Chapter 3.2: Microsoft Excel

Computer Fundamentals and Introduction to Programming

Worksheets | Data entry | Formulas | Data analysis | Charts

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INTRODUCTION

Learning Outcomes

Workbook

Use the ideas of sheet, cell, row, column and range.

Formulas

Calculate with cell references and basic functions.

Organizing data

Apply tables, sorting, filtering and validation.

Visualization

Pick a chart that fits the data and present it clearly.

INTRODUCTION

What Is Excel For?

Calculation

Repeatable calculations with formulas and functions.

List management

Organize records in rows and columns.

Analysis

Sorting, filtering and summarizing.

Visualization

Trends and comparisons with charts.

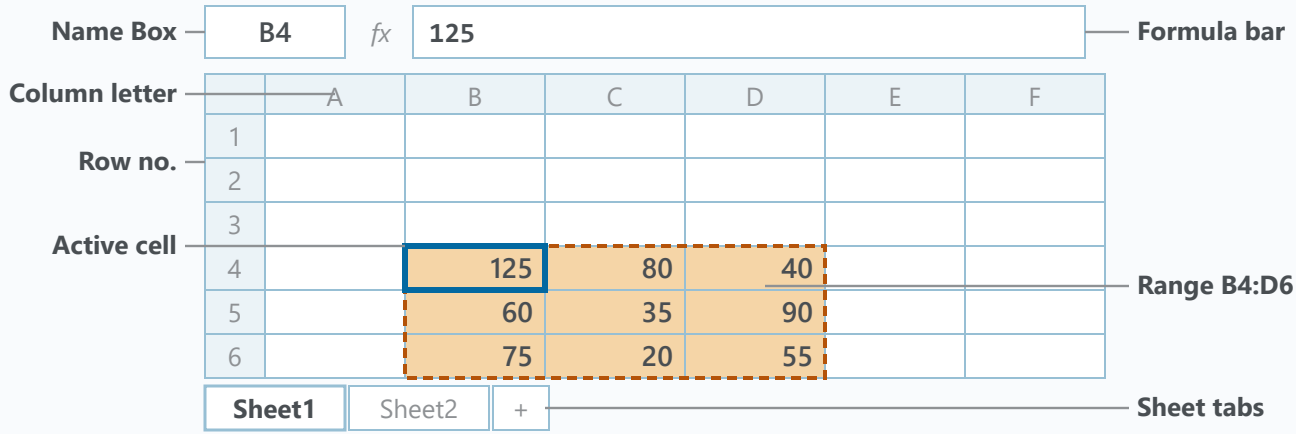
Planning

Budgets, schedules, stock and task tracking.

Sharing

Co-editing and commenting on a workbook.

Basic Concepts



Workbook

The whole Excel file (.xlsx).

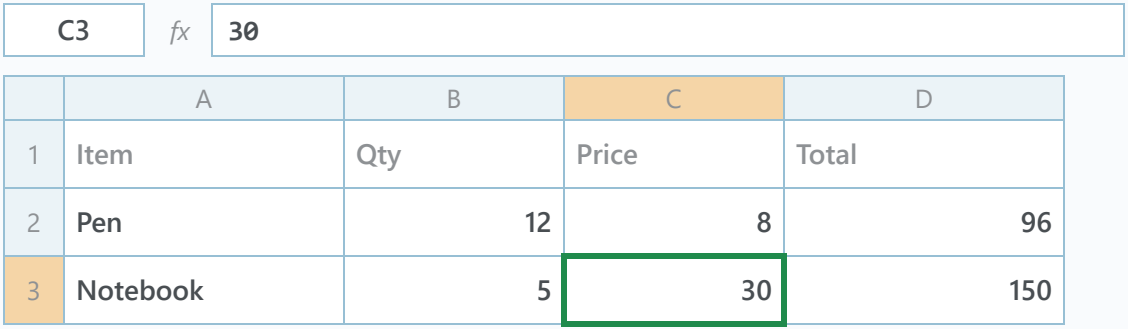
Worksheet

The grid of cells inside a workbook.

Cell / range

B4 is a single cell; B4:D6 is a rectangular range.

The Grid and Cell References



C3 = where column **C** meets row **3**. The Name Box shows the address of the selected cell; the formula bar shows its contents.

The Grid and Cell References

D2 *fx* =B2*C2

	A	B	C	D
1	Item	Qty	Price	Total
2	Pen	12	8	96
3	Notebook	5	30	150

D2 holds a formula: `=B2*C2`. The cell shows the result (96); the formula bar shows the formula itself.

The Grid and Cell References

D3 | *fx* | =B3*C3

	A	B	C	D
1	Item	Qty	Price	Total
2	Pen	12	8	96
3	Notebook	5	30	150

D3: `=B3*C3` → 5·30 = 150. A formula uses **addresses**, not values.

The Grid and Cell References

B2 *fx* 20

	A	B	C	D
1	Item	Qty	Price	Total
2	Pen	20	8	160
3	Notebook	5	30	150

B2 goes from 12 to 20, and D2 recalculates by itself (160). That is the power of references.

DATA ENTRY

Data Types

Pen	1250	1-Mar-2024	TRUE	24	#DIV/0!
Text left	**Number** right	**Date** right	**Logical** center	**Formula** =B2*2 result right	**Error value** center

Text

Names, descriptions and categories.

Number

A quantity that can take part in calculations.

Date and time

Time information that Excel stores as serial numbers.

Logical value

TRUE or FALSE.

Formula

A calculation that starts with an equals sign.

Error value

A special result that reports a problem with a formula or the data.

DATA ENTRY

Entering and Editing Data

Edit cell	F2	Confirm entry	Enter
New line in a cell	Alt+Enter	Clear contents	Delete
Select row	Shift+Space	Select column	Ctrl+Space

- Numbers stored as text can break sorting and calculations.
- One observation per cell and one attribute per column make analysis easier.

A2 | *fx* | Atatürk Cad. No:5

	A	B	C
1	Address	Amount	Code
2	Atatürk Cad. No:5 Giresun	1250	00125
3	İstasyon Sok. 3	980	00087

Edit

F2 / double-click
Edit mode; shown in the status bar

Alt+Enter
new line in the same cell (Giresun)

Green triangle
number stored as text (00125); left-aligned, SUM ignores it

WORKSHEETS

Rows, Columns and Sheets

Before scrolling

	A	B	C
1	Name	Midterm	Final
2	Ali	70	80
3	Ece	90	85
4	Can	60	72
5	Deniz	55	64

Scrolled down: row 1 stays put

	A	B	C
1	Name	Midterm	Final
41	Selin	88	91
42	Burak	76	70
43	Mert	65	81
44	Zehra	93	90

View → Freeze Panes → Freeze Top Row

Insert / delete

Changes the structure by shifting cells at the selected spot.

Size

Row height and column width are set by hand or automatically.

Hiding

Removes data from view without deleting it.

Freezing

Keeps header rows or columns visible while you scroll.

Sheet name

Use a short name that describes the contents.

Sheet layout

Keep data, calculation and report sheets apart.

FORMATTING

Cell Formatting

Before

	A	B	C
1	Item	Price	Qty
2	Pen	1250	12
3	Notebook	35.5	40
4	Eraser	8	100



After

	A	B	C
1	**Item**	**Price**	**Qty**
2	Pen	₺1,250.00	12
3	Notebook	₺35.50	40
4	Eraser	₺8.00	100

Font and fill

Set off headers and key areas.

Alignment

Positions text within a cell.

Borders

Can mark table edges; overuse hurts readability.

Wrap Text

Splits long content over several lines within a cell.

Merging

OK for titles; in data ranges it gets in the way of sorting and filtering.

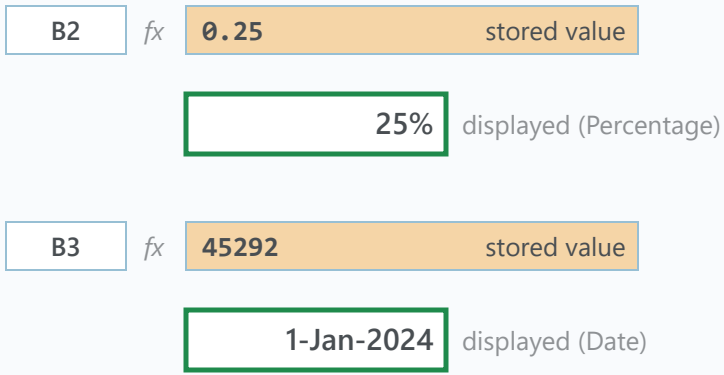
Cell styles

Apply repeated formats consistently.

FORMATTING

Number Formats

Value	Format	Display
0.25	Percentage	25%
1250	Currency	₺1,250.00
45292	Date	1-Jan-2024
0.5	Time	12:00
123456789	Scientific	1.23E+08

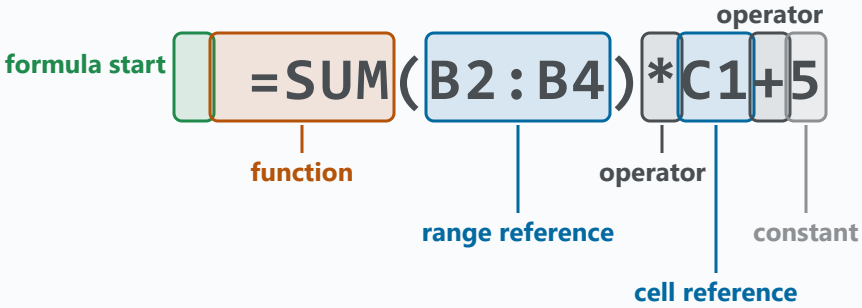


A format changes only the display; calculations use the underlying value shown in the formula bar.

FORMULAS

Formula Basics

Excel formulas start with an equals sign and can contain constants, references, operators and functions.



- Parentheses make the order explicit: `=(B2+C2)/2`.
- A formula recalculates when the cells it refers to change.
- Keeping constants in their own cells, not buried in formulas, makes maintenance easier.

FORMULAS

Operator Precedence

Precedence	Operation	Example
1	Parentheses	`=(A1+B1)*2`
2	Negation (sign)	`=-A1`
3	Percentage	`=A1*10%`
4	Exponent	`=A1^2`
5	Multiplication and division	`=A1*B1/C1`
6	Addition and subtraction	`=A1+B1-C1`
7	Joining	`=A1&" TL"`
8	Comparison	`=A1>B1`

Operations of equal precedence go left to right: `=12/3*2` → 8.

A Formula Evaluated Step by Step

	B
1	4

B1 = 4

$$=2+3*(B1-1)^2$$

reference → 4

Excel first replaces references with their values: B1 → 4.

A Formula Evaluated Step by Step

	B
1	4

B1 = 4

=2+3*(4-1)^2

inside parentheses → 3

Parentheses come first: (4-1) → 3.

A Formula Evaluated Step by Step

	B
1	4

B1 = 4

=2+3*3^2

exponent → 9

Then the exponent: 3^2 → 9.

A Formula Evaluated Step by Step

	B
1	4

B1 = 4

=2+3*9

multiplication → 27

Then multiplication: 3*9 → 27.

A Formula Evaluated Step by Step

	B
1	4

B1 = 4

=2+27

addition → 29

Addition last: 2+27 → 29.

A Formula Evaluated Step by Step

	B
1	4

B1 = 4

=29

result

The result is 29. Without the parentheses, =2+3*4-1^2 → 2+12-1 = 13.

A Formula Evaluated Step by Step

=-2^2

negation (sign) → -2

In Excel the sign (negation) is applied **before** the exponent: -2 becomes (-2) first.

A Formula Evaluated Step by Step

```
=(-2)^2
```

exponent → 4

(-2)^2 = 4. To get the mathematical $-2^2 = -4$, write =-(2^2) or =0-2^2.

A Formula Evaluated Step by Step

=4

result

The result is 4.

FORMULAS

Cell References

Relative

Shifts with the row and column when copied.

`A1`

Absolute

Stays fixed when copied.

`$A$1`

Mixed

Only the row or the column is fixed.

`$A1 · A$1`

Another sheet

Prefixed with the sheet name.

`Sales!B2`

Range

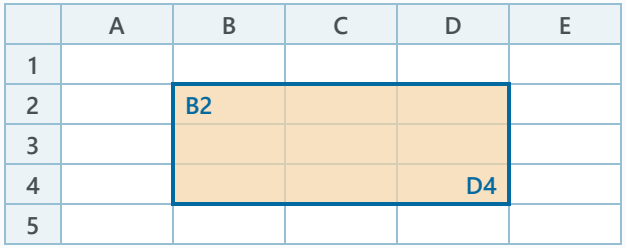
Covers everything from the first to the last cell.

