EXCEL

8 Financial Functions and What-If Analysis

In this chapter, you will learn about some of the financial functions frequently used in Excel. You will use these functions to analyze potentially changing circumstances with the What-If Analysis tools. What-if analyses allow you to see how the results of formulas change by altering the input values, such as the interest rate used in financial functions.

LEARNING OBJECTIVES

- Create financial functions
- Create one-variable and two-variable data tables
- Use the What-If Analysis tools to create scenarios
- Adjust input values using Goal Seek

Project: Making Financial Decisions

Airspace Travel has a number of big financial decisions to make. The company is currently seeing rapid growth in its business, but it is running out of office space and needs to expand. The owners have asked you to help them prepare for and analyze the potential impact of several decisions, including the purchase of a new office building, an investment opportunity, and an equipment purchase. You will use the tools in Excel, including various financial functions and What-If Analysis tools, to help them make the best choices.

Creating Financial Functions

Completing financial calculations is an important part of using Excel, and there is a whole category of financial functions to use. These types of calculations might include calculating your monthly payment on a loan or mortgage, finding out how much an investment will be worth in the future, or determining how long it will take to pay off a debt. Financial functions can be useful because they provide valuable information for decision-making, analysis, and forecasting. These functions can also provide the basis for more in-depth analysis tools in Excel.

Input Values for Financial Functions

When creating financial functions, it's good practice to avoid inserting constant values in your function arguments. A better way is to store the constant values, or inputs, on the worksheet so they are always visible and can be quickly changed and updated in all formulas.

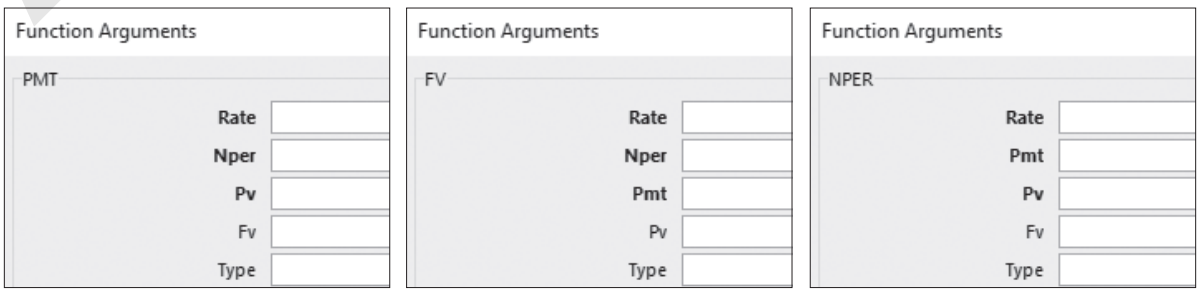
For example, to calculate a payment, you could insert the interest rate directly into the PMT function arguments. If you need to change the interest rate, you would have to go into the formula and manually change it. But if the interest rate is stored in a cell and properly labeled, changing the interest rate in that cell will automatically update any formula that refers to that interest rate.

This might not make a big difference if you have only one formula, but for large, complex worksheets you might have many different formulas all using the same input, such as the interest rate!

Formulas→Function Library→Financial

Financial Function Arguments

The arguments for many financial functions are similar, and Excel will help you build the correct formula to achieve the desired result. As with other functions, you can enter the arguments in the Insert Function dialog box or type them directly into the cell. With more complex functions, it can be easier to visualize your arguments using the dialog box.

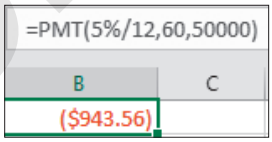


The field names for required arguments are shown in bold in the dialog box; the others are optional arguments.

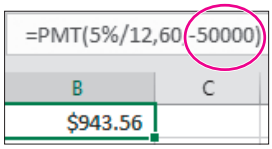
FINANCIAL FUNCTION ARGUMENTS

Argument	Description
Rate	Interest rate per payment period; so if the annual interest rate is 5%, the interest rate per period for a monthly payment would be 5% / 12
Nper	Number of payment periods over the life of the loan or investment, often monthly; so a five-year loan with monthly payments would have 5 x 12 = 60 payment periods
Pmt	Payment made on the loan or amount invested each period, which is a constant value (cannot change) over the life of the loan or investment
Pv	Loan amount or initial amount invested (Present Value)
Fv	Ending balance; for loans it's usually zero (or omitted) to pay off the loan, and for investments it's the desired amount at the end of the term (Future Value)
Type	Indicates whether payments are due at the beginning or end of each period

When financial functions are used in Excel, payments are considered negative values. For example, a $50,000 loan with 5% annual interest over 60 months would be paid back in installments payments of –$943.56.



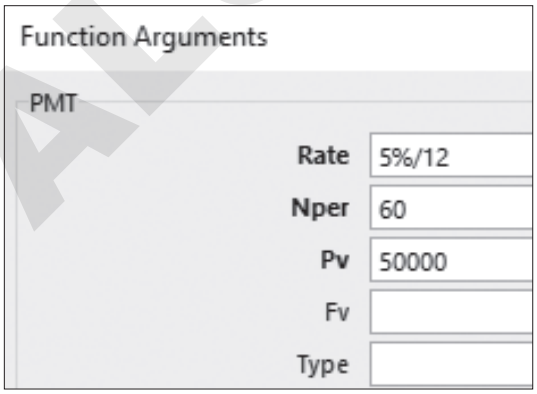
If you want the payment to appear as a positive number, you can reverse this by entering a negative number for the Pv argument (the loan amount) and think of that as a negative number, which represents a "debt."

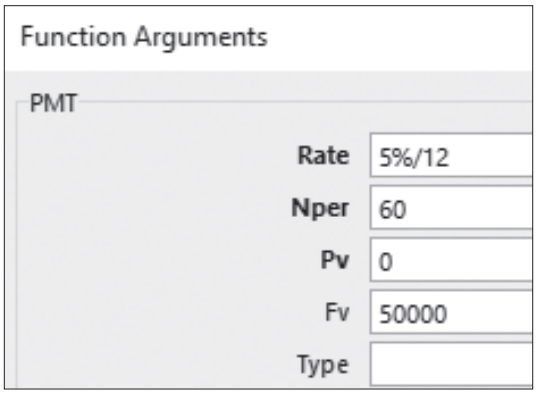


PMT Function

The PMT, or Payment, function is used to calculate the amount of each payment required to pay off a loan, where the payments and interest remain constant over the life of the loan. This is also called a *term loan* because there is a predetermined time period, or number of payments, to pay off the loan. The PMT function can also be used to determine how much you must save (the payment) each month to reach some future value amount. Again, this assumes the interest and payments are consistent and the length of time is known.

For example, you may want to know the payments required to pay off a $50,000 loan in five years at 5% annual interest or how much you have to save each month to have $50,000 saved after five years at the same interest rate. The Pv in the figure on the left below is the $50,000 loan, and the Fv on the right is the future value of $50,000 saved.





