

Navigating spreadsheets

INTRODUCTION TO SPREADSHEETS



James Chapman

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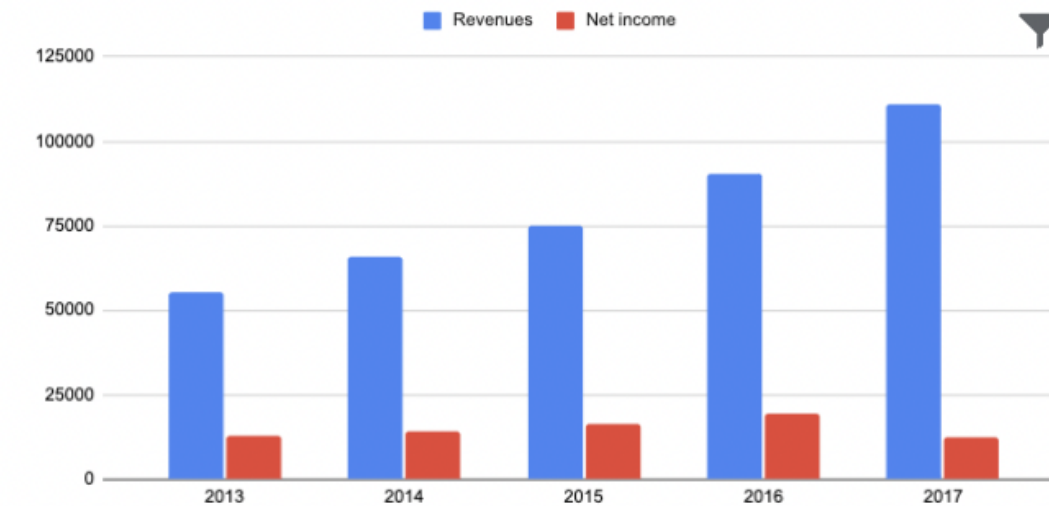
Spreadsheets

- Millions of users worldwide
- Intuitive interface
- Extract insights with a few clicks!

Income statement

\$ in millions

	2013	2014	2015	2016	2017
Revenues	55,519	66,001	74,989	90,272	110,855
Cost of revenues	21,993	25,691	28,164	35,138	45,583
Research and development	7,137	9,832	12,282	13,948	16,625
Sales and marketing	6,554	8,131	9,047	10,485	12,893
General and administrative	4,432	5,851	6,136	6,985	6,872
European Commission fine	0	0	0	0	2,736
Total costs and expenses	40,116	49,505	55,629	66,556	84,709
Income from operations	15,403	16,496	19,360	23,716	26,146
Other income (expense), net	496	763	291	434	1,047
Income before income taxes	15,899	17,259	19,651	24,150	27,193
Provision for income taxes	2,739	3,639	3,303	4,672	14,531
Net income	12,733	14,136	16,348	19,478	12,662
Less: Adjustment Payment to Class C capital stockholders	0	0	522	0	0
Net income available to all stockholders	12,733	14,136	15,826	19,478	12,662



¹ Annual financial data template from Google Sheets

Spreadsheet software

Google Sheets



- Supports live collaboration
- Completely free!
- **Used throughout this course**

Microsoft Excel



- Supports live collaboration
- Limited free version
- Integrates well with other Microsoft Products, including Power BI

Coming up...

Chapter 1

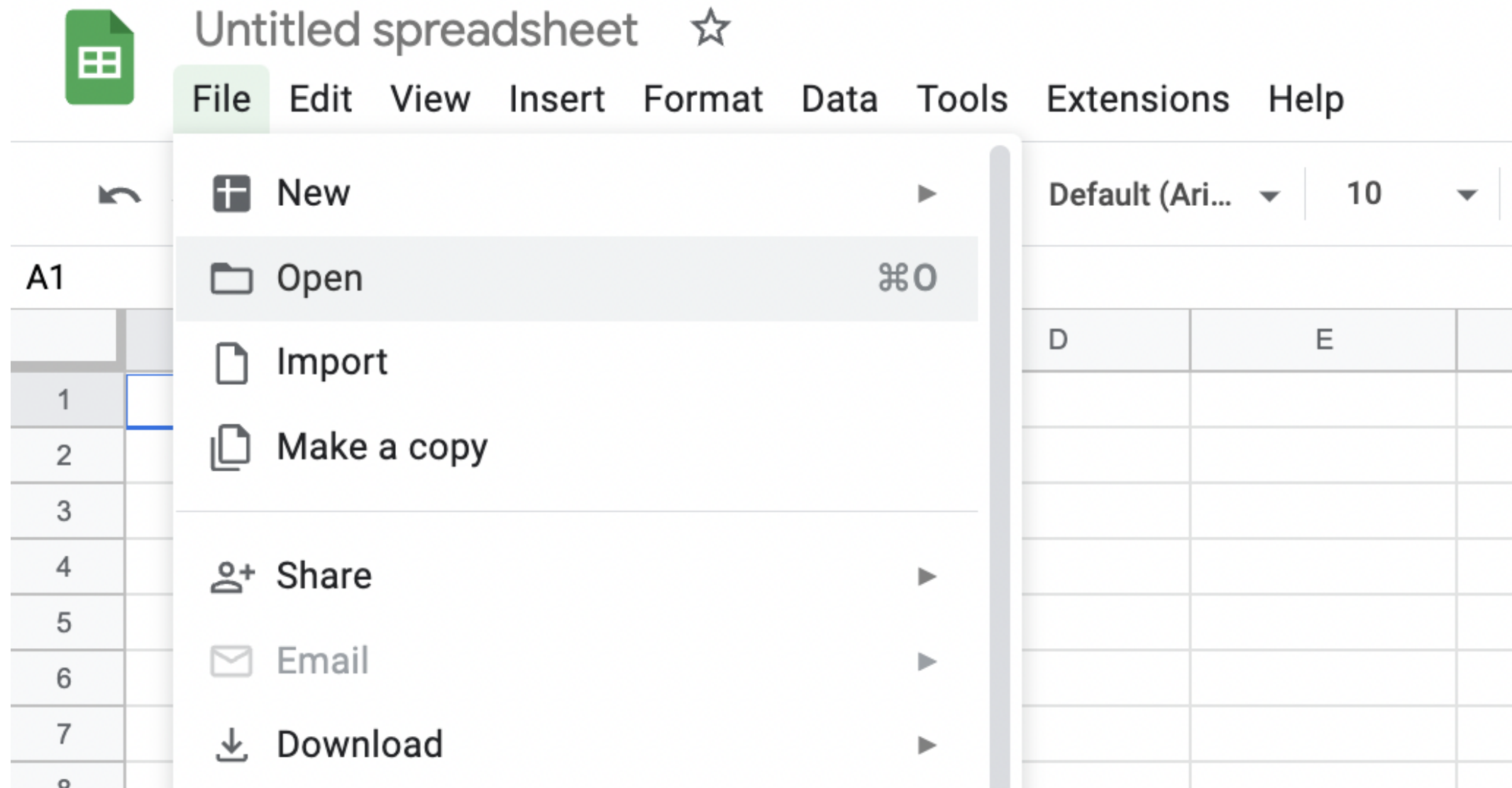
- Adding data to spreadsheets
- Creating formulas
- Formatting cells