`A1:A10`

Named range

A meaningful name makes the formula readable.

`VAT_Rate`



Range B2:D4 = 3 columns × 3 rows = 9 cells

Reference to another sheet

C1 *fx* `=Sales!B2*VAT_Rate`

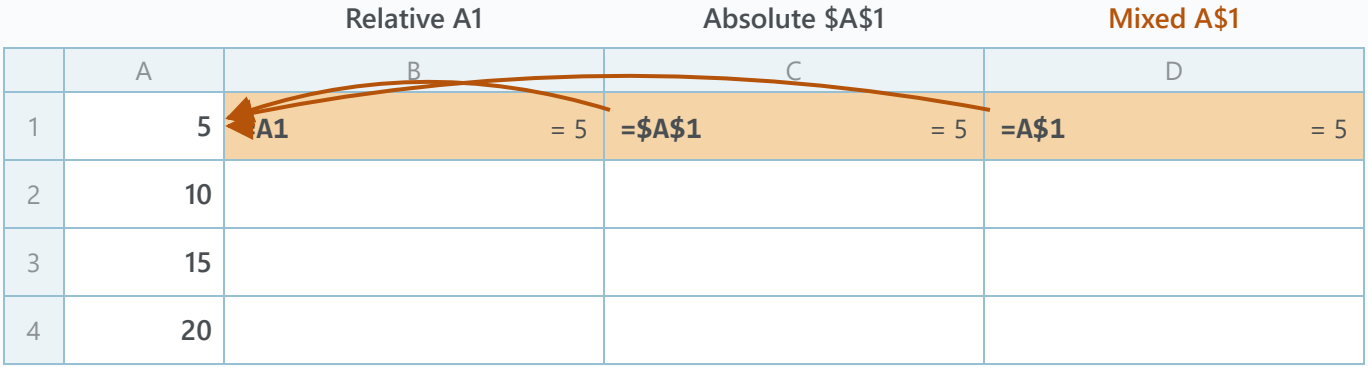
B2 on the Sales sheet = 1000

cell named VAT_Rate = 0.2 → C1 = 200

Summary | Sales | Settings

If the name has a space, quote it: 'Sales 2024'!B2

References When Filling Down



Three different formulas go in B1, C1 and D1; all three point to A1 (5).

References When Filling Down

		Relative A1	Absolute $A$1	Mixed A$1
	A	B	C	D
1	5	**=A1** = 5	**=$A$1** = 5	**=A$1** = 5
2	10	**=A2** = 10	**=$A$1** = 5	**=A$1** = 5
3	15			
4	20			

One row down with the fill handle: **A1** is relative, so it became A2; **$A$1** and **A$1** kept the row fixed.

References When Filling Down

		Relative A1	Absolute $A$1	Mixed A$1
	A	B	C	D
1	5	=A1 = 5	=$A$1 = 5	=A$1 = 5
2	10	=A2 = 10	=$A$1 = 5	=A$1 = 5
3	15	=A3 = 15	=$A$1 = 5	=A$1 = 5
4	20			

One more row: the relative reference moved to A3 (15). The absolute and mixed references still point to A1.

References When Filling Down

		Relative A1	Absolute $A$1	Mixed A$1
	A	B	C	D
1	5	**=A1** = 5	**=$A$1** = 5	**=A$1** = 5
2	10	**=A2** = 10	**=$A$1** = 5	**=A$1** = 5
3	15	**=A3** = 15	**=$A$1** = 5	**=A$1** = 5
4	20	**=A4** = 20	**=$A$1** = 5	**=A$1** = 5

Result: when filling down, **A$1** behaves like an absolute reference (the row is locked). To see the difference, fill right.

References When Filling Right

		A	B	C	D
	1	5	7	9	11
	2				
Relative A1	3	=A1 = 5			
Absolute $A$1	4	=$A$1 = 5			
Mixed A$1	5	=A$1 = 5			
Mixed $A1	6	=$A1 = 5			

Row 1 holds data (5, 7, 9, 11). Four kinds of reference go in A3:A6; all point to A1.

References When Filling Right

		A	B	C	D
	1	5	7	9	11
	2				
Relative A1	3	**=A1** = 5	**=B1** = 7		
Absolute $A$1	4	**=$A$1** = 5	**=$A$1** = 5		
Mixed A$1	5	**=A$1** = 5	**=B$1** = 7		
Mixed $A1	6	**=$A1** = 5	**=$A1** = 5		

One column right: **A1** → B1 and **A$1** → B$1 (the column moved); **$A$1** and **$A1** kept the column locked.

References When Filling Right

		A	B	C	D
	1	5	7	9	11
	2				
Relative A1	3	**=A1** = 5	**=B1** = 7	**=C1** = 9	
Absolute $A$1	4	**=$A$1** = 5	**=$A$1** = 5	**=$A$1** = 5	
Mixed A$1	5	**=A$1** = 5	**=B$1** = 7	**=C$1** = 9	
Mixed $A1	6	**=$A1** = 5	**=$A1** = 5	**=$A1** = 5	

In column C, the relative and A$1-style references point to C1 (9); a column letter with a $ never changes.

References When Filling Right

		A	B	C	D
	1	5	7	9	11
	2				
Relative A1	3	**=A1** = 5	**=B1** = 7	**=C1** = 9	**=D1** = 11
Absolute $A$1	4	**=$A$1** = 5	**=$A$1** = 5	**=$A$1** = 5	**=$A$1** = 5
Mixed A$1	5	**=A$1** = 5	**=B$1** = 7	**=C$1** = 9	**=D$1** = 11
Mixed $A1	6	**=$A1** = 5	**=$A1** = 5	**=$A1** = 5	**=$A1** = 5

The rule: **$** locks the part right after it. $A$1 locks both, A$1 only the row, $A1 only the column.

Mixed References: A Multiplication Table

B2 | *fx* | `=$A2*B$1`

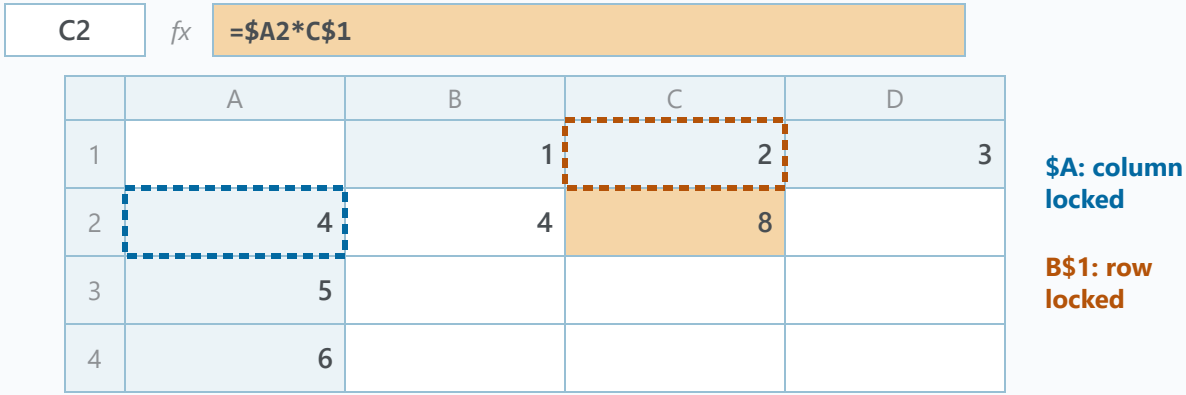
	A	B	C	D
1		1	2	3
2	4	4		
3	5			
4	6			

$A: column locked

B$1: row locked

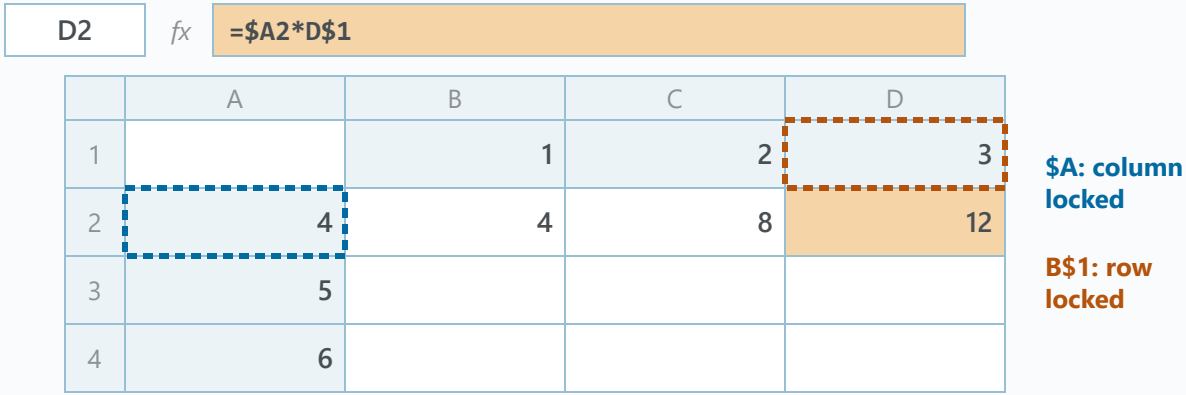
One formula goes in B2: `=$A2*B$1` → 4·1 = 4. Column A and row 1 are locked.

Mixed References: A Multiplication Table



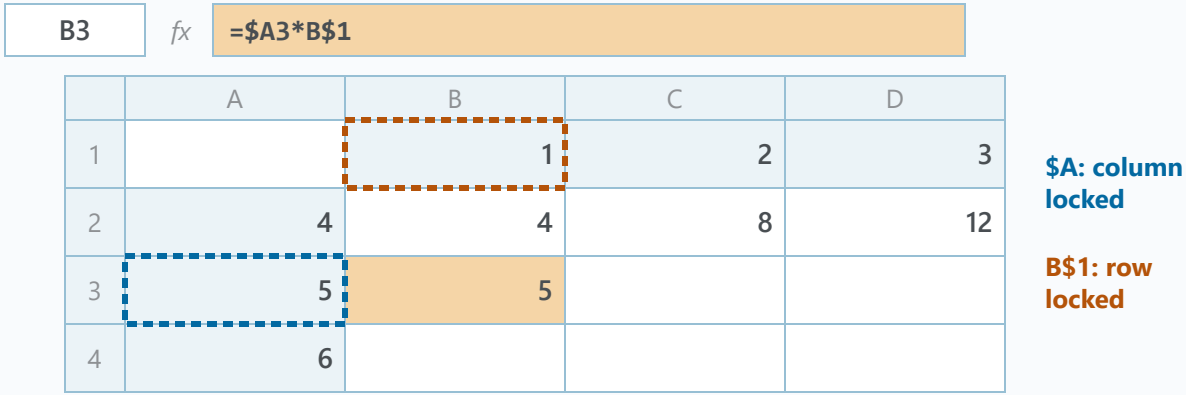
C2: `=$A2*C$1` → 8. Copied right, only the unlocked column letter changed (B→C).

Mixed References: A Multiplication Table



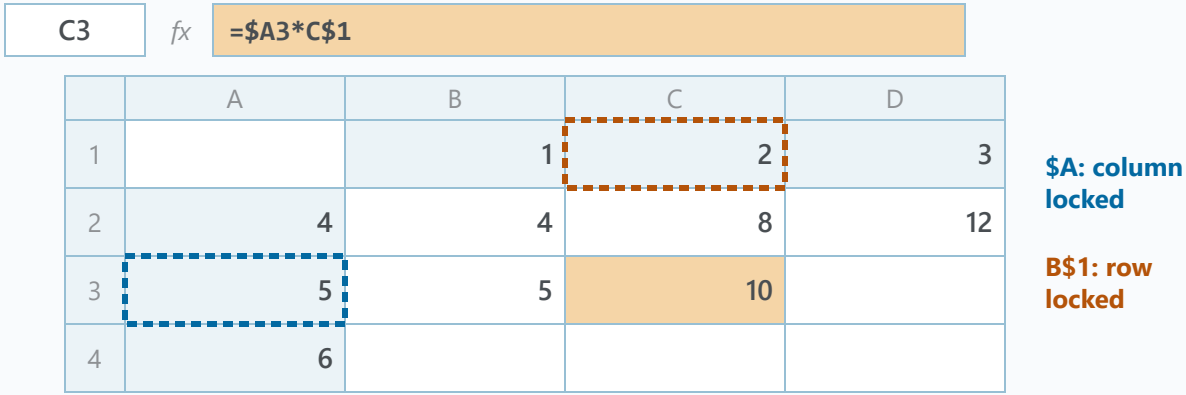
D2: `=$A2*D$1` → 12. Copied right, only the unlocked column letter changed (B→D).

