

How to Interpolate Missing Values in Excel?

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Dealing with incomplete datasets is a common challenge in data analysis. The process of interpolating missing values in Excel is essential for maintaining the integrity and completeness of your series data, allowing for accurate forecasting and modeling. While sophisticated functions like LINEST or the TREND function can be utilized, they generally employ techniques based on linear regression to estimate the missing data points.

The LINEST function is particularly powerful, capable of estimating multiple missing values simultaneously by calculating the line of best fit. Conversely, the TREND function typically focuses on predicting a single value based on established known data points. Both methods require the user to define the range of known independent and dependent variables. However, for most quick, straightforward series fills, a much simpler, highly efficient built-in tool exists that bypasses complex formula array entry.

Introduction to Data Interpolation in Excel

Data analysis often involves scenarios where you encounter one or more missing values within a time series or ordered dataset. Leaving these gaps unfilled can lead to skewed results in summaries, charts, and subsequent statistical analysis. Interpolation is the mathematical process of constructing new data points within the range of a discrete set of known data points. In the context of spreadsheet software, this means using surrounding values to create a logical estimate for the empty cells.

While advanced statistical modeling often requires complex methods like moving averages or polynomial fitting, Excel provides exceptionally user-friendly tools designed for rapid and accurate series interpolation. The most accessible method for filling these gaps is through the **Fill Series** function, which intelligently calculates the step required to bridge the gap between two existing data points, thereby maintaining the continuity of the trend.

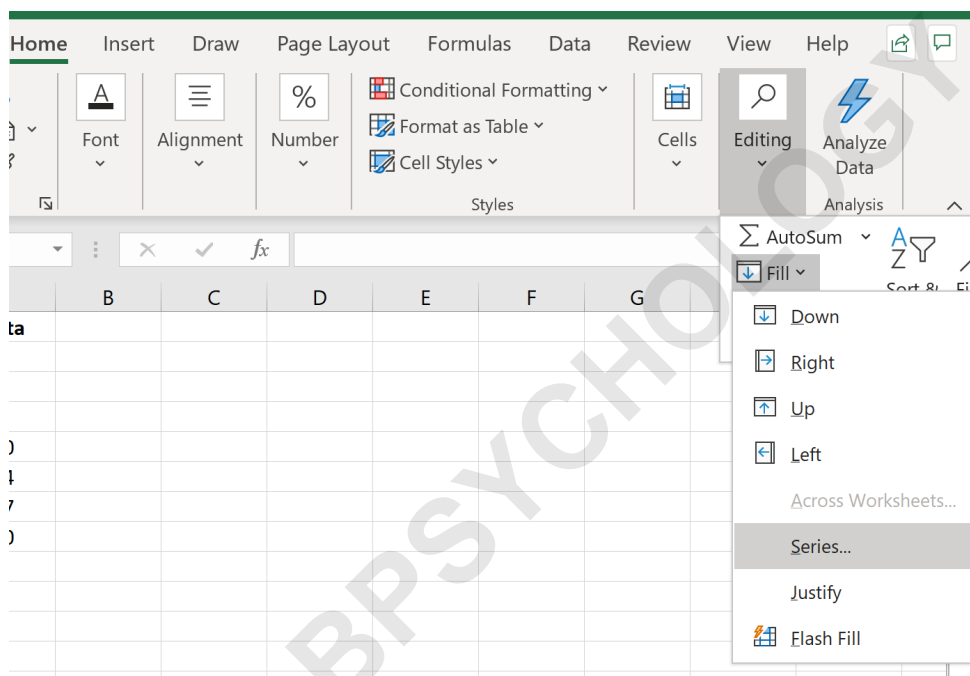
Understanding when and how to apply this feature is crucial. If your data exhibits a clear, predictable trend--be it linear, exponential, or even date-based--the **Fill Series** tool, found within the **Editing** section on the **Home** tab, is the fastest route to generating defensible placeholder values. This method is often preferred over manual calculation or complex formulas when dealing with simple sequential or time-based data gaps.