DEVELOP YOUR SKILLS: E8-D1

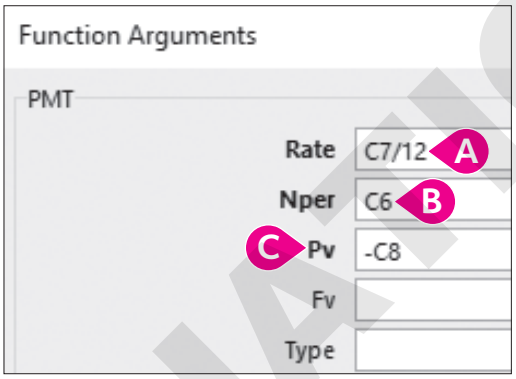
The Airspace owners are currently looking at buying a property for $650,000 with a $100,000 down payment for a thirty-year mortgage at 2.75% APR. In this exercise, you will find the amount of the monthly mortgage payment for the new office space and total interest over the life of the loan.

1. Start Excel, open **E8-D1-ATC** from your **Excel Chapter 8** folder, and save it as: **`E8-D1-ATCFinancials`**
2. Ensure the **Mortgage** sheet is active and **cell C8** is selected.

   The first step is to calculate the amount of the loan by starting with the purchase price and subtracting the down payment.
3. In **cell C8**, enter the formula: **`=C4-C5`**

   The loan amount will be $550,000. Now you can calculate the monthly payment based on the loan amount, interest rate, and term.
4. Select **cell C9** and choose **Formulas→Function Library→Financial →PMT** to insert the PMT function (you will need to scroll down through the list).

   As with other functions, you can either type or point and click to insert cell references. The point-and-click method can improve reliability and help ensure you select the correct cell.
5. Follow these steps to insert the PMT function arguments:



   A. Click **cell C7** and type **`/12`** to divide the annual percentage rate (APR) by 12, which returns the interest rate per month.

      If necessary, move the dialog box out of the way so you can click the cell in the worksheet.

   B. Tap Tab to move to the Nper box and then click **cell C6** for the number of payments (length of the term in months).

   C. Tap Tab to move to the Pv box and then type **–** and click **cell C8**, which is the amount borrowed.
6. Click **OK** to enter the formula and then adjust the number format to show two decimal places.

   The monthly mortgage payment will be $2,245.33.

   To calculate total interest, first you need to calculate total payments, which is the monthly payment multiplied by the term.
7. In **cell C10**, enter the formula: **`=C9*C6`**

   Next, take the total payments minus the loan amount to find the total interest paid over the life of the loan.

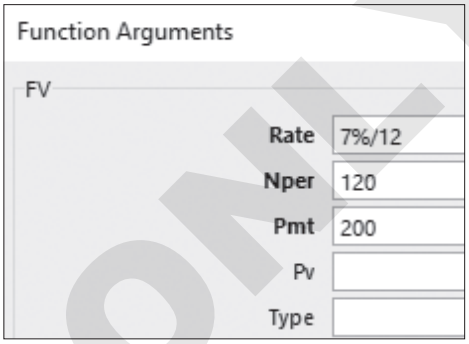
8. In **cell C11**, enter the formula: **=C10-C8**

   The total interest cost of the mortgage will be $258,318.

9. Save the file.

FV Function

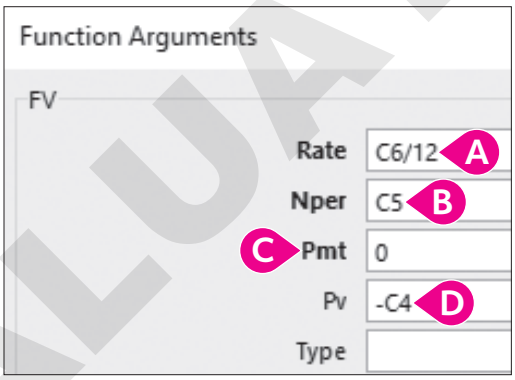
The FV, or Future Value, function calculates the future value of an investment when you specify the interest rate, length of the investment, and amount of each payment. Like the PMT function, the interest rate and payments must be constant throughout the term. For example, if you know you can invest $200 each month for 10 years into an account that earns 7% interest per year, the FV function will tell you how much you will have saved up at the end. You can include the Pv argument if the starting investment in the account is more than zero.



DEVELOP YOUR SKILLS: E8-D2

In this exercise, you will use the FV function to find out how much you would have after 10 years if Airspace were to invest $100,000 instead of purchasing the new office space.

1. Save your file as: **E8-D2-ATCFinancials**
2. Go to the **Investment** sheet and ensure **cell C7** is active.
3. Choose **Formulas→Function Library→Financial →FV** to insert the FV function.
4. Follow these steps to insert the FV function arguments:

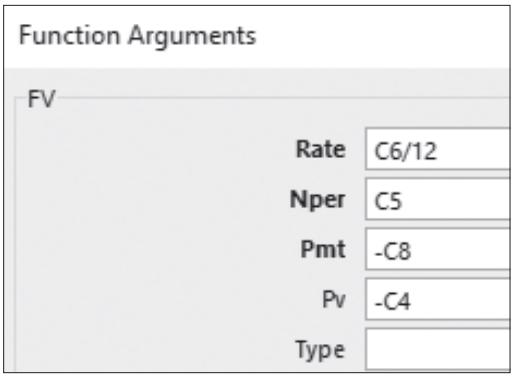


   A. Click **cell C6** and then type **/12** to get the interest rate per month.
   B. Tap Tab and click **cell C5** (length of the term in months).
   C. Tap Tab and enter **0** for the payment amount.
   D. Tap Tab then type **–** and click **cell C4** (amount you are investing up front).
   E. Click **OK**.

   With the compounding monthly interest, you would have $191,218 in 10 years. Now you will find out how much you would have if you were to invest an additional $200 each month.

5. Enter **200** in **cell C8**.

6. In **cell C9**, enter an FV function with the same arguments as step 4, except this time for the **Pmt** argument, type **–** and select **cell C8**.

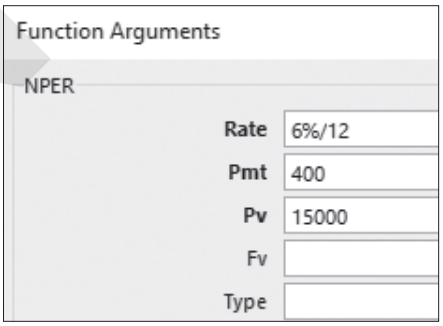


With an additional investment of $200 per month, you would have $224,899 after 10 years.

7. Save the file.

NPER Function

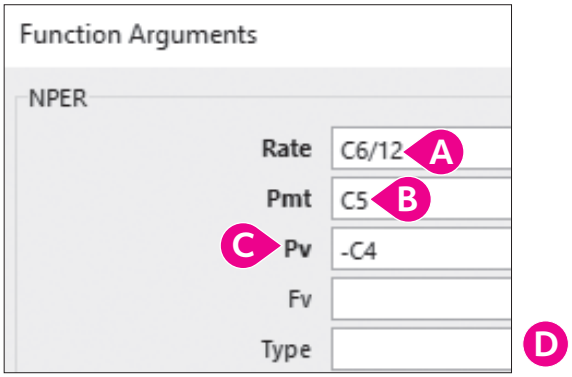
The NPER function is similar to the PMT and FV functions, but for this function the missing information is the number of periods, or the length of the term, required to reach the financial goal. Again, this could be reaching some investment amount or paying off some amount of debt where the interest rate remains constant. For example, if you want to pay off a $15,000 loan at 6% interest per year, you can find out how long it will take if you pay $400 per month.