Chapter 2

- Cell references
- Including cell references in formulas
- Absolute references

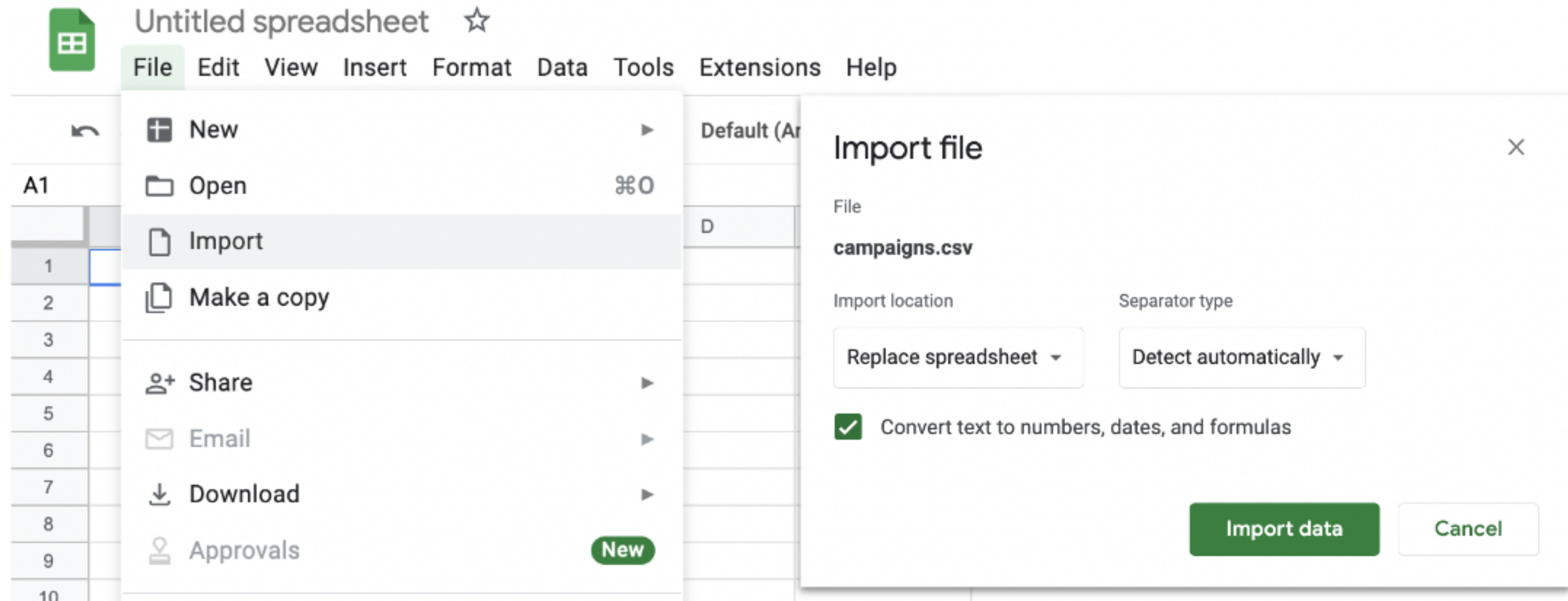
Opening spreadsheets

- To open an existing spreadsheet: File > Open



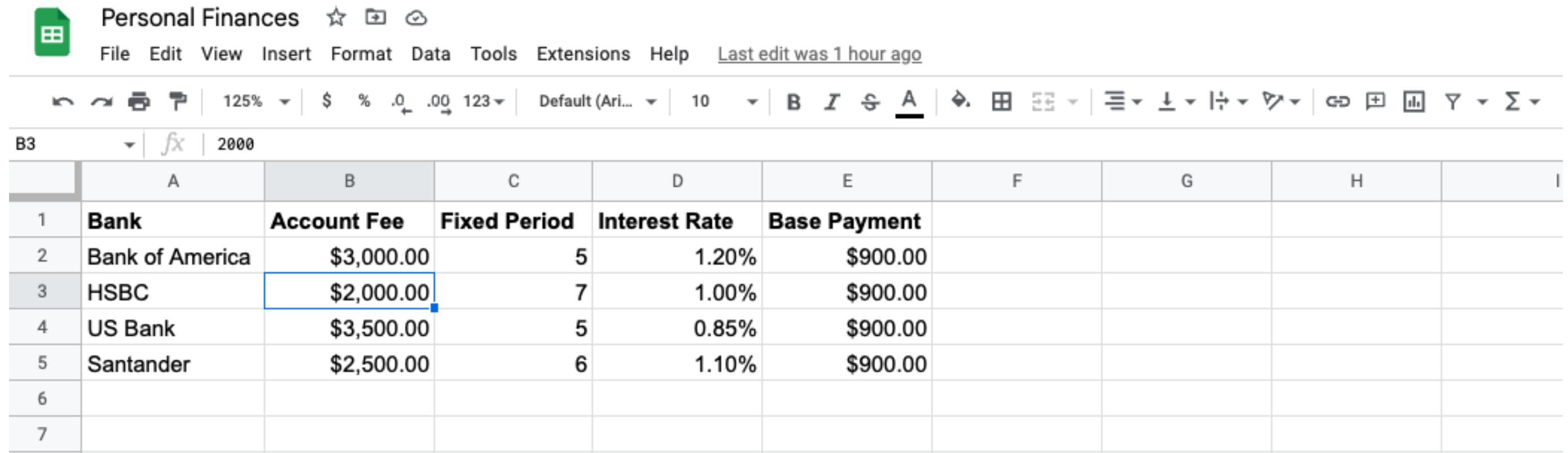
Importing data

- To import data: File > Import
- Can import many different file types, including: `.csv` , `.txt` , `.tsv` , `.xlsx`



Navigating spreadsheets

- Spreadsheets store **tabular data**
- Data is stored in individual **cells**
- Cells can contain data or perform calculations

