

Math, Statistical, Lookup, and Text Formulas in Excel

Rounding out the formulas section, this chapter explores Excel's math and statistical functions for summarizing and analyzing numerical data, followed by a practical look at lookup, information, and text functions. You'll learn how to retrieve data from tables, evaluate cell properties using the CELL function, and manipulate text strings, all skills with real-world applications in financial modeling, data cleanup, and report preparation. Accountants who work with large datasets will find these functions especially valuable for increasing efficiency.

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LEARNING ASSIGNMENTS AND OBJECTIVES

Assignment

- Study the full course materials included here.
- Complete the review questions after each chapter.
- Answer 10 final exam questions.
- Final exam is scored immediately, 70% or better passes.
- Certificate of completion is available in your account.
- Failed exams can be retaken free of charge.

Course Objectives

- Recognize how to build formulas using statistical functions.
- Recognize how to use text functions to manipulate text entries.

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Chapter 1: MATH AND STATISTICAL FORMULAS

Chapter Objective

After completing this chapter, you should be able to:

- Recognize how to build formulas using statistical functions.

This chapter examines two larger categories of Excel functions: Math & Trig and Statistical functions. The Math & Trig functions include all the specialized trigonometric functions such as those that return the sine, cosine, or tangents of various angles and logarithmic functions (for finding the base-10 and natural logarithms of a number), along with the more common math functions for summing numbers, rounding numbers up or down, raising a number to a certain power, and finding the square root of numbers.

The Statistical functions include the more common functions that return the average, highest, and lowest values in a cell range all the way to the very sophisticated and specialized functions that calculate such things as the chi-squared distribution, binomial distribution probability, frequency, standard deviation, variance, and the skewness (great word!) of a distribution in a particular population.

MATH & TRIG FUNCTIONS

You can access the Math & Trig functions either via the Insert Function icon on the Formula bar, or via the Ribbon's Formulas tab by clicking the Math & Trig drop-down menu.

The Math & Trig category groups together all the trigonometric functions with the more common arithmetic functions. Although the trigonometric functions are primarily of use to engineers and scientists, the mathematical functions provide you with the ability to manipulate any type of value. The math functions include SUM, the most commonly used of all functions; functions such as INT, EVEN, ODD, and ROUND, that rounds off the values in your worksheet; functions such as PRODUCT, SUMPRODUCT, and SUMSQ that you can use to calculate the products of various values in the worksheet; and the SQRT function that you can use to calculate the square root of a value.

Rounding off numbers

You use the ROUND function to round up or down fractional values in the worksheet as you might when working with financial worksheets that need to show monetary values only to the nearest dollar. Unlike when applying a number format to a cell, which affects only the number's display, the

ROUND function actually changes the way Excel stores the number in the cell that contains the function. ROUND uses the following syntax:

`ROUND(number, num:digits)`

In this function, the *number* argument is the value that you want to round off, and *num:digits* is the number of digits to which you want the number rounded. If you enter 0 (zero) as the *num:digits* argument, Excel rounds the number to the nearest integer. If you make the *num:digits* argument a positive value, Excel rounds the number to the specified number of decimal places. If you enter the *num:digits* argument as a negative number, Excel rounds the number to the left of the decimal point.

Instead of the ROUND function, you can use the ROUNDUP or ROUNDDOWN function. Both ROUNDUP and ROUNDDOWN take the same *number* and *num:digits* arguments as the ROUND function. The difference is that the ROUNDUP function always rounds up the value specified by the *number* argument, whereas the ROUNDDOWN function always rounds the value down.

Figure 12-1 (sample workbook: Round Function Examples.xlsx) illustrates the use of the ROUND, ROUNDUP, and ROUNDDOWN functions in rounding off the value of the mathematical constant pi (π). In cell A3, I entered the value of this constant (with just nine places of nonrepeating fraction displayed when the column is widened) into this cell, using Excel's PI function in the following formula:

`=PI()`

FIGURE 12-1: ROUNDING OFF THE VALUE OF PI WITH THE ROUND, ROUNDUP, AND ROUNDDOWN FUNCTIONS. (SAMPLE WORKBOOK: ROUND FUNCTION EXAMPLES.XLSX)

B3			=ROUND(\$A\$3,0)
	A	B	C
1	ROUND Examples		
2	Value of pi	Rounding pi	ROUND Function
3	3.141592654	3	=ROUND(\$A\$3,0)
4		3.1	=ROUND(\$A\$3,1)
5		3.14	=ROUND(\$A\$3,2)
6		3.142	=ROUND(\$A\$3,3)
7		3.15	=ROUNDUP(\$A\$3,2)
8		3.1416	=ROUNDUP(\$A\$3,4)
9		3.14	=ROUNDDOWN(\$A\$3,2)
10		3.1415	=ROUNDDOWN(\$A\$3,4)
11			

I then used the ROUND, ROUNDUP, and ROUNDDOWN functions in the cell range B3 through B10 to round this number up and down to various decimal places.