DEVELOP YOUR SKILLS: E8-D3

In this exercise, you will use the NPER function to determine how long it will take to pay for a new printer that costs $12,000 if Airspace opens a line of credit and pays $250 consistently each month.

1. Save your file as: **`E8-D3-ATCFinancials`**
2. Go to the **Printer** worksheet and ensure **cell C7** is selected.
3. Choose **Formulas→Function Library→Financial →NPER**.
4. Follow these steps to insert the NPER function arguments:
   - A Click **cell C6** and then type **`/12`** to determine the interest rate per month.
   - B Tap Tab and click **cell C5** for the payment amount for each month.
   - C Tap Tab and then type **–** and click **cell C4** (amount being borrowed up front to cover the purchase).
   - D Click **OK**.



The loan would take just over 51 months to be paid off.

5. Remove all of the decimals from the number format of **cell C7**.
6. Save the file.

Using What-If Analysis Tools

To understand the basics of using the What-If Analysis tools, you should recognize that it is just that: asking the question, what if? *What if the interest rate increases on my loan? What if I invest $200 per month instead of $150?*

To answer these questions, you could create your formula and then go through and systematically change the values of the arguments to see the different results. However, the What-If Analysis tools provide better ways to examine different possibilities and try out alternate values in your formulas via the Scenario Manager, Goal Seek, and data tables. What-if analyses work best with complex formulas, such as the financial functions PMT, FV, and NPER, because there are several input values that can potentially change.

Data Tables

A data table is *not* a table and it *does not* allow you to sort or filter or insert a total row. Data tables are quite different! A data table allows you to insert multiple input values to replace an argument in your formula and see the results for all of them at the same time.

One-Variable Data Tables

To create a one-variable data table, you must first set up the table. The table requires *either* a row or column of input cells to replace one of the formula arguments, as well as the cell that contains the formula itself. To use a column input cell, the formula must be at the top of the column; to use a row input cell, the formula must be the first cell at the left of the row.

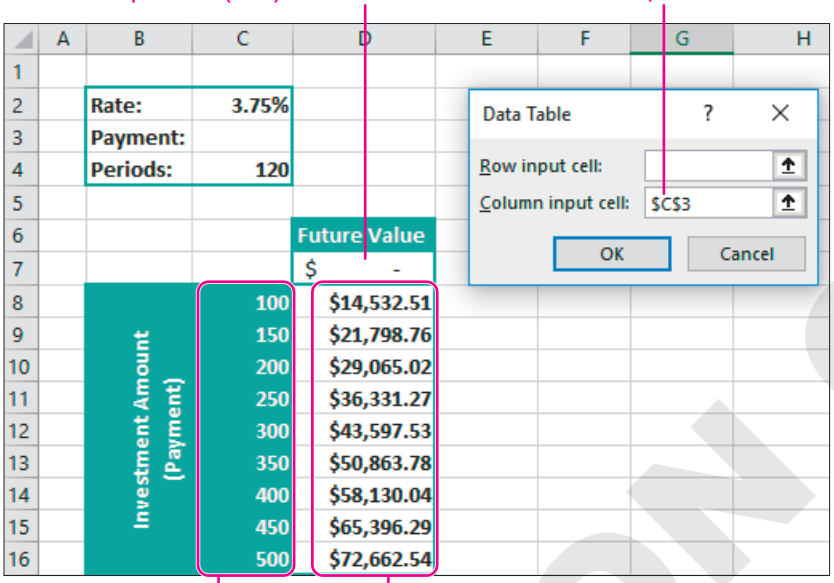
Note! *For a one-variable table, you enter only one input cell to change, hence either a row or a column (not both).*

For example, you might want to use the Future Value function to determine how much you would have after 10 years (120 months) based on different monthly investment amounts. If you know you can invest at a constant rate of 3.75% interest per year, you could use the following table. As your monthly investment amount grows, so does the amount you have at the end (the future value).

Tip! *To replace a variable in the formula, the formula argument* must *be a cell reference, not an actual value.*

Cell D7 contains the formula *=FV(C2/12,C4,-C3)*. The result is zero because cell C3 is blank, meaning the payment is zero. The formula also refers to the 3.75% rate in cell C2 and the number of periods (*120*) in cell C4.

Cell C3 is the payment amount, the argument that replaces zero with the new input values.



This column contains input values to be used in the formula instead of the existing payment value.

The results of the data table display below the formula.

You can also create a larger table that has multiple what-if formulas but still only one *variable* input for each of the formulas.

Two-Variable Data Tables

A two-variable data table is similar to a one-variable table, except that there is both a row and a column of input values to replace *two* different arguments in the formula. The formula for a two-variable table *must be in the upper-left cell* of the table.

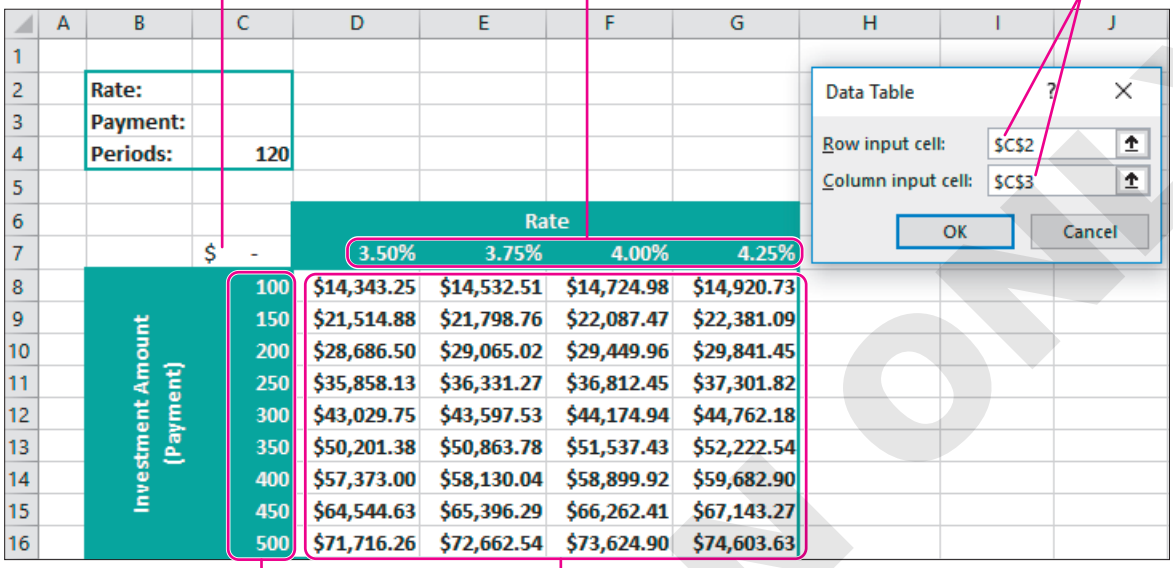
In the following example, the period is still 10 years and the investment varies from 100 to 500, but now the interest rate also varies from 3.5% to 4.25%.