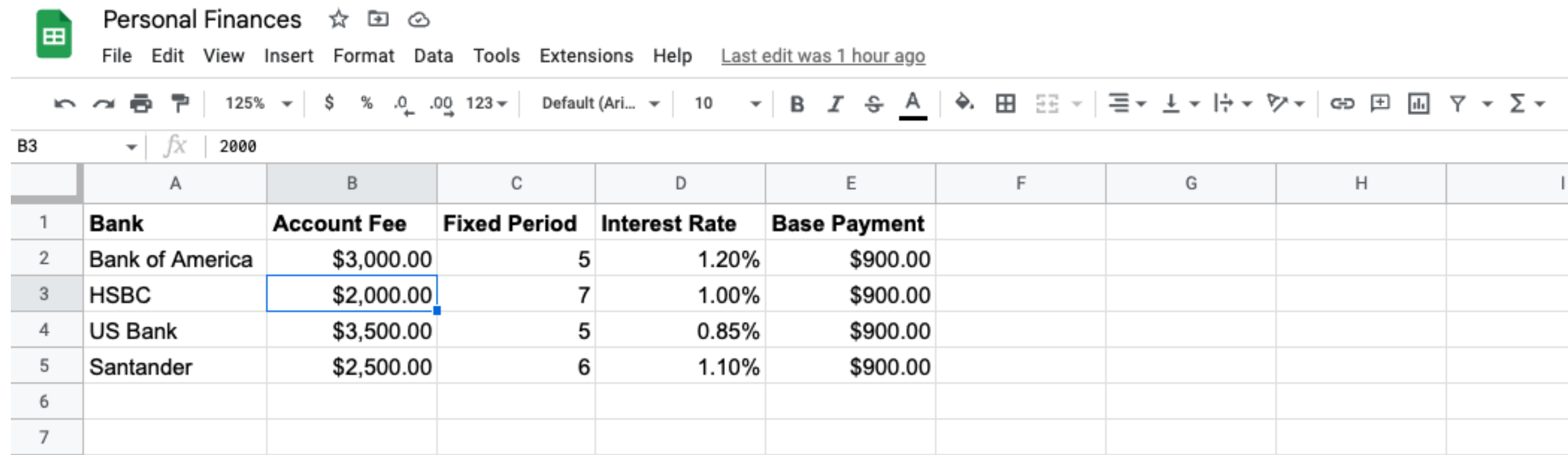


The screenshot shows a Google Sheet titled "Personal Finances" with a menu bar (File, Edit, View, Insert, Format, Data, Tools, Extensions, Help) and a status bar indicating the last edit was 1 hour ago. The toolbar includes various icons for undo, redo, print, copy, paste, font size (125%), currency (\$), percentage (%), decimal places (.0, .00), text color (123), background color (Default (Ari...)), bold (B), italic (I), strikethrough (ABC), underline (A), fill color, border, conditional formatting, text wrapping, text alignment, bullet points, indent, link, unlink, insert link, insert image, insert chart, insert table, and insert pivot table.

	A	B	C	D	E	F	G	H	I
1	Bank	Account Fee	Fixed Period	Interest Rate	Base Payment				
2	Bank of America	\$3,000.00	5	1.20%	\$900.00				
3	HSBC	\$2,000.00	7	1.00%	\$900.00				
4	US Bank	\$3,500.00	5	0.85%	\$900.00				
5	Santander	\$2,500.00	6	1.10%	\$900.00				
6									
7									

Cell addresses

- Cells can be *uniquely identified* by a column (letters) and row label (numbers)
- **Cell addresses** combine the column and row label
- Example: the value of \$2,000 is found in cell **B3**



Personal Finances

File Edit View Insert Format Data Tools Extensions Help Last edit was 1 hour ago

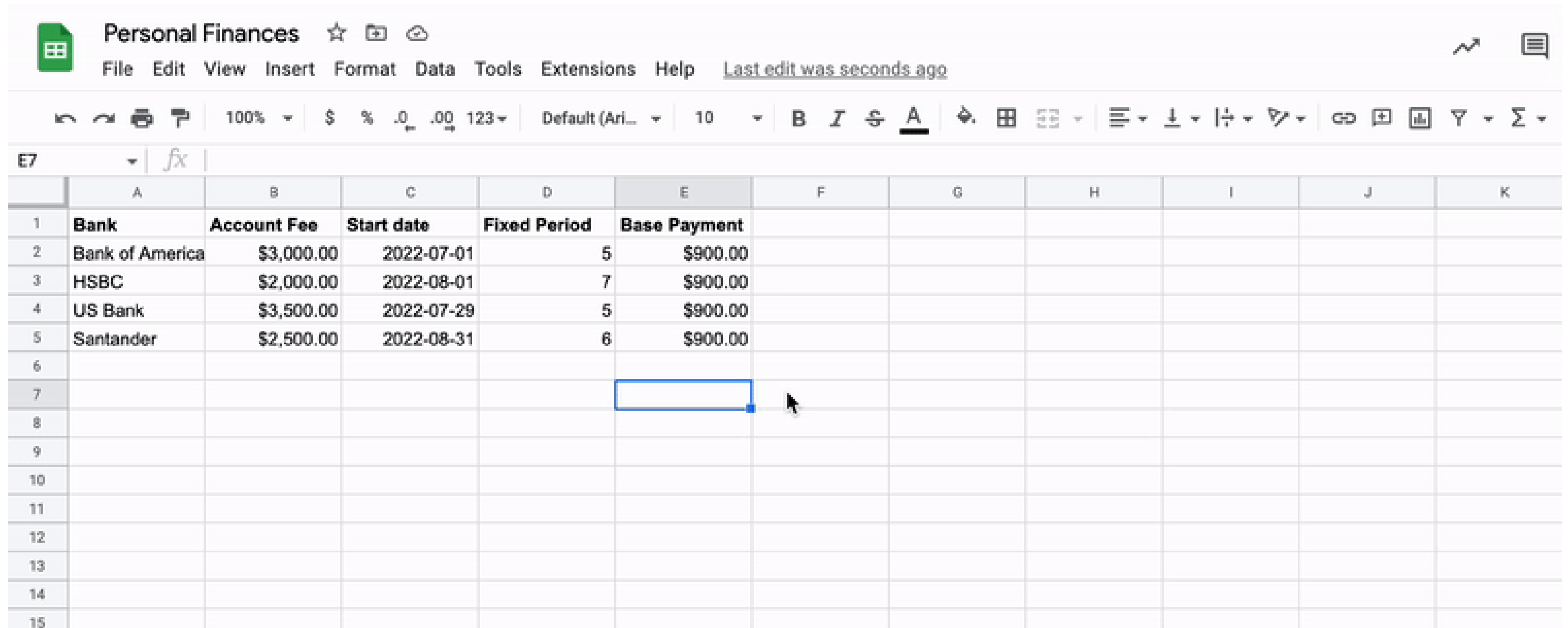
125% \$ % .0 .00 123 Default (Ari... 10 B I A

B3 2000

	A	B	C	D	E	F	G	H	I
1	Bank	Account Fee	Fixed Period	Interest Rate	Base Payment				
2	Bank of America	\$3,000.00	5	1.20%	\$900.00				
3	HSBC	\$2,000.00	7	1.00%	\$900.00				
4	US Bank	\$3,500.00	5	0.85%	\$900.00				
5	Santander	\$2,500.00	6	1.10%	\$900.00				
6									
7									

