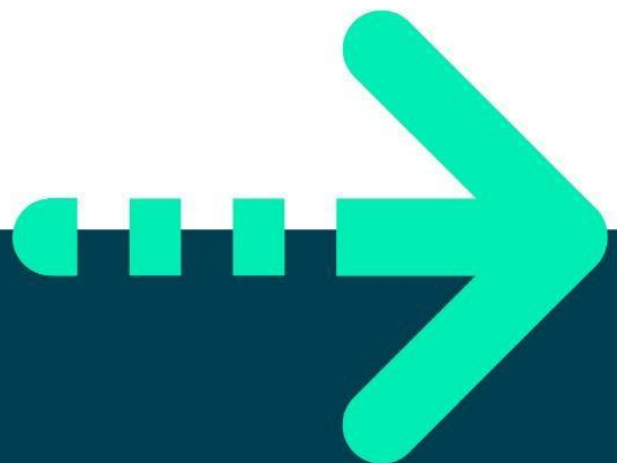




# Formulas and Functions

**Learner Guide**





# CONTENTS

How to Use This Workbook .....	3
Introduction.....	4
Objectives .....	4
Formulas and functions.....	5
VLOOKUP function.....	5
Formulas.....	6
IF function.....	7
AND function.....	7
AND .....	7
OR function.....	8
OR.....	8
MIN and MAX function .....	8
COUNTIF Function .....	8
SUMIF Function .....	9
Conditional formatting.....	10
Activity on formulas and functions.....	11

# How to Use This Workbook



## Activity

Alongside this icon you'll find details of the group/individual activity or a point for everyone to discuss.



## Important Idea or Concept

Generally, this icon is used to draw your attention to ideas that you need to understand by this point in the course. Let your trainer know if you do not understand or see the relevance of this idea or concept.



## Key Point

This icon is used to indicate something that practitioners in this field should know. It's likely to be one of the major things to remember from the course, so check you do understand these key points.



## Definition

Where a word with a very specific definition (or one that could be described as jargon) is introduced this will highlight that a definition is provided. (These words will also be found in the Glossary at the back of the workbook.)



## Useful Tool

This icon indicates a technique that will help you put what you learn into practice.



## Helpful Hint

This icon guides you to tips or hints that will help you avoid the standard pitfalls that await the unwary practitioner or to show you how you might increase your effectiveness or efficiency in practising what you have learnt.



## Reference Material

When we have only touched briefly on a topic this icon highlights where to look for additional information on the subject. It may also be used to draw your attention to International or National Standards or Web addresses that have interesting collections of information.



## Warning

This icon is used to point out important information that may affect you and your use of the product or service in question.



# Introduction

Formulas and functions are a vital process in data management and analysis, and are used to manipulate data and create insights from it.

Formulas and functions are defined differently in Excel:

- **Formula:** An equation or calculation devised by the user to calculate or return a value.
- **Function:** A pre-defined, in-built calculation in Excel. These functions allow us to carry out a myriad of tasks, like extracting, looking up, aggregating, and summarising data.

Your task is to apply various formulas and functions in Microsoft Excel.

## Objectives

The objectives of this activity are to:

- Input data
- Sort data
- Apply formulas to return equation-based results
- Apply the following functions on a small dataset:
  - VLOOKUP
  - IF, SUMIF, COUNTIF
  - SUM, MAX, MIN
  - AND, OR
  - FILTER
- Apply conditional formatting to highlight specific data.

# Formulas and functions

In this section, you will use the various formulas and function in Excel using the Book Sales dataset. The dataset provides information on a variety of books sold at the QA Bookstore.

The dataset consists of the following columns:

1. **Book Name:** The name of the book sold at QA Bookstore.
2. **Author:** The full name of the author of each book.
3. **Price:** The price of each book to the customer in £.
4. **Cost:** The cost of each book to the bookstore in £.
5. **Profit:** The amount of profit made from each book in £.
6. **Stock Level:** The number of each book in stock.
7. **Stock Order Status:** The status of whether a book needs to be reordered ('REORDER') or not ('OK').
8. **Rating:** The rating of the book, between 1 (lowest) and 5 (highest)
9. **Popularity:** The popularity of the book, between 1 (lowest) and 5(highest)
10. **High Demand?:** TRUE or FALSE value based on if the book is in high demand or not.
11. **Display in Shop?:** TRUE or FALSE value based on if the book shouldbe displayed on the main shop floor.