Note! *The FV function assumes a constant interest rate for the investment lifespan, but you could use this data table to determine when to invest if you want to lock in at a higher interest rate or to make assumptions about the* average *interest rate over the investment lifespan.*

Cell C7 contains the formula *=FV(C2/12,C4,-C3)*. The result is zero because cells C2 and C3 are blank. The formula also refers to the periods (*120*) in cell C4.

This row contains input values to use in the formula instead of the existing rate value.

Cell C2 is the rate and cell C3 is the payment amount. These are the two arguments to be replaced by the payment (column) and rate (row) input values.



This column contains the input values to enter in the formula instead of the existing payment value.

The results of the data table display here.

View the video "Creating One- and Two-Variable Data Tables."

Data→Forecast→What-If Analysis→Data Table...

DEVELOP YOUR SKILLS: E8-D4

In this exercise, you will create one- and two-variable data tables to analyze what happens to the payments when the loan amount changes and when both the loan amount and interest rate change. Airspace may want to negotiate a lower purchase price or look for a larger building, depending on the results of your analyses.

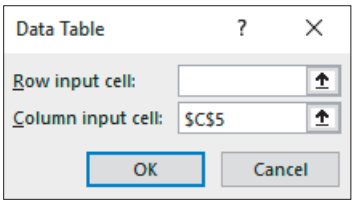
1. Save your file as: **`E8-D4-ATCFinancials`**
2. Go to the **Mortgage Variables** worksheet.

   The first step in creating a data table is to ensure the arguments are set up correctly. For your one-variable table, the constants are the rate and term in cells C3 and C4. You will enter the formula to use in cell D5.
3. In **cell D5**, enter the formula: **`=PMT(C3/12,C4,-C5)`**

   Cell C5 is a blank cell; it's the variable that will be replaced with the loan amount values in the table.
4. Apply the **White, Background 1** font color to **cell D5**.

5. Select the **range C5:D11** and choose **Data→Forecast→What-If Analysis** → **Data Table…**.

6. In the Data Table dialog box, click in the **Column Input Cell** box and then click **cell C5** in the worksheet.



Cell C5 is the cell that will be replaced by the new values in the Loan Amount column.

7. Click **OK** to insert the data table.

Rate:	2.75%	
Term:	360	Payments
Loan:		
Loan Amount	$500,000	$2,041.21
	$550,000	$2,245.33
	$600,000	$2,449.45
	$650,000	$2,653.57
	$700,000	$2,857.69
	$750,000	$3,061.81

The payment is the same as the original calculation on the Mortgage worksheet if the loan amount is $550,000. But if the loan amount goes up or down, you can see the change in the payment that would be required.

Now you will enter the PMT function again, using the same arguments, but in the upper-left corner of the two-variable table. The constant will be the term in cell C4, and this time the variables are both the Loan Amount (column) and the Rate (row).

8. In **cell G5**, enter the formula: **`=PMT(C3/12,C4,-C5)`**

Cells C3 and C5 will be replaced values in the table; C3 represents the variable interest rate and C5 represents the variable loan amount.

9. Apply the **White, Background 1** font color to **cell G5**.

10. Select the **range G5:K11** and choose **Data→Forecast→What-If Analysis** → **Data Table…**.

11. In the Data Table dialog box, enter **`C3`** in the Row Input Cell box and **`C5`** in the Column Input Cell box and then click **OK**.

		Rate			
		2.25%	2.50%	2.75%	3.00%
Loan Amount	$500,000	$1,911.23	$1,975.60	$2,041.21	$2,108.02
	$550,000	$2,102.35	$2,173.16	$2,245.33	$2,318.82
	$600,000	$2,293.48	$2,370.73	$2,449.45	$2,529.62
	$650,000	$2,484.60	$2,568.29	$2,653.57	$2,740.43
	$700,000	$2,675.72	$2,765.85	$2,857.69	$2,951.23
	$750,000	$2,866.85	$2,963.41	$3,061.81	$3,162.03

12. Save the file.

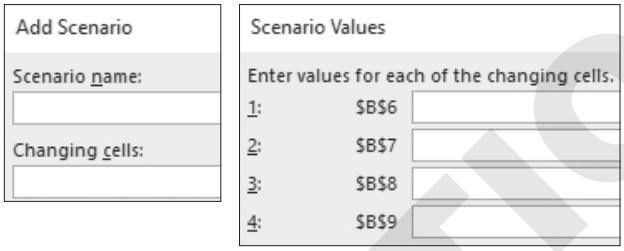
Scenario Manager

Data tables give you a lot of information about the potential outcome of variables in your calculations. However, you might not always want all of that data; you may want to compare results for only two or three possibilities. The Scenario Manager uses variable inputs similar to data tables but with several additional benefits:

- The Scenario Manager can handle more than just one or two variables. In fact, you can have as many as 32 variables.
- You can show the effects of these variables on multiple formulas at the same time.

For each set of variables, called changing cells, you can either choose to show the results of each scenario directly in the worksheet or create a scenario summary report that shows the results of each scenario side by side. This can be useful when comparing potential outcomes for manufacturing decisions or financial investments.

The Scenario Manager allows you to add, edit, delete, and display your scenarios. Each scenario requires creating a name, identifying the changing cells, and entering the values for each of the changing cells. The changing cells are the input cells that contain the values being used in your formulas.



It's best to avoid using a formula cell as a changing cell, because the scenario will replace the formula with a constant value, which could cause errors or mistakes in your calculations.

Tip! *It's good practice to create names for your input cells so users can easily see which values are being replaced.*

Data→Forecast→What-If Analysis→Scenario Manager...

DEVELOP YOUR SKILLS: E8-D5

In this exercise, you will create scenarios using the mortgage calculation to see what the result will be for a few specific situations that could arise.

1. Save your file as: **E8-D5-ATCFinancials**

   You will create three scenarios based on possible changes to the price, interest rate, down payment, and term. To begin, you will define names for the cells.

2. Switch to the **Mortgage** worksheet and select the **range B4:C11**.
3. Choose **Formulas→Defined Names→Create from Selection**.

4. Ensure **Left Column** is checked and click **OK**.

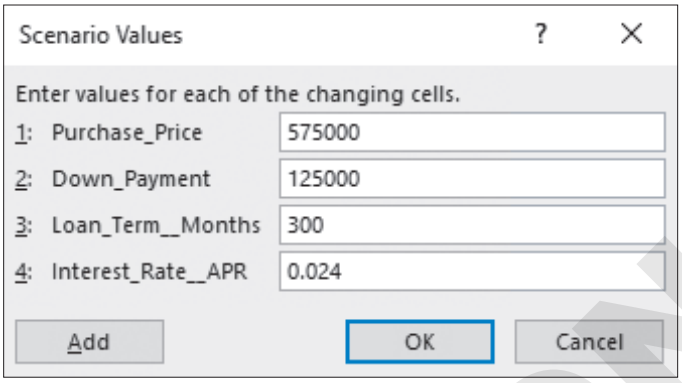
   This will name your input cells as well as the result cells in column C, using the labels in column B.