Adding and amending data

- Select the cell to add or amend, and type the new value



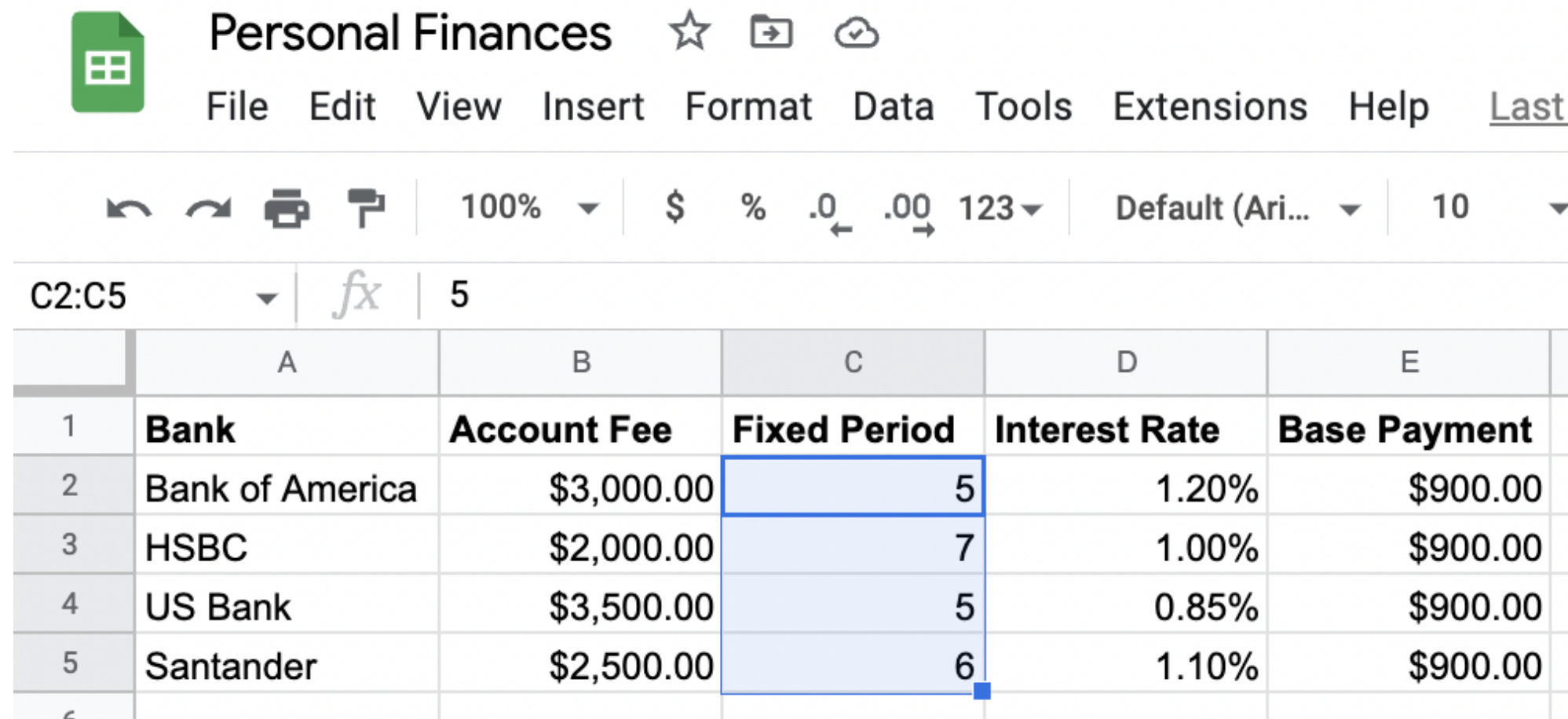
The screenshot shows a Google Sheet titled "Personal Finances" with a menu bar (File, Edit, View, Insert, Format, Data, Tools, Extensions, Help) and a toolbar with various formatting and editing tools. The sheet contains a table with the following data:

	A	B	C	D	E	F	G	H	I	J	K
1	Bank	Account Fee	Start date	Fixed Period	Base Payment						
2	Bank of America	\$3,000.00	2022-07-01	5	\$900.00						
3	HSBC	\$2,000.00	2022-08-01	7	\$900.00						
4	US Bank	\$3,500.00	2022-07-29	5	\$900.00						
5	Santander	\$2,500.00	2022-08-31	6	\$900.00						
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12											
13											
14											
15											

A new row is being added in column E, row 7, indicated by a blue border around the cell. A mouse cursor is pointing at the cell.

Cell ranges

- A **cell range** defines a rectangular group of cells
- Example: Column **C** between rows **2** and **5** → **C2:C5**