Mixed References: A Multiplication Table



B3: `=$A3*B$1` → 5. Copied down, only the unlocked row number changed.

Mixed References: A Multiplication Table



C3: `=$A3*C$1` → 10. Copied down, only the unlocked row number changed.

Mixed References: A Multiplication Table

D3 *fx* `=$A3*D$1`

	A	B	C	D
1		1	2	3
2	4	4	8	12
3	5	5	10	15
4	6			

$A: column locked

B$1: row locked

D3: `=$A3*D$1` → 15. Copied down, only the unlocked row number changed.

Mixed References: A Multiplication Table

D4 *fx* `=$A4*D$1`

	A	B	C	D
1		1	2	3
2	4	4	8	12
3	5	5	10	15
4	6	6	12	18

$A: column locked

B$1: row locked

The last row is filled too: one formula built the whole table; every cell multiplies its row's A value by row 1 of its column.

FORMULAS · STEP BY STEP

F4 and the Absolute Reference Shortcut

F2 | *fx* | **=B2*E1**

F4 not pressed yet

Column (E): **shifts**

Row (1): **shifts**

when filling down / right

=B2*E1 is typed. With the cursor on the **E1** reference, press **F4**. E1 is relative: filled down it becomes E2, E3.

Step 1 / 5

F4 works while editing a formula with the cursor on a reference. Laptops may need Fn+F4; on a Mac the shortcut may differ. You can also type the $ yourself.

F4 and the Absolute Reference Shortcut

F2 *fx* =B2*$E$1

Column (E): constant

Row (1): constant

F4 1st press

when filling down / right

1st F4: **$E$1**, absolute. Column and row are fixed; the VAT rate is always read from E1.

F4 works while editing a formula with the cursor on a reference. Laptops may need Fn+F4; on a Mac the shortcut may differ. You can also type the $ yourself.

F4 and the Absolute Reference Shortcut

F2 *fx* **=B2*E$1**

Column (E): **shifts**

Row (1): **constant**

F4 2nd press

when filling down / right

2nd F4: **E$1**, mixed. Only the row is fixed; the column letter changes when filled right.

F4 works while editing a formula with the cursor on a reference. Laptops may need `Fn+F4`; on a Mac the shortcut may differ. You can also type the `$` yourself.

F4 and the Absolute Reference Shortcut

F2 *fx* **=B2*$E1**

Column (E): constant

Row (1): shifts

F4 3rd press

when filling down / right

3rd F4: **$E1**, mixed. Only the column is fixed; the row number changes when filled down.

F4 works while editing a formula with the cursor on a reference. Laptops may need Fn+F4; on a Mac the shortcut may differ. You can also type the $ yourself.

F4 and the Absolute Reference Shortcut

F2 *fx* **=B2*E1**

Column (E): **shifts**

Row (1): **shifts**

F4 4th press: back to start

when filling down / right

4th F4: the cycle is complete, back to **E1** (relative). When you reach the form you want, press **Enter**.

F4 works while editing a formula with the cursor on a reference. Laptops may need Fn+F4; on a Mac the shortcut may differ. You can also type the $ yourself.

A Relative Reference Error in a Copied Formula

	A	B	C	D	E
1	Item	Price	Discounted	Discount	20%
2	Notebook	200			
3	Pen	150			
4	Eraser	80			

Three prices are in column B and the discount rate in a single cell: **E1 = 20%**. The discounted-price formula goes in C2.

Step 1 / 8

```
C2: =B2*(1-E1)
C3: =B3*(1-E2)    ← when copied
C4: =B4*(1-E3)
C2: =B2*(1-$E$1)
C3: =B3*(1-$E$1)
C4: =B4*(1-$E$1)
```

VARIABLES

C2 = – C3 = – C4 = –

A Relative Reference Error in a Copied Formula

	A	B	C	D	E
1	Item	Price	Discounted	Discount	20%
2	Notebook	200	160		
3	Pen	150			
4	Eraser	80			

=B2*(1-E1)

C2: **=B2*(1-E1)** → 200 × 0.8 = **160**. Correct.

Step 2 / 8

```
▶ C2: =B2*(1-E1)
2 C3: =B3*(1-E2)    ← when copied
3 C4: =B4*(1-E3)
4 C2: =B2*(1-$E$1)
5 C3: =B3*(1-$E$1)
6 C4: =B4*(1-$E$1)
```

VARIABLES

C2 = **160** | C3 = – | C4 = –

A Relative Reference Error in a Copied Formula

	A	B	C	D	E
1	Item	Price	Discounted	Discount	20%
2	Notebook	200	160		
3	Pen	150	150		
4	Eraser	80			

`=B3*(1-E2)`

Copied down with the fill handle, both references move one row: **=B3*(1-E2)**. E2 is empty, and an empty cell counts as 0 → 150 × 1 = **150**. No discount was applied!

Step 3 / 8

```
1 C2: =B2*(1-E1)
▶ C3: =B3*(1-E2)     ← when copied
3 C4: =B4*(1-E3)
4 C2: =B2*(1-$E$1)
5 C3: =B3*(1-$E$1)
6 C4: =B4*(1-$E$1)
```

VARIABLES

C2 = **160** C3 = **150** C4 = **–**

A Relative Reference Error in a Copied Formula

	A	B	C	D	E
1	Item	Price	Discounted	Discount	20%
2	Notebook	200	160		
3	Pen	150	150		
4	Eraser	80	80		

`=B4*(1-E3)`

C4: **=B4*(1-E3)** → 80. Excel **shows no error message**: the results are numbers, so at first glance they don't look wrong. This is the sneakiest relative-reference bug.

Step 4 / 8

```
1 C2: =B2*(1-E1)
2 C3: =B3*(1-E2)     ← when copied
▶ C4: =B4*(1-E3)
4 C2: =B2*(1-$E$1)
5 C3: =B3*(1-$E$1)
6 C4: =B4*(1-$E$1)
```

VARIABLES

C2 = **160** C3 = **150** C4 = **80**

A Relative Reference Error in a Copied Formula

	A	B	C	D	E
1	Item	Price	Discounted	Discount	20%
2	Notebook	200	160		
3	Pen	150			
4	Eraser	80			

`=B2*(1-$E$1)`

The fix: in C2, with the cursor on E1, press **F4** → **=B2*(1-$E$1)**. B2 stays relative (each row needs its own price); E1 becomes absolute.

Step 5 / 8

```
1 C2: =B2*(1-E1)
2 C3: =B3*(1-E2)     ← when copied
3 C4: =B4*(1-E3)
▶ C2: =B2*(1-$E$1)
5 C3: =B3*(1-$E$1)
6 C4: =B4*(1-$E$1)
```

VARIABLES

C2 = **160** C3 = – C4 = –

A Relative Reference Error in a Copied Formula

	A	B	C	D	E
1	Item	Price	Discounted	Discount	20%
2	Notebook	200	160		
3	Pen	150	120		
4	Eraser	80			

`=B3*(1-$E$1)`

Copied down: **=B3*(1-$E$1)**. It moved to B3 while $E$1 stayed put → 150 × 0.8 = **120**.

Step 6 / 8

```
1 C2: =B2*(1-E1)
2 C3: =B3*(1-E2)     ← when copied
3 C4: =B4*(1-E3)
4 C2: =B2*(1-$E$1)
▶ C3: =B3*(1-$E$1)
6 C4: =B4*(1-$E$1)
```

VARIABLES

C2 = **160** C3 = **120** C4 = **–**

A Relative Reference Error in a Copied Formula

	A	B	C	D	E
1	Item	Price	Discounted	Discount	20%
2	Notebook	200	160		
3	Pen	150	120		
4	Eraser	80	64		

`=B4*(1-$E$1)`

C4: **=B4*(1-$E$1)** → 80 × 0.8 = **64**. Change the rate to 30% and all three results update at once.


```
1 C2: =B2*(1-E1)
2 C3: =B3*(1-E2)     ← when copied
3 C4: =B4*(1-E3)
4 C2: =B2*(1-$E$1)
5 C3: =B3*(1-$E$1)
▶ C4: =B4*(1-$E$1)
```

VARIABLES

C2 = **160** C3 = **120** C4 = **64**

A Relative Reference Error in a Copied Formula

	A	B	C	D	E
1	Item	Price	Discounted	Discount	20%
2	Notebook	200	160		
3	Pen	150	120		
4	Eraser	80	64		

```
=B2*(1-$E$1)
=B3*(1-$E$1)
=B4*(1-$E$1)
```

Check: **Formulas** → **Show Formulas** (Ctrl + `) shows formulas instead of results. If a reference to a single cell must stay the same on every row, look for the $.

Step 8 / 8

```
1 C2: =B2*(1-E1)
2 C3: =B3*(1-E2)     ← when copied
3 C4: =B4*(1-E3)
4 C2: =B2*(1-$E$1)
5 C3: =B3*(1-$E$1)
6 C4: =B4*(1-$E$1)
```

VARIABLES

`C2 = 160` `C3 = 120` `C4 = 64`

Basic Functions

Function	Example	Result
SUM	`=SUM(B2:B10)`	Adds the values
AVERAGE	`=AVERAGE(B2:B10)`	Arithmetic mean
MAX	`=MAX(B2:B10)`	Largest value
MIN	`=MIN(B2:B10)`	Smallest value
COUNT	`=COUNT(B2:B10)`	Number of numeric cells
COUNTIF / SUMIF	`=COUNTIF(B2:B10,">=50")`	Counts / sums the cells that meet a condition
TODAY	`=TODAY()`	Current date

Functions on the Same Data

	B
1	Score
2	12
3	7
4	*none*
5	20
6	
7	5

B4: text, B6: empty cell

`=SUM(B2:B7)`	44	adds the numbers
`=AVERAGE(B2:B7)`		
`=MAX(B2:B7)`		
`=MIN(B2:B7)`		
`=COUNT(B2:B7)`		

SUM adds only the numbers: 12+7+20+5 = 44. The text “none” and the empty cell are ignored.

Functions on the Same Data

	B
1	Score
2	12
3	7
4	*none*
5	20
6	
7	5

B4: text, B6: empty cell

`=SUM(B2:B7)`	44	adds the numbers
`=AVERAGE(B2:B7)`	11	sum / count
`=MAX(B2:B7)`		
`=MIN(B2:B7)`		
`=COUNT(B2:B7)`		

AVERAGE = 44 / 4 = 11. The divisor is 4, not 6: only numbers count (an empty cell is not taken as 0).

Functions on the Same Data

	B
1	Score
2	12
3	7
4	*none*
5	20
6	
7	5

B4: text, B6: empty cell

`=SUM(B2:B7)`	44	adds the numbers
`=AVERAGE(B2:B7)`	11	sum / count
`=MAX(B2:B7)`	20	largest
`=MIN(B2:B7)`		
`=COUNT(B2:B7)`		

MAX finds the largest number: 20.

Functions on the Same Data

	B
1	Score
2	12
3	7
4	*none*
5	20
6	
7	5

B4: text, B6: empty cell

`=SUM(B2:B7)`	44	adds the numbers
`=AVERAGE(B2:B7)`	11	sum / count
`=MAX(B2:B7)`	20	largest
`=MIN(B2:B7)`	5	smallest
`=COUNT(B2:B7)`		

MIN finds the smallest number: 5.

Functions on the Same Data

	B
1	Score
2	12
3	7
4	*none*
5	20
6	
7	5

B4: text, B6: empty cell

`=SUM(B2:B7)`	44	adds the numbers
`=AVERAGE(B2:B7)`	11	sum / count
`=MAX(B2:B7)`	20	largest
`=MIN(B2:B7)`	5	smallest
`=COUNT(B2:B7)`	4	how many numbers

COUNT counts the cells that hold numbers: 4. (For all non-empty cells, use COUNTA.)

