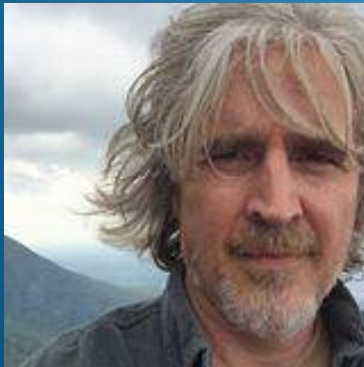




# Introduction to What-If Analysis

Written and Presented by  
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**About the speaker:**

David H. Ringstrom, CPA, is an author and nationally recognized instructor who teaches scores of webinars each year. His Excel courses are based on over 25 years of consulting and teaching experience. His mantra is “Either you work Excel, or it works you.” David offers spreadsheet and database consulting services nationwide.

# Excel Versions

**Excel 2016**

You can play back a recording of this presentation for free by way of your Lambers account.

**Excel 2013**

**Excel 2010**

**Excel 2007**

This button is equivalent to the File menu in other Excel versions.

1 File

Cautionary notes, where applicable, will appear in red.

2 Open

Detailed handouts with numbered steps enable you to recreate the steps I demonstrate.

19 [Excel Tip: Calculating Interest](#)

20 [Excel Tip: C](#)

21 [Improving](#)

22 [Exploring the Nuances of the SUM Function in Excel](#)

23 [How to Find Circular References in Excel](#)

Related Articles

58 As referred to during the presentation:

59 Page 4

60 Page 5

61 Page 6

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Car Payment

Hover over slide numbers within the example workbook to view the PowerPoint slides.



# Excel's What If Analysis Features

The screenshot shows the Microsoft Excel interface with the **Data** tab selected. The ribbon includes the following groups and items:

- Get & Transform Data**: Get Data, Refresh All.
- Queries & Connections**: Sort, Filter, Clear, Reapply, Advanced.
- Sort & Filter**: Sort, Filter, Clear, Reapply, Advanced.
- Text to Columns**: Text to Columns.
- What-If Analysis**: What-If Analysis (circled with a red circle and labeled 2), Forecast Sheet (circled with a red circle and labeled 4), Outline.
- Data Analysis**: Solver (circled with a red circle and labeled 5).

Numbered callouts provide additional information:

- 1**: The **Data** tab is highlighted.
- 2**: The **What-If Analysis** group is highlighted.
- 3**: A yellow callout box states: "These commands are available in all versions of Excel." It points to the **What-If Analysis** group.
- 4**: A yellow callout box states: "Forecast Sheets can only be created in Excel 2016 but the results can be viewed in earlier versions of Excel." It points to the **Forecast Sheet** button.
- 5**: A yellow callout box states: "The Solver command only appears on the Data menu once you've enabled the Solver Add-In." It points to the **Solver** button.

# PMT Function

	A	B	C	D	E	F	G	H
1	Interest	5.25%						
2	Term	360						
3	Principal	350,000						
4	Payment	1,932.71	<b>=-PMT(B1/12,B2,B3)</b>					
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

Excel assumes an outflow, so add a minus sign before PMT to show a positive amount.

**=-PMT(B1/12,B2,B3)**

rate	nper	pv
B1/12	B2	B3
the interest rate for the loan expressed on same basis as nper, i.e. divide by 12 if term is in months	the length of the loan (in this case in months)	present value of amount being borrowed (or lent)

PMT Function

# CUMIPMT Function

	A	B	C	D
1	Interest	5.25%		Excel assumes an outflow, so add a minus sign before CUMIPMT to show a positive amount.
2	Term	360		
3	Principal	350,000		
4	Payment	1,933	=-PMT(B1/12,B2,B3)	
5	Total Interest	342,746	=-CUMIPMT(B1/12,B2,B3,1,B2,1)	
6				
7				
8				
9				

## =-CUMIPMT(B1/12,B2,B3,1,B2,0)

rate	nper	pv	start_period	end_period	type
B1/12	B2	B3	1	B2	0
the interest rate for the loan expressed on same basis as nper, i.e. divide by 12 if term is in months	the length of the loan (in this case in months)	present value of amount being borrowed (or lent)	The month number of the first period in the calculation	The month number of the last period in the calculation	0 (zero) for payments made at the end of a period  1 for payments made at the beginning of a period

CUMIPMT Function



# Scenario Manager Feature

The image shows the Excel Scenario Manager feature in use. It includes a worksheet with loan data, the Scenario Manager dialog box, and the Scenario Values dialog box. Numbered callouts (1-8) highlight key steps: 1. Selecting input cells (B1:B3), 2. Clicking the 'Data' tab, 3. Clicking 'What-If Analysis', 4. Clicking 'Scenario Manager...', 5. Clicking 'Add...', 6. Assigning a name to the scenario, 7. Clicking 'OK', and 8. Clicking 'Add' in the Scenario Values dialog.

**Worksheet Data:**

	A	B	C
1	Interest	5.25%	
2	Term	360	
3	Loan	350,000	
4	Payment	\$1,932.71	
5	Total Interest	\$ 342,745.90	
6		$=\text{PMT}(\text{B1}/12, \text{B2}, \text{B3})$	
7		$=\text{CUMIPMT}(\text{B1}/12, \text{B2}, \text{B3}, 1, \text{B2}, 1)$	

**Scenario Manager Dialog:**

- Add Scenario**
- Scenario name: 503 Elm Street - 30 Year Loan
- Changing cells: B1:B3
- Comment: Created by David on 5/31/20xx
- Protection: ☒ Prevent changes, ☐ Hide
- Buttons: Add..., Delete, Edit..., Merge..., Summary..., OK, Cancel, Show, Close

**Scenario Values Dialog:**

- Enter values for each of the changing cells.
- 1: \$B\$1 0.0525
- 2: \$B\$2 360
- 3: \$B\$3 350000
- Buttons: Add, OK, Cancel

# Scenario Manager Feature

**Left Screenshot: Add Scenario Dialog Box**

- Scenario name:** 503 Elm Street - 15 Year Loan (circled with 9)
- Changing cells:** B1:B3
- Comment:** Created by David on 5/31/20xx
- Protection:**
  - ☒ Prevent changes
  - ☐ Hide
- OK button:** circled with 10

**Right Screenshot: Scenario Values Dialog Box**

- Enter values for each of the changing cells:**
  - 1: \$B\$1: 0.0475 (circled with 11)
  - 2: \$B\$2: 180 (circled with 11)
  - 3: \$B\$3: 350000
- OK button:** circled with 12

**Bottom Screenshot: Scenario Manager List**

- 13** Add two additional scenarios:
  - 231 Maple Street - 30 year loan
    - \$B\$1: 0.0525
    - \$B\$2: 360
    - \$B\$3: 275000
  - 231 Maple Street - 15 year loan
    - \$B\$1: 0.0475
    - \$B\$2: 180
    - \$B\$3: 275000



# Scenario Manager Feature

**Left Screenshot (Initial Setup):**

	A	B	C
1	Interest	5.25%	<code>=-PMT(B1/12,B2,B3)</code>
2	Term	360	<code>=-CUMIPMT(B1/12,B2,B3,1,B2,1)</code>
3	Loan	350,000	
4	Payment	\$1,932.71	
5	Total Interest	\$ 342,745.90	

**Scenario Manager Dialog Box:**

Scenarios:

- 503 Elm Street - 30 Year Loan
- 503 Elm Street - 15 Year Loan
- 231 Maple Street - 30 Year Loan
- 231 Maple Street - 15 Year Loan** (Selected)

Buttons: Add..., Delete, Edit..., Merge..., Summary...