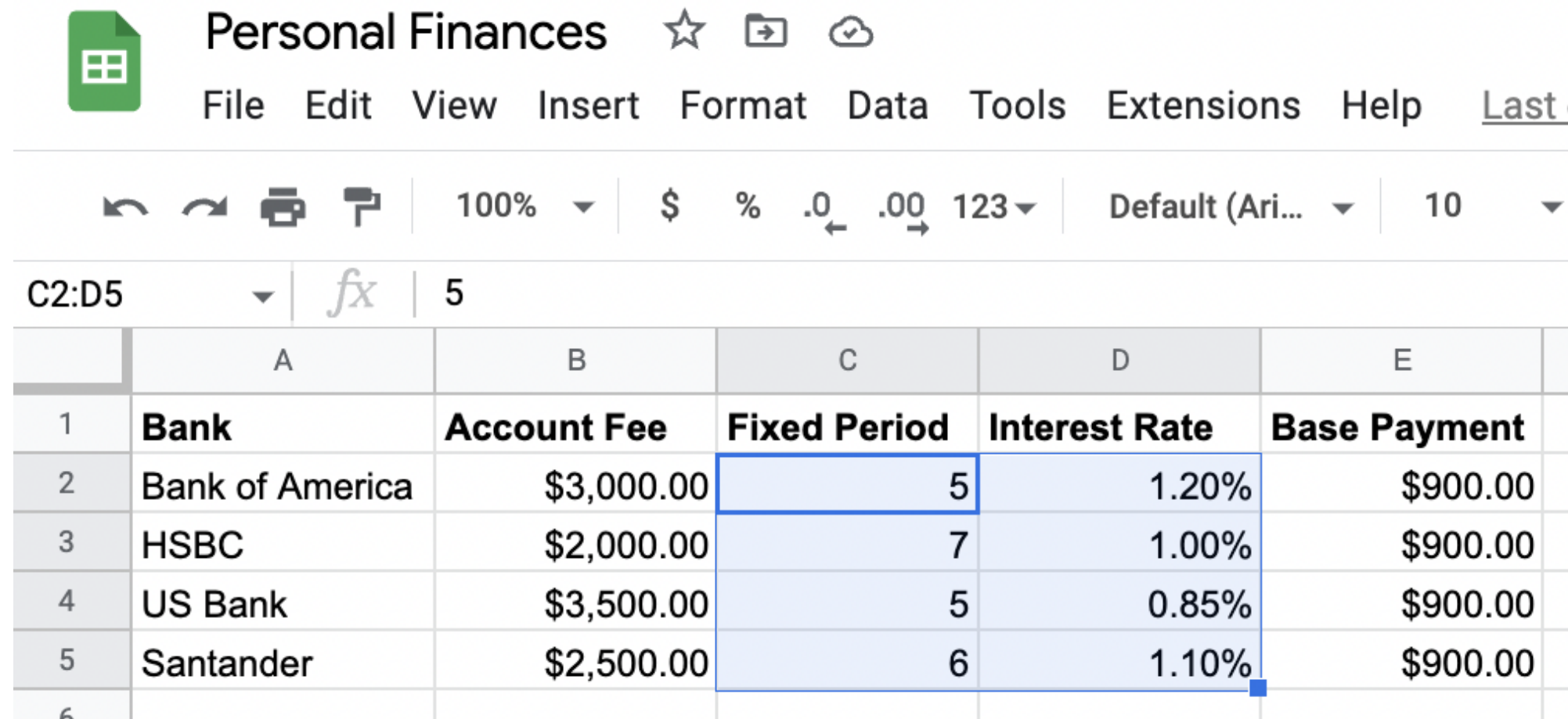


The screenshot shows the Google Sheets interface for a spreadsheet titled "Personal Finances". The menu bar includes File, Edit, View, Insert, Format, Data, Tools, Extensions, Help, and Last. The toolbar shows undo, redo, print, copy, zoom (100%), currency (\$), percentage (%), decimal places (.0, .00), text alignment (123), font face (Default (Ari...)), and font size (10). The active cell range is C2:C5, with the formula bar showing "fx" and the value "5". The spreadsheet data is as follows:

	A	B	C	D	E
1	Bank	Account Fee	Fixed Period	Interest Rate	Base Payment
2	Bank of America	\$3,000.00	5	1.20%	\$900.00
3	HSBC	\$2,000.00	7	1.00%	\$900.00
4	US Bank	\$3,500.00	5	0.85%	\$900.00
5	Santander	\$2,500.00	6	1.10%	\$900.00
6					

Cell ranges

- For groups across columns, define the range from *top-left* to *bottom-right*
- Example: Columns **C** and **D** between rows **2** and **5** → **C2:D5**

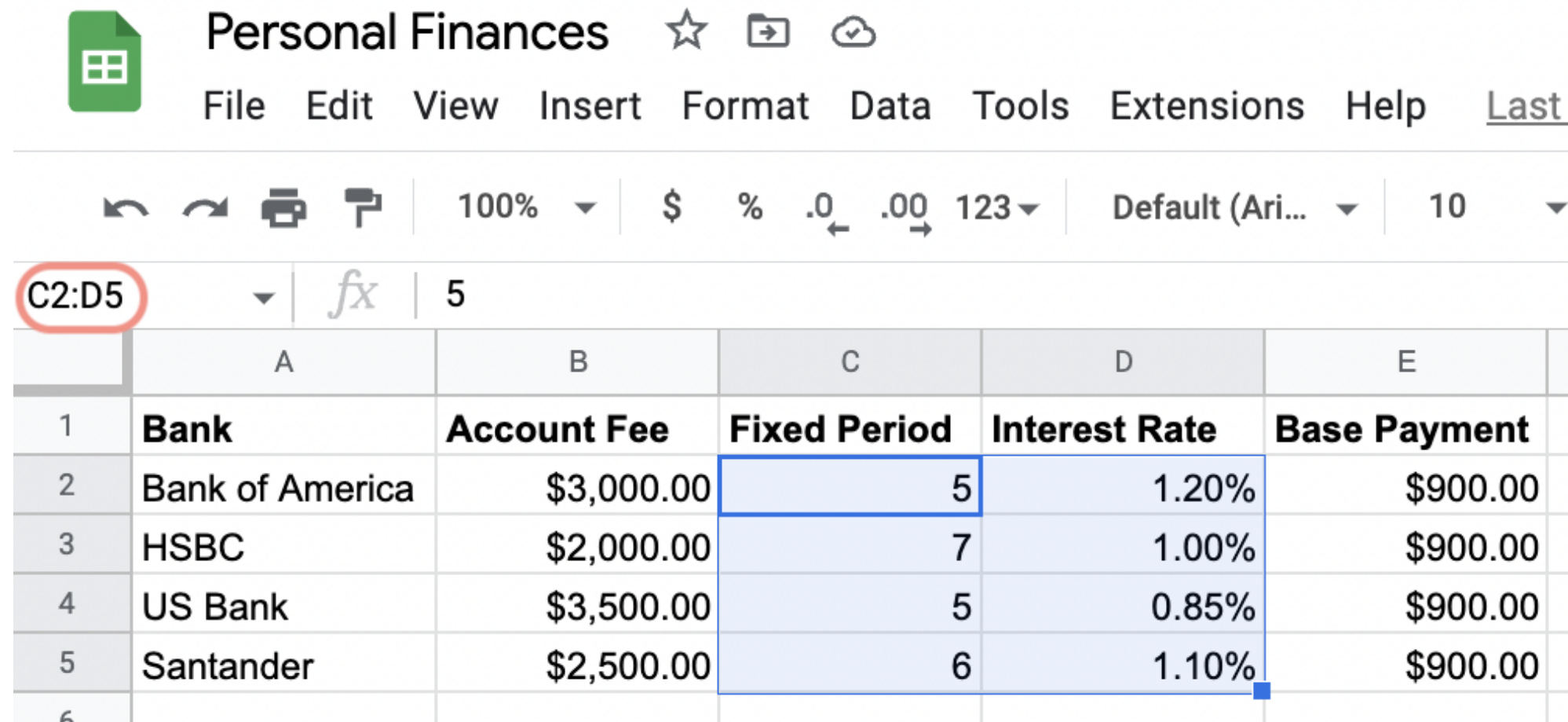


The screenshot shows the Google Sheets interface for a spreadsheet titled "Personal Finances". The menu bar includes File, Edit, View, Insert, Format, Data, Tools, Extensions, Help, and Last. The toolbar shows undo, redo, print, and copy icons, along with zoom (100%), currency (\$), percentage (%), decimal places (.0, .00), and text alignment (123). The formula bar shows the selected range C2:D5. The spreadsheet data is as follows:

	A	B	C	D	E
1	Bank	Account Fee	Fixed Period	Interest Rate	Base Payment
2	Bank of America	\$3,000.00	5	1.20%	\$900.00
3	HSBC	\$2,000.00	7	1.00%	\$900.00
4	US Bank	\$3,500.00	5	0.85%	\$900.00
5	Santander	\$2,500.00	6	1.10%	\$900.00
6					

Cell ranges

- For groups across columns, define the range from *top-left* to *bottom-right*
- Example: Columns **C** and **D** between rows **2** and **5** → **C2:D5**



The screenshot shows the Google Sheets interface for a file named "Personal Finances". The menu bar includes File, Edit, View, Insert, Format, Data, Tools, Extensions, Help, and Last. The toolbar shows undo, redo, print, copy, zoom (100%), currency (\$), percentage (%), decimal places (.0, .00), text color (123), font family (Default (Ari...)), and font size (10). The formula bar shows the selected range C2:D5, a function icon (fx), and the value 5. The spreadsheet data is as follows:

	A	B	C	D	E
1	Bank	Account Fee	Fixed Period	Interest Rate	Base Payment
2	Bank of America	\$3,000.00	5	1.20%	\$900.00
3	HSBC	\$2,000.00	7	1.00%	\$900.00
4	US Bank	\$3,500.00	5	0.85%	\$900.00
5	Santander	\$2,500.00	6	1.10%	\$900.00
6					

Let's practice!