FORMULAS

The IF Function

```
=IF(B2>=60, "Pass", "Fail")
```

Logical test

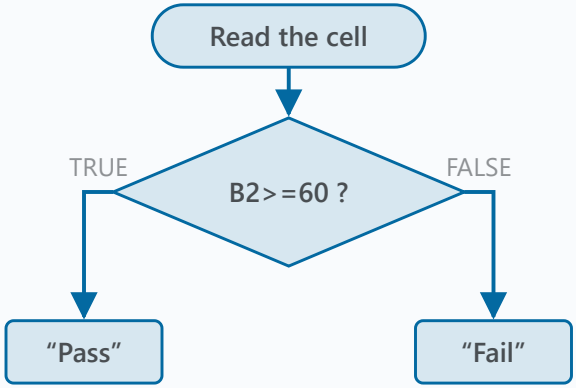
Produces TRUE or FALSE: `B2>=60`

Value if true

Returned when the test is TRUE: “Pass”

Value if false

Returned when the test is FALSE: “Fail”

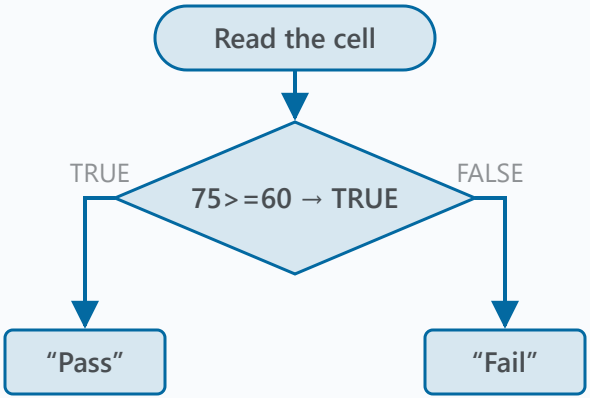


Function names and argument separators depend on Excel's language and regional settings: some localized versions translate the names and separate arguments with **;** (Turkish Excel writes `=EĞER(B2>=60;"Pass";"Fail")`).

IF Row by Row

C2	*fx*	`=IF(B2>=60,"Pass","Fail")`

	A	B	C
1	Name	Score	Result
2	Ali	75	
3	Can	45	
4	Ece	60	

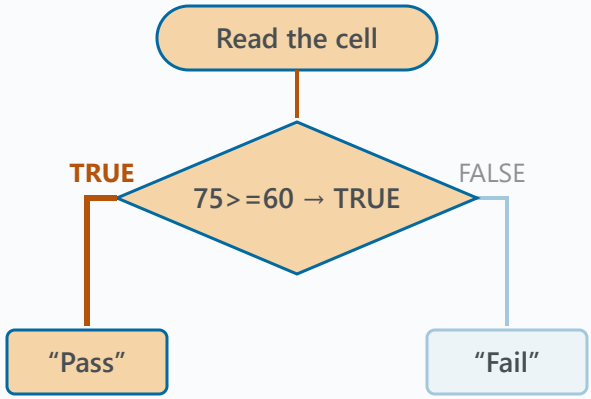


C2: B2 is 75; the test is **75>=60 → TRUE**.

IF Row by Row

C2 *fx* `=IF(B2>=60,"Pass","Fail")`

	A	B	C
1	Name	Score	Result
2	Ali	75	Pass
3	Can	45	
4	Ece	60	

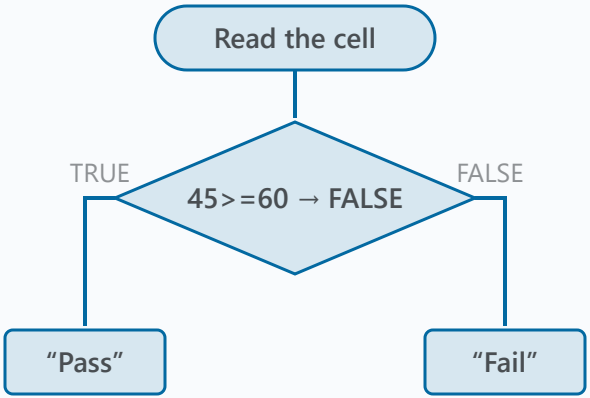


The test is TRUE, so the second argument is returned: C2 = “Pass”.

IF Row by Row

C3	*fx*	`=IF(B3>=60,"Pass","Fail")`

	A	B	C
1	Name	Score	Result
2	Ali	75	Pass
3	Can	45	
4	Ece	60	

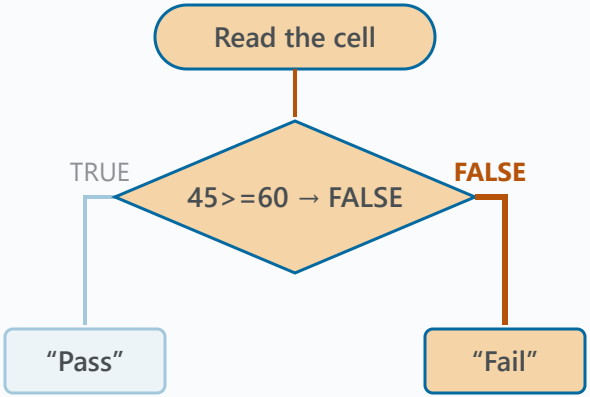


C3: B3 is 45; the test is **45>=60 → FALSE**.

IF Row by Row

C3 *fx* `=IF(B3>=60,"Pass","Fail")`

	A	B	C
1	Name	Score	Result
2	Ali	75	Pass
3	Can	45	Fail
4	Ece	60	

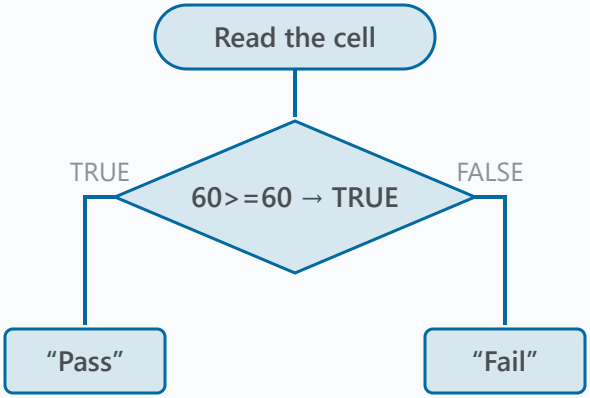


The test is FALSE, so the third argument is returned: C3 = “Fail”.

IF Row by Row

C4	*fx*	`=IF(B4>=60,"Pass","Fail")`

	A	B	C
1	Name	Score	Result
2	Ali	75	Pass
3	Can	45	Fail
4	Ece	60	

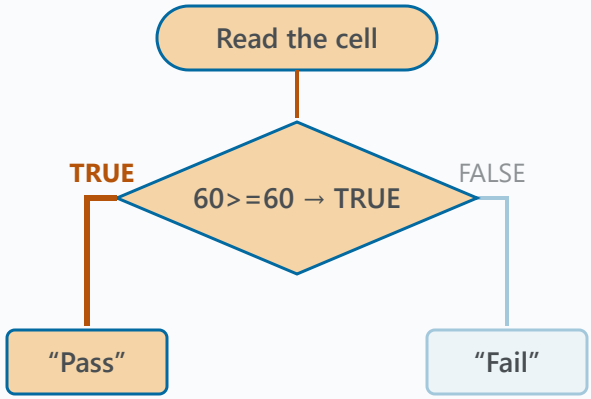


C4: B4 = 60; **60>=60 → TRUE** (>= includes equality; with > it would be FALSE).

IF Row by Row

C4 *fx* `=IF(B4>=60,"Pass","Fail")`

	A	B	C
1	Name	Score	Result
2	Ali	75	Pass
3	Can	45	Fail
4	Ece	60	Pass



The test is TRUE, so the second argument is returned: C4 = “Pass”.

FORMULAS

Logical Functions: AND, OR, NOT, IFERROR

Sample data: **B2 = 72** (grade), **C2 = 65** (attendance %), **D2 = 0**

Formula	Result	Description
`=AND(B2>=60,C2>=70)`	FALSE	Both must be TRUE; C2 fails
`=OR(B2>=60,C2>=70)`	TRUE	At least one TRUE is enough
`=NOT(B2>=60)`	FALSE	Turns TRUE into FALSE
`=IFERROR(B2/D2,"Can't compute")`	Can't compute	B2/0 is an error; text is shown instead
`=IF(B2>=85,"AA",IF(B2>=70,"BB","CC"))`	BB	Nested IF: the value of the first true condition
`=IF(AND(B2>=60,C2>=70),"Pass","Fail")`	Fail	AND serves as the test of IF

In a nested IF the conditions are tried in order; start from the highest threshold, and every IF closes its own `)`.

FORMULAS

COUNTIF and SUMIF

	A	B	C
1	Name	Dept	Score
2	Ali	Electrical	72
3	Ece	Computer	91
4	Can	Electrical	85
5	Deniz	Computer	64
6	Burak	Mechanical	78
7	Selin	Electrical	58

```
=COUNTIF(B2:B7,"Electrical")
```
counts rows where Dept = “Electrical” = 3

```
=SUMIF(B2:B7,"Electrical",C2:C7)
```

```
=COUNTIF(C2:C7,">=80")
```

COUNTIF(range, criteria): “Electrical” appears 3 times in the Dept column.

Step 1 / 3

COUNTIF and SUMIF

	A	B	C
1	Name	Dept	Score
2	Ali	Electrical	72
3	Ece	Computer	91
4	Can	Electrical	85
5	Deniz	Computer	64
6	Burak	Mechanical	78
7	Selin	Electrical	58

```
=COUNTIF(B2:B7,"Electrical")
```
counts rows where Dept = “Electrical” = 3

```
=SUMIF(B2:B7,"Electrical",C2:C7)
```
adds the scores of rows that meet the condition = 215

```
=COUNTIF(C2:C7,">=80")
```

SUMIF(range, criteria, sum_range): the Electrical rows' scores 72+85+58 = 215.

COUNTIF and SUMIF

	A	B	C
1	Name	Dept	Score
2	Ali	Electrical	72
3	Ece	Computer	91
4	Can	Electrical	85
5	Deniz	Computer	64
6	Burak	Mechanical	78
7	Selin	Electrical	58

`=COUNTIF(B2:B7,"Electrical")`
counts rows where Dept = “Electrical” = 3

`=SUMIF(B2:B7,"Electrical",C2:C7)`
adds the scores of rows that meet the condition = 215

`=COUNTIF(C2:C7,">=80")`
counts scores of 80 and above = 2

Criteria can be a comparison too: `">=80"` goes in quotes → 2 people (91, 85).

Lookup with VLOOKUP

D2 *fx* `=VLOOKUP("Ece",A2:B5,2,0)`

	A	B
1	Name	Score
2	Ali	72
3	Ece	91
4	Can	85
5	Deniz	64

lookup value: “Ece”
table: A2:B5 (searched in the first column)
column: 2 (Score)
0: exact match

VLOOKUP(lookup_value, table, col_index, 0): finds the value in the **first column** of the table and returns the requested column from the same row. A last argument of **0** (FALSE) means exact match; approximate match (1/TRUE) on sorted data is not for this job.

Lookup with VLOOKUP

D2 *fx* `=VLOOKUP("Ece",A2:B5,2,0)`

	A	B
1	Name	Score
2	Ali	72
3	Ece	91
4	Can	85
5	Deniz	64

lookup value: “Ece”
table: A2:B5 (searched in the first column)
column: 2 (Score)
0: exact match

A2 = “Ali” ≠ “Ece” → move down a row.

Lookup with VLOOKUP

D2 *fx* `=VLOOKUP("Ece",A2:B5,2,0)`

	A	B
1	Name	Score
2	Ali	72
3	Ece	91
4	Can	85
5	Deniz	64

lookup value: “Ece”
table: A2:B5 (searched in the first column)
column: 2 (Score)
0: exact match

A3 = “Ece” = “Ece” → **found**.

Lookup with VLOOKUP

D2 *fx* `=VLOOKUP("Ece",A2:B5,2,0)`

	A	B
1	Name	Score
2	Ali	72
3	Ece	91
4	Can	85
5	Deniz	64

lookup value: “Ece”
table: A2:B5 (searched in the first column)
column: 2 (Score)
0: exact match

D2 = 91

Column 2 of the found row, B3, is returned: **91**.

Lookup with VLOOKUP

D2 *fx* `=VLOOKUP("Mert",A2:B5,2,0)`

	A	B
1	Name	Score
2	Ali	72
3	Ece	91
4	Can	85
5	Deniz	64

lookup value: “Mert”
table: A2:B5 (searched in the first column)
column: 2 (Score)
0: exact match

D2 = #N/A

“Mert” isn't in any row of the first column: every row was tried and the result is **#N/A** (value not available).

Approximate Match with VLOOKUP: a Grading Scale

	A	B	C	D	E
1	Name	Score	Letter	Threshold	Letter
2	Ece	72		0	F
3	Can	85		50	D
4	Mert	49		60	C
5	Ada	-5		70	B
6				85	A

Columns D–E hold the grading scale: the first column is the **threshold**, sorted ascending. The last argument is **TRUE**: not exact but **approximate match**. The threshold table is locked with $, so it doesn't shift when the formula is copied down.

