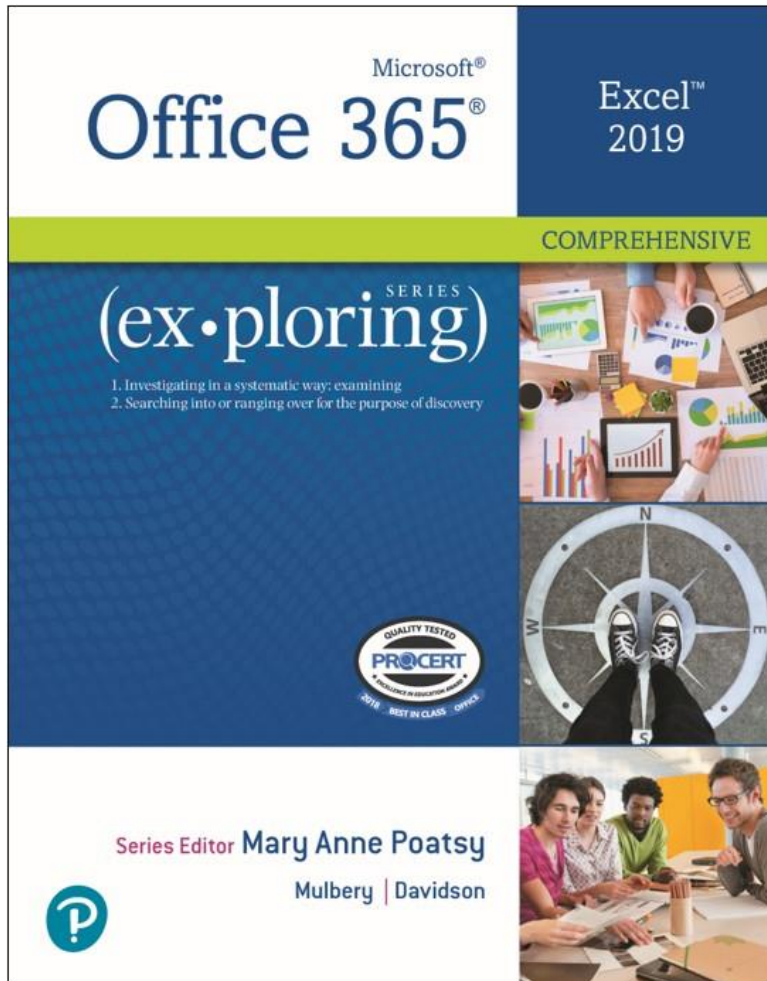


Microsoft® Office 365® Excel™ 2019 Comprehensive



Chapter 6

What-If Analysis

Learning Objectives

- 6.1 Create and Maintain Range Names
- 6.2 Create a One-Variable Data Table
- 6.3 Create a Two-Variable Data Table
- 6.4 Determine Optimal Input Values Using Goal Seek
- 6.5 Use Scenario Manager
- 6.6 Load the Solver Add-In
- 6.7 Optimize Results with Solver

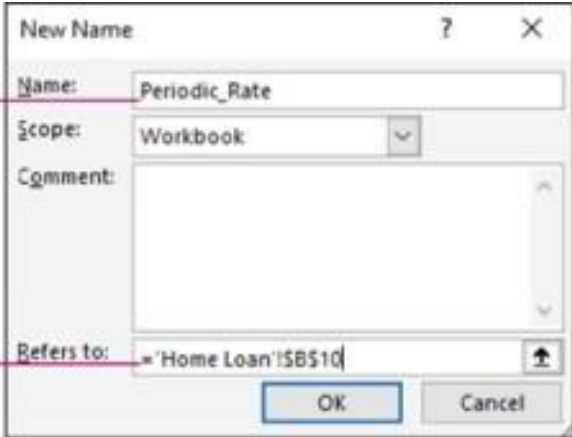
Creating and Maintaining Range Names (1 of 5)