INTRODUCTION TO SPREADSHEETS

Cell mathematics!

INTRODUCTION TO SPREADSHEETS



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Formulas

- Calculate results from other values
- Support common arithmetic operations, including: `+` , `-` , `*` , and `/`
- Allow interested stakeholders to see how values were calculated

Writing formulas

- `=` tells the spreadsheet that we are writing a formula in the cell

<div><div><div><div></div><div></div><div></div><div></div></div><div>100% ▾</div><div>\$ % .0_← .00_→ 123 ▾</div><div>Default (Ari... ▾</div><div>10 ▾</div><div>B</div></div></div>						
D2	<div><div><div><div></div><div><i>fx</i></div><div>=</div></div></div></div>					
	A	B	C	D	E	F
1	Bank	Account Fee	Fixed Period	Interest Rate	Base Payment	
2	Bank of America	\$3,000.00		<div><div>?</div><div>=</div></div>	\$900.00	
3	HSBC	\$2,000.00	7	1.00%	\$900.00	
4	US Bank	\$3,500.00	5	0.85%	\$900.00	
5	Santander	\$2,500.00	6	1.10%	\$900.00	
6						

Arithmetic examples

Addition

- Formula: `= 5 + 15`
- Displayed value: `20`

Multiplication

- Formula: `= 2 * 3.2`
- Displayed value: `6.4`

Subtraction

- Formula: `= 12.5 - 7`
- Displayed value: `5.5`

Division

- Formula: `= 8 / 3`
- Displayed value: `2.666666667`
- Dividing by zero → `#DIV/0!`

More advanced arithmetic

- Exponentiation: `^` → *caret*

Formula: `= 2 ^ 3`

Displayed value: `8`

- Specify order of operations: `()`

Formula: `= (2 + 3) * 6`

Displayed value: `30`

Order of operations

- Complex formula: $= (2 + 4) / 3 - 2$
 - Parentheses $()$
 - Exponents $^$
 - Multiplication $*$ and division $/$
 - Addition $+$ and subtraction $-$

Editing formulas

100%

\$

%

.0

.00

123

Default (Ari...

10

B

I

G12

fx

	A	B	C	D	E	F
1	Bank	Account Fee	Fixed Period	Interest Rate	Base Payment	
2	Bank of America	\$3,000.00	5	0.80%	\$900.00	
3	HSBC	\$2,000.00	7	1.00%	\$900.00	
4	US Bank	\$3,500.00	5	0.85%	\$900.00	
5	Santander	\$2,500.00	6	1.10%	\$900.00	
6						

Editing formulas

<div><div><div><div>↶</div><div>↷</div><div>🖨</div><div>📌</div></div><div>100% ▾</div><div><div>\$</div><div>%</div><div>.0 ↵</div><div>.00 ↲</div><div>123 ▾</div></div><div>Default (Ari... ▾</div><div>10 ▾</div><div><div>B</div><div><i>I</i></div><div><u>S</u></div></div></div></div>						
D2	<div><div><div>fx</div><div>= (2 * 1.2) / 300</div></div></div>					
	A	B	C	D	E	F
1	Bank	Account Fee	Fixed Period	Interest Rate	Base Payment	
2	Bank of America	\$3,000.00	5	0.80%	\$900.00	
3	HSBC	\$2,000.00	7	1.00%	\$900.00	
4	US Bank	\$3,500.00	5	0.85%	\$900.00	
5	Santander	\$2,500.00	6	1.10%	\$900.00	
6						

Editing formulas

<div><div><div><div></div><div></div><div></div><div></div></div><div>100% ▾</div><div><div>\$</div><div>%</div><div>.0</div><div>.00</div><div>123 ▾</div></div><div>Default (Ari... ▾</div><div>10 ▾</div><div><div>B</div><div>I</div><div>S</div></div></div></div>						
D2	<div><div><div>fx</div><div>?</div></div><div>= (2 * 1.2) / 150</div></div>					
	A	B	C	D	E	F
1	Bank	Account Fee	Fixed Period	Interest Rate	Base Payment	
2	Bank of America	\$3,000.00	5	= (2 * 1.2) / 150	\$900.00	
3	HSBC	\$2,000.00	7	1.00%	\$900.00	
4	US Bank	\$3,500.00	5	0.85%	\$900.00	
5	Santander	\$2,500.00	6	1.10%	\$900.00	
6						

Editing formulas

<div><div><div><div>↶</div><div>↷</div><div>🖨</div><div>📑</div></div><div>100% ▾</div><div><div>\$</div><div>%</div><div>.0 ↵</div><div>.00 ↵</div><div>123 ▾</div></div><div>Default (Ari... ▾</div><div>10 ▾</div><div><div>B</div><div><i>I</i></div><div>🔗</div></div></div></div>						
<div><div>D3 ▾</div><div><div><i>fx</i></div><div>1%</div></div></div>						
	A	B	C	D	E	F
1	Bank	Account Fee	Fixed Period	Interest Rate	Base Payment	
2	Bank of America	\$3,000.00	5	1.60%	\$900.00	
3	HSBC	\$2,000.00	7	1.00%	\$900.00	
4	US Bank	\$3,500.00	5	0.85%	\$900.00	
5	Santander	\$2,500.00	6	1.10%	\$900.00	
6						

Calculating percentages

<div><div><div><div>↶</div><div>↷</div><div>🖨</div><div>📌</div></div><div>100% ▾</div><div>\$ % .0_← .00_→ 123 ▾</div><div>Default (Ari... ▾</div><div>10 ▾</div><div>B <i>I</i> S <u>A</u></div><div>📌 🏠</div></div></div>							
<div>F2 ▾ <i>fx</i></div>							
	A	B	C	D	E	F	G
1	Bank	Account Fee	Fixed Period	Interest Rate	Base Payment		
2	Bank of America	\$3,000.00	5	0.80%	\$900.00		
3	HSBC	\$2,000.00	7	1.00%	\$900.00		
4	US Bank	\$3,500.00	5	0.85%	\$900.00		
5	Santander	\$2,500.00	6	1.10%	\$900.00		
6							