Changing cells: \$B\$1:\$B\$3

Comment: Created by David on 5/31/20xx

Buttons: Show, Close

**Annotation 14:** Choose any scenario.

**Annotation 15:** Show

**Right Screenshot (Results after Selection):**

	A	B	C
1	Interest	4.75%	<code>=-PMT(B1/12,B2,B3)</code>
2	Term	180	<code>=-CUMIPMT(B1/12,B2,B3,1,B2,1)</code>
3	Loan	275,000	
4	Payment	\$2,139.04	
5	Total Interest	\$ 108,508.74	

**Annotation 16:** The spreadsheet now shows the inputs for the scenario you selected.



# Scenario Manager Summary

The image shows the Excel interface with the Scenario Manager and Scenario Summary tools. Numbered callouts highlight the following steps:

- 1**: Click the **Data** tab in the ribbon.
- 2**: Click the **What-If Analysis** button in the Data tab.
- 3**: Click **Scenario Manager...** in the What-If Analysis dropdown.
- 4**: Click the **Summary...** button in the Scenario Manager dialog.
- 5**: Click **OK** in the Scenario Summary dialog.
- 6**: A new worksheet titled **Scenario Summary** is created, comparing all scenarios side-by-side.

The Scenario Summary worksheet displays the following data:

		503 Elm Street - 30 Year Loan	503 Elm Street - 15 Year Loan	231 Maple Street - 30 Year Loan	231 Maple Street - 15 Year Loan
<b>Current Values:</b>					
<b>Changing Cells:</b>					
\$B\$1	4.75%	5.25%	4.75%		
\$B\$2	180	360	180		
\$B\$3	275,000	350,000	350,000		
<b>Result Cells:</b>					
\$B\$4	\$2,139.04	\$1,932.71	\$2,722.41		
\$B\$5	\$108,508.74	\$342,745.90	\$138,102.04		

# Named Ranges/Scenario Summary

**1** Select the cells that comprise the scenario inputs and formulas.

**2** Formulas

**3** Create from Selection

**4** OK

**5** Data

**6** What-If Analysis

**7** Scenario Manager...

**8** Summary..

**9** OK



# Named Ranges/Scenario Summary

The image displays two side-by-side screenshots of an Excel Scenario Summary report, illustrating the use of named ranges versus cell addresses.

**Left Screenshot (Named Ranges):**

Scenario Summary			
		503 Elm Street - 30	503 Elm Street
Current Values:		Year	Loan
<b>Changing Cells:</b>			
Interest	5.25%	5.25%	4
Term	360	360	
Loan	350,000	350,000	350,000
<b>Result Cells:</b>			
Payment	1,933	1,933	2
Total Interest	342,746	342,746	138

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.

**Right Screenshot (Cell Addresses):**

Scenario Summary		
Changing Cells:		
\$B\$1		
\$B\$2		
\$B\$3		
Result Cells:		
\$B\$4		
\$B\$5		

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.

**Excel uses range names instead of cell addresses when available, which greatly improves the readability of the Scenario Summary report.**



# Scenario Summary Pivot Table

**Scenario Manager**

Scenarios:

- 503 Elm Street - 30 Year Loan
- 503 Elm Street - 15 Year Loan
- 231 Maple Street - 30 Year Loan
- 231 Maple Street - 15 Year Loan

Buttons: Add..., Delete, Edit..., Merge..., Summary...

Changing cells: \$B\$1:\$B\$3

**Scenario Summary**

Report type:

- ☐ Scenario summary
- ☒ Scenario PivotTable report

Result cells: B4,B5

Buttons: OK, Cancel

**Scenario PivotTable**

Row Labels	Payment	Total Interest
231 Maple Street - 15 Year Loan	2139.037774	108508.7438
231 Maple Street - 30 Year Loan	2210.663717	121186.1547
503 Elm Street - 30 Year Loan	1932.712957	342745.9014
503 Elm Street - 15 Year Loan	2722.411712	138102.0376

Pivot Table generated by Scenario Manager.

# Merging Scenarios

**1** Open a workbook that contains scenarios.

**2** Scenario Manager.xlsx - Excel

**3** Data

**4** Scenario Manager...

**5** Merge...

**6** Merge Scenarios

**7** Merge scenarios from  
Scenario Manager.xlsx  
Sheet: Scenario Manager

**8** Click OK to import all scenarios from the selected worksheet into the current workbook.

**9** The scenarios are now part of the current workbook.

Excel indicates if the worksheet selected in step 7 contains any scenarios.

There are 4 scenarios on source sheet.

OK Cancel

**Scenario Manager**

Scenarios:

No Scenarios defined. Choose Add to

Changing cells:

	A	B	C	D	E	F	G	H
1	Interest	2.25%						
2	Term	360						
3	Loan	300,000	$=-PMT(B1/12,B2,B3)$					
4	Payment	\$1,146.74	$=-CUMIPMT(B1/12,B2,B3,1,B2,1)$					
5	Total Interest	\$112,053.19						

**Scenario Manager**

Scenarios:

- 503 Elm Street - 30 Year Loan
- 503 Elm Street - 15 Year Loan
- 231 Maple Street - 30 Year Loan
- 231 Maple Street - 15 Year Loan



# Scenarios With > 32 Fields

**1** Type these values in a blank worksheet.

**2** Drag the Fill Handle from cell A1 down to cell A64 to create a series.

**3** Select cells B1:B2 and then double-click the Fill Handle to create a series of numbers.

**4** Select cells B1:B32.

**5** Data

**6** What-If Analysis

**7** Scenario Manager

**8** Add...



# Scenarios With > 32 Fields

**9** Add Scenario

Scenario name: 10 - Set 1 of 2

Changing cells: B1:B32

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

Comment: Created by David on 11/28/20xx

Protection

☒ Prevent changes

☐ Hide

**10** OK

**11** Scenario Values

Enter values for each of the changing cells.

	1:	SB\$1	10
2:	SB\$2	20	
3:	SB\$3	30	
4:	SB\$4	40	
5:	SB\$5	50	

**12** Close

**13** Type 100 in cell B1, 200 in cell B2, and then double-click the Fill Handle in cell B2 to create a new series.

**14** Data

**15** What-If Analysis

**16** Scenario Manager...

**17** Add...

Scenarios:

Scenarios:
10 - Set 1 of 2
10 - Set 2 of 2

Changing cells: \$B\$33:\$B\$64

# Scenarios With > 32 Fields

**Step 18:** Add Scenario dialog box. Scenario name: 100 - Set 1 of 2. Changing cells: B1:B32. Comment: Created by David on 11/28/20xx. Protection: ☒ Prevent changes, ☐ Hide. OK button.

**Step 19:** Click cells to select non-adjacent changing cells.

**Step 20:** OK button.

**Step 22:** Add Scenario dialog box. Scenario name: 100 - Set 2 of 2. Changing cells: B33:B64. Comment: Created by David on 11/28/20xx. Protection: ☒ Prevent changes, ☐ Hide. OK button.