Cell B3, the first cell that uses one of the ROUND functions to round off the value of pi, rounds this value to 3 because I used 0 (zero) as the num:digits argument of its ROUND function (causing Excel to round the value to the nearest whole number).

In Figure 12-1, note the difference between using the ROUND and ROUNDUP functions both with 2 as their num:digits arguments in cells B5 and B7, respectively. In cell B5, Excel rounds the value of pi off to 3.14, whereas in cell B7, the program rounds its value up to 3.15. Note that using the ROUNDDOWN function with 2 as its num:digits argument yields the same result, 3.14, as does using the ROUND function with 2 as its second argument.

The whole number and nothing but the whole number

You can also use the INT (for Integer) and TRUNC (for Truncate) functions to lop off unneeded parts of values in your worksheets. You use these functions only when you don't care about all or part of the fractional portion of the value.

When you use the INT function, which requires only a single number argument, Excel rounds the value down to the nearest integer (whole number). For example, cell A3 contains the value of pi, as shown in Figure 12-1, and you enter the following INT function formula in the worksheet:

```
=INT(A3)
```

Excel returns the value 3 to the cell, the same as when you use 0 (zero) as the num:digits argument of the ROUND function in cell B3.

The TRUNC function uses the same number and num:digits arguments as the ROUND, ROUNDUP, and ROUNDDOWN functions, except that in the TRUNC function, the num:digits argument is purely optional. This argument is required in the ROUND, ROUNDUP, and ROUNDDOWN functions.

The TRUNC function doesn't round off the number in question; it truncates the number to the nearest integer by removing the fractional part of the number. However, if you specify a num:digits argument, Excel uses that value to determine the precision of the truncation. So, going back to the example illustrated in Figure 12-1, if you enter the following TRUNC function, omitting the optional num:digits argument as in

```
=TRUNC($A$3)
```

Excel returns 3 to the cell just like the formula =ROUND(\$A\$3,0) does in cell B3. However, if you modify this TRUNC function by using 2 as its num:digits argument, as in

```
=TRUNC($A$3,2)
```

Excel then returns 3.14 (by cutting the rest of the fraction) just as the formula =ROUND(\$A\$3,2) does in cell B5.

The only time you notice a difference between the INT and TRUNC functions is when you use them with negative numbers or when you use a negative value for the TRUNC function's num:digits argument. For example, if you use the TRUNC function to truncate the value -5.4 in the following formula:

```
=TRUNC(-5.4)
```

Excel returns -5 to the cell. If, however, you use the INT function with the same negative value, as in

```
=INT(-5.4)
```

Excel returns -6 to the cell. This is because the INT function rounds numbers down to the nearest integer using the fractional part of the number.

Similarly, if you use INT with the value 12345.678, as in the following formula:

```
=INT(12345.678)
```

Excel returns 12345. However, if you use TRUNC on the same value, but with -2 as the num:digits argument, as in the formula:

```
=TRUNC(12345.678, -2)
```

Excel returns 12300. In this case, TRUNC “truncates” the first two digits to the left of the decimal point by converting them to 0s.

Let’s call it even or odd

Excel’s EVEN and ODD functions also round off numbers. The EVEN function rounds the value specified as its number argument up to the nearest even integer. The ODD function, of course, does just the opposite: rounding the value up to the nearest odd integer. So, for example, if cell C18 in a worksheet contains the value 345.25 and you use the EVEN function in the following formula:

```
=EVEN(C18)
```

Excel rounds the value up to the next whole even number and returns 346 to the cell. If, however, you use the ODD function on this cell, as in

```
=ODD(C18)
```

Excel rounds the value up to the next odd whole number and returns 347 to the cell instead.