Understanding Excel's Core Interpolation Mechanisms

Before diving into the examples, it is important to recognize that Excel's interpolation relies heavily on identifying the underlying pattern of the data sequence. When you utilize the **Fill Series** tool, Excel employs different mathematical algorithms based on the type of series you specify--most commonly, **Linear** or **Growth**.

The primary advantage of using **Fill Series** over manual entry or even advanced formulas for simple interpolation tasks is its speed and robustness. It automatically calculates the necessary step increment or growth multiplier based on the beginning and ending values of the selected range, distributing this change evenly across the missing values. This ensures that the generated values are smoothly integrated into the existing dataset, minimizing unexpected jumps or discontinuities in your chart or analysis.

To initiate this process, you must first navigate to the proper command location. The simplest way to fill in missing values involves selecting the range encompassing the known start and end points of the gap, and then using the following navigation path: **Home** tab > **Editing** group > **Fill** dropdown > **Series**.



The subsequent examples will detail the specific application of the two most critical types: **Linear** interpolation, suitable for arithmetic progressions, and **Growth** interpolation, appropriate for geometric or exponential trends.

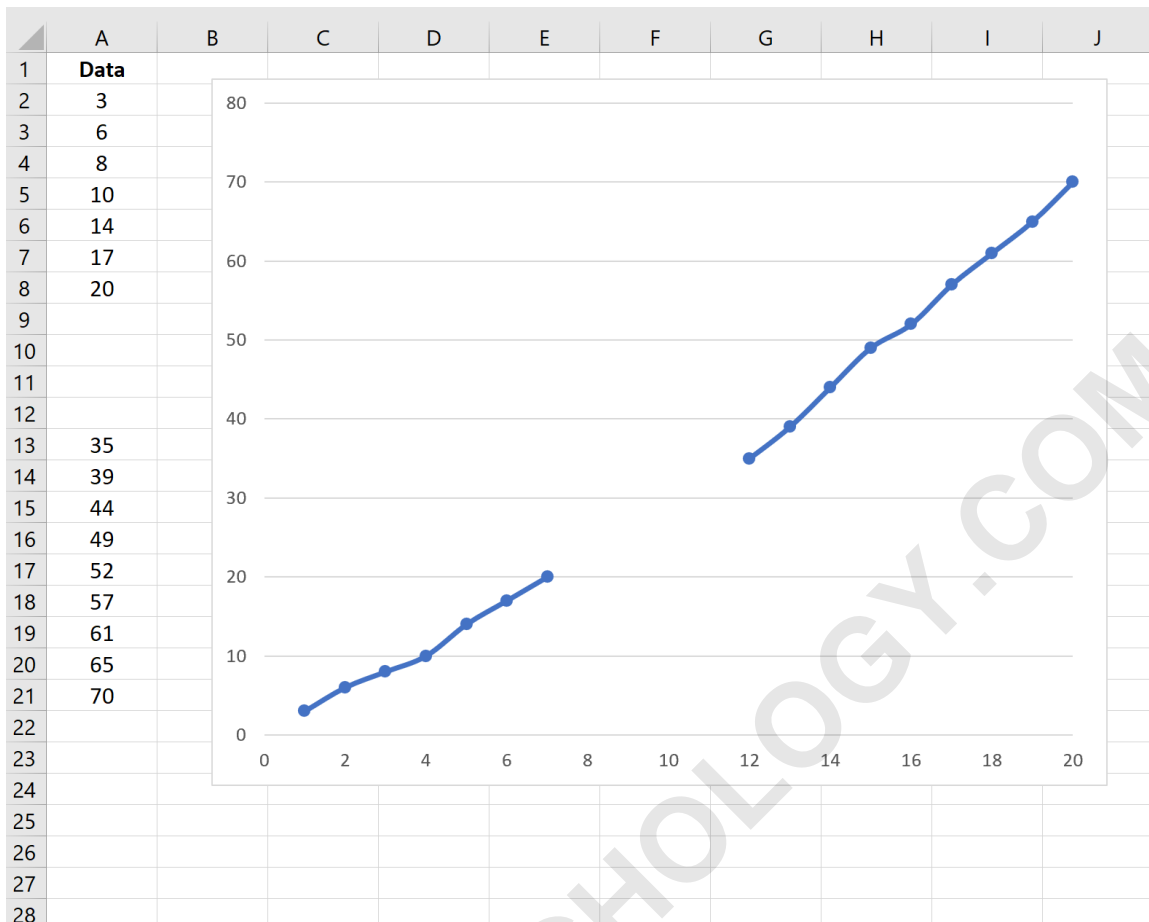
Detailed Case Study 1: Interpolation with a Linear Trend