Consisting of 9 columns and 25 rows.

## VLOOKUP function

In this section, you will use the VLOOKUP function to find and return values from another table based on a value in the current table.



### Guided activity: LOOKUP in Excel Tables

1. Open the 'Book Sales.XLSX' workbook.
2. Familiarise yourself with the data in the current 'Book Sales' worksheet.
3. Explore the 'Lookup Table' worksheet. This worksheet contains a lookup table for all the book names, along with the Author, Stock Level, Rating and Price values which are not in the main 'Book Sales' worksheet.
4. Go back to the main worksheet named 'Book Sales' and select the first empty cell under the 'Author' column. You are required to populate this cell with the author's name that corresponds to the relative book name, as listed in the lookup table.
5. Type in the = operator to enable a function. Write the VLOOKUP function so that it first looks at the relative book name, then selects the entire table array from the lookup table, followed by the column index number of the return value (Author), followed by 'FALSE', indicating that an exact match is required.



### Helpful hint

Here is a breakdown of what each of the arguments mean in the tooltip that displays whilst creating a VLOOKUP:

1. Identify the value you want to look at first (to decide what the return value should be).
2. Choose the table array which has all the corresponding values in it - the lookup table.
3. Choose the column index number within that table array which has the return value.
4. Do you want an approximate match? (Approx = TRUE, Exact = FALSE)

6. You may want to check a few values against the lookup table to ensure they are correct.



### Helpful hint

Be sure to use absolute cell referencing to select the same table array for all cells in that column by adding \$ to cell column and row references.

7. Once you are sure the function returns the correct result, use the fill handle to replicate the function to the rest of the column.
8. You may want to check a few values against the lookup table to ensure they are correct.
9. Carry out the same steps for Price, Stock Level and Rating, simply adjusting the column index number to return the value from each time.

## Formulas

In this section, you will apply a formula to calculate the profit for each book.



### Guided activity: Apply formulas

The profit will be based on the price of each book subtracted by the cost.

1. Select the first empty cell in the Profit column.
2. Type in the = operator to enable a formula. Write the formula as a mathematical calculation and hit enter.
3. Once you are sure the formula returns the correct result, use the fillhandle to replicate the function to the rest of the column.

## IF function

In this section, you will apply the IF function to return a value based on aspecific.



### Guided activity: Apply IF function

The Stock Order Status column should contain the value 'REORDER' if the Stock Level is less than 5 and 'OK' in the contrary.

1. Select the first empty cell in the Stock Order Status column.
2. Type in the = operator to enable a function. Write the IF function sothat it first tests if Stock Level is less than 5, if so, it returns 'REORDER', else, it returns 'OK'.
3. Once you are sure the function returns the correct result, use the fillhandle to replicate the function to the rest of the column.

## AND function

In this section, you will apply the AND function to return 'TRUE' or 'FALSE' based on the outcome of two logical tests **both** being true.



### Guided activity: Apply AND function

1. Select the first empty cell in the High Demand? column.
2. Type in the = operator to enable a function. Write the AND function so that it tests whether **both** logical tests are true or not and returns 'TRUE' or 'FALSE' respectively.
3. The two logical tests are:
  - Rating is greater than 3
  - AND**
  - Popularity is greater than 3
4. Once you are sure the function returns the correct result, use the fillhandle to replicate the function to the rest of the column.



## OR function

In this section, you will apply the OR function to return 'TRUE' or 'FALSE' based on **one** of the outcomes of two logical tests being true.



### Guided activity: Apply OR function

1. Select the first empty cell in the Display in Shop? column.
2. Type in the = operator to enable a function. Write the OR function so that it tests whether at least **one** of the logical tests are true or not and returns 'TRUE' or FALSE' respectively.
3. The two logical tests are:
  - Rating is greater than 3
  - OR**
  - Popularity is greater than 3
4. Once you are sure the function returns the correct result, use the fill handle to replicate the function to the rest of the column.

## MIN and MAX function

In this section, you will apply the MIN and MAX functions to return the minimum number value and maximum number value from a given set of numbers.



