

# CHAPTER 11: RELATIVE ADDRESSING

“Addresses are given to us to conceal our whereabouts.”

– H. H. Munro (“Saki”)

By default, cell addresses are relative. This means that when a formula is created using various cell addresses (regardless of whether those addresses were specified by point-and-click or direct address), Excel calculates the value based on the *relative positions* of cells.

## RELATIVE ADDRESSING

Place this formula in cell B1:

=A1

	A	B	C	D
1	123	123		
2	124			
3	125			
4	126			

In relative terms, cell B1 is saying, “place the contents of the cell to my left here.” Now, if you copy this formula down through cell B4, what formula will appear in cell B3? In B4?

	A	B	C	D
1	123	123		
2	124	124		
3	125	125		
4	126	126		

So you see that cell B3 also says, “place the contents of the cell to my left here.” This is the essence of relative addressing. Whenever you copy a formula that contains cell addresses, Excel copies their relative positions—no matter how complicated the formula becomes.

## THE INFLATION PROBLEM

This is a typical problem for a spreadsheet: given what we know now and a few assumptions, what will the outcome be in the future? Here’s an example. Let’s say we had the following budget. What will we have to pay in the future, say in 20 years for these things?

## REVIEW

First, let’s create and format a simple worksheet. This is simply a review of past concepts.

**Step 1:** Recreate the following worksheet:

	A	B	C	D
1		2001		
2	Food	500		
3	Housing	1000		
4	Insurance	300		
5	Gas	200		
6	Total			

**Step 2:** Now, place the proper formula in cell B6:

- Type: `=sum (`
- Press **↑**, to move the cursor to one corner of the range.
- Hold down **Shift** as you tap **↑** three more times, to select the range.
- Type **)** to close the range and press **←Enter**.

The total, 2000, should now appear in cell B6.

**Step 3:** Format cell B6 by pressing **Ctrl Shift \$**.

**Step 4:** Format rows 2 through 5 with commas:

- Click the row 2 header and drag down to the row 5 header.
- Click the comma format icon, **,**, on the Formatting toolbar.

**Step 5:** Select the column and row titles and change the background color to green.

**Step 6:** Add a single border above and a double border below cell B6.

Your worksheet should look like this:

	A	B	C	D
1		2001		
2	Food	500.00		
3	Housing	1,000.00		
4	Insurance	300.00		
5	Gas	200.00		
6	Total	\$2,000.00		

### EXTEND YEAR SEQUENCE

We can extend the years heading from 2001 to 2025 by clicking and dragging cell B1's fill handle. To extend the range of years to 2025:

**Step 1:** Select cell B1.

**Step 2:** Depress **Ctrl** as you click and drag its fill handle to the right, to 2025.

Now look closely at the results:

- the cells to the right now have the same formatting as cell B1; and,
- they should number 2001, 2002, 2003 . . . 2025.

	A	B	C	D
1		2001	2002	2003
2	Food	500.00		
3	Housing	1,000.00		
4	Insurance	300.00		
5	Gas	200.00		
6	Total	\$2,000.00		

(If each cell says "2001" it is because you released **Ctrl** before you released your mouse finger. Press **Ctrl** **Z** and try it again.)

### COPY THE FORMULA

In addition to extending a sequence, remember that you can click and drag the fill handle to copy. Let's use this feature to copy the formula in cell B6 to the right:

**Step 1:** Select cell B6.

**Step 2:** Click and drag its fill handle to the right to cell Z6.

	A	B	C	D
1		2001	2002	2003
2	Food	500.00		
3	Housing	1,000.00		
4	Insurance	300.00		
5	Gas	200.00		
6	Total	\$2,000.00	\$0.00	\$0.00

Again, look very closely at the results:

- the cells to the right now have the same formatting as cell B6; and,
- the formula of B6 was copied to each cell to the right. . . or was it?

### RELATIVE ADDRESSING

If you move back to cell B6, look at its contents:

**=SUM(B2 : B5)**

Now, move to cell C6, and look at its contents:

**=SUM(C2 : C5)**

And D6?

**=SUM(D2 : D5)**

Stop and think about this. If, by clicking and dragging the cell B6's fill handle, we had truly copied its contents, each cell would contain:

**=SUM(B2 : B5)**

which wouldn't be very helpful, would it? Instead, Excel looked at that formula and said, "This formula adds up the four cells above me." Then, when this is copied to C6, C6 now contains "This formula adds up the four cells above me."

This is the essence of what is known as "relative addressing." Whenever you copy a formula, Excel translates the cell addresses within that formula to relative addresses.

Here's another example. Suppose we had the following spreadsheet. If cell AB1 contains:

**=AA1/2**

it will display 5, of course. Now, if we click its fill handle straight down through cell AB5, what will be in cell AB5?

	AA	AB	AC	AD
1	10	5		
2	8	4		
3	9	4.5		
4	50	25		
5	20	10		

Think of it this way: the Cell AB contains a formula. In relative addressing terms, it says, "Take the number to my left, and divide it by 2." Then as we copy it down, each cell contains this relative address. Thus, the formula in cell AB3 says, "Take the number to my left, and divide it by 2," which is AA3/2.

Similarly, the formula in cell AB5 also says, "take the number to my left, and divide it by 2," which is AA5/2.