Step 1 / 6

```
1 C2: =VLOOKUP(B2,$D$2:$E$6,2,TRUE)
2 C3: =VLOOKUP(B3,$D$2:$E$6,2,TRUE)
3 C4: =VLOOKUP(B4,$D$2:$E$6,2,TRUE)
4 C5: =VLOOKUP(B5,$D$2:$E$6,2,TRUE)
```

VARIABLES

`lookup = –` `threshold = –`

`result = –`

Approximate Match with VLOOKUP: a Grading Scale

	A	B	C	D	E
1	Name	Score	Letter	Threshold	Letter
2	Ece	72	B	0	F
3	Can	85		50	D
4	Mert	49		60	C
5	Ada	-5		70	B
6				85	A

```
0 ≤ 72 ? yes
50 ≤ 72 ? yes
60 ≤ 72 ? yes
70 ≤ 72 ? yes
85 ≤ 72 ? no
```

C2: looking up **72**. The result is the **largest threshold less than or equal to 72** in the first column: 0, 50, 60, 70 qualify, 85 doesn't → the row of 70, column 2 → **B**.

Step 2 / 6

```
▶ C2: =VLOOKUP(B2,$D$2:$E$6,2,TRUE)
2 C3: =VLOOKUP(B3,$D$2:$E$6,2,TRUE)
3 C4: =VLOOKUP(B4,$D$2:$E$6,2,TRUE)
4 C5: =VLOOKUP(B5,$D$2:$E$6,2,TRUE)
```

VARIABLES

`lookup = 72` `threshold = 70` `result = B`

Approximate Match with VLOOKUP: a Grading Scale

	A	B	C	D	E
1	Name	Score	Letter	Threshold	Letter
2	Ece	72	B	0	F
3	Can	85	A	50	D
4	Mert	49		60	C
5	Ada	-5		70	B
6				85	A

```
0 ≤ 85 ? yes
50 ≤ 85 ? yes
60 ≤ 85 ? yes
70 ≤ 85 ? yes
85 ≤ 85 ? yes
```

C3: looking up **85**. Equality counts too: 85 ≤ 85 → the largest qualifying threshold is 85 → **A**.

Step 3 / 6

```
1 C2: =VLOOKUP(B2,$D$2:$E$6,2,TRUE)
▶ C3: =VLOOKUP(B3,$D$2:$E$6,2,TRUE)
3 C4: =VLOOKUP(B4,$D$2:$E$6,2,TRUE)
4 C5: =VLOOKUP(B5,$D$2:$E$6,2,TRUE)
```

VARIABLES

`lookup = 85` `threshold = 85` `result = A`

Approximate Match with VLOOKUP: a Grading Scale

	A	B	C	D	E
1	Name	Score	Letter	Threshold	Letter
2	Ece	72	B	0	F
3	Can	85	A	50	D
4	Mert	49	F	60	C
5	Ada	-5		70	B
6				85	A

```
0 ≤ 49 ? yes
50 ≤ 49 ? no
60 ≤ 49 ? no
70 ≤ 49 ? no
85 ≤ 49 ? no
```

C4: looking up **49**. Only 0 qualifies (50 > 49) → **F**. With exact match (FALSE), scores missing from the table, like 72 or 49, would give #N/A.

Step 4 / 6

```
1 C2: =VLOOKUP(B2,$D$2:$E$6,2,TRUE)
2 C3: =VLOOKUP(B3,$D$2:$E$6,2,TRUE)
▶ C4: =VLOOKUP(B4,$D$2:$E$6,2,TRUE)
4 C5: =VLOOKUP(B5,$D$2:$E$6,2,TRUE)
```

VARIABLES

`lookup = 49` `threshold = 0` `result = F`

Approximate Match with VLOOKUP: a Grading Scale

	A	B	C	D	E
1	Name	Score	Letter	Threshold	Letter
2	Ece	72	B	0	F
3	Can	85	A	50	D
4	Mert	49	F	60	C
5	Ada	-5	#N/A	70	B
6				85	A

```
0 ≤ -5 ? no
50 ≤ -5 ? no
60 ≤ -5 ? no
70 ≤ -5 ? no
85 ≤ -5 ? no
```

C5: looking up **−5**. No threshold is less than or equal to −5 → **#N/A**. The smallest threshold should be the smallest possible score (0); invalid scores can be blocked with data validation.

Step 5 / 6

```
1 C2: =VLOOKUP(B2,$D$2:$E$6,2,TRUE)
2 C3: =VLOOKUP(B3,$D$2:$E$6,2,TRUE)
3 C4: =VLOOKUP(B4,$D$2:$E$6,2,TRUE)
▶ C5: =VLOOKUP(B5,$D$2:$E$6,2,TRUE)
```

VARIABLES

`lookup = −5` `threshold = none` `result = #N/A`

Approximate Match with VLOOKUP: a Grading Scale

	A	B	C	D	E
1	Name	Score	Letter	Threshold	Letter
2	Ece	72	B	0	F
3	Can	85	A	50	D
4	Mert	49	F	60	C
5	Ada	-5	#N/A	70	B
6				85	A

In approximate match Excel doesn't scan row by row; it does a **binary search**, so the first column must be **sorted ascending**. On an unsorted scale it can return the wrong letter with no error message.

Step 6 / 6

```
C2: =VLOOKUP(B2,$D$2:$E$6,2,TRUE)
C3: =VLOOKUP(B3,$D$2:$E$6,2,TRUE)
C4: =VLOOKUP(B4,$D$2:$E$6,2,TRUE)
C5: =VLOOKUP(B5,$D$2:$E$6,2,TRUE)
```

VARIABLES

`lookup = –` `threshold = –` `result = –`

FORMULAS

Modern Functions: XLOOKUP and FILTER

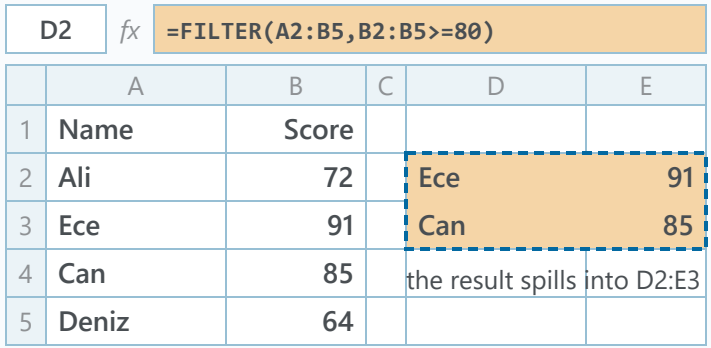
```
=XLOOKUP("Ece",A2:A5,B2:B5)  → 91
=FILTER(A2:B5,B2:B5>=80)  → Ece 91 /
Can 85
```

XLOOKUP(lookup_value, lookup_array, return_array)

The modern successor to VLOOKUP; no column number needed, and it can look left.

#SPILL!

Appears when a non-empty cell blocks the spill range; clear it and the result appears.



These functions exist in **Microsoft 365** and **Excel 2021 and later**; they don't work in Excel 2019 or earlier. The Excel version of whoever opens the file matters too.

FORMULAS

Dates and Times



TODAY

Returns the current date.

`=TODAY()`

NOW

Returns the current date and time.

`=NOW()`

Date difference

Dates are numbers, so you can subtract them.

`=B2−A2`

Format

The same value can be shown as a date, a time or a number.

Invalid dates

A date stored as text may not take part in calculations.

Durations

A duration over 24 hours may need a suitable custom format.

Formula Errors

`=B2/C2 (C2 = 0)`

#DIV/0!

Division by zero:
check the divisor

`=SUMM(A1:A3)`

#NAME?

Unknown name:
function spelling (SUM)

`="apple"+5`

#VALUE!

Wrong data type:
arithmetic on text

`=B2+#REF!`

#REF!

Invalid reference:
column C was deleted

`1250000 (narrow column)`

#####

Value doesn't fit:
widen the column

`=VLOOKUP("Mert",A2:B5,2,0)`

#N/A

Value not found:
not in the lookup list

Selecting an error cell shows a warning icon, and the Formulas → Formula Auditing tools help trace the source.

Formula Errors Step by Step

D2 *fx* `=B2/C2` 1

	A	B	C	D
1	**Item**	**Amount**	**Qty**	**Unit price**
2	Pen	500	0	**#DIV/0!** 2
3	Notebook	300	5	60
4	Eraser	90	3	30

3 Cause

C2 is 0: division by zero is undefined.
An empty cell counts as zero too.

4 Fix

Check the divisor or make it conditional:
`=IF(C2=0,"",B2/C2)`

#DIV/0!: the formula `=B2/C2` gives **#DIV/0!**. Cause: the divisor C2 = 0 (an empty cell counts as 0). Fix: check the divisor or write `=IF(C2=0,"",B2/C2)`.

Formula Errors Step by Step

B5 *fx* `=SUMM(B2:B4)` 1

	A	B
1	**Item**	**Price**
2	Pen	50
3	Notebook	120
4	Eraser	30
5	Total	**#NAME?** 2

3 Cause

Excel doesn't recognize “SUMM”: the function name is misspelled.

4 Fix

Fix the function name (picking it from the Formulas tab avoids typos):

`=SUM(B2:B4)`

#NAME?: the formula `=SUMM(B2:B4)` gives **#NAME?**. Cause: Excel doesn't recognize “SUMM” (a misspelled function name; text without quotes gives the same error). Fix: `=SUM(B2:B4)`.

Formula Errors Step by Step

C2 *fx* =B2*2 ❶

	A	B	C
1	**Item**	**Price**	**Double**
2	Pen	12 TL	**#VALUE!** ❷
3	Notebook	25	50
4	Eraser	8	16

❸ Cause

"12 TL" in B2 is text, not a number.
You can't do arithmetic on text.

❹ Fix

Type just 12 in the cell; show TL with a number format (Currency):

=B2*2 → 24

#VALUE!: the formula `=B2*2` gives **#VALUE!**. Cause: B2 holds the text "12 TL" (left-aligned), not a number. Fix: type just `12` in B2 and show "TL" with a number format.

Formula Errors Step by Step

C2 | *fx* | =B2+#REF! (1)

	A	B	C
1	**Item**	**Price**	**Total**
2	Pen	12	**#REF!** (2)
3	Notebook	25	**#REF!**
4	Eraser	8	**#REF!**

3 Cause

The column the formula used was deleted; a reference to a deleted cell is invalid.

4 Fix

Undo the deletion right away with Ctrl+Z, or retype the reference. Clearing contents instead of deleting the column keeps it.

#REF!: the formula `=B2+#REF!` gives **#REF!**. Cause: a column the formula used was deleted (invalid reference). Fix: undo with **Ctrl+Z** or retype the reference.

Formula Errors Step by Step

C2 | *fx* | `=VLOOKUP(D2,A2:B4,2,0)` ❶

	A	B	C	D
1	**Name**	**Grade**	**Result**	**Lookup**
2	Ali	70	**#N/A**	❷lin
3	Ayşe	85		
4	Can	60		

❸ **Cause**

The lookup value D2 (“Selin”) isn't in A2:A4. The last argument 0 means exact match.

❹ **Fix**

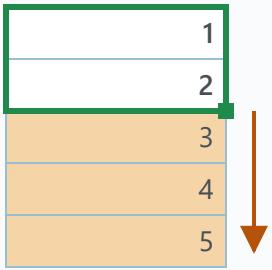
Check spelling and spaces, or add the record; show “-” instead of the error:

```
=IFNA(VLOOKUP(D2,A2:B4,2,0),"-")
```

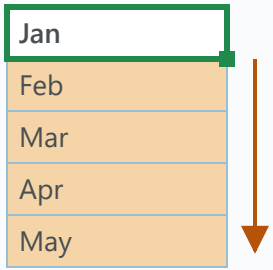
#N/A: the formula `=VLOOKUP(D2,A2:B4,2,0)` gives **#N/A**. Cause: “Selin” isn't in the list (exact match). Fix: check the spelling, add the record, or show a message with `IFNA` (Excel 2013+).

ORGANIZING DATA

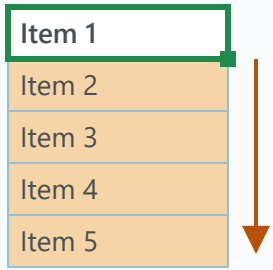
AutoFill



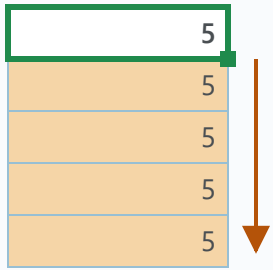
two values: step 1



month names



text + number



single number: copies

Copying

Carries a formula or constant into adjacent cells.

Series

Continues a pattern such as 1, 2, 3 or dates.

Relative reference

Shifts with position as the formula is copied.

Fill handle

Drag it from the bottom-right corner of the selection.

Options

Choose results such as Copy Cells, Fill Series or Fill Formatting Only.