**Step 23:** Ctrl+click cells to select non-adjacent changing cells.

**Step 24:** OK button.

**Step 26:** Scenario Manager dialog box. Scenarios list: 100 - Set 1 of 2, 100 - Set 2 of 2. Add... button.

**Step 27:** Show button.

**Step 28:** Scenario Manager dialog box. Scenarios list: 100 - Set 1 of 2, 100 - Set 2 of 2. Add... button.

**Step 29:** Show button.

**Step 21:** Scenario Values dialog box. Enter values for each of the changing cells. Add button.

**Step 25:** Scenario Values dialog box. Enter values for each of the changing cells. OK button.

**Callout:** You can manually apply the scenarios in succession since they affect two different groups of cells.



# Automating Scenarios > 32 Fields

The image shows two windows from the Microsoft Excel environment. On the left is the 'Macro' dialog box, and on the right is the 'Microsoft Visual Basic for Applications' editor.

**Macro Dialog Box (Left):**

- 1** The 'View' button in the top ribbon is circled.
- 2** The 'Macros' button in the 'Tell me what you want to do' section is circled.
- 3** The 'Macro name:' field contains 'ApplyScenario1' and is circled.
- 4** The 'Create' button is circled.

**Visual Basic Editor (Right):**

- The window title is 'Microsoft Visual Basic for Applications - Scenario Summary - 64 Inputs.xlsm - [Module2 ...]'.
- The 'General' tab is selected, and the 'ApplyScenario1' module is chosen.
- 5** The first macro code is circled:
 

```
Sub ApplyScenario1()  
    ActiveSheet.Scenarios("10 - Set 1 of 2").Show  
    ActiveSheet.Scenarios("10 - Set 1 of 2").Show  
End Sub
```
- 6** A yellow callout box points to the second macro code, stating: 'Copy and paste the first macro below the second one, and then edit the scenario names.'
- The second macro code is:
 

```
Sub ApplyScenario2()  
    ActiveSheet.Scenarios("100 - Set 1 of 2").Show  
    ActiveSheet.Scenarios("100 - Set 1 of 2").Show  
End Sub
```



# Automating Scenarios > 32 Fields

**1** Insert

**2** Shapes

**3** [Rectangle Shape]

**4** Draw a rectangle, and then type Scenario 1 within the shape.

**5** Right-click.

**6** Assign Macro...

**7** Assign Macro

Macro name:

ApplyScenario1

ApplyScenario1

ApplyScenario2

Macros in: This Workbook

Description:

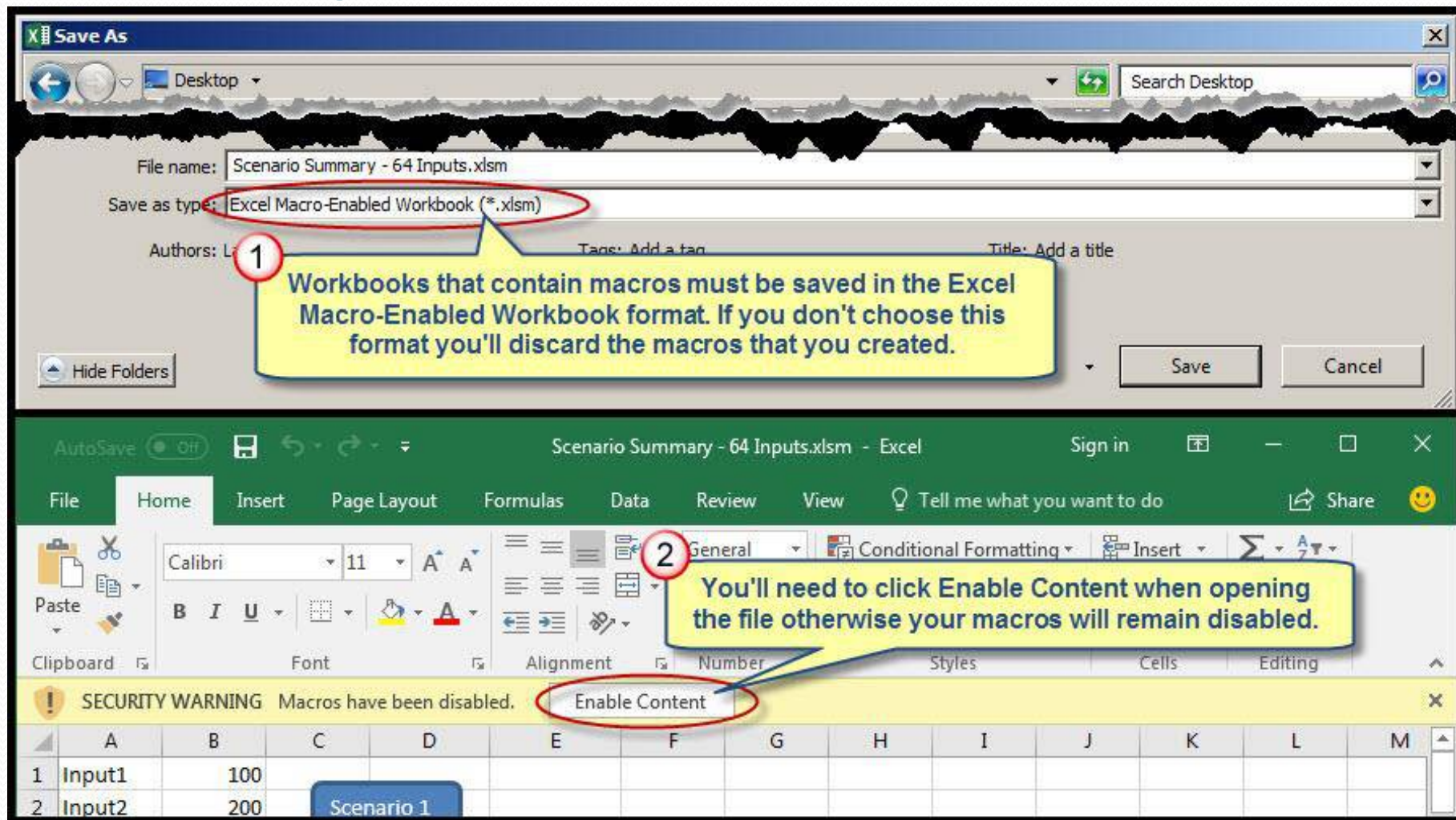
**8** OK

**9** Repeat steps 1 through 8 to create a Scenario 2 button. You can now toggle the scenarios with the click of either button.

	A	B	C	D
1	Input1	100		
2	Input2	200		
3	Input3	300		
4	Input4	400		
5	Input5	500		
6	Input6	600		
7	Input7	700		
8	Input8	800		
9	Input9	900		
10	Input10	1000		
11	Input11	1100		

	A	B	C	D
1	Input1	100		
2	Input2	200		
3	Input3	300		
4	Input4	400		
5	Input5	500		
6	Input6	600		
7	Input7	700		
8	Input8	800		
9	Input9	900		
10	Input10	1000		
11	Input11	1100		
12	Input12	1200		
13	Input13	1300		
14	Input14	1400		
15	Input15	1500		
16	Input16	1600		
17	Input17	1700		
18	Input18	1800		
19	Input19	1900		
20	Input20	2000		
21	Input21	2100		
22	Input22	2200		

## Automating Scenarios > 32 Fields





# Goal Seek Feature

**Panel 1: Initial Setup**

	A	B	C	D
1	Interest	5.25%		
2	Term	36		
3	Principal			
4	Payment	\$0.00		
5	=-PMT(B1/12,B2,B3)			

1 Goal seek can be used to solve for a single missing input with a formula. For instance how much can we borrow and have a \$500 payment?