- Range name—word or string of characters assigned to one or more cells
- Range name rules
 - Can contain up to 255 characters
 - Must begin with a letter or an underscore
 - Combination of upper- or lowercase letters, numbers, periods, and underscores
 - Cannot include spaces or special characters
 - Create range names that describe the range of cells being named
 - Keep the range names short

Creating and Maintaining Range Names (2 of 5)

Type range name

Check range address



New Name

Name: Periodic_Rate

Scope: Workbook

Comment:

Refers to: =Home Loan!\$B\$10

OK Cancel

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Create Names from Selection

Create names from values in the:

☐ Top row

☒ Left column

☐ Bottom row

☐ Right column

OK Cancel

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Creating and Maintaining Range Names (3 of 5)

The screenshot shows the 'Name Manager' dialog box in Microsoft Excel. It contains a table of defined names and buttons for managing them. Three callouts with lines pointing to specific elements provide instructions:

- Create a new range name:** Points to the 'New...' button.
- Select a range name:** Points to the 'Periodic_Rate' entry in the 'Name' column of the table.
- Edit or delete the selected range name:** Points to the 'Edit...' and 'Delete' buttons.

The table in the Name Manager has the following data:

Name	Value	Refers To	Scope	Comment
Periodic_Rate	0.50%	= 'Home Loan'!\$B\$10	Workbook	

Below the table, the 'Refers to:' section shows the formula `= 'Home Loan'!$B$10` with a 'Close' button at the bottom right.

Creating and Maintaining Range Names (4 of 5)

Part of range name being entered

Indicates function

Indicates range name

	A	B	C	D
1	Purchase	\$175.25		
2	Tax Rate	3.25%		
3	Tax Amount	=Purchase*Ta		
4				
5				
6				

fx TAN
fx TANH
Tax_Rate

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Creating and Maintaining Range Names (5 of 5)

The screenshot shows the Microsoft Excel interface with the 'Formulas' ribbon selected. The 'Defined Names' group shows a list of names and their references. A callout points to the 'Paste Name' button, stating 'Select option to display Paste Name dialog box'. Another callout points to the 'Paste list' button in the 'Paste Name' dialog box, stating 'Insert a list of range names'. A third callout points to the 'Paste list' button, stating 'Names pasted starting in active cell'.

Range Names	References
Amount_of_Loan	=Home Loan!\$B\$9
No_Payment_Periods	=Home Loan!\$B\$11
Periodic_Rate	=Home Loan!\$B\$10
Purchase	=Sheet1!\$B\$1
Tax_Rate	=Sheet1!\$B\$2

Paste Name dialog box options:

- ☒ Paste list
- ☐ Paste range
- ☐ Paste values
- ☐ Paste formulas
- ☐ Paste comments
- ☐ Paste styles

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Creating a One-Variable Data Table (1 of 5)

The screenshot shows the Microsoft Excel interface with the 'Data' tab selected. The ribbon includes options like 'Fill', 'Clear', 'Sort & Filter', and 'Select'. A 'One-Variable Data Table' is set up with the following data:

Input Area		One-Variable Data Table: APR		Two-Variable Data Table: APR and Cost of Car	
		Calculated Results for Each APR		Monthly Payment by Cost/APR	
Cost of home	\$150,000.00	APR			
Down Payment	\$ 10,000.00	5.00%			
APR	4.00%	5.50%			
No. Years for Loan	30	6.00%			
Payments Per Year	12	6.50%			
Out		7.00%			
Amor		7.50%			
Periodic Rate	0.33%	8.00%			
No. Payment Periods	360	8.50%			
Monthly Payment	\$ 668.38	9.00%			
Total to Repay Loan	\$ 240,617.31				
Total Interest Paid	\$ 100,617.31				

The 'Series' dialog box is open, showing 'Columns' selected under 'Series in' and 'Linear' selected under 'Type'. The 'Step value' is set to .50% and the 'Stop value' is set to 9.00%.