Building in a ceiling

The CEILING.MATH function enables you to not only round up a number, but also set the multiple of significance to be used when doing the rounding. This function can be very *useful* when dealing with figures that need rounding to particular units. For example, suppose that you’re building a worksheet that lists the retail prices for the products that you sell, all based upon a particular markup over wholesale, and that many of these calculations result in prices with cents below 50. If you don’t want to have any prices in the list that aren’t rounded to the nearest 50 cents or whole dollar, you can use the CEILING function to round up all these calculated retail prices to the nearest half dollar.

The CEILING.MATH function uses the following syntax:

```
CEILING.MATH(number, [significance], [mode])
```

The number argument specifies the number you want to round up and the optional significance argument specifies the multiple to which you want to round. (By *default*, the significance is +1 for positive numbers and -1 for negative numbers.) The optional *mode* argument comes into play only when dealing with negative numbers where the mode value indicates the *direction* toward (+1) or away (-1) from 0.

For the half-dollar example, suppose that you have the calculated number \$12.35 in cell B3 and you enter the following formula in cell C3:

```
=CEILING.MATH(B3, 0.5)
```

Excel then returns \$12.50 to cell C3. Further, suppose that cell B4 contains the calculated value \$13.67, and you copy this formula down to cell C4 so that it contains

```
=CEILING.MATH(B4, 0.5)
```

Excel then returns \$14.00 to that cell.

POWER and SQRT

Although you can use the caret (^) operator to build a formula that raises a number to any power, you also need to be aware that Excel includes a math function called POWER that accomplishes the same thing. For example, to build a formula that raises 5.9 to the third power (that is, cubes the number), you can use the exponentiation operator, as in

```
=5.9 ^ 3
```

You can have Excel perform the same calculation with the POWER function by entering this formula: =POWER(5.9, 3)

In either case, Excel returns the same result, 205.379. The only difference between using the exponentiation operator and the POWER function occurs on that rare, rare occasion when you have to raise a number by a fractional power. In that case, you need to use the POWER function instead of the caret (^) operator to get the correct result. For example, suppose that you need to raise 20 by the fraction 3/4; to do this, you build the following formula with the POWER function:

```
=POWER(20, 3/4)
```

To use the exponentiation operator to calculate the result of raising 20 by the fraction 3/4, you can convert the fraction into decimal form, as in

```
=20 ^ 0.75
```

The SQRT function calculates the square root of any number that you specify as its sole number argument. For example, if you use the SQRT function to build the following formula in a cell:

```
=SQRT(144)
```

Excel returns 12 to that cell.

```
=SQRT(ABS(A15))
```

Excel then returns 7 instead of #NUM! to cell A16 because the ABS function removes the negative sign from the 49.00 before the SQRT function calculates its square root. (Remember that Excel always performs the calculations in the innermost pair of parentheses first.)

The SUM of the parts

No function in the entire galaxy of Excel functions comes anywhere close to the popularity of the SUM function in the worksheets that you build. So popular is this function, in fact, that Excel has its own Alt+= shortcut key as well as a Sum command button located on the Home tab and on the Formula tab of the Ribbon (the one with the Σ on it) that you most often use to build your SUM formulas. You should, however, be aware of the workings of the basic SUM function that the AutoSum button enables you to use so easily.

For the record, the syntax of the SUM function is as follows:

```
SUM(number1, [number2], [...])
```

When using the SUM function, only the number1 argument is required; this is the range of numbers in a cell range or *array constant* that you want added together. Be aware that you can enter up to a total of 29 other optional number arguments in a single SUM formula. For example, you can build a SUM formula that totals numbers in several different ranges, as in

```
=SUM(B3:B10, Sheet2!B3:B10, Sheet3!B3:B10)
```

In this example, Excel sums the values in the cell range B3:B10 on Sheet1, Sheet2, and Sheet3 of the workbook, giving you the grand total of all these values in whatever cell you build this SUM formula.

Conditional summing

The SUM function is perfect when you want to get the totals for all the numbers in a particular range or set of ranges. But what about those times when you only want the total of certain items within a cell range? For those situations, you can use the SUMIF or SUMIFS function.

The SUMIF function enables you to tell Excel to add together the numbers in a particular range only when those numbers meet the criteria that you specify. The syntax of the SUMIF function is as follows:

```
SUMIF(range, criteria, [sum:range])
```

In the SUMIF function, the range argument specifies the range of cells that you want Excel to evaluate when doing the summing; the criteria argument specifies the criteria to be used in evaluating whether to include certain values in the range in the summing; and finally, the optional sum:range argument is the range of all the cells to be summed. If you omit the sum:range argument, Excel sums the cells specified in the range argument if they meet the criteria specified in the criteria argument.