**Panel 2: Goal Seek Dialog Box**

	A	B	C	D
1	Interest	5.25%		
2	Term	36		
3	Principal			
4	Payment	\$0.00		
5	=-PMT(B1/12,B2,B3)			

5 Set cell: \$B\$4

6 To value: 500

7 By changing cell: \$B\$3

8 OK

**Panel 3: Goal Seek Status Dialog Box**

	A	B	C	D
1	Interest	5.25%		
2	Term	36		
3	Principal	16,621		
4	Payment	\$500.00		
5	=-PMT(B1/12,B2,B3)			

9 In this case Excel keeps entering numbers into cell B3 until the formula in cell B4 returns \$500.



# Pausing Goal Seek

**1** Excel Sign in

**2** Data Review View Tell me

**3** What-If Analysis

**4** Goal Seek...

**5** Goal Seek

**6** Set cell: B4

**7** To value: 1000000

**8** By changing variable: \$B\$3

**9** OK

**10** Goal Seek Status

**11** Step

**12** Pause

**13** Continue

**14** OK

**15** Cancel

**16** Goal Seeking with Cell B4 found a solution.

**17** Target value: 1000000

**18** Current value: \$1,000,000.00

**19** OK

**20** Cancel

**21** Goal Seeking with Cell B4 on iteration #21.

**22** Target value: 1000000

**23** Current value: \$3,154.46

**24** Step

**25** Pause

**26** Continue

**27** OK

**28** Cancel

**29** Goal Seeking with Cell B4 on iteration #22.

**30** Target value: 1000000

**31** Current value: \$6,308.92

**32** Step

**33** Continue

**34** OK

**35** Cancel

**36** Goal Seeking with Cell B4 found a solution.

**37** Target value: 1000000

**38** Current value: \$1,000,000.00

**39** Step

**40** Pause

**41** Continue

**42** OK

**43** Cancel

**44** Goal Seeking with Cell B4 on iteration #21.

**45** Target value: 1000000

**46** Current value: \$3,154.46

**47** Step

**48** Continue

**49** OK

**50** Cancel

**51** Goal Seeking with Cell B4 on iteration #22.

**52** Target value: 1000000

**53** Current value: \$6,308.92

**54** Step

**55** Continue

**56** OK

**57** Cancel

**58** Goal Seeking with Cell B4 found a solution.

**59** Target value: 1000000

**60** Current value: \$1,000,000.00

**61** Step

**62** Pause

**63** Continue

**64** OK

**65** Cancel

**66** Goal Seeking with Cell B4 on iteration #21.

**67** Target value: 1000000

**68** Current value: \$3,154.46

**69** Step

**70** Continue

**71** OK

**72** Cancel

**73** Goal Seeking with Cell B4 on iteration #22.

**74** Target value: 1000000

**75** Current value: \$6,308.92

**76** Step

**77** Continue

**78** OK

**79** Cancel

**80** Goal Seeking with Cell B4 found a solution.

**81** Target value: 1000000

**82** Current value: \$1,000,000.00

**83** Step

**84** Pause

**85** Continue

**86** OK

**87** Cancel

**88** Goal Seeking with Cell B4 on iteration #21.

**89** Target value: 1000000

**90** Current value: \$3,154.46

**91** Step

**92** Continue

**93** OK

**94** Cancel

**95** Goal Seeking with Cell B4 on iteration #22.

**96** Target value: 1000000

**97** Current value: \$6,308.92

**98** Step

**99** Continue

**100** OK

**101** Cancel

**102** Goal Seeking with Cell B4 found a solution.

**103** Target value: 1000000

**104** Current value: \$1,000,000.00

**105** Step

**106** Pause

**107** Continue

**108** OK

**109** Cancel

**110** Goal Seeking with Cell B4 on iteration #21.

**111** Target value: 1000000

**112** Current value: \$3,154.46

**113** Step

**114** Continue

**115** OK

**116** Cancel

**117** Goal Seeking with Cell B4 on iteration #22.

**118** Target value: 1000000

**119** Current value: \$6,308.92

**120** Step

**121** Continue

**122** OK

**123** Cancel

**124** Goal Seeking with Cell B4 found a solution.

**125** Target value: 1000000

**126** Current value: \$1,000,000.00

**127** Step

**128** Pause

**129** Continue

**130** OK

**131** Cancel

**132** Goal Seeking with Cell B4 on iteration #21.

**133** Target value: 1000000

**134** Current value: \$3,154.46

**135** Step

**136** Continue

**137** OK

**138** Cancel

**139** Goal Seeking with Cell B4 on iteration #22.

**140** Target value: 1000000

**141** Current value: \$6,308.92

**142** Step

**143** Continue

**144** OK

**145** Cancel

**146** Goal Seeking with Cell B4 found a solution.

**147** Target value: 1000000

**148** Current value: \$1,000,000.00

**149** Step

**150** Pause

**151** Continue

**152** OK

**153** Cancel

**154** Goal Seeking with Cell B4 on iteration #21.

**155** Target value: 1000000

**156** Current value: \$3,154.46

**157** Step

**158** Continue

**159** OK

**160** Cancel

**161** Goal Seeking with Cell B4 on iteration #22.

**162** Target value: 1000000

**163** Current value: \$6,308.92

**164** Step

**165** Continue

**166** OK

**167** Cancel

**168** Goal Seeking with Cell B4 found a solution.

**169** Target value: 1000000

**170** Current value: \$1,000,000.00

**171** Step

**172** Pause

**173** Continue

**174** OK

**175** Cancel

**176** Goal Seeking with Cell B4 on iteration #21.

**177** Target value: 1000000

**178** Current value: \$3,154.46

**179** Step

**180** Continue

**181** OK

**182** Cancel

**183** Goal Seeking with Cell B4 on iteration #22.

**184** Target value: 1000000

**185** Current value: \$6,308.92

**186** Step

**187** Continue

**188** OK

**189** Cancel

**190** Goal Seeking with Cell B4 found a solution.

**191** Target value: 1000000

**192** Current value: \$1,000,000.00

**193** Step

**194** Pause

**195** Continue

**196** OK

**197** Cancel

**198** Goal Seeking with Cell B4 on iteration #21.

**199** Target value: 1000000

**200** Current value: \$3,154.46

**201** Step

**202** Continue

**203** OK

**204** Cancel

**205** Goal Seeking with Cell B4 on iteration #22.

**206** Target value: 1000000

**207** Current value: \$6,308.92

**208** Step

**209** Continue

**210** OK

**211** Cancel

**212** Goal Seeking with Cell B4 found a solution.

**213** Target value: 1000000

**214** Current value: \$1,000,000.00

**215** Step

**216** Pause

**217** Continue

**218** OK

**219** Cancel

**220** Goal Seeking with Cell B4 on iteration #21.

**221** Target value: 1000000

**222** Current value: \$3,154.46

**223** Step

**224** Continue

**225** OK

**226** Cancel

**227** Goal Seeking with Cell B4 on iteration #22.

**228** Target value: 1000000

**229** Current value: \$6,308.92

**230** Step

**231** Continue

**232** OK

**233** Cancel

**234** Goal Seeking with Cell B4 found a solution.

**235** Target value: 1000000

**236** Current value: \$1,000,000.00

**237** Step

**238** Pause

**239** Continue

**240** OK

**241** Cancel

**242** Goal Seeking with Cell B4 on iteration #21.

**243** Target value: 1000000

**244** Current value: \$3,154.46

**245** Step

**246** Continue

**247** OK

**248** Cancel

**249** Goal Seeking with Cell B4 on iteration #22.

**250** Target value: 1000000

**251** Current value: \$6,308.92

**252** Step

**253** Continue

**254** OK

**255** Cancel

**256** Goal Seeking with Cell B4 found a solution.