Checking

Inspect the first and last results for a wrong pattern.

Shortcuts and Flash Fill

Undo	`Ctrl+Z`	Format Cells	`Ctrl+1`
Create table	`Ctrl+T`	Toggle filter	`Ctrl+Shift+L`
Flash Fill	`Ctrl+E`	Find and Replace	`Ctrl+H`

	A	B
1	Full Name	Name
2	Ayşe Yılmaz	Ayşe
3	Mehmet Demir	
4	Zeynep Kaya	

1) Type an example in B2, Ctrl+E in B3

`Ctrl+E` →

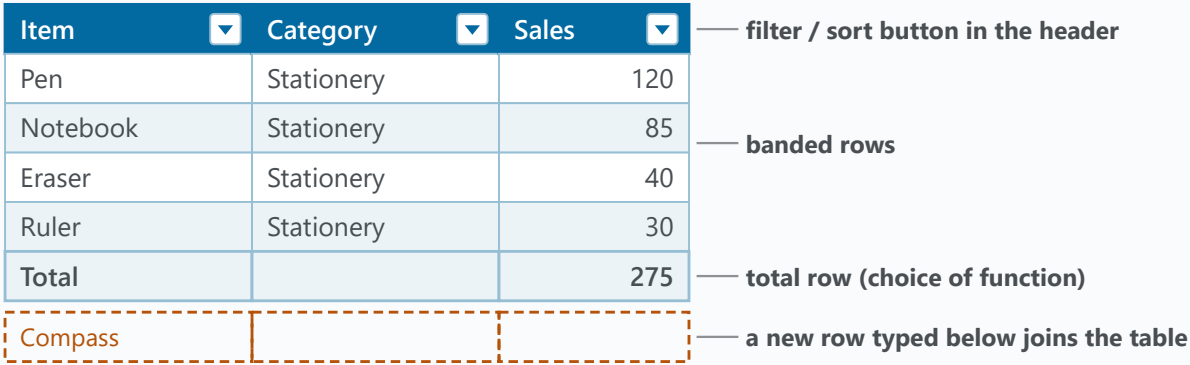
	A	B
1	Full Name	Name
2	Ayşe Yılmaz	Ayşe
3	Mehmet Demir	Mehmet
4	Zeynep Kaya	Zeynep

2) Pattern is guessed: values, not formulas

- **Flash Fill:** next to the “Ayşe Yılmaz” column, type **Ayşe** in the first row and press `Ctrl+E` in the next cell; Excel guesses the pattern and fills the column.
- The results are values, not formulas, and don't update when the source changes; review the filled rows one by one.
- Before a bulk change with Ctrl+H, check the search scope under **Options**.

DATA ANALYSIS

Excel Tables



Structured data

Turns a range with headers into a table.

Auto-expansion

Can take in new rows and columns.

Filter and sort

Adds controls to the header cells.

Structured references

Formulas can use column names instead of cell addresses.

Total row

Summarizes with the functions you pick.

Style

Gives banded rows and a consistent look.

DATA ANALYSIS

Sorting

Sorting rearranges records by certain columns while keeping each row intact.

Text

A to Z or Z to A.

Number

Smallest to largest or the reverse.

Date

Oldest to newest or the reverse.

Multilevel

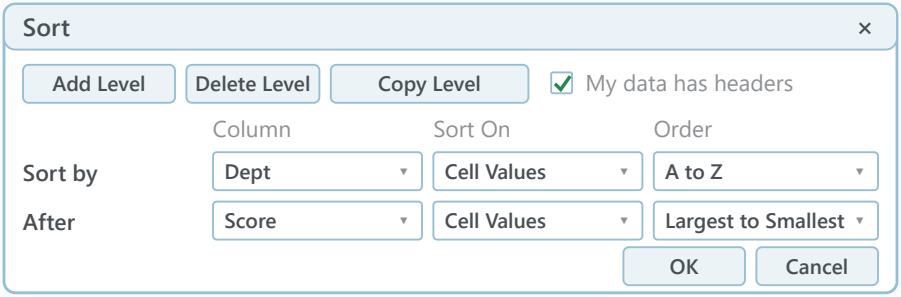
More than one key, e.g. department first, then score.

Header row

Must not be sorted along with the data.

Consistent type

Don't mix numbers and numbers stored as text in one column.



Result

Dept	Score
Physics	88
Physics	71
Chemistry	92
Chemistry	64
Math	80

Dept A→Z; within a dept, score largest to smallest

DATA ANALYSIS

Sorting Before / After

	A	B	C
1	Name	Dept	Score
2	Ali	Electrical	72
3	Ece	Computer	91
4	Can	Electrical	85
5	Deniz	Computer	64
6	Burak	Mechanical	78

Unsorted data

5 records, 3 columns

Start: records in the order they were entered. Each row holds one student's data.

DATA ANALYSIS

Sorting Before / After

	A	B	C	
1	Name ▾	Dept ▾	Score ↓	
2	Ece	Computer	91	(was row 3)
3	Can	Electrical	85	(was row 4)
4	Burak	Mechanical	78	(was row 6)
5	Ali	Electrical	72	(was row 2)
6	Deniz	Computer	64	(was row 5)

Sort: Score

Largest to Smallest

rows move as a whole

Data → Sort, **Score: largest to smallest**. Rows moved as whole units: every name kept its own score.

DATA ANALYSIS

Sorting Before / After

	A	B	C	
1	Name ▾	Dept ↑	Score ↓	
2	Ece	Computer	91	(was row 3)
3	Deniz	Computer	64	(was row 5)
4	Can	Electrical	85	(was row 4)
5	Ali	Electrical	72	(was row 2)
6	Burak	Mechanical	78	(was row 6)

Multilevel sort

1. Dept: A to Z
2. Score: largest to smallest

Multilevel: **Dept** A→Z first, and within the same dept by **Score** (Electrical: 85, 72).

Sorting Before / After

	A	B	C
1	Name ▾	Dept ▾	Score ↓
2	Ali	Electrical	91
3	Ece	Computer	85
4	Can	Electrical	78
5	Deniz	Computer	72
6	Burak	Mechanical	64

ERROR: rows broken

Only the Score column was selected, “Continue with the current selection” was chosen

Wrong use: sort only the Score column and names and scores no longer match (Ali now has 91!). In the warning, choose “Expand the selection”.

DATA ANALYSIS

Filtering

Purpose

Shows only the rows that meet the criteria; it doesn't delete the others.

Value filter

Shows the chosen categories.

Number / date filter

Applies greater-than, less-than, between or period conditions.

Text filter

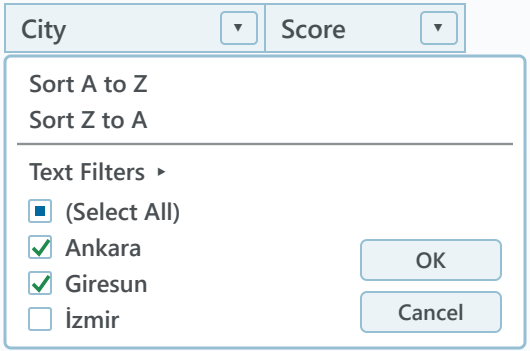
Uses contains, begins with or equals.

Several columns

Conditions narrow the results together.

Clearing

Remove the filter and all records show again.



Result

1	City	Score
2	Ankara	78
4	Giresun	85
5	Ankara	66
7	Giresun	90

rows 3 and 6 (İzmir) hidden, not deleted

Blue row numbers and a funnel icon: filter on

Filtering Before / After

	A	B	C
1	Name ▾	Dept ▾	Score ▾
2	Ali	Electrical	72
3	Ece	Computer	91
4	Can	Electrical	85
5	Deniz	Computer	64
6	Burak	Mechanical	78
7	Selin	Electrical	58

No filter
all 6 records visible

Data → **Filter**: drop-down buttons (▾) appear on the headers; all records are still visible.

DATA ANALYSIS

Filtering Before / After

	A	B	C
1	Name ▾	Dept ⧩	Score ▾
2	Ali	Electrical	72
4	Can	Electrical	85
7	Selin	Electrical	58

Dept = Electrical
3 of 6 records visible
row numbers skip

Only **Electrical** is selected in the Dept column. The row numbers are blue and skip: the other rows weren't deleted, just **hidden**.

Filtering Before / After

	A	B	C
1	Name ▾	Dept ⧩	Score ⧩
4	Can	Electrical	85

Dept = Electrical
AND Score > 80
1 of 6 records

A second condition: Number Filters → Greater Than 80. The conditions narrow together (AND): only Can is left.

Filtering Before / After

	A	B	C
1	Name ▾	Dept ▾	Score ▾
2	Ali	Electrical	72
3	Ece	Computer	91
4	Can	Electrical	85
5	Deniz	Computer	64
6	Burak	Mechanical	78
7	Selin	Electrical	58

Filter cleared

all 6 records are back

Clear Filter: every record shows again. Filtering doesn't change the data; it only narrows the view.

Multilevel Sort, Filter and SUBTOTAL

	A	B	C
1	**Name**	**Dept**	**Score**
2	Selin	Computer	78
3	Can	Electrical	85
4	Çağla	Computer	91
5	Ali	Electrical	64
6	İrem	Mechanical	70
7	Burak	Computer	55

`C9: =SUM(C2:C7)` **443**
`C10: =SUBTOTAL(9,C2:C7)` **443**
`C11: =SUBTOTAL(1,C2:C7)` **73.8**

Six records in entry order. Below them, three formulas: **SUM**, **SUBTOTAL(9,...)** (sum) and **SUBTOTAL(1,...)** (average). For now all three cover every row: 443 and 73.8.

Step 1 / 6

```
1 Sort: Dept A to Z, Score Largest to Smallest
2 Data → Filter; Dept ▾: Computer only
3 Score ▾: Number Filters → Greater Than 75
4 Data → Clear
5 Name ▾: Sort A to Z
```

VARIABLES

`visible = 6` `SUM = 443` `SUBTOTAL(9) = 443`

Multilevel Sort, Filter and SUBTOTAL

	A	B	C
1	**Name**	**Dept**	**Score**
2	Çağla	Computer	91
3	Selin	Computer	78
4	Burak	Computer	55
5	Can	Electrical	85
6	Ali	Electrical	64
7	İrem	Mechanical	70

`C9: =SUM(C2:C7)` **443**
`C10: =SUBTOTAL(9,C2:C7)` **443**
`C11: =SUBTOTAL(1,C2:C7)` **73.8**

Two levels in the Sort dialog: **Dept** A to Z first, and within each dept **Score** largest to smallest. Computer: Çağla 91, Selin 78, Burak 55. Rows moved as whole units.

Step 2 / 6

▶ **Sort: Dept A to Z, Score Largest to Smallest**
2 Data → Filter; Dept ▾: Computer only
3 Score ▾: Number Filters → Greater Than 75
4 Data → Clear
5 Name ▾: Sort A to Z

VARIABLES

`visible = 6` `SUM = 443` `SUBTOTAL(9) = 443`

Multilevel Sort, Filter and SUBTOTAL

	A	B	C
1	Name ▾	Dept ▾	Score ▾
2	Çağla	Computer	91
3	Selin	Computer	78
4	Burak	Computer	55

Dept = Computer

```
C9: =SUM(C2:C7)          443
C10: =SUBTOTAL(9,C2:C7)  224
C11: =SUBTOTAL(1,C2:C7)  74.7
```

Filter: Computer only. Row numbers skip; 5–7 are hidden. **SUM is still 443**: it adds hidden rows too. **SUBTOTAL** counts only the visible ones: 91 + 78 + 55 = **224**, average 74.7.

Step 3 / 6

```
1 Sort: Dept A to Z, Score Largest to Smallest
▶ Data → Filter; Dept ▾: Computer only
3 Score ▾: Number Filters → Greater Than 75
4 Data → Clear
5 Name ▾: Sort A to Z
```

VARIABLES

visible = 3 | SUM = 443 | SUBTOTAL(9) = 224

Multilevel Sort, Filter and SUBTOTAL

	A	B	C
1	Name ▾	Dept ▾	Score ▾
2	Çağla	Computer	91
3	Selin	Computer	78

and Score > 75

```
C9: =SUM(C2:C7)
C10: =SUBTOTAL(9,C2:C7)
C11: =SUBTOTAL(1,C2:C7)
```

443
169
84.5

A second condition, Score > 75: the two filters narrow together, and Burak (55) is hidden too. SUBTOTAL(9) = **169**, SUBTOTAL(1) = **84.5**. SUM didn't change.