5. Select the **range C4:C7** (which will be the changing cells) and choose **Data→Forecast→What-If Analysis→Scenario Manager…**.

6. In the Scenario Manager dialog box, which shows there are currently no scenarios created, click **Add**.

7. Enter **`Best`** for the scenario name, confirm the changing cells are C4:C7 based on your previous selection, and click **OK**.

8. For the Best scenario, enter these new values for the changing cells:



   You believe the best possible situation allows you to negotiate a price of $575,000 for the property, pay $125,000 down, pay the mortgage off in 25 years (300 months), and obtain an interest rate of 2.4% (0.024).

9. Click **OK** to create the new scenario, which brings you back to the Scenario Manager.

10. Add another scenario named **`Worst`** that uses the same changing cells as step 5.

11. Enter the new values as indicated:

Purchase_Price	**`690000`**
Down_Payment	**`75000`**
Loan_Term__Months	**`420`**
Interest_Rate__APR	**`0.0299`**

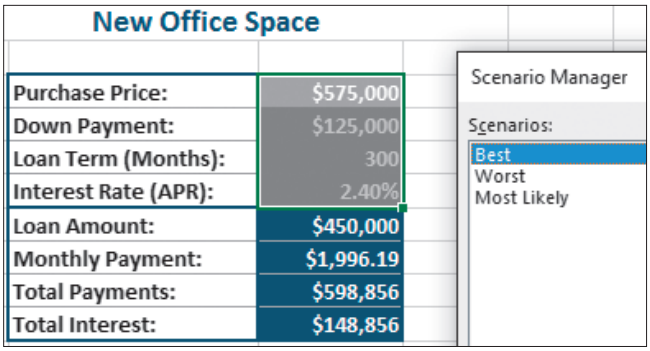
    The worst scenario is that the property costs $690,000, you can only pay a $75,000 down payment, the mortgage is for 35 years, and the interest rate goes up to 2.99%.

12. Add a third scenario named **`Most Likely`** using these values:

Purchase_Price	**`640000`**
Down_Payment	**`90000`**
Loan_Term__Months	**`360`**
Interest_Rate__APR	**`0.0269`**

    The most likely situation is that the property costs $640,000, the down payment is $90,000, the mortgage term is 30 years, and the interest rate is 2.69%.

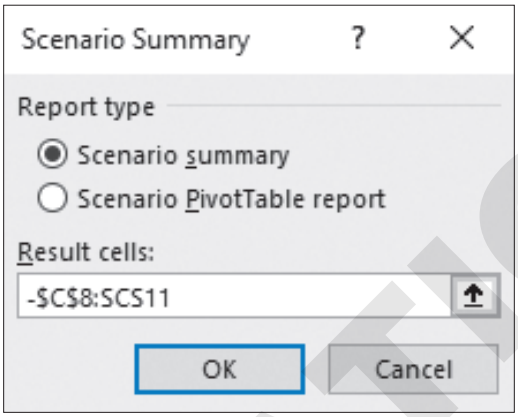
13. In the dialog box, choose the **Best** scenario and click **Show** to display the new values in the gray input cells, which automatically update the results in the blue formula cells.



Note the changes to the loan amount, payments, and interest.

14. In the dialog box, click **Summary**.

15. Choose the **Scenario Summary** report type and the **range C8:C11** as the result cells and then click **OK**.



The Scenario Manager inserts a new sheet that shows the values of the changing cells and result cells listed for the three scenarios as well as the current values that match the best scenario.

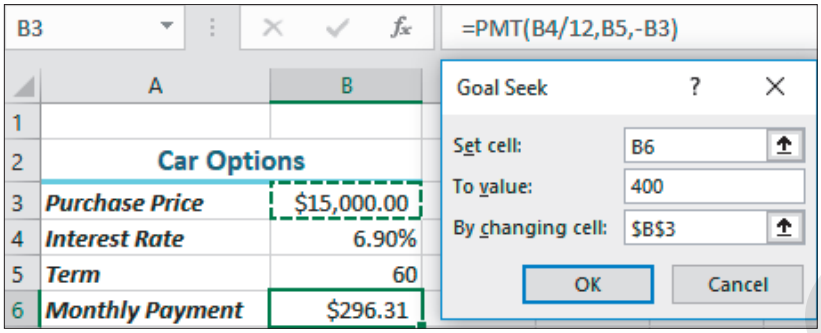
Scenario Summary	Current Values:	Best	Worst	Most Likely
Changing Cells:				
Purchase_Price	$575,000	$575,000	$690,000	$640,000
Down_Payment	$125,000	$125,000	$75,000	$90,000
Loan_Term__Months	300	300	420	360
Interest_Rate__APR	2.40%	2.40%	2.99%	2.69%
Result Cells:				
Loan_Amount	$450,000	$450,000	$615,000	$550,000
Monthly_Payment	$1,996.19	$1,996.19	$2,363.40	$2,227.89
Total_Payments	$598,856	$598,856	$992,627	$802,039
Total_Interest	$148,856	$148,856	$377,627	$252,039

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.

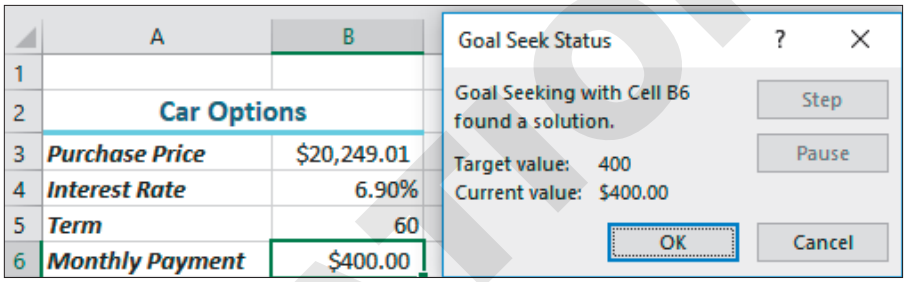
16. Save your work.

Goal Seek

Another What-If Analysis tool is Goal Seek, which is useful when you know the desired result and you want Excel to find the input required to achieve that result. For example, you might want your monthly car payment to be $400, and you know the interest rate and term. You could use Goal Seek to work backward to figure out how much you can afford to spend on the car (the loan amount).



The set cell *must* contain a formula. In this example, cell B6 contains the formula *=PMT(B4/12,B5,-B3)*. The changing cell must be a cell reference that directly or indirectly impacts the result of the formula—in this case, cell B3. Goal Seek can take a few seconds, as Excel has to work through the hundreds or thousands of possible variables until a solution is found.



The new result displays in cell B3, showing you can afford to spend $20,249.01.

Data→Forecast→What-If Analysis→Goal Seek...