**257** Target value: 1000000

**258** Current value: \$1,000,000.00

**259** Step

**260** Pause

**261** Continue

**262** OK

**263** Cancel

**264** Goal Seeking with Cell B4 on iteration #21.

**265** Target value: 1000000

**266** Current value: \$3,154.46

**267** Step

**268** Continue

**269** OK

**270** Cancel

**271** Goal Seeking with Cell B4 on iteration #22.

**272** Target value: 1000000

**273** Current value: \$6,308.92

**274** Step

**275** Continue

**276** OK

**277** Cancel

**278** Goal Seeking with Cell B4 found a solution.

**279** Target value: 1000000

**280** Current value: \$1,000,000.00

**281** Step

**282** Pause

**283** Continue

**284** OK

**285** Cancel

**286** Goal Seeking with Cell B4 on iteration #21.

**287** Target value: 1000000

**288** Current value: \$3,154.46

**289** Step

**290** Continue

**291** OK

**292** Cancel

**293** Goal Seeking with Cell B4 on iteration #22.

**294** Target value: 1000000

**295** Current value: \$6,308.92

**296** Step

**297** Continue

**298** OK

**299** Cancel

**300** Goal Seeking with Cell B4 found a solution.

**301** Target value: 1000000

**302** Current value: \$1,000,000.00

**303** Step

**304** Pause

**305** Continue

**306** OK

**307** Cancel

**308** Goal Seeking with Cell B4 on iteration #21.

**309** Target value: 1000000

**310** Current value: \$3,154.46

**311** Step

**312** Continue

**313** OK

**314** Cancel

**315** Goal Seeking with Cell B4 on iteration #22.

**316** Target value: 1000000

**317** Current value: \$6,308.92

**318** Step

**319** Continue

**320** OK

**321** Cancel

**322** Goal Seeking with Cell B4 found a solution.

**323** Target value: 1000000

**324** Current value: \$1,000,000.00

**325** Step

**326** Pause

**327** Continue

**328** OK

**329** Cancel

**330** Goal Seeking with Cell B4 on iteration #21.

**331** Target value: 1000000

**332** Current value: \$3,154.46

**333** Step

**334** Continue

**335** OK

**336** Cancel

**337** Goal Seeking with Cell B4 on iteration #22.

**338** Target value: 1000000

**339** Current value: \$6,308.92

**340** Step

**341** Continue

**342** OK

**343** Cancel

**344** Goal Seeking with Cell B4 found a solution.

**345** Target value: 1000000

**346** Current value: \$1,000,000.00

**347** Step

**348** Pause

**349** Continue

**350** OK

**351** Cancel

**352** Goal Seeking with Cell B4 on iteration #21.

**353** Target value: 1000000

**354** Current value: \$3,154.46

**355** Step

**356** Continue

**357** OK

**358** Cancel

**359** Goal Seeking with Cell B4 on iteration #22.

**360** Target value: 1000000

**361** Current value: \$6,308.92

**362** Step

**363** Continue

**364** OK

**365** Cancel

**366** Goal Seeking with Cell B4 found a solution.

**367** Target value: 1000000

**368** Current value: \$1,000,000.00

**369** Step

**370** Pause

**371** Continue

**372** OK

**373** Cancel

**374** Goal Seeking with Cell B4 on iteration #21.

**375** Target value: 1000000

**376** Current value: \$3,154.46

**377** Step

**378** Continue

**379** OK

**380** Cancel

**381** Goal Seeking with Cell B4 on iteration #22.

**382** Target value: 1000000

**383** Current value: \$6,308.92

**384** Step

**385** Continue

**386** OK

**387** Cancel

**388** Goal Seeking with Cell B4 found a solution.

**389** Target value: 1000000

**390** Current value: \$1,000,000.00

**391** Step

**392** Pause

**393** Continue

**394** OK

**395** Cancel

**396** Goal Seeking with Cell B4 on iteration #21.

**397** Target value: 1000000

**398** Current value: \$3,154.46

**399** Step

**400** Continue

**401** OK

**402** Cancel

**403** Goal Seeking with Cell B4 on iteration #22.

**404** Target value: 1000000

**405** Current value: \$6,308.92

**406** Step

**407** Continue

**408** OK

**409** Cancel

**410** Goal Seeking with Cell B4 found a solution.

**411** Target value: 1000000

**412** Current value: \$1,000,000.00

**413** Step

**414** Pause

**415** Continue

**416** OK

**417** Cancel

**418** Goal Seeking with Cell B4 on iteration #21.

**419** Target value: 1000000

**420** Current value: \$3,154.46

**421** Step

**422** Continue

**423** OK

**424** Cancel

**425** Goal Seeking with Cell B4 on iteration #22.

**426** Target value: 1000000

**427** Current value: \$6,308.92

**428** Step

**429** Continue

**430** OK

**431** Cancel

**432** Goal Seeking with Cell B4 found a solution.

**433** Target value: 1000000

**434** Current value: \$1,000,000.00

**435** Step

**436** Pause

**437** Continue

**438** OK

**439** Cancel

**440** Goal Seeking with Cell B4 on iteration #21.

**441** Target value: 1000000

**442** Current value: \$3,154.46

**443** Step

**444** Continue

**445** OK

**446** Cancel

**447** Goal Seeking with Cell B4 on iteration #22.

**448** Target value: 1000000

**449** Current value: \$6,308.92

**450** Step

**451** Continue

**452** OK

**453** Cancel

**454** Goal Seeking with Cell B4 found a solution.

**455** Target value: 1000000

**456** Current value: \$1,000,000.00

**457** Step

**458** Pause

**459** Continue

**460** OK

**461** Cancel

**462** Goal Seeking with Cell B4 on iteration #21.

**463** Target value: 1000000

**464** Current value: \$3,154.46

**465** Step

**466** Continue

**467** OK

**468** Cancel

**469** Goal Seeking with Cell B4 on iteration #22.

**470** Target value: 1000000

**471** Current value: \$6,308.92

**472** Step

**473** Continue

**474** OK

**475** Cancel

**476** Goal Seeking with Cell B4 found a solution.

**477** Target value: 1000000

**478** Current value: \$1,000,000.00

**479** Step

**480** Pause

**481** Continue

**482** OK

**483** Cancel

**484** Goal Seeking with Cell B4 on iteration #21.

**485** Target value: 1000000

**486** Current value: \$3,154.46

**487** Step

**488** Continue

**489** OK

**490** Cancel

**491** Goal Seeking with Cell B4 on iteration #22.

**492** Target value: 1000000

**493** Current value: \$6,308.92

**494** Step

**495** Continue

**496** OK

**497** Cancel

**498** Goal Seeking with Cell B4 found a solution.

**499** Target value: 1000000

**500** Current value: \$1,000,000.00

**501** Step

**502** Pause

**503** Continue

**504** OK

**505** Cancel

**506** Goal Seeking with Cell B4 on iteration #21.

**507** Target value: 1000000

**508** Current value: \$3,154.46

**509** Step

**510** Continue

**511** OK

**512** Cancel

**513** Goal Seeking with Cell B4 on iteration #22.

**514** Target value: 1000000

**515** Current value: \$6,308.92

**516** Step

**517** Continue

**518** OK

**519** Cancel

**520** Goal Seeking with Cell B4 found a solution.