The most frequent scenario for interpolation involves a dataset that follows a relatively consistent, straight-line progression. When the difference between consecutive known values is approximately constant, the data is best described by a linear regression model. For this example, let us assume we have a time series where the values should increase by a fixed amount over a specific period, but several observations are missing.

Suppose we begin with the following dataset, which clearly shows a gap in the values corresponding to weeks 2 through 5. The objective is to smoothly fill these missing values while preserving the evident linear trend suggested by the known points (20 and 35).

	A	B	C	D	E	F
1	Data					
2	3					
3	6					
4	8					
5	10					
6	14					
7	17					
8	20					
9						
10						
11						
12						
13	35					
14	39					
15	44					
16	49					
17	52					
18	57					
19	61					
20	65					
21	70					
22						
23						
24						
25						

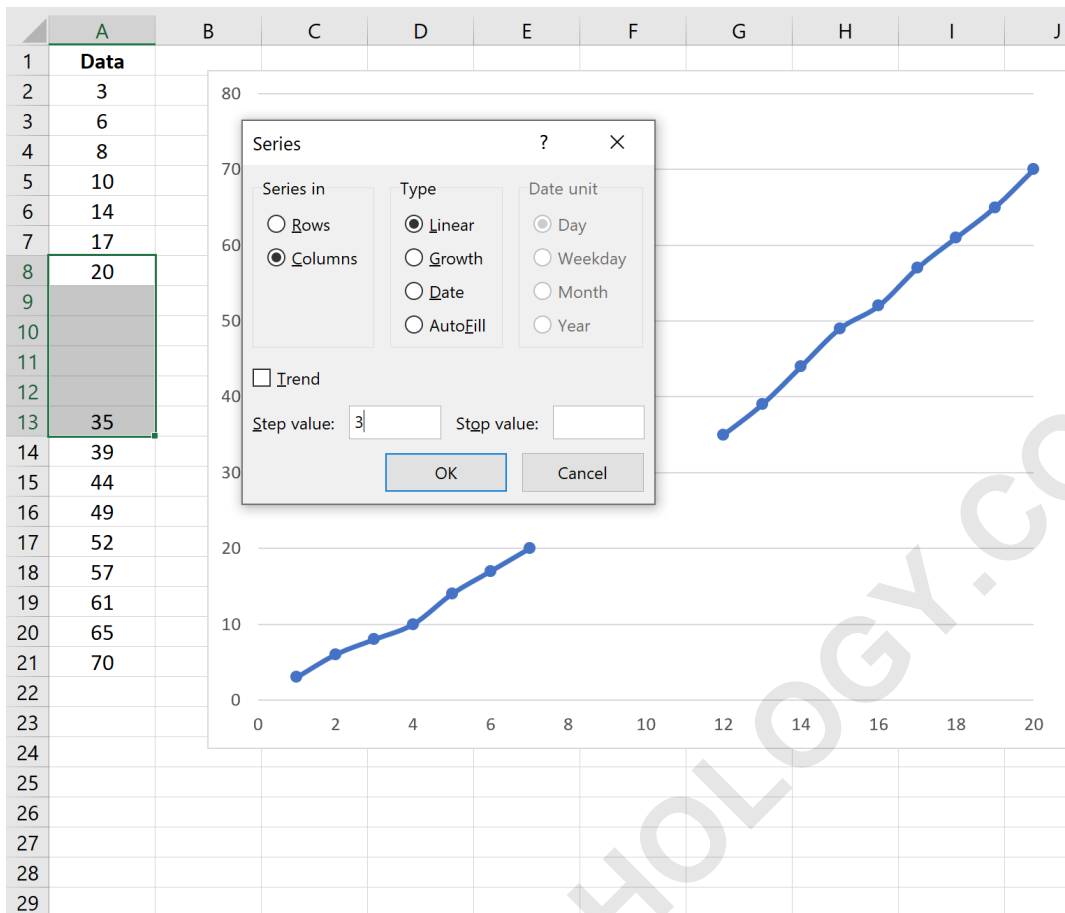
A quick visual inspection, perhaps by generating a simple line chart, immediately confirms that the relationship between the week number and the value measurement is indeed linear, which validates the use of the **Linear** series type.