Annotations:

- Fill command
- Series of substitution values for input cell
- Create a column of substitution values
- Enter increment value
- Enter last substitution value

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Creating a One-Variable Data Table (2 of 5)

Location of Substitution Values	Enter the First Formula Reference	Enter Additional Formula References
Vertically in a column	On the row above and one column to the right of the first substitution value	To the right of the first formula reference
Horizontally in a row	On the row below and one column to the left of the first substitution value	Below the first formula reference

Creating a One-Variable Data Table (3 of 5)

[illegible]

Creating a One-Variable Data Table (4 of 5)

The screenshot shows the Microsoft Excel interface with the 'Data' tab selected. The ribbon includes options for 'Get & Transform Data', 'Queries & Connections', 'Data Types', 'Sort & Filter', and 'Data Tools'. The 'Data Table' command is highlighted in the 'Data Tools' group. A callout points to the 'Data Table' command, stating 'Display list containing the Data Table command'. Another callout points to the 'Input Area' of the 'One-Variable Data Table: APR', stating 'Reference to original formulas'.

Input Area		One-Variable Data Table: APR				Two-Variable Data Table: APR and Cost of Car			
		Calculated Results for Each APR				Monthly Payment by Cost/APR			
Cost of home	\$150,000.00	APR	\$ 668.38	\$ 240,617.31	\$ 100,617.31				
Down Payment	\$ 10,000.00	5.00%	\$ 751.55	\$ 270,558.10	\$ 130,558.10				
APR	4.00%	5.50%	\$ 794.90	\$ 286,165.66	\$ 146,165.66				
No. Years for Loan	30	6.00%	\$ 839.37	\$ 302,173.46	\$ 162,173.46				
Payments Per Year	12	6.50%	\$ 884.90	\$ 318,562.28	\$ 178,562.28				
		7.00%	\$ 931.42	\$ 335,312.46	\$ 195,312.46				
		7.50%	\$ 978.90	\$ 352,404.11	\$ 212,404.11				
		8.00%	\$ 1,027.27	\$ 369,817.35	\$ 229,817.35				
		8.50%	\$ 1,076.48	\$ 387,532.40	\$ 247,532.40				
		9.00%	\$ 1,126.47	\$ 405,529.80	\$ 265,529.80				

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Creating a One-Variable Data Table (5 of 5)

The screenshot shows an Excel spreadsheet titled "Mortgage Analysis - Excel". The spreadsheet contains a "One-Variable Data Table: APR" with columns for APR, Payment, Total Repaid, and Total Interest. The data table is located in the range D3:E14. The "Payment" column is highlighted in blue. The "Format Cells" dialog box is open, showing the "Number" tab. The "Category" is set to "Custom", and the "Type" is set to "Payment". The "Sample" text shows the formatted value "Payment".

Annotations in the image include:

- Cell E3 contains a reference
- Open the Format Cells dialog box
- General replaced with "Payment" to display in cell E3
- Displays Payment label entered in the Type box
- Custom number category

Input Area		One-Variable Data Table: APR			
		Calculated Results for Each APR			
		APR	Payment	Total Repaid	Total Interest
Cost of home	\$ 150,000.00	5.00%	\$ 751.55	\$ 270,558.10	\$ 130,558.10
Down Payment	\$ 10,000.00	5.50%	\$ 794.90	\$ 286,165.66	\$ 146,165.66
APR	4.00%	6.00%	\$ 839.37	\$ 302,173.46	\$ 162,173.46
No. Years for Loan	30	6.50%	\$ 884.90	\$ 318,562.28	\$ 178,562.28
Payments Per Year	12	7.00%	\$ 931.42	\$ 335,312.46	\$ 195,312.46
Output Area		7.50%	\$ 978.90	\$ 352,404.11	\$ 212,404.11
Amount of Loan	\$ 140,000.00	8.00%	\$ 1,027.27	\$ 369,817.35	\$ 229,817.35
Periodic Rate	0.33%	8.50%	\$ 1,076.48	\$ 387,532.40	\$ 247,532.40
No. Payment Periods	360	9.00%	\$ 1,126.47	\$ 405,529.80	\$ 265,529.80
Monthly Payment	\$ 668.38				
Total to Repay Loan	\$ 240,617.31				
Total Interest Paid	\$ 100,617.31				