Calculating percentages

100% \$ % .0 .00 123 Default (Ari... 10 B I S A							
F2	fx	=					
	A	B	C	D	E	F	G
1	Bank	Account Fee	Fixed Period	Interest Rate	Base Payment		
2	Bank of America	\$3,000.00	5	0.80%	\$900.00	=	
3	HSBC	\$2,000.00	7	1.00%	\$900.00		
4	US Bank	\$3,500.00	5	0.85%	\$900.00		
5	Santander	\$2,500.00	6	1.10%	\$900.00		
6							

Calculating percentages

100% \$ % .0 .00 123 Default (Ari... 10 B I S A							
F2	fx	= 900					
	A	B	C	D	E	F	G
1	Bank	Account Fee	Fixed Period	Interest Rate	Base Payment		
2	Bank of America	\$3,000.00	5	0.80%	\$900.00	= 900	
3	HSBC	\$2,000.00	7	1.00%	\$900.00		
4	US Bank	\$3,500.00	5	0.85%	\$900.00		
5	Santander	\$2,500.00	6	1.10%	\$900.00		
6							

Calculating percentages

100%

\$
%
.0
.00
123

Default (Arial)
10
B
I
S
A

F2	fx	= 900 * 0.8%					
	A	B	C	D	E	F	G
1	Bank	Account Fee	Fixed Period	Interest Rate	Base Payment		
2	Bank of America	\$3,000.00	5	0.80%	\$900.00	= 900 * 0.8%	
3	HSBC	\$2,000.00	7	1.00%	\$900.00		
4	US Bank	\$3,500.00	5	0.85%	\$900.00		
5	Santander	\$2,500.00	6	1.10%	\$900.00		
6							

Calculating percentages

<div><div><div><div>↶</div><div>↷</div><div>🖨</div><div>📌</div></div><div>100% ▾</div><div>\$ % .0_← .00_→ 123 ▾</div><div>Default (Ari... ▾</div><div>10 ▾</div><div>B <i>I</i> <u>A</u></div><div>🔍 🏠</div></div></div>							
<div>F3 ▾ <i>fx</i></div>							
	A	B	C	D	E	F	G
1	Bank	Account Fee	Fixed Period	Interest Rate	Base Payment		
2	Bank of America	\$3,000.00	5	0.80%	\$900.00	7.2	
3	HSBC	\$2,000.00	7	1.00%	\$900.00		
4	US Bank	\$3,500.00	5	0.85%	\$900.00		
5	Santander	\$2,500.00	6	1.10%	\$900.00		
6							

Let's practice!

INTRODUCTION TO SPREADSHEETS

Data types and formatting

INTRODUCTION TO SPREADSHEETS



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Spreadsheet data types

- Types of data seen so far:
 - Numbers
 - Text
 - Dates
 - Currencies
- Every cell value has a data type

Spreadsheet data types

- Cell data types are automatically detected, but can also be manually assigned
- Data type determines:
 - What operations can be performed on the cell value
 - How the value be displayed

Data type: Number

- Any number inputted into a cell → Number data type
- Allow arithmetic operations and other statistical operations
- Numerical data is *right-aligned*, by default

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I9 ▾	<div><div>fx</div><div></div></div>					
	A	B	C	D	E	F
1	Bank	Account Fee	Start date	Interest Rate	Base Payment	
2	Bank of America	\$3,000.00	2022-07-01	0.80	\$900.00	
3	HSBC	\$2,000.00	2022-08-01	1.00	\$900.00	
4	US Bank	\$3,500.00	2022-07-29	0.85	\$900.00	
5	Santander	\$2,500.00	2022-08-31	1.10	\$900.00	
6						

Changing decimal places

<div><div><div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div></div><div>100% ▾</div><div><div>\$</div><div>%</div><div><div>.0</div><div>.00</div></div><div>123 ▾</div></div><div>Default (Ari... ▾</div><div>10 ▾</div><div><div>B</div><div><i>I</i></div><div><u>S</u></div></div><div>.</div></div></div>						
<div><div>D2:D5 ▾</div><div><i>fx</i></div><div>0.8</div></div>						
	A	B	C	D	E	F
1	Bank	Account Fee	Start date	Interest Rate	Base Payment	
2	Bank of America	\$3,000.00	2022-07-01	0.80	\$900.00	
3	HSBC	\$2,000.00	2022-08-01	1.00	\$900.00	
4	US Bank	\$3,500.00	2022-07-29	0.85	\$900.00	
5	Santander	\$2,500.00	2022-08-31	1.10	\$900.00	
6						

Reducing decimal places

<div><div><div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div></div><div>100% ▾</div><div><div>\$</div><div>%</div><div><div>.0</div><div>←</div></div><div><div>.00</div><div>→</div></div><div>123 ▾</div></div><div>Default (Ari... ▾</div><div>10 ▾</div><div><div>B</div><div><i>I</i></div><div><u>S</u></div></div><div>■</div></div></div>						
<div><div>D2:D5 ▾</div><div><i>fx</i></div><div>0.8</div></div>						
	A	B	C	D	E	F
1	Bank	Account Fee	Start date	Interest Rate	Base Payment	
2	Bank of America	\$3,000.00	2022-07-01	0.8	\$900.00	
3	HSBC	\$2,000.00	2022-08-01	1.0	\$900.00	
4	US Bank	\$3,500.00	2022-07-29	0.9	\$900.00	
5	Santander	\$2,500.00	2022-08-31	1.1	\$900.00	
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Adding decimal places

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<div><div>D2:D5 ▾</div><div><div><i>fx</i></div><div>0.8</div></div></div>						
	A	B	C	D	E	F
1	Bank	Account Fee	Start date	Interest Rate	Base Payment	
2	Bank of America	\$3,000.00	2022-07-01	0.800	\$900.00	
3	HSBC	\$2,000.00	2022-08-01	1.000	\$900.00	
4	US Bank	\$3,500.00	2022-07-29	0.850	\$900.00	
5	Santander	\$2,500.00	2022-08-31	1.100	\$900.00	
6						

Data type: Plain text

- Assigned to cell values if no other data types are detected
- Can force a cell to Plain text using the Format > Number > Plain text










The screenshot shows the Google Sheets interface for a spreadsheet titled "Personal Finances". The "Format" menu is open, and the "Number" submenu is also open, with "Plain text" selected. The background spreadsheet has two columns: "Bank" and "Account Fee".

	A	B
1	Bank	Account Fee
2	Bank of America	\$3,000.00
3	HSBC	\$2,000.00
4	US Bank	\$3,500.00
5	Santander	\$2,500.00
6		
7		
8		
9		
10		
11		

The "Format" menu options are: Theme, Number, Text, Alignment, Wrapping, Rotation, Font size, Merge cells. The "Number" submenu options are: Automatic (checked), Plain text, Number (1,000.12), Percent (10.12%), Scientific (1.01E+03), Accounting (\$ (1,000.12)), Financial ((1,000.12)).