**521** Target value: 1000000

**522** Current value: \$1,000,000.00

**523** Step

**524** Pause

**525** Continue

**526** OK

**527** Cancel

**528** Goal Seeking with Cell B4 on iteration #21.

**529** Target value: 1000000

**530** Current value: \$3,154.46

**531** Step

**532** Continue

**533** OK

**534** Cancel

**535** Goal Seeking with Cell B4 on iteration #22.

**536** Target value: 1000000

**537** Current value: \$6,308.92

**538** Step

**539** Continue

**540** OK

**541** Cancel

**542** Goal Seeking with Cell B4 found a solution.

**543** Target value: 1000000

**544** Current value: \$1,000,000.00

**545** Step

**546** Pause

**547** Continue

**548** OK

**549** Cancel

**550** Goal Seeking with Cell B4 on iteration #21.

**551** Target value: 1000000

**552** Current value: \$3,154.46

**553** Step

**554** Continue

**555** OK

**556** Cancel

**557** Goal Seeking with Cell B4 on iteration #22.

**558** Target value: 1000000

**559** Current value: \$6,308.92

**560** Step

**561** Continue

**562** OK

**563** Cancel

**564** Goal Seeking with Cell B4 found a solution.

**565** Target value: 1000000

**566** Current value: \$1,000,000.00

**567** Step

**568** Pause

**569** Continue

**570** OK

**571** Cancel

**572** Goal Seeking with Cell B4 on iteration #21.

**573** Target value: 1000000

**574** Current value: \$3,154.46

**575** Step

**576** Continue

**577** OK

**578** Cancel

**579** Goal Seeking with Cell B4 on iteration #22.

**580** Target value: 1000000

**581** Current value: \$6,308.92

**582** Step

**583** Continue

**584** OK

**585** Cancel

**586** Goal Seeking with Cell B4 found a solution.

**587** Target value: 1000000

**588** Current value: \$1,000,000.00

**589** Step

**590** Pause

**591** Continue

**592** OK

**593** Cancel

**594** Goal Seeking with Cell B4 on iteration #21.

**595** Target value: 1000000

**596** Current value: \$3,154.46

**597** Step

**598** Continue

**599** OK

**600** Cancel

**601** Goal Seeking with Cell B4 on iteration #22.

**602** Target value: 1000000

**603** Current value: \$6,308.92

**604** Step

**605** Continue

**606** OK

**607** Cancel

**608** Goal Seeking with Cell B4 found a solution.

**609** Target value: 1000000

**610** Current value: \$1,000,000.00

**611** Step

**612** Pause

**613** Continue

**614** OK

**615** Cancel

**616** Goal Seeking with Cell B4 on iteration #21.

**617** Target value: 1000000

**618** Current value: \$3,154.46

**619** Step

**620** Continue

**621** OK

**622** Cancel

**623** Goal Seeking with Cell B4 on iteration #22.

**624** Target value: 1000000

**625** Current value: \$6,308.92

**626** Step

**627** Continue

# Data Table Overview

	A	B	C	D	E	F
1	Interest Rate	3.25%	3.25%	3.25%	3.25%	
2	Term	120	180	240	300	
3	Principal	350,000	350,001	350,002	350,003	
4		\$3,420.17	\$2,459.35	\$1,985.20	\$1,705.62	
5		=PMT(B1/12,B2,B3)				
6	Interest Rate	3.75%	3.75%	3.75%	3.75%	
7	Term	120	180			
8	Principal	350,000	350,001			
9		\$3,502.14	\$2,545.29	\$2,075.00		
10						
11	Interest Rate	4.75%	4.75%	4.75%	4.75%	
12	Term	120	180	240	300	
13	Principal	350,000	350,001	350,002	350,003	
14		\$3,669.67	\$2,722.42	\$2,261.80	\$1,995.43	
15						
16	Interest Rate	5.25%	5.25%	5.25%	5.25%	
17	Term	120	180			
18	Principal	350,000	350,001			
19		\$3,755.21	\$2,813.58			
20						
21						
22						
23						

	A	B	C	D
1	Interest	3.25%		
2	Term	120		
3	Principal	350,000		
4		=PMT(B1/12,B2,B3)		
5		\$3,420	120	180
6		3.25%		240
7		3.75%		
8		4.25%		
9		4.75%		
10		5.25%		

	A	B	C	D
1	Interest	3.25%		
2	Term	120		
3	Principal	350,000		
4		=PMT(B1/12,B2,B3)		
5		\$3,420	120	180
6		3.25%	3,420	2,459
7		3.75%	3,502	2,545
8		4.25%	3,568	2,588
9		4.75%	3,670	2,722
10		5.25%	3,755	2,814

1 A formula anchors the top left corner of a Data Table, along with the inputs to be swapped out.

2 The completed Data Table shows the payment at various combinations of interest rate/term.

Users unaware of features like Data Table often resort to brute-force methods such as this to calculate payments at different interest rates/terms.



# Data Table - One Variable

**1** Place a formula in the top row of the table. The formula needs at least one argument you want to swap, in this case Interest (cell B1).

A	B	C
1 Interest Rate	3.25%	
2 Term	120	
3 Principal	350,000	
4		
5		\$3,420.17
6		

**2** Position the alternate values you want to swap into the formula.

A	B	C
1 Interest Rate	3.25%	
2 Term	120	
3 Principal	350,000	
4		
5		\$3,420.17
6	3.25%	
7	3.75%	
8	4.75%	
9	5.25%	
10		

**3** Select the table area.

**4** Select What-If Analysis from the Data menu.

**5** Data Table...

**6** The alternate Interest rates are in column B, so specify B1 from the original formula as the Column Input.

**7** OK

# Data Table - Two Variables

**1** Place a formula in the top left-corner the table. The formula needs at least two arguments you want to swap, in this case Interest (cell B1) and Term (cell B2)

**2** Position the alternate values you want to swap into the formula.

**3** Select the table area.

**4** Select What-If Analysis from the Data menu.

**5** Data Table...

**6** The alternate Term periods are on row 5 so specify B2 from the original formula as the Row Input.

**7** The alternate Interest rates are in column B, so specify B1 from the original formula as the Column Input.

**8** OK

	A	B	C	D	E
1	Interest	3.25%			
2	Term	120			
3	Principal	350,000			
4					
5	\$3,420				
6					
7					
8					
9					
10					

Formula: `=PMT(B1/12,B2,B3)`

	A	B	C	D	E
1	Interest	3.25%			
2	Term	120			
3	Principal	350,000			
4					
5	\$3,420	120	180	240	360
6	3.25%				
7	3.75%				
8	4.25%				
9	5.25%				
10					

Data Table

	A	B	C	D	E	F	G	H	I
1	Interest	3.25%							
2	Term	120							
3	Principal	350,000							
4									
5	\$3,420	120	180	240	360				
6	3.25%								
7	3.75%								
8	4.25%								
9	5.25%								
10									

Data Table

Row input cell: B\$2

Column input cell: B\$1



# Data Table - Three Variables

**Step 1:** Type a term and principal amount in cell B2 as regular text.

	A	B
1	Interest Rate	3.25%
2		120/375,000
3	Term	
4	Principal	120/375,000

**Step 2:** Use the LEFT function to extract the first 3 characters from the left.

	A	B
1	Interest Rate	3.25%
2		120/375,000
3	Term	120
4	Principal	=LEFT(B2,3)

**Step 3:** Optional: Use the FIND function to locate the position of the / character in cell B2.

	A	B	C
1	Interest Rate	3.25%	
2		120/375,000	
3	Term	120	
4	Principal	=FIND("/",B2)	

**Step 4:** Optional: Incorporate the FIND function into the LEFT function, and subtract 1 to exclude the / itself.

	A	B	C
1	Interest Rate	3.25%	
2		120/375,000	
3	Term	120	
4	Principal	=LEFT(B2,FIND("/",B2)-1)	

**Step 5:** Use the MID function to extract the next 50 characters (50 is an arbitrarily large number) starting from the 5th character onward.