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Creating a Two-Variable Data Table (1 of 2)

Input Area

Cost of home	\$150,000.00
Down Payment	\$ 10,000.00
APR	4.00%
No. Years for Loan	30
Payments Per Year	12

Output Area

Amount of Loan	\$140,000.00
Periodic Rate	0.33%
No. Payment Periods	360
Monthly Payment	\$ 668.38
Total to Repay Loan	\$240,617.31
Total Interest Paid	\$100,617.31

Two-Variable Data Table: APR and Cost of Car

Monthly Payment by Cost/APR	\$ 10,000.00	\$ 15,000.00	\$ 20,000.00
5.00%	\$668.38		
5.50%			
6.00%			
6.50%			
7.00%			
7.50%			
8.00%			
8.50%			
9.00%			

Annotations:

- Interest rate variable substitution values (points to APR values in the data table)
- Down payment variable substitution values (points to Cost of Car values in the data table)
- Top-left cell contains reference to Monthly Payment (points to the \$668.38 cell)

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Creating a Two-Variable Data Table (2 of 2)

	A	B	C	D	E	F	G
1	Input Area			Two-Variable Data Table: APR and Cost of Car			
2	Cost of home	\$ 150,000.00		Monthly Payment by Cost/APR			
3	Down Payment	\$ 10,000.00		APR	\$ 10,000.00	\$ 15,000.00	\$ 20,000.00
4	APR	4.00%		5.00%	\$ 751.55	\$ 724.71	\$ 697.87
5	No. Years for Loan	30		5.50%	\$ 794.90	\$ 766.52	\$ 738.13
6	Payments Per Year	12		6.00%	\$ 839.37	\$ 809.39	\$ 779.42
7				6.50%	\$ 884.90	\$ 853.29	\$ 821.69
8	Output Area			7.00%	\$ 931.42	\$ 898.16	\$ 864.89
9	Amount of Loan	\$ 140,000.00		7.50%	\$ 978.90	\$ 943.94	\$ 908.98
10	Periodic Rate	0.33%		8.00%	\$ 1,027.27	\$ 990.58	\$ 953.89
11	No. Payment Periods	360		8.50%	\$ 1,076.48	\$ 1,038.03	\$ 999.59
12	Monthly Payment	\$ 668.38		9.00%	\$ 1,126.47	\$ 1,086.24	\$ 1,046.01
13	Total to Repay Loan	\$ 240,617.31					
14	Total Interest Paid	\$ 100,617.31					
15							