## BACK TO OUR PROBLEM

Let's return to our original problem. We are all set up to peer into the future, but what will determine prices in the future? In general, the prices in the future will be determined by the inflation rate. Let's make a couple of changes in our spreadsheet to build an inflation rate into our model.

### INSERT TWO ROWS

We would like to insert two lines above our current worksheet, so that it looks like this:

	A	B	C	D
1	Inflation =	10%		
2				
3		2001	2002	2003
4	Food	500.00		
5	Housing	1,000.00		
6	Insurance	300.00		
7	Gas	200.00		
8	Total	\$2,000.00	\$0.00	\$0.00

**Step 1:** Click the header of row 1 and drag down to row 2.

**Step 2:** Right-click either header and select **I**nsert from the pop-up menu.

- Two new rows should now appear.

**Step 3:** Enter:

**Inflation =**

in cell A1 and:

**10%**

in cell B1.

**Step 4:** Right-align cell A1 and left-align cell B1.

## THE FUTURE

Now before we have Excel project into the future, let's do a little peering of our own. If this year food costs \$500, and there is 10% inflation, what will it cost next year? Off the top of your head, you know that it will be \$550—that is, 10% more than this year.

Now, let's see if we can translate that into Excel. What should go in cell C4?

**=B4+B4\*B1**

which, in this case, would translate to  $500 + 500 * 10\%$ , or 550, just as we expected.

If you are a little confused by the order of precedence, even after reviewing the concept on 64, don't feel bad. For most people, it's been a while since we did this in school. Does it help to see this formula grouped with parentheses?

**=B4 + (B4 \* B1)**

If so, please use parentheses. It slows you down a little, but speed is always secondary to accuracy. If grouping factors with parentheses helps you, then, by all means, use them!

Let's enter this into your spreadsheet:

**Step 1:** In cell C4, type **=**, because it will contain a formula.

**Step 2:** Press **←** and type **+**.

**Step 3:** Press **←** and type **\***.

**Step 4:** Press **←** once and tap **↑** three times.

- This should take you to cell B1.

**Step 5:** Press **↵**.

The results in cell C4 should be 550.00.

## COPYING FORMULAS, PART 2

Remember how we copied the formula for the total to the cells to its right? We simply clicked its fill handle and dragged to the right.

That worked so well, let's use the same technique to copy the formula in cell C4 down through cell C7:

**Step 1:** Select cell C4.

**Step 2:** Click its fill handle and drag it down three cells.

Release your mouse, and instantly, you have an answer. There's only one tiny problem: the answer is wrong, which will be immediately obvious, as soon as you widen the columns.

	A	B	C	D
1	Inflation =	10%		
2				
3		2001	2002	2003
4	Food	500.00	550.00	
5	Housing	1,000.00	1,000.00	
6	Insurance	300.00	#####	
7	Gas	200.00	#####	
8	Total	\$2,000.00	#####	\$0.00

The culprit is our new old friend relative addressing. You will recall the formula that we placed in cell C4:

**=B4 + B4 \* B1**

Put in relative addressing terms, this formula says: "Take the number to my left, plus the number to my left, times the number that is one cell to my left and three cells up." Remember it is this relative addressing thing that we are really copying when we copy a formula.

This means that cell C5 takes the number to its left, plus the number to its left times the number that is one cell to its left and three cells up—in other words:

**=B5 + B5 \* B2**

which yields 1,000 + 1,000 \* nothing, or 1,000. Instead, we wanted it to say

**=B5 + B5 \* B1**

because in each case, we want to refer to the one cell that contains the inflation rate—cell B1. When we must refer to one specific location, we call that cell an absolute address.

## TRY IT AGAIN

Delete anything that you have in the range C4:C7, so we can start fresh:

**Step 1:** In cell C4, type **=**

**Step 2:** Press **<** and type **+**.

**Step 3:** Press **<** and type **\***.

**Step 4:** Press **<** once and tap **↑** three times.

- This should take you to cell B1.

**Step 5:** Press **F4**.

- This is called the "Absolute address key."
- As you can see, it placed a \$ before the column and row.
- This has *nothing* to do with formatting.

**Step 6:** Press **↵**.

- The results in cell C4 should be 550.00.

**Step 7:** Select cell C4.

**Step 8:** Click its fill handle and drag it down three cells.

**Step 9:** Select the range C4:C7.

**Step 10:** Click its fill handle and drag it right 23 cells.

Release your mouse, and instantly, you have an answer. This time, though, it is correct.

## TEST THE RESULTS

To see how cool this is, experiment with different values of inflation. For example, if you enter 0% in cell B1, what results should you get? 100%?

## SUMMARY

The good news is that absolute addressing issue only applies when we are copying formulas. The bad news is that we copy formulas all the time.

So now we have something more to worry about. Whenever you copy a formula, you must ask yourself, "Is this an absolute addressing issue?" The answer will almost always be no. That's why relative addressing is the default.

Absolute addressing only comes into play when a formula is copied *and* cell addresses in that formula refer to a specific location.

To create an absolute address:

**Step 1:** Move to the cell.

**Step 2:** Either:

- **Point-and-click:** press **F4**, or,
- **Direct address:** type **\$** before both the row and the column; i.e., if you want to use the value in cell D4 divided by two, type:

**\$D\$4/2**

## NOTES