	A	B	C
1	Interest Rate	3.25%	
2		120/375,000	
3	Term	120	
4	Principal	=MID(B2,5,50)	

**Step 6:** Optional: Use the FIND function to find the position of the / character in cell B2, and then add 1

	A	B	C
1	Interest Rate	3.25%	
2		120/375,000	
3	Term	120	
4	Principal	=MID(B2,FIND("/",B2)+1,50)	



# Data Table - Three Variables

**Step 1:** Place a formula in the top left-corner of the table. The formula needs to reference cells B3 and B4.

**Step 2:** Position the alternate values you want to swap into the formula.

**Step 3:** Select the table area.

**Step 4:** Select What-If Analysis from the Data menu.

**Step 5:** Select Data Table...

**Step 6:** The alternate Term/Principal are on row 5 so specify B2 from the original formula as the Row Input.

**Step 7:** The alternate Interest rates are in column B, so specify B1 from the original formula as the Column Input.

**Step 8:** OK

	A	B	C
1	Interest Rate	3.25%	
2		120/375,000	
3	Term	120	
4	Principal	375,000	
5			
6	\$3,664.46	=PMT(B1/12,B3,B4)	

	A	B	C
1	Interest Rate	3.25%	
2		120/375,000	
3	Term	120	
4	Principal	375,000	
5			
6	\$3,664.46	120/375,000	180/400,000
7	3.25%		
8	3.75%		
9	4.25%		
10	5.25%		

	A	B	C
1	Interest Rate	3.25%	
2		120/375,000	
3	Term	120	
4	Principal	375,000	
5			
6	\$3,664.46	120/375,000	180/400,000
7	3.25%		
8	3.75%		
9	4.25%		
10	5.25%		

	A	B	C	D	E	F
1	Interest Rate	3.25%				
2		120/375,000				
3	Term	120				
4	Principal	375,000				
5						
6	\$3,664.46	120/375,000	180/400,000	240/450,000	300/500,000	
7	3.25%					
8	3.75%					
9	4.25%					
10	5.25%					

**Data Table Dialog Box:**

Row input cell:

Column input cell:

OK Cancel



# Resizing Data Tables

**1** Select one or more cells within the data table and press Delete.

**2** Can't change part of a data table. OK

**3** Select all formula cells within the data table and press Delete.

**4** You can now select a smaller range of cells and create the data table again.

	B	C	D	E	F	G
4						
5	\$3,420.17	120	180	240	360	
6	3.25%	\$ 3,420.17	\$ 2,459.34	\$ 1,985.19	\$ 1,523.22	
7	3.75%	\$ 3,502.14	\$ 2,545.28	\$ 2,075.11	\$ 1,620.90	
8	4.25%	\$ 3,585.31	\$ 2,632.97	\$ 2,167.32	\$ 1,721.79	
9	4.75%	\$ 3,669.67	\$ 2,722.41	\$ 2,261.78	\$ 1,825.77	
10	5.25%	\$ 3,755.21	\$ 2,813.57	\$ 2,358.45	\$ 1,932.71	
11						
12						
13						

	B	C	D	E	F	G
4						
5	\$3,420.17	120	180	240		
6	3.25%					
7	3.75%					
8	4.25%					
9	4.75%					
10						
11						
12						
13						

# Forecast Feature (Excel 2016)

**1** Select a range of date-based data.

Date	Sales
1/1/2018	4,354,231
2/1/2018	3,132,885
3/1/2018	3,818,843
4/1/2018	4,860,457
5/1/2018	4,757,324
6/1/2018	2,838,035
7/1/2018	3,874,406
8/1/2018	4,782,868

**2** Data

**3** Forecast Sheet

**4** Choose between line and bar chart.

**5** Forecast End 12/1/2019

**6** Create

Use historical data to create a visual forecast worksheet

7,000,000  
6,000,000  
5,000,000  
4,000,000  
3,000,000  
2,000,000  
1,000,000

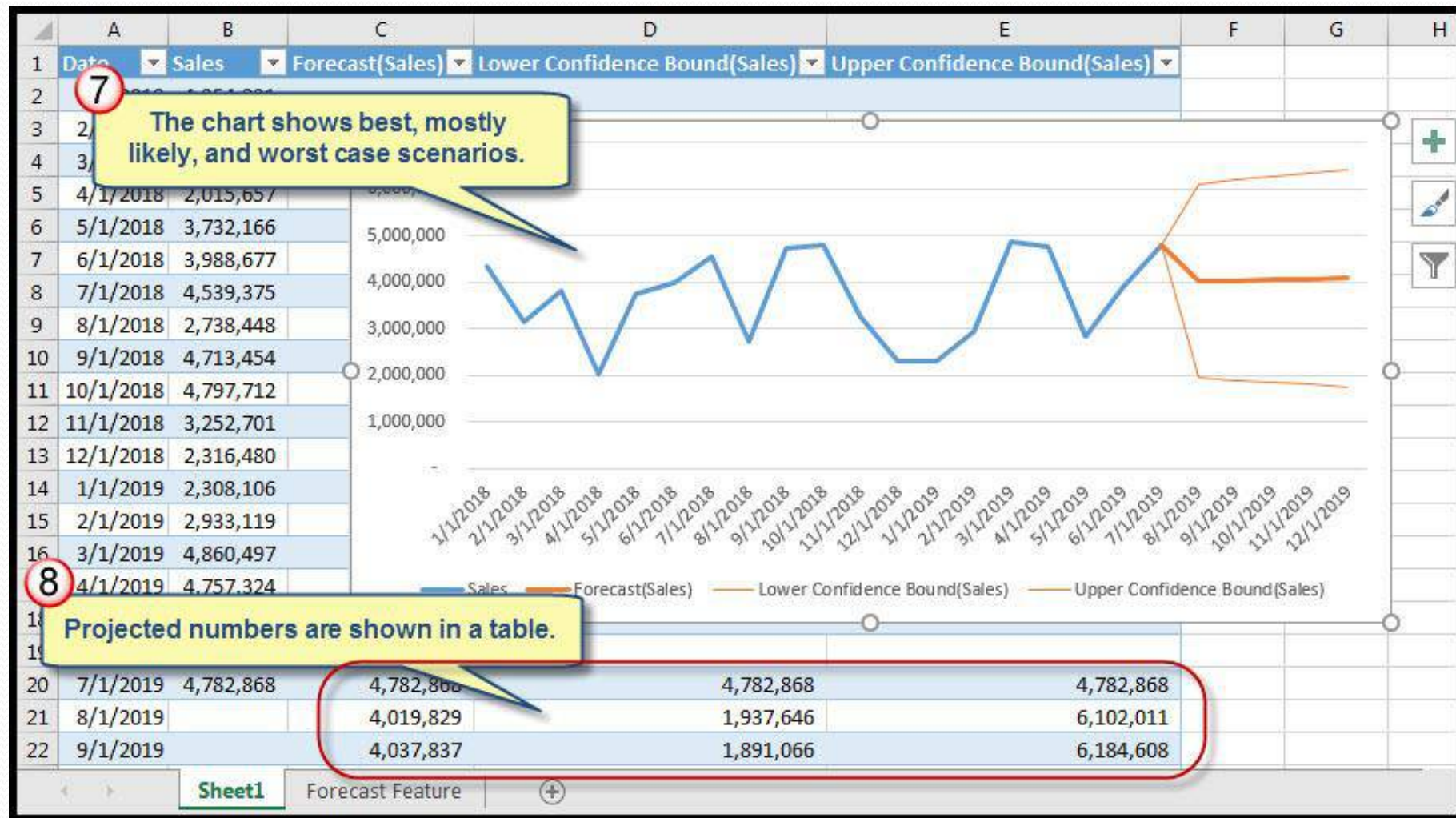
1/1/2018 2/1/2018 3/1/2018 4/1/2018 5/1/2018 6/1/2018 7/1/2018 8/1/2018 9/1/2018 10/1/2018 11/1/2018 12/1/2018 1/1/2019 2/1/2019 3/1/2019 4/1/2019 5/1/2019 6/1/2019 7/1/2019 8/1/2019 9/1/2019 10/1/2019 11/1/2019 12/1/2019