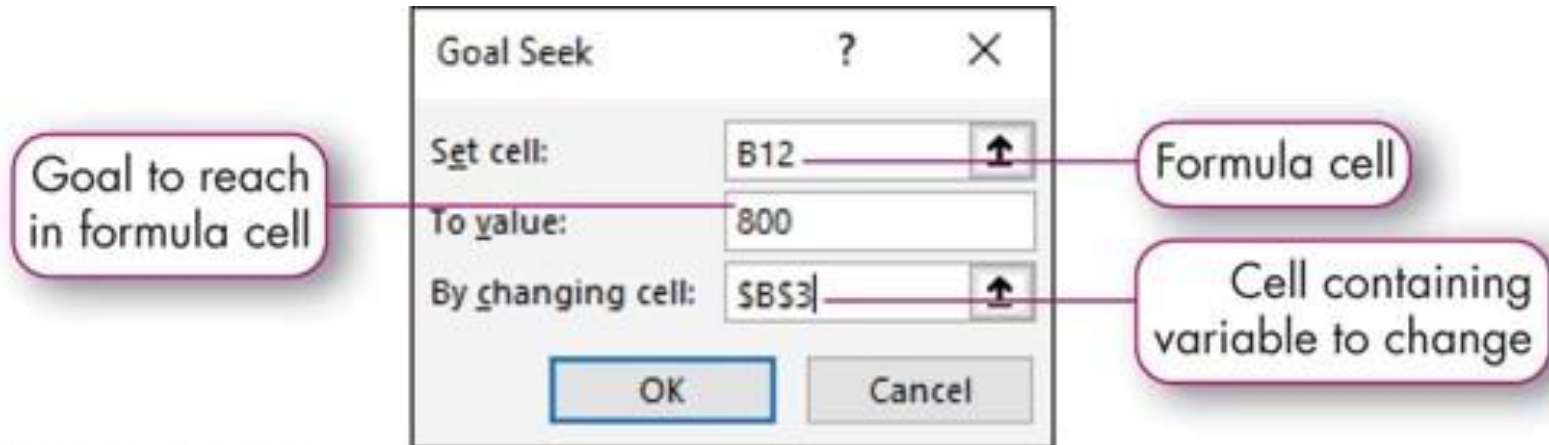
Merged column heading added above substitution values

Formatted results

Custom number format applied

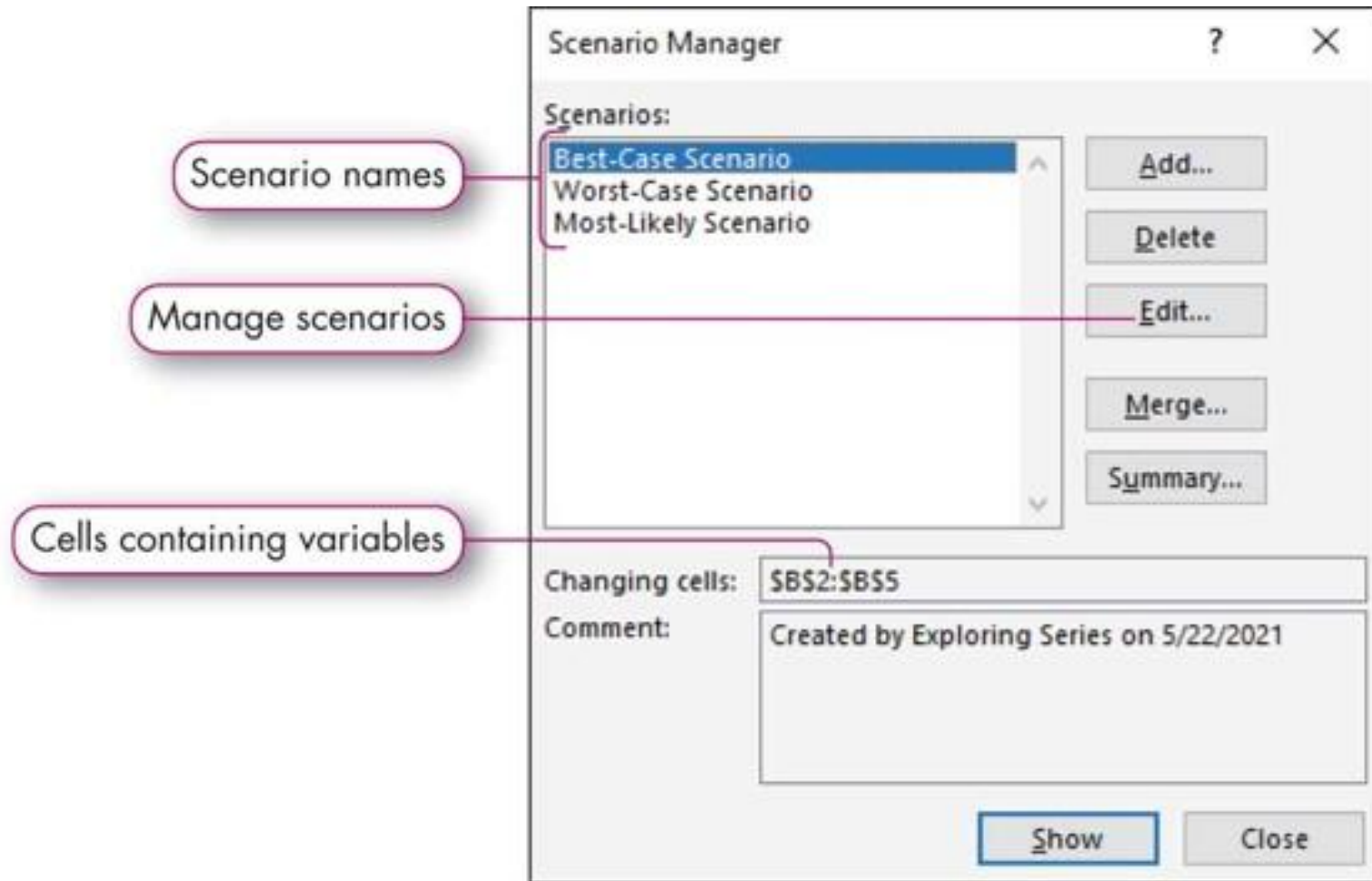
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Determining Optimal Input Values Using Goal Seek



