

important

A *synonym* is a word you use when you can't spell the other one.

Baltasar Gracián
(Philosopher 1601-1658)

Excel uses different terminology in various menus, dialog boxes and task panes that mean the same thing (in the context of this lesson):

Series, *Forecast* and *Trend* mean the same thing.

Growth and *Exponential* also mean the same thing.

In this lesson I'll consistently use the terminology *Series* and *Exponential*.

note

Excel can calculate a linear series when the step values of cells are not equal

Excel calculates a linear series (Autofill also calls this a *fill series*) using this formula:

Start Value + Step Value

Sometimes you may need to produce linear series values from a series of numbers that have different step values. For example, consider this range:

	A	B
2	Value	Step Value
3	1	
4	2.1	1.1
5	2.9	0.8
6	4.1	1.2

In this case Excel will use a more complex mathematical operation (called the *least-squares algorithm*) to determine the correct step value to use. In the above example, Excel would calculate a step value of 1.01.

Rabbit Population

Lesson 2-18: Understand linear and exponential series

Linear series

In: *Lesson 2-14: Use AutoFill for text and numeric series*, you used AutoFill's *Fill Series* method to automatically create these numeric series:

	A	B	C
18	Monday	1	9
19	Tuesday	2	18
20	Wednesday	3	27

These are both examples of *Linear* series.

Imagine that you had originally selected cells B1:B2 before auto filling column B:

	B
1	9
2	18
3	

To calculate a linear series Excel first identifies the *step value*. The linear series in column B has a *step value* of nine ($18-9=9$).

When you use AutoFill to *Fill Series*, Excel adds the *step value* to the *start value* (the number shown in the previous cell).

After you have AutoFilled down to cell B3, the value shown in cell B3 will thus be twenty-seven (18 (the start value) $+9$ (the step value) $= 27$)

This is an example of a very simple linear series. Excel is also able to calculate a linear series even when the step values of the selected cells are not equal (see sidebar).

Exponential (or Growth) series

An exponential series is calculated by *multiplying* (rather than adding) the *start value* by the *step value*. This type of series is usually referred to as an *exponential* (rather than linear) series. Excel also uses the term *growth series* as a synonym for *exponential series* (see sidebar).

Here's an example:

- A truly excellent restaurant opens in town. On the first day they only have one customer but the customer is so delighted by the food, service and value that the customer tells two friends.
- The next day the two friends eat there and the restaurant has two diners.
- The two friends are also so pleased with their experience that they each also tell two friends. On the third day the restaurant has four diners.

You can see that the restaurant owner might expect that this trend will continue and that each day the number of diners will double (in Excel's

note

Here's how you could have used the Ribbon to complete this lesson:

1. Enter the value **200** into cell B4.
2. Select cells B4:B51.
3. Click: Home→Editing→Fill→Series...

The *Series* dialog appears.

4. Enter the following values into the *Series* dialog:

Note that the value: **1.2** is used because an exponential (growth) series multiplies each *start value* by the *step value*.

trivia

According to an old legend, the inventor of the game of Chess presented his new game to a powerful king. The king was so pleased with the game that he offered the inventor any reasonable reward.

The inventor asked for one grain of rice for the first square on the chessboard, two for the second, four for the third... and so on for each square on the chessboard.

The king thought the inventor was foolish to ask for such a simple gift. Much later he found that there was not enough rice in the entire world to fulfil the inventor's request.

With the Excel skills you have learned in this lesson, you should easily be able to model the King's dilemma and discover exactly how many grains of rice would have been needed (about 18.5 Quintillion).

terminology, the *step value* is 2). Eventually, of course, the restaurant will become full and the trend will have to end (in Excel's terminology the number of seats in the restaurant is the *stop value*).

In this lesson you will model this type of exponential series.

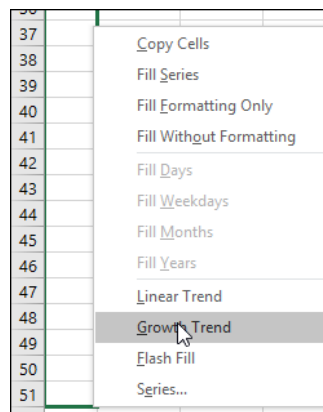
1. Open *Rabbit Population* from your sample files folder.
2. If the rabbit population of an island increases at the rate of 20% per month, use an exponential progression to calculate how a newly introduced community of 200 rabbits will grow in four years.

1. Type the value: **200** into cell B4 to set the rabbit population at the beginning of the period.
2. Type the value: **240** into cell B5 to set the rabbit population after one month.
3. Select the range B4:B5.

Hold down the right-click mouse button on the AutoFill handle at the bottom-right of the selected range and drag down to Autofill to cell B51.

	A	B
1	Rabbit Population	
2		
3	Month	Population
4	1	200
5	2	240
6	3	
7	4	

4. Click *Growth Trend* on the shortcut menu. Note that this is the shortcut menu's synonym for: *Exponential Series*.



5. After four years (48 months) the 200 rabbits will have grown to a population of a little over a million.

	A	B
49	46	731,452
50	47	877,743
51	48	1,053,291

3. Save your work as *Rabbit Population-1*.