### Guided activity: Apply MIN and MAX function

1. Select the empty cell next to 'Lowest Book Price'.
2. Type in the = operator to enable a function. Write the MIN function so that it finds the minimum number value from all of the book prices.
3. Once you are sure the function returns the correct result, use the fill handle to replicate the function to the rest of the column.
4. Carry out the same steps using the MAX function in the cell next to 'Highest Book Price'.

## COUNTIF Function

In this section, you will apply COUNTIF function to count the number of times a specific value is present in a set of values.



### Guided activity: Apply COUNTIF function

1. Select the first empty cell in the 'COUNTIF' column for the first author.
2. Type in the = operator to enable a function. Write the COUNTIF function so it selects the entire Author column as the range, then the name of the author as the criteria (by selecting the cell with the author's name in it or typing the name in speech marks).



**Helpful hint**

Be sure to use absolute cell referencing to select the same table array for all cells in that column by adding \$ to cell column and row references.

3. Once you are sure the function returns the correct result, use the fill handle to replicate the function to the rest of the column.

**SUMIF Function**

In this section, you will apply SUMIF function to sum up all the number values that match a specific criterion.

**Guided activity:**

Apply SUMIF function

1. To calculate the total of all prices for each author separately, we can use the SUMIF function, which will sum the prices, if they belong to a specific author (of choice). Select the first empty cell in the 'SUMIF' column for the first author.
2. Type in the = operator to enable a function. Write the SUMIF function so that selects the entire Author column as the range, then the name of the author as the criteria (by selecting the cell with the author's name in it or typing the name in speech marks, followed by the entire Price column as the sum range (which are the values to add up if they meet the Author criteria).

**Helpful hint**

Be sure to use absolute cell referencing to select the same table array for all cells in that column by adding \$ to cell column and row references.

3. Once you are sure the function returns the correct result, use the fill handle to replicate the function to the rest of the column.

## Conditional formatting

In this section, you will apply the conditional formatting feature to highlight cells values based on specific criteria.



### Guided activity:

Apply Conditional formatting

The values in the Rating column should be formatted as follows:

- a. Lowest values in red
- b. Highest values in red

Using the *colour scales* formatting tool allows you to set the colour scales as above, with the numbers ranging between the colours.

1. Select all the values in which the conditional formatting should be applied – all values in the Rating column.
2. Go to the 'Home' menu from the ribbon, then select 'Conditional Formatting'.
3. From the list of options, select 'Colour Scales'.
4. Select the option to set 'More Rules'.
5. Select yellow for the lowest value and orange for the highest value.
6. Click OK to apply the formatting.

# Activity on formulas and functions

## Task - Species Dataset

You have been tasked to explore and apply various Excel formulas and functions to the Species dataset to generate specific insights.

**Objective:** Familiarise yourself with various logical, lookup and aggregate formulas and functions in Excel using data from the Species dataset.

The main table in the dataset consists of 12 rows and 11 columns. There is also a small table, of just 1 row of data and 8 columns, summarising some elements of the main dataset.

	Column headers	Definition
1	Species	The name of the species.
2	Num Legs	The number of legs the species has.
3	Num Eyes	The number of eyes the species has.
4	Danger Level 1-4	The perceived danger level 1-4 (low-high)
5	Category	Mammal/Fish/Amphibian/Reptile
6	Deadly or Safe?	Deadly/Safe based on Danger Level
7	Ordinary	True/False based on Num Legs and Num Eyes
8	Extraordinary	True/False based on Num Legs and Num Eyes
9	Strength Factor	The strength value of the species based on Num Legs, Num Eyes and Danger Level
10	Blooded	Whether the species is Warm/Cold/Both blooded based on Category
11	Habitat	The species' habitat being Land/Water/Both based on Species
	Column headers	Definition
1	Min Num Legs	Minimum number of legs from all species
2	Max Num Legs	Maximum number of legs from all species
3	Min Num Eyes	Minimum number of eyes from all species
4	Max Num Eyes	Maximum number of eyes from all species
5	Num Ordinary	Number of ordinary species
6	Num Extraordinary	Number of extraordinary species
7	Sum Danger Levels	The sum of all danger levels of all species

8	Sum Danger Levels = 4	The sum of all danger levels that are 4
9	Sum Danger Levels for Mammals	The sum of all danger levels for mammals



#### Independent activity:

Apply formulas and functions to multiple columns on the Species dataset.