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Using Scenario Manager (1 of 3)



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Using Scenario Manager (2 of 3)

Add Scenario

Scenario name:

Changing cells:

Ctrl+click cells to select non-adjacent changing cells.

Comment:

Created by Exploring Series on 5/22/2021

Protection

☒ Prevent changes

☐ Hide

OK Cancel

Scenario names

Collapse button

Date created
automatically added

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Using Scenario Manager (3 of 3)

The screenshot displays the Excel Scenario Manager interface. A 'Scenario Summary' table is shown, detailing current values and three scenarios: Best-Case, Worst-Case, and Most-Likely. The table includes changing cells (B5:B5) and result cells (B12:B14). Callouts point to specific features: 'Blank column to delete' (column D), 'Blank row to delete' (row 2), 'Current values' (B5:B5), 'Scenario names, parameters, and results columns' (the main table area), and 'New worksheet tab for scenario summary' (the 'Scenario Summary' tab at the bottom).

Scenario Summary		Current Values:	Best-Case Scenario	Worst-Case Scenario	Most-Likely Scenario
Changing Cells:					
\$B\$2	\$	150,000.00	\$ 150,000.00	\$ 150,000.00	\$ 150,000.00
\$B\$3	\$	10,000.00	\$ 10,000.00	\$ 45,000.00	\$ 30,000.00
\$B\$4		4.50%	2.25%	6.00%	4.25%
\$B\$5		30	15	45	30
Result Cells:					
\$B\$12	\$	709.36	\$ 917.12	\$ 563.10	\$ 590.33
\$B\$13	\$	255,369.40	\$ 165,081.36	\$ 304,073.35	\$ 212,518.03
\$B\$14	\$	115,369.40	\$ 25,081.36	\$ 199,073.35	\$ 92,518.03