DEVELOP YOUR SKILLS: E8-D6

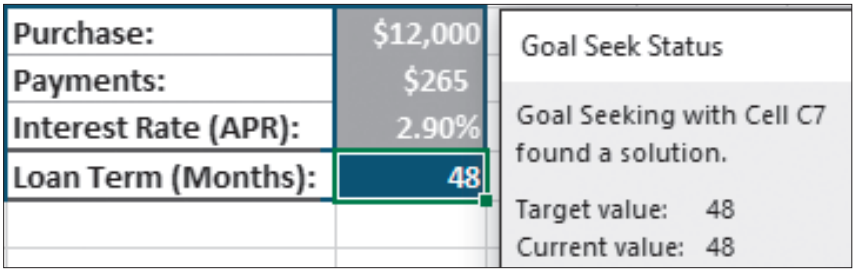
Airspace is purchasing a new printer. In this exercise, you will use Goal Seek to determine the monthly payment required to pay for the new printer in four years (48 months).

1. Save your file as: **`E8-D6-ATCFinancials`**
2. Switch to the **Printer** sheet, select **cell C7** if necessary, and choose **Data→Forecast→What-If Analysis→Goal Seek...**.

   Because you selected cell C7 in the worksheet, C7 appears in the Set Cell box by default.
3. Enter **48** in the To Value box.

4. In the By Changing Cell box, select **cell C5** and click **OK**.

   Goal Seek works through the possibilities and finds the solution. In the worksheet, the payment has been adjusted to $265 (rounded) and the loan term is now 48 months.



5. Click **OK** to close the Goal Seek window and keep the new values.
6. Select **cell C5** and increase the decimal to show two decimal places and the exact payment of $265.08.
7. Save the file.

Self-Assessment

Check your knowledge of this chapter's key concepts and skills using the Self-Assessment in your ebook or online (eLab course or Student Resource Center).

Reinforce Your Skills

REINFORCE YOUR SKILLS: E8-R1

Use Financial Functions and Data Tables

In this exercise, you will use financial functions and data tables to calculate the Kids for Change budget for the upcoming year, which includes paying down a loan and purchasing a new van and also takes into consideration the anticipated funding obtained from their summer charity race.

1. Open **E8-R1-Forecast** from your **Excel Chapter 8** folder and save it as: **`E8-R1-Forecast2023`**

   There are two vans you are looking at purchasing. One is a bit more expensive, but the seller is offering better loan terms. You will insert the calculations for the first option and then copy the formulas for the second option.

2. Calculate the loan amount in **cell C11** by entering the formula: **`=C7-C8`**
3. In **cell C12**, choose **Formulas→Function Library→Financial →PMT**.
4. Enter these arguments for the PMT function (note the **–** sign in the Pv argument):

Rate	**`C10/12`**
Nper	**`C9`**
Pv	**`-C11`**

5. Click **OK**.

   The monthly payment is $331.11 for option 1.

6. Calculate the total payments by entering the formula **`=C12*C9`** in **cell C13**.
7. Calculate the total interest by inserting the formula **`=C13-C11`** in **cell C14**.
8. Select all four formulas in the **range C11:C14** and use the **fill handle** to copy them across to **column D**.

   The monthly payment for option 2 is $194.14, which is much lower, but the total interest is higher.

Future Purchase Planning			
Transportation		Option #1	Option #2
	Purchase Price:	$11,900	$13,500
	Down Payment:	$1,000	$1,000
	Loan Term (Months):	36	72
	Interest Rate (APR):	5.90%	3.75%
	Loan Amount:	$10,900	$12,500
	Monthly Payment:	$331.11	$194.14
	Total Payments:	$11,920	$13,978
	Total Interest:	$1,020	$1,478

The charity holds a $12,000 loan at a low interest rate that is renewed each year, so you would like to calculate the remaining debt after making payments of $100 each month.

9. In **cell C21**, insert the FV function with these arguments (note the – sign):

Rate	`C20/12`
Nper	`C18`
Pmt	`C19`
Pv	`-C17`

The debt at the end of the year will be $11,019.

Now you will create forecasts for the funds you expect to raise at the summer charity race. The formula calculates the funds raised based on an estimated $2.50 in costs for each participant, an average of $25.00 raised by each participant, and fixed costs of $300 to rent tents and tables for the event and supply food for volunteers.

10. Select **cell G25**.

In the Formula Bar, see that the formula is a reference to the formula in cell C29 (the result of the formula doesn't show on the worksheet because it is formatted in white font color).

11. Select the **range F25:G36** and choose **Data→Forecast→What-If Analysis** → **Data Table…**.

12. Click the **Column Input Cell** box and then click **cell C27** (the expected number of participants) in the worksheet.

This replaces the value of 150 with the values 100–200 in column F to calculate the amount of funds raised if there are anywhere from 100 to 200 participants.

13. Click **OK** to insert the data table.

14. Select the **range G26:G36** and change the number format to **Currency** with no decimals.

The average amount raised per participant is an estimate based on last year's results. If the participants are not as successful at raising funds this year, or if you encourage them to try harder by offering an incentive, this number could fluctuate.

15. Select the **range J25:O36** and choose **Data→Forecast→What-If Analysis** → **Data Table…**.

Notice the formula in cell J25 is again a reference to cell C29.

16. In the Data Table dialog box, indicate **cell C26** as the row input cell and **cell C27** as the column input cell and then click **OK**.

17. Select the **range K26:O36** and change the number format to **Currency** with no decimals.

18. Save your work.

REINFORCE YOUR SKILLS: E8-R2

Work with Scenario Manager and Goal Seek

After doing some more shopping, you found two more appealing vehicles. In this exercise, you will add more options for vehicles to purchase and adjust the payments made to the loan to pay off more of the debt.

1. Save your file as: `E8-R2-Forecast2023`

2. Select the **range D6:D10** and choose **Data→Forecast→What-If Analysis** → **Scenario Manager…**.

3. Choose **Add**, type `Option #2` for the scenario name, and click **OK**.

4. Confirm these values for the new scenario:

Option	**#2**
Purchase_Price	**13500**
Down_Payment	**1000**
Loan_Term_Months	**72**
Interest_Rate__APR	**0.0375**

5. Click **Add** to save the scenario values for Option #2 and add a new scenario for Option #3.
6. Enter **Option #3** for the name and click **OK**.
7. Enter these values for the new scenario:

Option	**#3**
Purchase_Price	**14999**
Down_Payment	**1000**
Loan_Term__Months	**60**
Interest_Rate__APR	**0.0299**

8. Click **Add** to save the scenario values for Option #3 and add another new scenario.
9. Use **Option #4** as the scenario name, enter these values, and click **OK**:

Option	**#4**
Purchase_Price	**12575**
Down_Payment	**1000**
Loan_Term__Months	**60**
Interest_Rate__APR	**0.048**

10. Select **Option #3** and click **Show** to display the scenario on your worksheet, then select **Option #4** and click **Show** again.

    Options #1 and #4 are displayed on the worksheet; options #2 and #3 are saved as scenarios that you can view again later.

11. Close the Scenario Manager.

    Now you want to determine the payments needed to bring the loan down to $10,000 at the end of the year.

12. Use Goal Seek to set **cell C21** to the value of **10000** by changing **cell C19**.
13. Format **cell C19** with two decimal places.