Executing the Linear Interpolation Step-by-Step

To properly execute the linear fill, follow these precise steps. It is critical to select the entire range, including the starting known value, all empty cells, and the ending known value. In our scenario, if the values are in column B, you would highlight the range B2 through B6.

Once the range is highlighted, navigate through the ribbon: click **Home** > locate the **Editing** group > click **Fill** > select **Series**. This action opens the Series dialog box, where you configure the interpolation parameters.



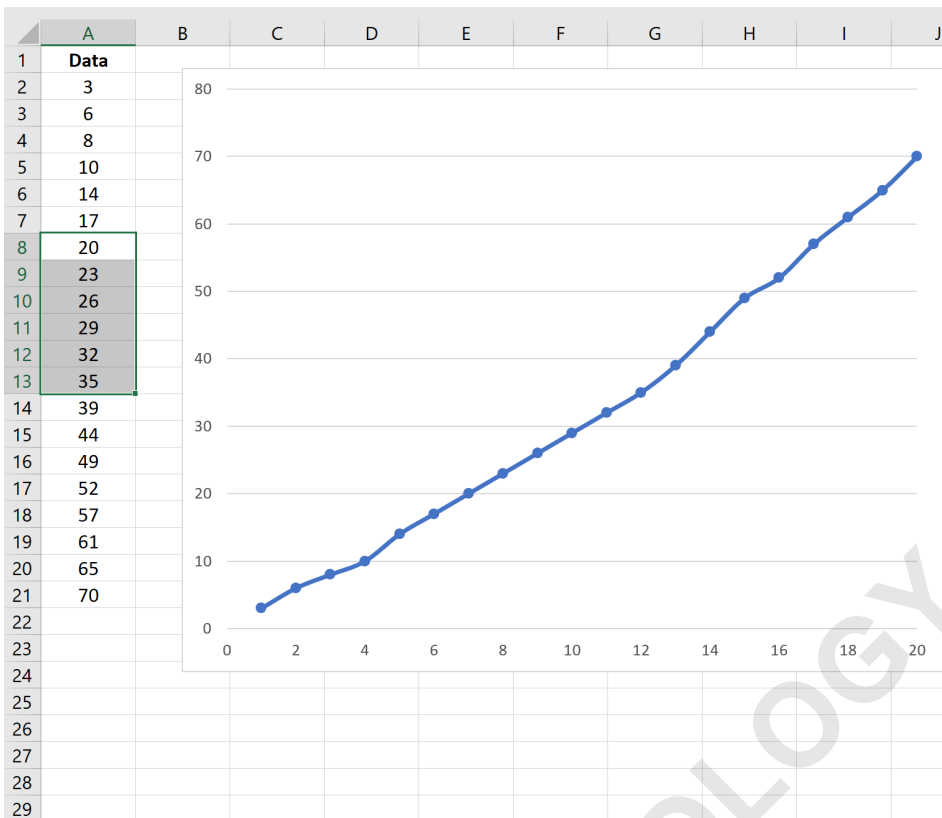
Within the dialog box, ensure the **Type** is set to **Linear**. By default, when interpolating a gap between two existing values, Excel implicitly checks the **Trend** checkbox, though it may not always be explicitly visible. When **Linear** is selected, Excel mathematically determines the necessary step value to create a smooth progression from the starting value to the ending value.