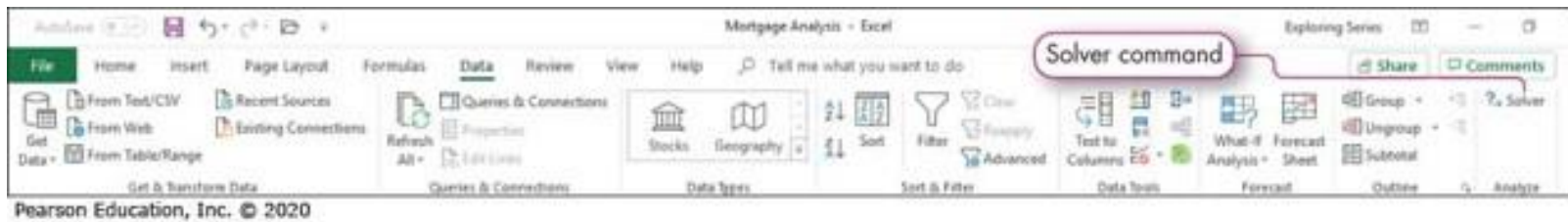
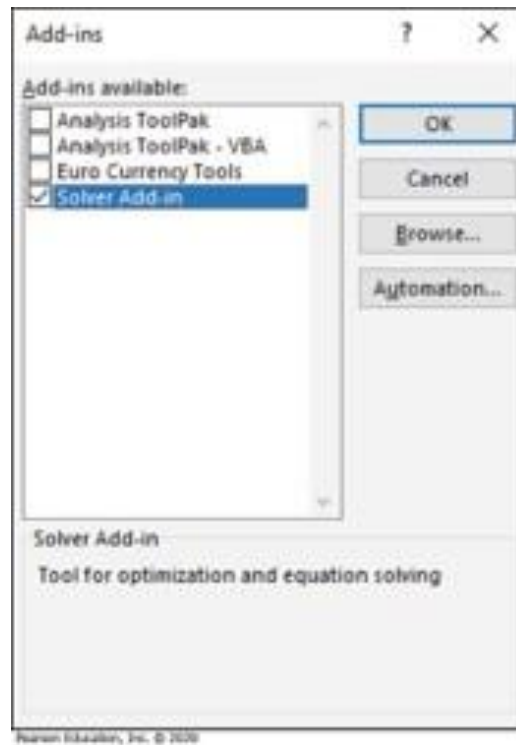
Notes: Current Values column represents values of changing cells at time Scenario Summary Report was created. Changing cells for each scenario are highlighted in gray.

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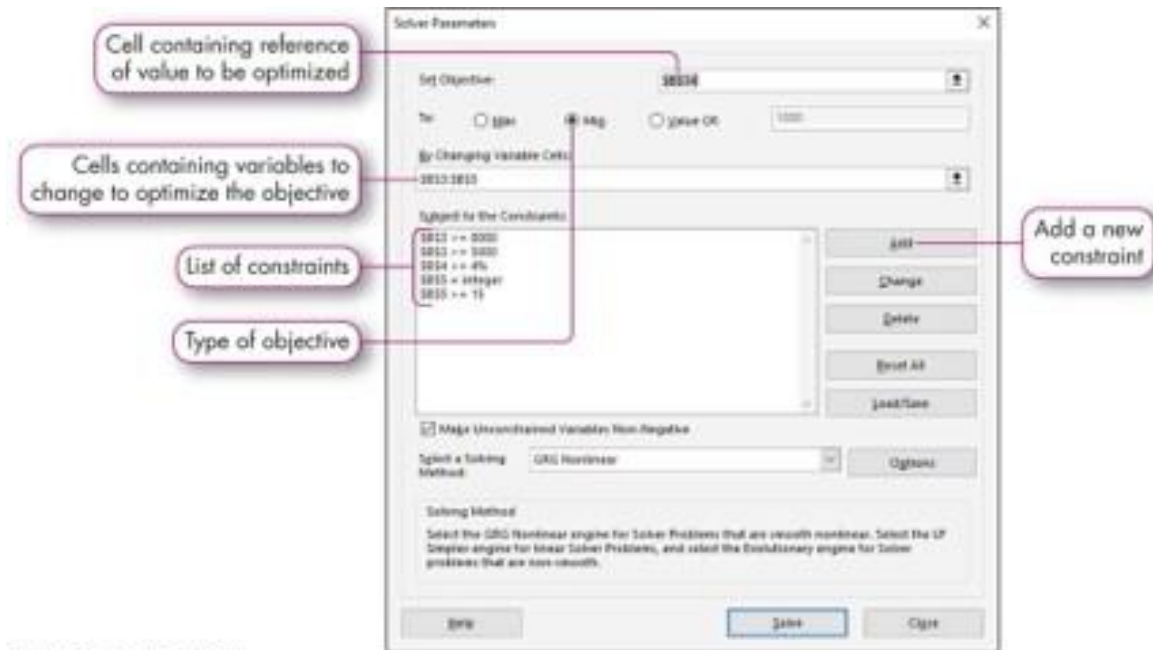
Solver