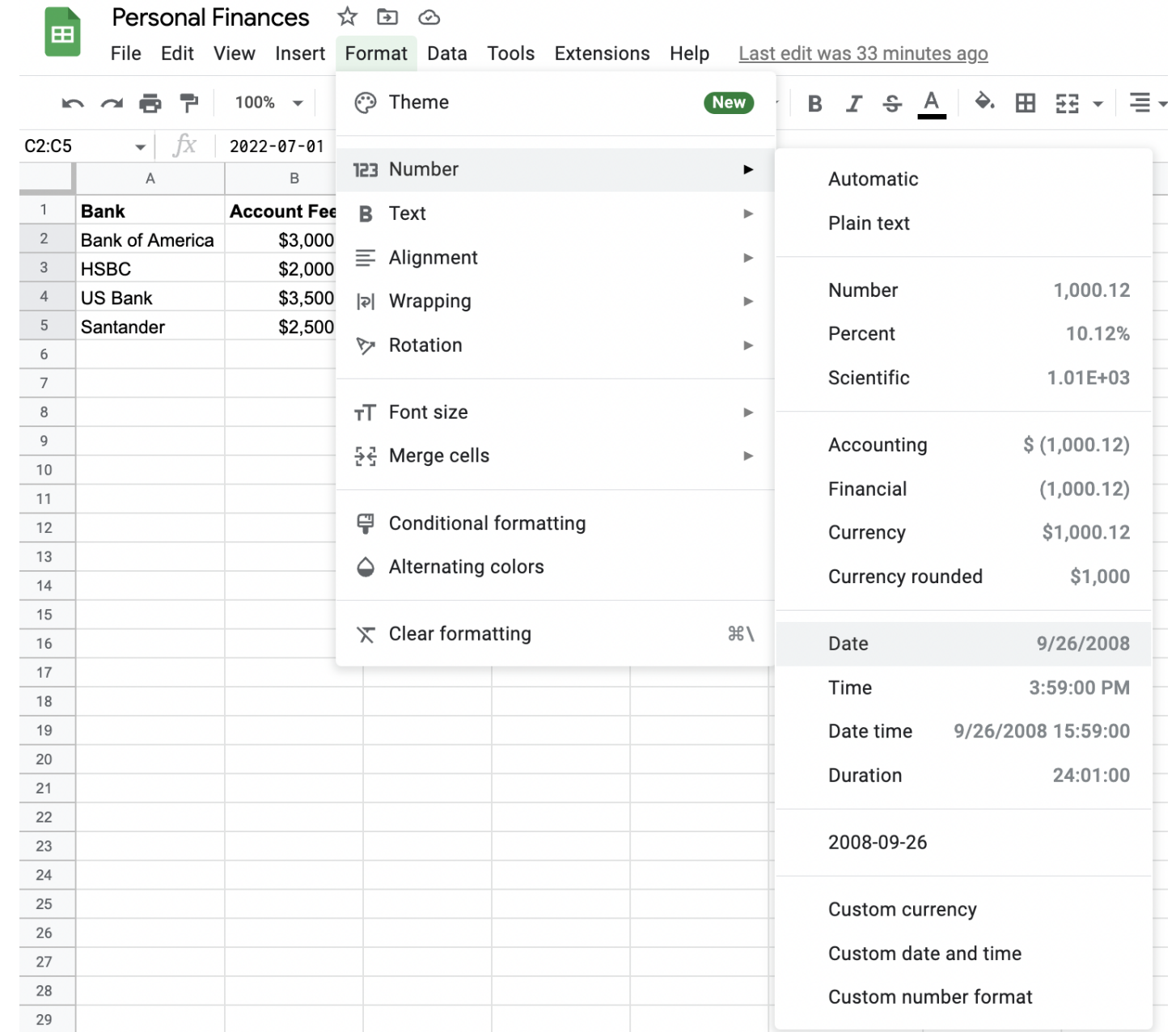
Data type: Plain text

- Assigned to cell values if no other data types are detected
- Can force a cell to Plain text by prepending the contents with `'`
 - Example: `'2` and `'= 2 + 3`
- Left-aligned by default

<div><div></div><div>100% ▾</div><div><div>\$</div><div>%</div><div>.0 </div><div>.00 </div><div>123 ▾</div></div><div>Default (Ari... ▾</div><div>10 ▾</div><div>B</div><div><i>I</i></div><div></div><div></div></div>						
I9 ▾	<div><div></div></div>					
	A	B	C	D	E	F
1	Bank	Account Fee	Start date	Interest Rate	Base Payment	
2	Bank of America	\$3,000.00	2022-07-01	0.80	\$900.00	
3	HSBC	\$2,000.00	2022-08-01	1.00	\$900.00	
4	US Bank	\$3,500.00	2022-07-29	0.85	\$900.00	
5	Santander	\$2,500.00	2022-08-31	1.10	\$900.00	
6						









Data type: Date

- Many different date formats:
 - 2022-07-29
 - 29/7/2022
 - July 29, 2022
- Can auto-detect many date formats
- Manually specify or convert dates:
 - Format > Number
- Right-aligned by default



Data type: Currency

- Cells starting with \$, £ , € , or other currency symbol, then a number → Currency
- Right-aligned by default

<div><div></div><div>100% ▾</div><div><div>\$</div><div>%</div><div>.0 </div><div>.00 </div><div>123 ▾</div></div><div>Default (Ari... ▾</div><div>10 ▾</div><div>B</div><div><i>I</i></div><div><u>S</u></div><div></div></div>						
I9 ▾	<div><div></div></div>					
	A	B	C	D	E	F
1	Bank	Account Fee	Start date	Interest Rate	Base Payment	
2	Bank of America	\$3,000.00	2022-07-01	0.80	\$900.00	
3	HSBC	\$2,000.00	2022-08-01	1.00	\$900.00	
4	US Bank	\$3,500.00	2022-07-29	0.85	\$900.00	
5	Santander	\$2,500.00	2022-08-31	1.10	\$900.00	
6						

Data type: Logical

- Logical/Boolean values: `TRUE` and `FALSE`
- Logical values are case-sensitive
- Different cases will be converted, e.g., `true` → `TRUE`
- Center-aligned by default

Comparison operators

- Equal to: `=`
 - `= 1 + 2 = 3` → `TRUE`
- Not equal to: `<>`
 - `= 1 + 2 <> 3` → `FALSE`
- Greater than: `>`
 - `= 1 + 2 > 3` → `FALSE`
- Less than: `<`
 - `= 1 + 2 < 3` → `FALSE`
- Greater than or equal to: `>=`
 - `= 1 + 2 >= 3` → `TRUE`
- Less than or equal to: `<=`
 - `= 1 + 2 <= 3` → `TRUE`

Let's practice!

INTRODUCTION TO SPREADSHEETS