    The payments will now be $184.22 to reduce the debt to $10,000.

14. Save and close the file.

REINFORCE YOUR SKILLS: E8-R3

Determine Relocation Costs

Kids for Change is moving! In this exercise, you will calculate the cost of relocating the headquarters to a downtown location versus an office in the suburbs. You'll also create a data table to forecast funds that can be raised from holding a charity dinner to help pay for the move.

1. Open **E8-R3-HQ** from your **Excel Chapter 8** folder and save it as: **E8-R3-HQOptions**
2. In **cell C10** on the **HQ** sheet, enter **=C6-(C7*C6)** to calculate the loan amount.

   The down payment is 5%, so the loan amount is the purchase price less 5% of the purchase price. Note: If you use the mouse to select the cells, the formula will show cell names instead of C6 and C7.
3. In **cell C11**, enter the formula **=PMT(C9/12,C8,-C10)** to calculate the monthly payment amount.
4. In **cell C12**, enter **=C11*C8** to calculate total payments.
5. In **cell C13**, enter **=C12-C10** to calculate total interest.

   Total payments are $395,823 and total interest is $125,073.
6. Select the **range C5:C9** and create a new scenario named **Downtown** that uses the current worksheet values.
7. Add a second scenario named **Suburbs** using these values:

Option	Suburbs
Purchase_Price	239500
Down_Payment	0.05
Loan_Term__Months	300
Interest_Rate__APR	0.0319

   The purchase price is lower at $239,500; the interest rate (3.19%) is lower, too.
8. Show the Suburbs option in the worksheet and then close the Scenario Manager.
9. Switch to the **Dinner** worksheet and in **cell B9**, enter **=(B6-B5)*B7-B8** to calculate expected funds raised at the charity dinner if the maximum capacity is reached.

   The formula takes each ticket price less the cost per guest, multiplies by capacity if the event sells out and 300 guests attend, and then subtracts the cost of the hall rental.
10. Select the **range E5:J10**.

    Cell E5 contains a reference to the formula you created in cell B9, which you can use to create a data table to see the results if anywhere from 200 to 300 tickets are sold and the ticket price is increased or decreased between $42 and $52.
11. Create a data table in which the row input cell is the ticket price in **cell B6** and the column input cell is the max capacity in **cell B7**.

    You will now use Goal Seek to determine how many tickets need to be sold to break even.
12. Select **cell B9** and use Goal Seek to set that cell to **0** (which represents only covering the costs) by changing **cell B7**.

    You need to sell at least 18 tickets to cover your costs.
13. Save your work and close the file.

Apply Your Skills

APPLY YOUR SKILLS: E8-A1

Forecast Return on Investment (ROI)

In this exercise, you will use data from the marketing team at Universal Corporate Events to forecast the return on investment from a proposed advertising campaign.

1. Open **E8-A1-Advert** from your **Excel Chapter 8** folder and save it as: **`E8-A1-AdvertROI`**

   The information presented here shows a calculation based on how many hours the ad runs, the reach of the audience, and the average sales rate for converting the audience into sales.

2. In **cell B15** on the **ROI** sheet, enter a formula to calculate the net profit by subtracting total costs from total sales.
3. Select the **range E7:K12**.
4. Insert a data table based on the formula in **cell B15** using the appropriate cells for the two variables, sales rate, and ad hours.
5. Adjust the number format for the **range F8:K12** to Currency with no decimals.
6. Select the **range A6:B15** and use the **Create from Selection** command to create defined names for the cells from the values in the left column.
7. Select the **range B8:B10** plus **cell B12**.

   Hint: Use the Ctrl key.

   You will create another scenario, and these will be the changing cells.

8. Use the Scenario Manager to add an **`Estimate`** scenario that uses the current worksheet values.

   You have to decide whether to invest in better production (by paying a higher production cost and paying more for prime-time ad spots), if the results increase the sales rate and amount enough to increase your overall profit.

9. Add a second scenario named **`High Quality`** using these values:

Sales_Rate	**`0.0192`**
Costs_Per_Hour_Airtime	**`14500`**
Total_Production_Cost	**`120000`**
Avg_Sale_Amount	**`625`**

10. Show the results for the High Quality scenario in the worksheet and then close the Scenario Manager.

    Your net profit based on this scenario would be $830,000.

11. Save your work.

APPLY YOUR SKILLS: E8-A2

Determine Interest Costs

In this exercise, you will use the NPER function to determine the interest cost if Universal Corporate Events borrows $1M to pay for the ad campaign.

1. Save your file as: **`E8-A2-AdvertROI`**

   UCE has budgeted $25,000 per month, and the interest rate is fixed at 5.89%.

2. Switch to the **Financing** sheet and in **cell B9**, use a function to calculate the term of the loan based on the finance amount, interest rate, and payments.

   Hint: Remember to divide the interest rate by 12 to get the monthly rate, since you want to determine the number of monthly periods; use a negative value for Pv to represent a loan.

   The actual term is more than 44 months.

3. Use Goal Seek to change the payments so the term is exactly 48 months.

4. The result displays eight decimal places, but you can round this off, so decrease the decimal places to zero.

   The monthly payments would be $23,435 to pay off the $1M loan in four years.

5. In **cell B10**, enter a formula that multiplies the payments by the term and then subtracts the initial finance amount to return the total interest.

   The total interest cost for the loan is $124,862.03, which you will add to the total costs of the campaign on the ROI sheet.

6. Go to the **ROI** sheet and edit the formula in **cell B14** so the total cost includes the total interest from the Financing sheet.

   The total costs are now $1,694,862, which reduces the overall profit to $705,138.

7. Save your work and close the file.

APPLY YOUR SKILLS: E8-A3

Perform a Cost Analysis

In this exercise, you will use financial functions and what-if analyses to help Universal Corporate Events analyze its office renovation project and decide how to finance it.

1. Open **E8-A3-Reno** from your **Excel Chapter 8** folder and save it as: **`E8-A3-RenoCosts`**
2. In **cell B10**, insert the PMT function based on the renovation costs, term, and interest rate.

   Hint: Multiply years by 12 to get the number of payments for the Nper argument.

3. In **cell B11**, insert a formula to calculate the total interest by multiplying the payments by the years, multiplying by 12, and then subtracting the renovation costs.
4. Select **cell F6** and insert a formula with a cell reference to the interest cost formula in **cell B11**.
5. Select the **range E6:F11** and insert a one-variable data table, substituting the values in **column E** for the length of the loan term in years.
6. Hide **row 6** in the worksheet.

7. Select the **range A7:B11** and create defined names for the cells from the selection based on the left column.

   Now you will create three scenarios and generate a summary report that compares the options.

8. Using **cells B7**, **B8**, and **B9** as the changing cells, create a scenario called **`Average`** based on the current worksheet data.

9. Create a new scenario called **`Best`** that uses these values:

Renovation costs	**`21,000`**
Term (years)	**`10`**
Interest rate	**`4.25%`**

10. Create another scenario called **`Worst`** that uses these values:

Renovation costs	**`30,000`**
Term (years)	**`20`**
Interest rate	**`5.5%`**

11. Generate a scenario summary report with the monthly payments and total interest cost for the result cells.

    The monthly payments for the Best scenario are slightly higher, but the total interest cost is much lower.