Step 4 / 6

```
1 Sort: Dept A to Z, Score Largest to Smallest
2 Data → Filter; Dept ▾: Computer only
▶ Score ▾: Number Filters → Greater Than 75
4 Data → Clear
5 Name ▾: Sort A to Z
```

VARIABLES

visible = **2** SUM = **443** SUBTOTAL(9) = **169**

Multilevel Sort, Filter and SUBTOTAL

	A	B	C
1	Name ▾	Dept ▾	Score ▾
2	Çağla	Computer	91
3	Selin	Computer	78
4	Burak	Computer	55
5	Can	Electrical	85
6	Ali	Electrical	64
7	İrem	Mechanical	70

```
C9: =SUM(C2:C7)                443
C10: =SUBTOTAL(9,C2:C7)        443
C11: =SUBTOTAL(1,C2:C7)        73.8
```

Clear: the filters go, all rows return, and SUBTOTAL is 443 again. Filtering deleted no data.


```
1 Sort: Dept A to Z, Score Largest to Smallest
2 Data → Filter; Dept ▾: Computer only
3 Score ▾: Number Filters → Greater Than 75
▶ Data → Clear
5 Name ▾: Sort A to Z
```

VARIABLES

visible = 6 | SUM = 443 | SUBTOTAL(9) = 443

Multilevel Sort, Filter and SUBTOTAL

	A	B	C
1	Name ▾	Dept ▾	Score ▾
2	Ali	Electrical	64
3	Burak	Computer	55
4	Can	Electrical	85
5	Çağla	Computer	91
6	İrem	Mechanical	70
7	Selin	Computer	78

```
C9: =SUM(C2:C7)                443
C10: =SUBTOTAL(9,C2:C7)        443
C11: =SUBTOTAL(1,C2:C7)        73.8
```

Name A to Z: with a Turkish sort locale **Ç comes after C** and **İ after I**: Ali, Burak, Can, Çağla, İrem, Selin. The formulas point to C2:C7, so sorting doesn't change their results.

Step 6 / 6

```
1 Sort: Dept A to Z, Score Largest to Smallest
2 Data → Filter; Dept ▾: Computer only
3 Score ▾: Number Filters → Greater Than 75
4 Data → Clear
▶ Name ▾: Sort A to Z
```

VARIABLES

`visible = 6` `SUM = 443` `SUBTOTAL(9) = 443`

DATA ANALYSIS

Conditional Formatting

Cell rules

Apply a format at certain thresholds.

Color scales

Show low and high values with a color gradient.

Data bars

Visualize the size of a value inside the cell.

Icon sets

Mark status or trend with icons.

Formula rule

Uses a custom logical condition.

Restraint

Too many colors and rules make the data hard to read.

Highlight Cells Rules

45
80
62
95
30

Greater Than 60 → filled

Data Bars

45
80
62
95
30

bar length ∝ value

Color Scales

45
80
62
95
30

low red → high green

Icon Sets

▼	45
▲	80
▶	62
▲	95
▼	30

≥67% ▲ ≥33% ▶ other ▼

A Conditional Formatting Example

	A	B
1	Name	Score
2	Ali	72
3	Ece	91
4	Can	85
5	Deniz	64
6	Burak	78
7	Selin	58
8	Mert	45

Raw scores

No rule

The same data shown five ways: first the raw scores.

A Conditional Formatting Example

	A	B
1	Name	Score
2	Ali	72
3	Ece	91
4	Can	85
5	Deniz	64
6	Burak	78
7	Selin	58
8	Mert	45

Cell rule

Less Than 60 → red fill

Home → Conditional Formatting → Highlight Cells Rules → **Less Than** 60: 58 and 45 turn red. If a value changes, so does its format.

A Conditional Formatting Example

	A	B
1	Name	Score
2	Ali	72
3	Ece	91
4	Can	85
5	Deniz	64
6	Burak	78
7	Selin	58
8	Mert	45

Data bars

Bar length proportional to value

Data bars: the largest value (91) gets the longest bar; compare without reading the numbers.

A Conditional Formatting Example

	A	B
1	Name	Score
2	Ali	72
3	Ece	91
4	Can	85
5	Deniz	64
6	Burak	78
7	Selin	58
8	Mert	45

Color scale

Low light → high dark

Color scale: the lowest value (45) gets the lightest shade, the highest (91) the darkest.

A Conditional Formatting Example

	A	B
1	Name	Score
2	Ali	● 72
3	Ece	▲ 91
4	Can	▲ 85
5	Deniz	● 64
6	Burak	▲ 78
7	Selin	▼ 58
8	Mert	▼ 45

Icon set

▲ ≥ 67% · ● ≥ 33% · ▼ other

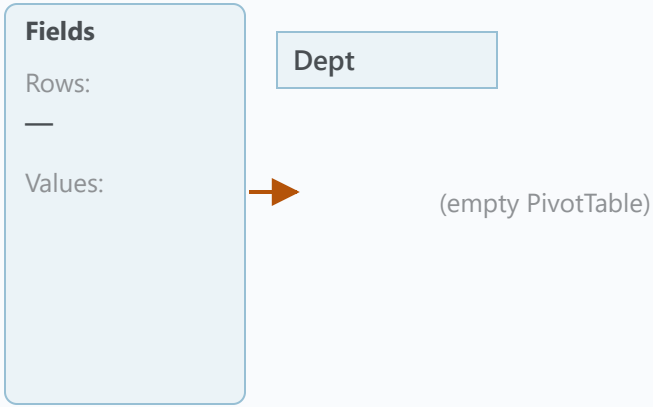
thresholds: 75.8 and 60.2

Icon set: the top third of the range (45–91) gets ▲, the middle ●, the bottom ▼. The default thresholds are 67% and 33%, so the cut-offs are 75.8 and 60.2.

DATA ANALYSIS

PivotTables

	A	B	C
1	**Name**	**Dept**	**Score**
2	Ali	Electrical	72
3	Ece	Computer	91
4	Can	Electrical	85
5	Deniz	Computer	64
6	Burak	Mechanical	78
7	Selin	Electrical	58



Source: a list with headers and no blank rows. Insert → **PivotTable** opens an empty PivotTable on a new sheet.

PivotTables

	A	B	C
1	**Name**	**Dept**	**Score**
2	Ali	Electrical	72
3	Ece	Computer	91
4	Can	Electrical	85
5	Deniz	Computer	64
6	Burak	Mechanical	78
7	Selin	Electrical	58

Fields

Rows:
Dept

Values:

Dept
Computer
Electrical
Mechanical
Grand Total

The Dept field is dragged to **Rows**: each dept is listed once (3 rows + Grand Total).

PivotTables

	A	B	C
1	**Name**	**Dept**	**Score**
2	Ali	Electrical	72
3	Ece	Computer	91
4	Can	Electrical	85
5	Deniz	Computer	64
6	Burak	Mechanical	78
7	Selin	Electrical	58

Fields

Rows:
Dept

Values:
Sum of Score

Dept	Sum of Score
Computer	155
Electrical	215
Mechanical	78
Grand Total	**448**

The Score field goes to **Values**: each dept's total score is calculated (Electrical: 72+85+58 = 215).

DATA ANALYSIS

PivotTables

	A	B	C
1	Name	Dept	Score
2	Ali	Electrical	72
3	Ece	Computer	91
4	Can	Electrical	85
5	Deniz	Computer	64
6	Burak	Mechanical	78
7	Selin	Electrical	58

Fields

Rows:
Dept

Values:
Average of Score
Count of Name

Dept	Avg Score	People
Computer	77.5	2
Electrical	71.7	3
Mechanical	78.0	1
Grand Total	**74.7**	**6**

Score is summarized by Average, and the Name field is counted: Electrical averages 71.7 with 3 people. A summary with no formulas; when the source changes, **Refresh**.

DATA ANALYSIS

Data Validation

List

Electrical

- Electrical
- Computer
- Mechanical

Input message

Enter a grade

Whole number from 0 to 100

Error alert (150 typed)

Microsoft Excel

This value doesn't match the data validation restrictions defined for this cell.

Retry Cancel

List

Offers the user drop-down choices.

Number range

Accepts only values within set limits.

Date limit

Limits entries to a date range.

Input message

Explains the expected data when the cell is selected.

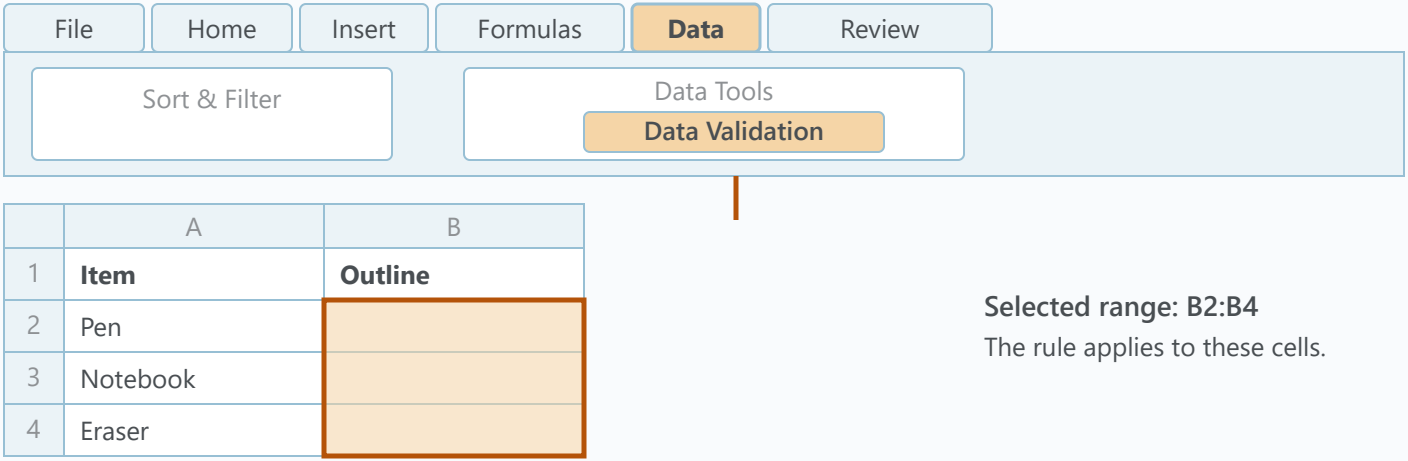
Error alert

Tells the user about invalid entries.

Limitation

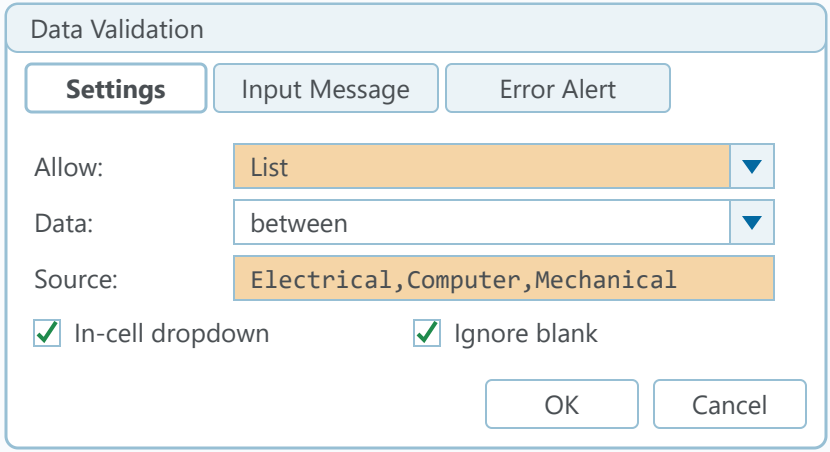
Copy and paste can get around some validation checks, so audit the data.

Data Validation: List and Error Alert



1. Select the range: select the cells to validate (B2:B4) and open **Data → Data Tools → Data Validation**.

Data Validation: List and Error Alert



The source can be given two ways:

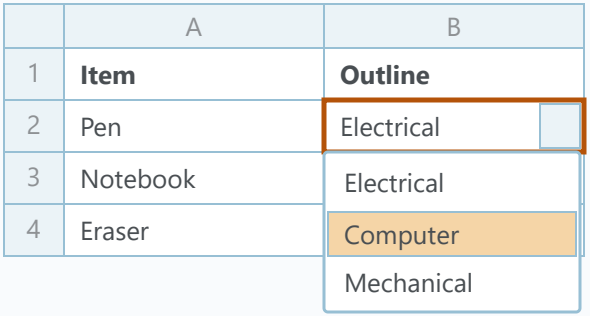
Typed in directly:
`Electrical,Computer,Mechanical`

Or linked to a cell range:
`=$E$2:$E$4`

The separator follows regional settings (a comma in English settings).