The formula employed by Excel for this specific linear interpolation is based on simple arithmetic progression, calculating the required step size (or common difference) to span the known difference over the number of available steps:

$$\text{Step} = (\text{End Value} - \text{Start Value}) / (\text{Number of Missing Observations} + 1)$$

Applying this formula to our example: the Start Value is 20, the End Value is 35, and there are 4 missing observations. The calculation is: $(35 - 20) / (4 + 1) = 15 / 5 = 3$.

Upon clicking **OK**, Excel automatically applies this calculated step value, incrementing each subsequent cell by 3, resulting in a perfectly interpolated linear series: 20, 23, 26, 29, 32, 35.



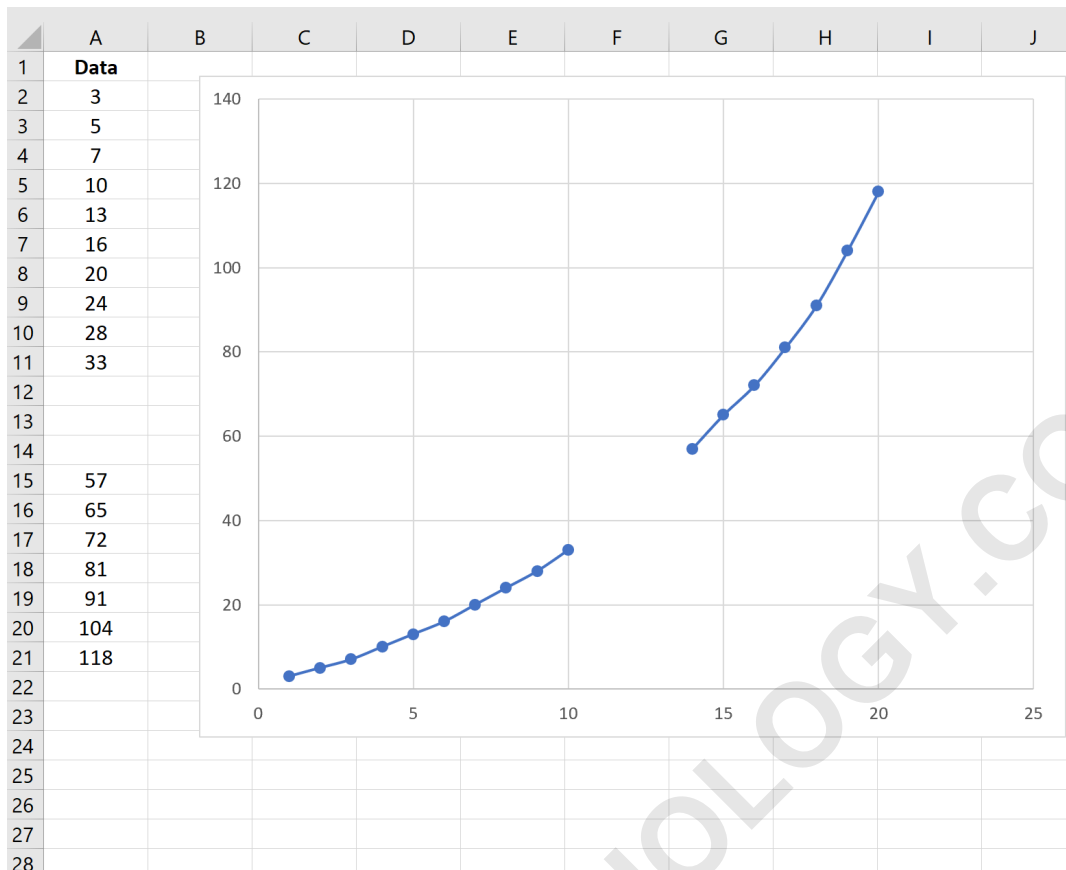
Advanced Interpolation Case Study 2: Modeling Growth and Exponential Trends

Not all data follows a simple linear path. Financial models, population statistics, and certain scientific measurements often exhibit an accelerating pattern, characteristic of an exponential or "growth" trend. In such cases, the relationship between consecutive values is multiplicative rather than additive. Using a linear fill on exponential data would severely underestimate the trend, leading to inaccurate interpolation results.