- Add-ins—programs that can be added to Excel
- Solver—add-in that searches for the best or optimum solution to a problem
- Optimization models—find the highest, lowest, or exact value for one result

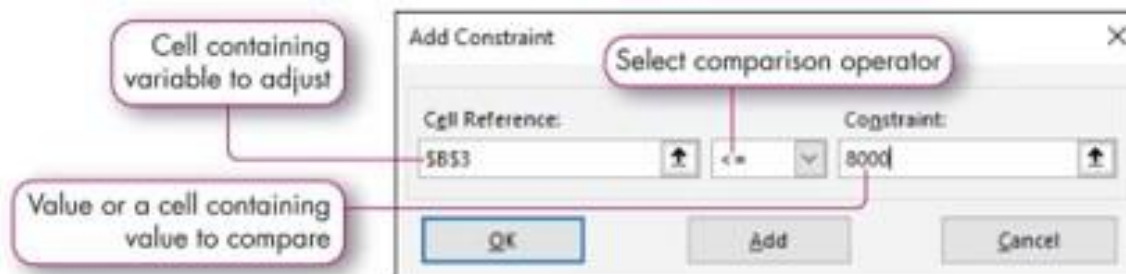
Loading the Solver Add-In



Optimizing Results with Solver (1 of 3)



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Optimizing Results with Solver (2 of 3)

Solver Results

Solver found a solution. All Constraints and optimality conditions are satisfied.

☒ **Keep Solver Solution**

☐ **Restore Original Values**

☐ **Return to Solver Parameters Dialog**

☐ **Outline Reports**

Reports

Answer

OK **Cancel** **Save Scenario...**

Solver found a solution. All Constraints and optimality conditions are satisfied.

When the GRG engine is used, Solver has found at least a local optimal solution. When Simplex LP is used, this means Solver has found a global optimal solution.

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Optimizing Results with Solver (3 of 3)

Solver report information

Objective Cell section

Variable Cells section

New worksheet created for Solver report

A	B	C	D	E	F	G	H
1	Microsoft Excel 15.0 Answer Report						
2	Worksheet: [e06h3mortgage_LastFirst.xlsx]Home Loan						
3	Report Created: 5/18/2021 3:49:10 PM						
4	Result: Solver found a solution. All Constraints and optimality conditions are satisfied.						
5	Solver Engine						
6	Engine: GRG Nonlinear						
7	Solution Time: 0.109 Seconds.						
8	Iterations: 1 Subproblems: 2						
9	Solver Options						
10	Max Time Unlimited, Iterations Unlimited, Precision 0.000001.						
11	Convergence 0.0001, Population Size 100, Random Seed 0, Derivatives Central						
12	Max Subproblems Unlimited, Max Integer Sols Unlimited, Integer Tolerance 1%, Assume NonNegative						
13							
14	Objective Cell (Value Of)						
15	Cell	Name	Original Value	Final Value			
16	\$B\$12	Monthly Payment	\$ 668.38	\$ 1,000.00			
17							
18							
19	Variable Cells						
20	Cell	Name	Original Value	Final Value	Integer		
21	\$B\$3	Down Payment	\$ 10,000.00	\$ 10,000.00	Contin		
22	\$B\$4	APR	4.00%	5.96%	Contin		
23	\$B\$5	No. Years for Loan	30	20	Integer		
24							
		Answer Report 1	Scenario Summary	Home Loan			
Ready							

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