 49 |
| . |  |
| . |  |
| 30 | 210 |

**Lesson 4.2**

**By now, you should have noticed, the examples above seem to have similar functions. This is because we have been adding numbers to the previous. Simply put, the times tables follows a simple Arithmetic Progression. What is an Arithmetic Progression?**

**An Arithmetic Progression is a number sequence such that the difference of any two successive numbers is a constant. Let us look at such an example:**

**3, 5, 7, 9, 11…**

|  |  |
| --- | --- |
| **Term** | **Value** |
| **1** | **3+2x0 = 3** |
| **2** | **3+2x1 = 5** |
| **3** | **3+2x2 = 7** |
| **4** | **3+2x3 = 9** |
| **5** | **3+2x4 = 11** |

**As seen above, the Arithmetic Progression is a number sequence as there is a fixed rule to add 2 each time. With this fixed rule, we can now find create a function that can find the value of any term in this sequence.**

**From the table above, we can find a nth term by using the formula 3 + 2 x (n-1). Hence, we can write a function to find the first 5 terms.**

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

**Where a represents the first term, d the common difference and n the number of the term we are interested in.**

**Question: What happens if we swap lines 4 and 5?**

**Lesson 4.2**

Task 1:

James writes a sequence of numbers. He begins with the number 5 and adds 4 to each subsequent number. Edit the function below to print the first 15 terms of this Arithmetic Progression. Your answer should be in the format:

“Term number \_\_\_ has a value of \_\_\_.”

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

Task 2:

Thomas is calculating his profits. He knows that his profits follow an Arithmetic Progression based on the number of products he sells. His first product will earn him a profit of $5, with an increment of $3 for each subsequent product. Edit the function below to print the first 21 terms of this Arithmetic Progression. Your answer should be in the format:

“Thomas will earn $\_\_\_ if he sells \_\_\_ products.”

|  |  |
| --- | --- |
| 1 | def A\_P(a,d,n): |
| 2 | first = a |
| 3 | for num in range(n): |
| 4 |  |
| 5 |  |
| 6 |  |
| 7 |  |
| 8 | A\_P( |

**Lesson 4.2**

Task 3:

Tom has a garden that has a snail problem. He decides to track the number of snails in his garden over 3 months. In the first month, he notices there were 5 snails. In the second month, he notices there were 8 snails, and in the third month, there were 11 snails. He deduces that the number of snails in his garden follows an Arithmetic Sequence. Help him determine the values of a and d (in the Arithmetic Sequence).

Using the information above, write a function to help him find the number of snails in 6 months. Print your answer in the format:

“After 6 months, Tom will have \_\_\_ snails in his garden.”

Task 4:

James loves peaches too much, and he is worried that he has been consuming too many peaches. He decides to track the total number of peaches he has consumed over 30 days. He has tracked the number of peaches he has eaten over 5 days, and tabulated the data as shown below. He notices that his consumption of peaches follows an Arithmetic Progression. Help to find the first term (a) and common difference (d) of his consumption.

|  |  |
| --- | --- |
| **Day** | **Peaches Consumed in Total** |
| 1 | 3 |
| 2 | 7 |
| 3 | 11 |
| 4 | 15 |
| 5 | 19 |

Using the information above, write a function that can predict how many peaches James will eat in total over the 30 days. Print your answer in the format:

“By day \_\_\_, James would have consumed \_\_\_ peaches.”

**End of Lesson 4 Quiz:**

Question 1:

Amon is writing an Arithmetic Sequence, starting at 4 and increasing by 7. Write a function that prints the first 25 terms of this sequence. Your answer should be in the format:

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

Question 2:

Alfred is tracking the production rate of his factory. He knows that the number of calculators his factory is able to make each day follows an Arithmetic Progression, which he has tabulated below. Write a function to represent this Arithmetic Progression.

|  |  |
| --- | --- |
| **Day** | **Calculators Produced** |
| 1 | 4 |
| 2 | 7 |
| 3 | 10 |
| 4 | 13 |

* 1. Alfred wants to know how many calculators are produced on day 30. Using your function, find the number of calculators his factory will produce on day 30.
  2. Now, Alfred wants to know how many calculators are produced IN TOTAL after 30 days. Edit your function to help him calculate how many calculators are produced IN TOTAL after 30 days.

HINT: Global Variables

Question 3:

Jamie works for Company A. She knows she gets a pay raise every year. Her starting pay was $2100 a month. It increases by $100 a month every year. Write a function that can tell her how much her pay would be after n number of years.

She plans to work in this company for 10 years. How much would her monthly pay be in 10 years? Print your answer in the format:

“In \_\_\_ years, Jamie’s monthly pay will be $\_\_\_.”

Edit this simple function to find how much Jamie would have earned IN TOTAL after working for Company A for 10 years. Print your answer in the format:

“In \_\_\_ years, Jamie would have earned $\_\_\_.”

HINT: Global Variables