2. List rule: on the Settings tab choose **Allow: List**; type the choices in Source, or point it at a cell range.

Data Validation: List and Error Alert

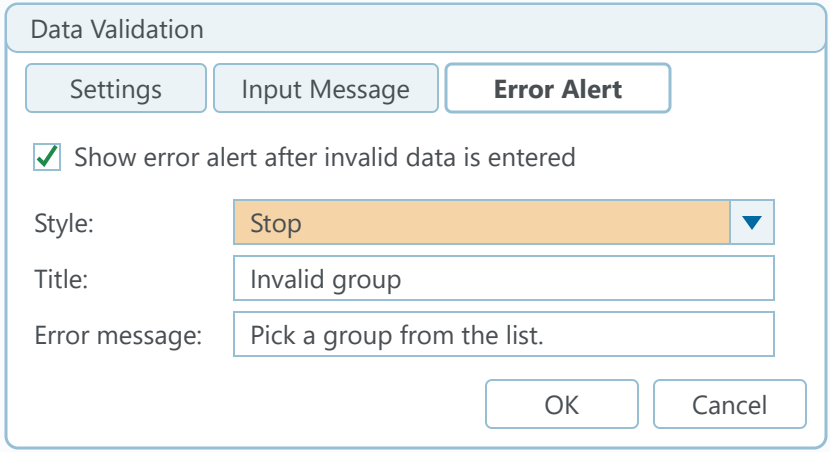


Select the cell and an arrow appears.

The only choices are the values in the source; the chosen value goes into the cell. Typing anything else triggers the error alert.

3. Result: a drop-down list appears in the cell; the user can only pick one of the source values.

Data Validation: List and Error Alert



Style options:

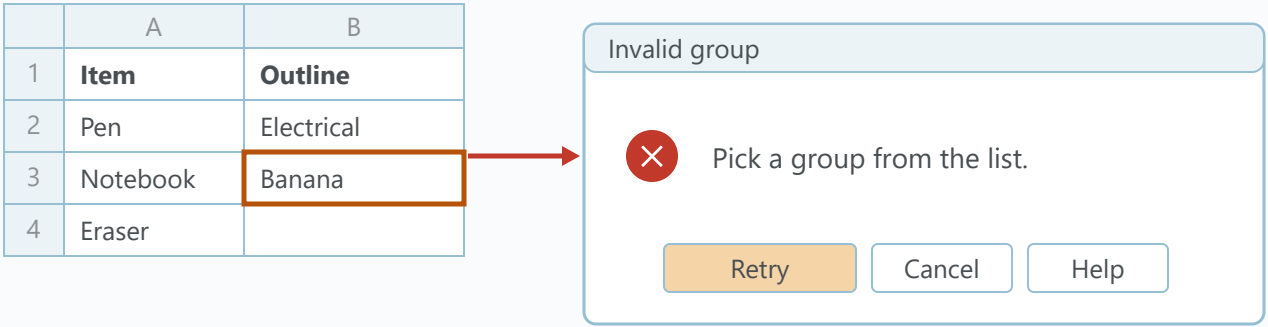
Stop: rejects the wrong entry.

Warning: the user can accept it anyway.

Information: informs; OK accepts the value.

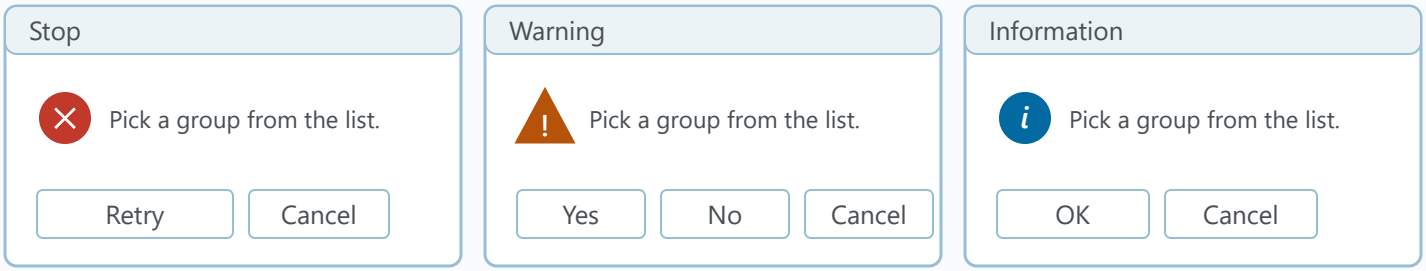
4. Error alert: on the Error Alert tab set the **Style**, **Title** and **Error message**.

Data Validation: List and Error Alert



5. Invalid entry: type “Banana”, which isn't in the list, and the Stop style rejects it; **Retry** puts the cell back into editing.

Data Validation: List and Error Alert



Stop: rejects the entry.

Warning: Yes accepts it anyway.

Information: OK accepts it.

6. Styles: Stop blocks the entry; Warning and Information let the user accept the value anyway.

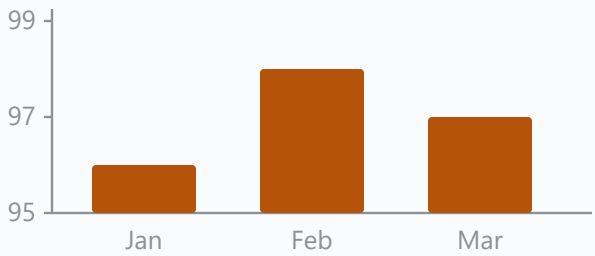
Choosing a Chart

Purpose	Suitable chart	Example
Comparing categories	Column or bar	
Showing change over time	Line chart	
Part-to-whole	A pie chart with few categories, or a 100% bar	
Relationship between two numeric variables	Scatter chart (XY)	
Showing the shape of a distribution	Histogram	

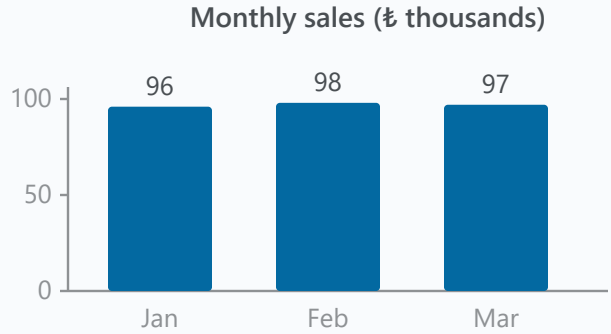
CHARTS

Clear Charts

Misleading: axis starts at 95



Clear: axis from 0, with title and units



Title

Says what the chart shows.

Axes and units

Say what the values mean.

Source data

Pick the right range and series.

Scale

Set so that differences aren't exaggerated.

Color

Separates series; doesn't carry meaning on its own.

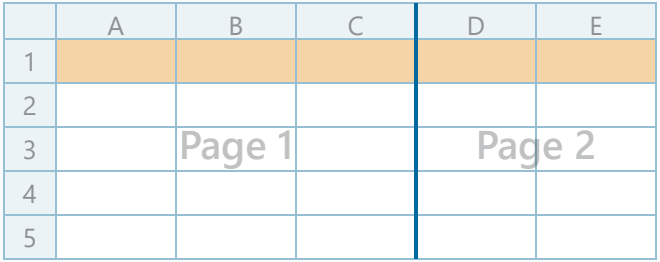
Simplicity

Drop needless 3-D effects and decoration.

REPORTING

Printing and Page Layout

Page Break Preview



Print Titles: row 1 on every page



Print area

Sets which cells go into the printout.

Orientation

Consider landscape for wide tables.

Scaling

Can fit a table to the page width.

Print Titles

Repeats the header row on multi-page printouts.

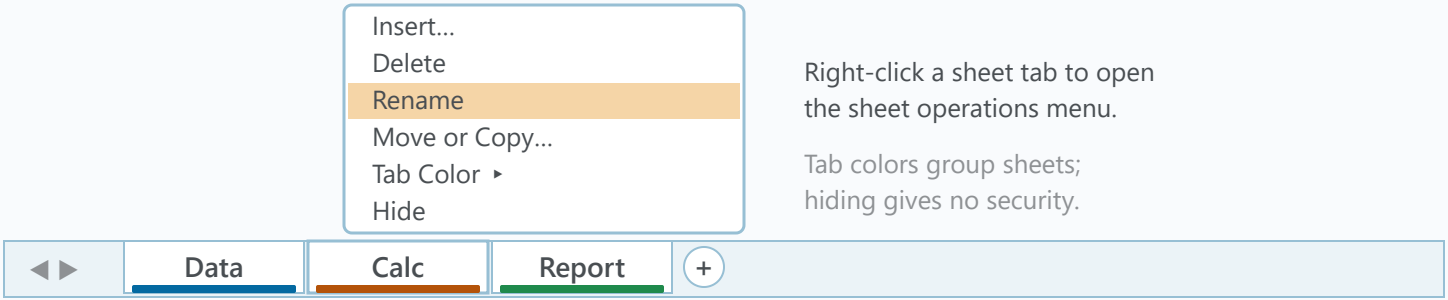
Page breaks

Control where the printout splits.

Print preview

Check for blank pages, cut-off columns and readability.

Managing Workbooks



Right-click a sheet tab to open the sheet operations menu.

Tab colors group sheets; hiding gives no security.

Insert / delete sheets

Shape the workbook to your needs.

Rename

Give a name that describes the sheet's contents.

Move / copy

Moves a sheet within the same or another workbook.

Hide / unhide

Takes helper sheets out of view; no security.

Tab color

Groups sheets visually.

Links

Manage references to other sheets or workbooks carefully.

WORKBOOK

Protection and Collaboration

Sheet protection

Protects certain cells and operations from changes.

Workbook structure

Can restrict inserting, deleting or moving sheets.

File encryption

Can require a password to open the file.

Comments

Enable discussion and feedback on cells.

Version history

Gives access to earlier versions in a supported cloud location.

Limitation

Sheet protection is not the same as strong encryption.

1) Unlock the input cells

Format Cells → Protection

☐ **Locked** (cleared for B2:B4)

☐ **Hidden**

Default: every cell is Locked

2) Protect Sheet

Review → Protect Sheet

Password (optional):

••••••

Locking works only once protection is on

3) Result

Item	Qty	Amount
Pen	3	120
Notebook	5	200
Eraser	2	80

Qty cells can be edited;
Amount (=B2*40) is locked

QUALITY

Good Data Layout

✗ **Not fit for analysis**

	A	B	C
1	2024 Sales (merged)		
2	Item	Quantity	
3	Apple	12 kg	
4	(blank row)		
5	Subtotal	12 kg	

✓ **Tidy**

	A	B	C
1	Date	Item	Quantity (kg)
2	5-Jan-2024	Apple	12
3	5-Jan-2024	Pear	8
4	6-Jan-2024	Apple	15

totals in a separate cell / report sheet

- Each row should hold one record, and each column one variable.
- Headers should be short, unique and meaningful; put the unit in the header.
- No blank rows, merged cells or subtotals in raw data.
- Keep raw data, calculations and report output on separate sheets.

SUMMARY

Chapter Summary

- A workbook consists of one or more worksheets.
- Formulas start with an equals sign and use cell references.
- Relative and absolute references behave differently when a formula is copied.
- Functions standardize common calculations; errors point to a problem in the data or a reference.
- Tables, sorting, filtering and validation keep data organized.
- The right chart depends on the purpose of the data and the kind of relationship.
- COUNTIF/SUMIF count and sum by condition; VLOOKUP pulls values from a table; a PivotTable summarizes without formulas.

SUMMARY

Review Questions

1. What is the difference between a workbook and a worksheet?
2. Does a number format change a cell's underlying value?
3. How do the references A1 and $A$1 behave differently?
4. What are the three parts of the IF function?
5. Why must rows stay intact when sorting?
6. Which chart suits showing change over time?

SUMMARY

Exercises

1. Build a 5-row table with Item, Qty and Price columns; compute the Total and the total with VAT (VAT rate in a single cell, with `$`).
2. Fill a 1–10 multiplication table with one formula typed in B2 (`=$A2*B$1`).
3. In a grade list, show Pass/Fail with IF; find the number of passing students with COUNTIF and the class average with AVERAGE.
4. Compute the total score per department with SUMIF; check the same result with a PivotTable.
5. From a name–score list, fetch a student's score with VLOOKUP; try a name that isn't in the list and observe #N/A.
6. Apply a “red if below 60” rule to the scores and draw a column chart whose axis starts at 0.

References

- Microsoft Support, Basic tasks in Excel.
- Microsoft Support, Overview of formulas in Excel.
- Microsoft Support, Sort data in a range or table.

The End

Microsoft Excel

Previous: Chapter 3.1: Microsoft Word · Next: Chapter 3.3: Microsoft PowerPoint