12. Save your work and close the file.

Project Grader

If your class is using eLab (labyrinthelab.com), you may upload your completed Project Grader assignments for automatic grading. You may complete these projects even if your class doesn't use eLab, though you will not be able to upload your work.

PROJECT GRADER: E8-P1

Calculating Costs Using Financial Functions and Scenarios

Taylor Games is considering the purchase of a new mill for making dice. The purchase involves variable terms. In this exercise, you will create a report that displays the possible costs of purchasing the mill at different rates and payments. Then, you will use this data in a data table to show what production rates and profits would be required to break even.

1. Download and open your Project Grader starting file.
   - *Using eLab:* Download **E8_P1_eStart** from the Assignments page. You *must* start with this file or your work cannot be automatically graded.
   - *Not using eLab:* Open **E8_P1_Start** from your **Excel Chapter 8** folder.
2. In **cell C9** of the **Dice Maker Finance** worksheet, use the NPER financial function to calculate the term in months.
3. In **cell C10**, calculate the total interest using the formula: **`=(C8*C9)-C6`**
4. Create a new scenario using these settings:
   - Scenario name: **`Best`**
   - Base it on the range: **C6:C8**
   - Change the annual interest rate to: **`0.0425`**
   - Change the monthly payment to: **`750`**
5. Create another scenario using these settings:
   - Scenario name: **`Worst`**
   - Base it on the range: **C6:C8**
   - Change the annual interest rate to: **`0.075`**
   - Change the monthly payment to: **`500`**
6. Create a scenario summary that uses **`A6:C13`** for the Result cells.
7. Move the **Scenario Summary** worksheet to the end of the workbook (to the right of the *Dice Maker ROI* worksheet).
8. In **cell C10** of the **Dice Maker Finance** worksheet, use the Goal Seek tool and these settings to adjust the total interest:
   - Adjust the total interest to: **`5000`**
   - By changing the Monthly Payment amount
9. In **cell D8** of the **Dice Maker ROI** worksheet, create a reference to **cell C13** of the **Dice Maker Finance** worksheet.
10. In the Dice Maker ROI worksheet, create a two-variable data table using these guidelines:
    - Base the data table on the **range G7:J10**.
    - Use **cell D7** (*Profit Per Dice*) as the row input cell.
    - Use **cell D6** (*Monthly Production Rate*) as the column input cell.

11. Save your workbook.
    - *Using eLab:* Save it to your **Excel Chapter 8** folder as **`E8_P1_eSubmission`** and attach the file to your eLab assignment for grading.
    - *Not using eLab:* Save it to your **Excel Chapter 8** folder as: **`E8_P1_Submission`**

PROJECT GRADER: E8-P2

Creating Finance Tools

Classic Cars Club would like to offer finance tools for club members to calculate the costs of purchasing a classic car as well as possible investment value. In this exercise, you will create tables with formulas that will assist in calculating loan payments and future value. Then, you will display these formulas based on the value of a member's vehicle.

1. Download and open your Project Grader starting file.
    - *Using eLab:* Download **E8_P2_eStart** from the Assignments page. You *must* start with this file or your work cannot be automatically graded.
    - *Not using eLab:* Open **E8_P2_Start** from your **Excel Chapter 8** folder.
2. In **cell C9** of the **Finance Tools** worksheet, use the PMT financial function to determine the monthly payment based on the data provided in the **Payment Calculator** table.
3. In **cell C11**, calculate the total interest using the formula: **`=(C9*C10)-C7`**
4. Create a new scenario using these guidelines:
    - Scenario name: **`Best`**
    - Base it on the annual interest rate and term: (**cells C8** and **C10**)
    - Change the annual interest rate to: **`0.035`**
    - Change the term to: **`84`**
5. Create a new scenario using these guidelines:
    - Scenario name: **`Worst`**
    - Base it on the annual interest rate and term: (**cells C8** and **C10**)
    - Change the annual interest rate to: **`0.06`**
    - Change the term to: **`60`**
6. Show the Worst scenario.
7. In **cell G8**, calculate the future value using these settings:
    - Rate: **Cell F7**
    - Nper: **Cell F8**
    - Pmt: **`0`**
    - Pv: Use the negative value of **cell C7**.
8. Create a one-variable data table using these guidelines:
    - Base the data table on the **range F8:G16**.
    - Set the column input cell to **cell F8**.
9. Save your workbook.
    - *Using eLab:* Save it to your **Excel Chapter 8** folder as **`E8_P2_eSubmission`** and attach the file to your eLab assignment for grading.
    - *Not using eLab:* Save it to your **Excel Chapter 8** folder as: **`E8_P2_Submission`**

Extend Your Skills

These exercises challenge you to think critically and apply your new skills in a real-world setting. You will be evaluated on your ability to follow directions, completeness, creativity, and the use of proper grammar and mechanics. Save files to your chapter folder. Submit assignments as directed.

E8-E1 That's the Way I See It

You are in the market for a new car and want to compare prices and payment options for your favorite cars. Open **E8-E1-Cars** and save it as: **E8-E1-CarOptions**

Research local car dealerships online and find at least three cars you might want to buy. Enter the details for your favorite option into the range B4:B8 in the worksheet. Enter the PMT function in cell B9 and save this option as a scenario, using the car's make and model for the scenario name. Add two more scenarios for the other cars and then create a summary report. Finally, create a one-variable data table in the range D4:E8 to calculate the different payments you would have to make if the interest rate for the loan fluctuates up or down slightly (you will have to enter the various interest rates first, in the range D5:D8).

E8-E2 Be Your Own Boss

Blue Jean Landscaping needs to purchase new equipment to expand its operations, including lawn tractors, trailers, and a new vehicle—all of which add up to a total loan of $65,000. The bank has several financing options that you are comparing. Open **E8-E2-Expansion** and save it as: **E8-E2-ExpansionFinancing**

Insert the appropriate formulas into the range C7:C9 and then create a two-variable data table next to the calculations to compare the total interest paid based on changing the years and interest rates, using the options shown. Determine which option has the lowest total interest and highlight that option with an appropriate format. Then, use Goal Seek to determine what interest rate you would have to negotiate to reduce total interest to $5,750.

Loan Options
5 years at 3.5%
7 years at 3.25%
10 years at 3.0%

E8-E3 Demonstrate Proficiency

With your recent success selling BBQ sauce by the bottle in local retail shops, you expect to see sales grow even more next year. To forecast growth in profit, you will use a data table. Open **E8-E3-SauceSales** and save it as: **E8-E3-SauceSalesGrowth**

The formulas for last year's sales and profits have been created, as has the total for all three BBQ sauce flavors and the expected growth in sales and profit for next year. Using references to the formulas in the range B12:D12 and cell B13, create a data table in the range A16:E24 that shows forecasts for next year if the expected growth of 5% is replaced with values from 3% to 10%. Then create two scenarios, one using current data and another in which the price is $8.00 and the cost is reduced to $3.00 for all three flavors.