Sales Forecast(Sales) Lower Confidence Bound(Sales) Upper Confidence Bound(Sales)

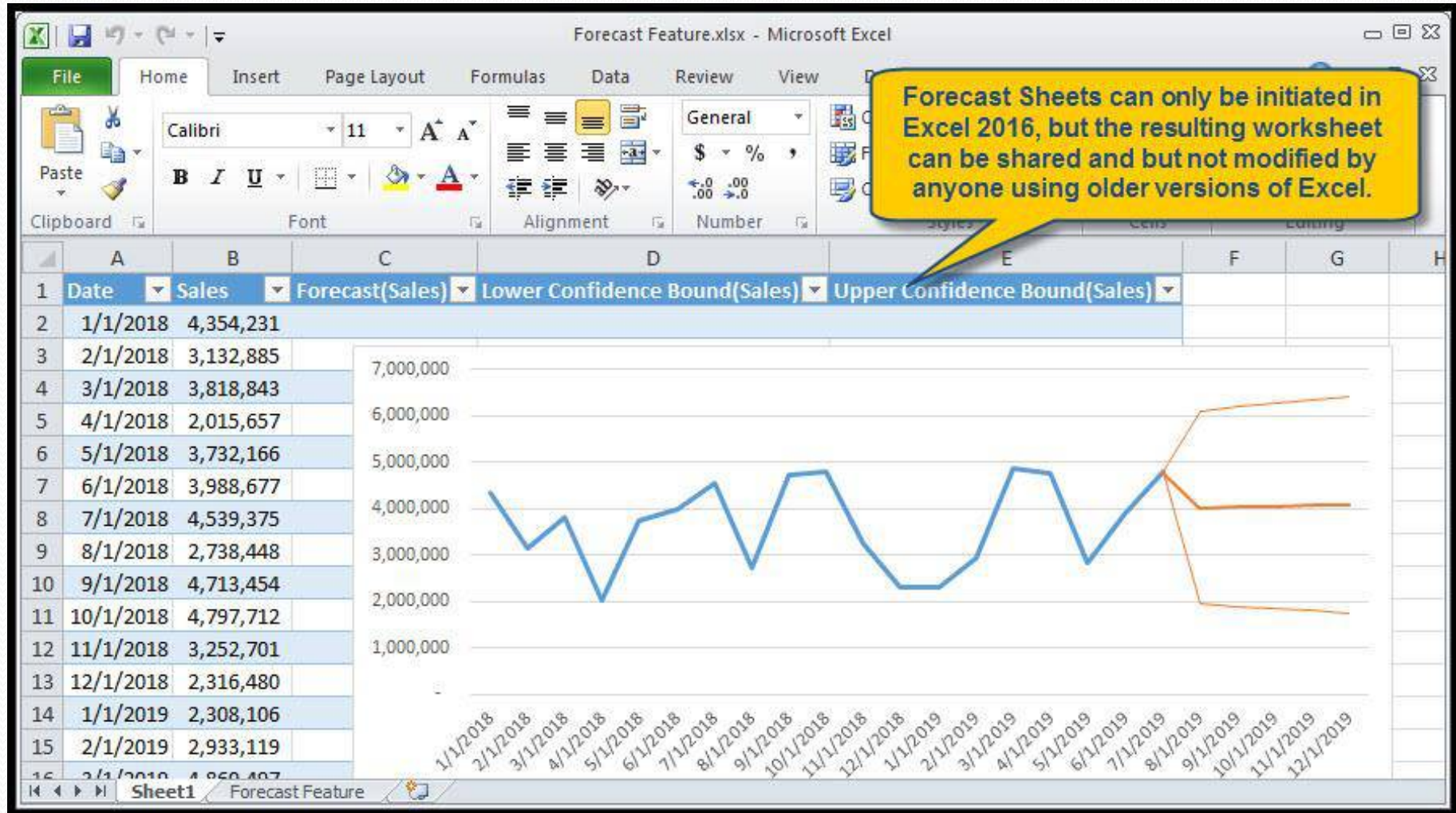
Options



# Forecast Feature (Excel 2016)



# Forecast Feature Compatibility





# Enabling Excel's Solver Add-In

**1** File

**2** Options

**3** Add-ins

**4** Go...

**5** Solver Add-in

**6** OK

**7** OK

Excel for Mac: Choose Tools, and then Add-Ins in lieu of steps 1 through 3.

# Introduction to Solver

**Excel Worksheet Data:**

	A	B	C	D
1	Interest	5.25%		
2	Term	36		
3	Principal	0		
4	Payment	\$0.00		

**Solver Parameters Dialog Box:**

- Set Objective:** \$B\$4 (3)
- To:** ☐ Max ☐ Min ☒ Value Of: (4)
- By Changing Variable Cells:** \$B\$3 (6)
- Subject to the Constraints:** (5)
- ☒ Make Unconstrained Variables Non-Negative
- Select a Solving Method:** GRG Nonlinear
- Solving Method:** Select the GRG Nonlinear engine for Solver Problems that are smooth nonlinear. Select the LP Simplex engine for linear Solver Problems, and select the Evolutionary engine for Solver problems that are non-smooth.
- Buttons:** Add, Change, Delete, Reset All, Load/Save, Help, Solve (7), Close

**Excel Data Analysis Ribbon:**

- Data Analysis:** Solver (2)

**Annotations:**

- 1:** We'll use Solver to solve for a loan payment.
- 2:** A Solver command appears at the right of Excel's Data menu once you enable the add-in.



# Saving Solver Results to Scenarios

The screenshot illustrates the steps for saving Solver results to scenarios in Microsoft Excel. The Solver Results dialog box is open, showing the solution found. The Scenario Manager dialog box is also open, showing the scenario '350 Loan payment'. Red circles and numbers 8 through 16 highlight specific steps in the process. A yellow callout box states 'Steps 8 - 10 are optional'.

**Solver Results Dialog Box:**

- 9** Scenario Name: 350 Loan payment
- 10** OK
- 11** OK

**Scenario Manager Dialog Box:**

- 12** Data
- 13** What-If Analysis
- 14** Scenario Manager...
- 15** 350 Loan payment
- 16** Show

**Steps 8 - 10 are optional**

# Resolving Solver32.dll Error

**Microsoft issued an update to PowerQuery and PowerPivot that resulted in many users experiencing a Solver32.dll error. If you experience this error in Excel check for updates in your respective version of Excel as the problem should be resolved when you install any available updates.**

**Excel bugs such as this are being ever more frequent.**



# Thank you for attending!

I'm happy to hear from you (*e-mail is best*):

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