1. Open the 'Species.XLSX' workbook
2. Enable filters
3. **Input Num Legs data:**
  - Use your own knowledge and online research to enter the data relating to each species.
4. **Input Num Eyes data:**
  - Use your own knowledge and online research to enter the data relating to each species.
5. **Input Danger Level 1-4 data:**
  - Use your own knowledge and online research to enter the data relating to each species.
6. **Apply conditional formatting colour scales to Danger Level 1-4:**
  - The values should be coloured from yellow (lowest value) to red (highest value).
7. **Input Category data:**
  - Use the drop-down feature in each row to select the correct value based on your own knowledge and online research.
  - The values to choose from are Mammal, Fish, Reptile, Amphibian, Arachnid, Insect, Bird, and Echinoderm.
8. **Use the Sort feature to sort the Species column into alphabetical order:**
  - This should also sort all related data belonging to that species.



#### Helpful hint

Select only the actual Species values and not the entire column since there is non-related data further down in the same column.

9. **Apply the IF function to populate Deadly or Safe data:**
  - Apply the IF function to establish if the species is deadly or safe.
  - This is based on the danger level. If the danger level is greater than 2, it should return the value 'Deadly', otherwise, it should return 'Safe'.
10. **Apply the AND function to populate Ordinary data:**
  - Apply the AND function to return TRUE for all species that have 4 legs AND 2 eyes.
  - By default, it will return FALSE in the contrary.
11. **Apply the OR function to populate Extraordinary data:**

- Apply the OR function to return TRUE for all species that have more than 4 legs OR do not have 2 eyes.
- By default, it will return FALSE in the contrary.

12. **Apply a formula to calculate Strength Factor:**

- The strength factor of a species is a number value calculated by adding the number of legs and eyes and then multiplying this by the danger level.



**Helpful hint**

Calculation operators work as follows:

- +** Add
- Subtract
- /** Divide
- \*** Multiply
- ( )** Brackets for order of calculation
- =** Equals
- <>** Not equal to

This equation has multiple operations, so be sure to put brackets in the correct place, or it will return different results.

13. **Apply the VLOOKUP function to populate Blooded data:**

- Apply the VLOOKUP function and the lookup table in the 'Lookup Tables' worksheet to return the correct value relating to the species' category.
- Remember to use absolute cell referencing.

14. **Apply conditional formatting to Blooded:**

- The values should be coloured yellow, orange, and blue to the values Warm, Both, and Cold, respectively.

15. **Apply the VLOOKUP or XLOOKUP function to populate Habitat data:**

- Apply the VLOOKUP function and the lookup table in the 'Lookup Tables' worksheet to return the correct value relating to the actual species.
- Remember to use absolute cell referencing.
- You may wish to enhance your understanding and application of skills by using an XLOOKUP function instead.



**Reference Material:**

Excel XLOOKUP Function:

<https://support.microsoft.com/en-au/office/xlookup-function-b7fd680e-6d10-43e6-84f9-88eae8bf5929>

16. Apply the MIN and MAX functions to populate the Min Num Legs, Num Legs, Min Num Eyes and Max Num Eyes.

17. Apply the COUNTIF function to return the number Ordinary and Extraordinary species.
18. Apply the SUMIF function to return the sum of all Danger Level values.
19. Apply the SUMIF function to return the sum of all Danger Level values for mammals.
20. Apply the SUMIF function to return the sum of all Danger Level values greater than 4.
21. Optional Challenge: Apply the FILTER function to populate the table named 'Species Filtered by Category':
  - In this table, use the FILTER function to return the Species according to each Category as follows:
    - Column A: All the Mammal Species listed as rows.
    - Column B: All the Fish Species listed as rows.
    - Column C: All the Reptile Species listed as rows.
    - Column D: All the Amphibian Species listed as rows.

**Reference material:**

Excel Filter Function:

<https://support.microsoft.com/en-au/office/filter-function-f4f7cb66-82eb-4767-8f7c-4877ad80c759>

22. Save your MS Excel file.