Consider a new dataset where the values are expected to increase by a fixed percentage or multiplier, but several intermediate points are missing. We have a starting point and an ending point, and we need to calculate the common ratio that bridges the gap.

	A	B	C	D	E	F	G
1	Data						
2	3						
3	5						
4	7						
5	10						
6	13						
7	16						
8	20						
9	24						
10	28						
11	33						
12							
13							
14							
15	57						
16	65						
17	72						
18	81						
19	91						
20	104						
21	118						
22							
23							
24							
25							
26							

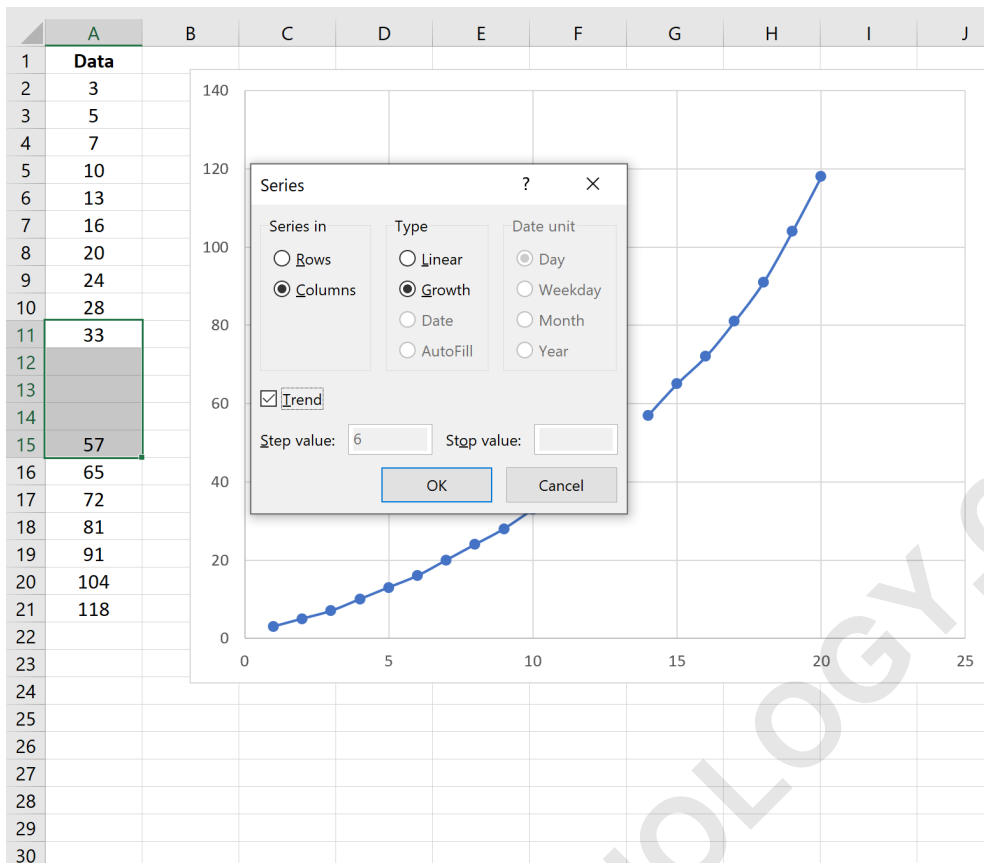
When charted, this data exhibits a clear upward curve, confirming the presence of a growth trend. This visual confirmation is vital; it dictates that we must use the **Growth** series type during interpolation.



The mathematical logic here differs significantly from the linear case. Instead of calculating a common difference (addition/subtraction), Excel calculates the common ratio (multiplication/division) required to move from the start value to the end value over the specified number of steps. This ensures that the percentage increase between each interpolated point remains consistent, accurately modeling the growth trend.

Executing the Growth Trend Interpolation

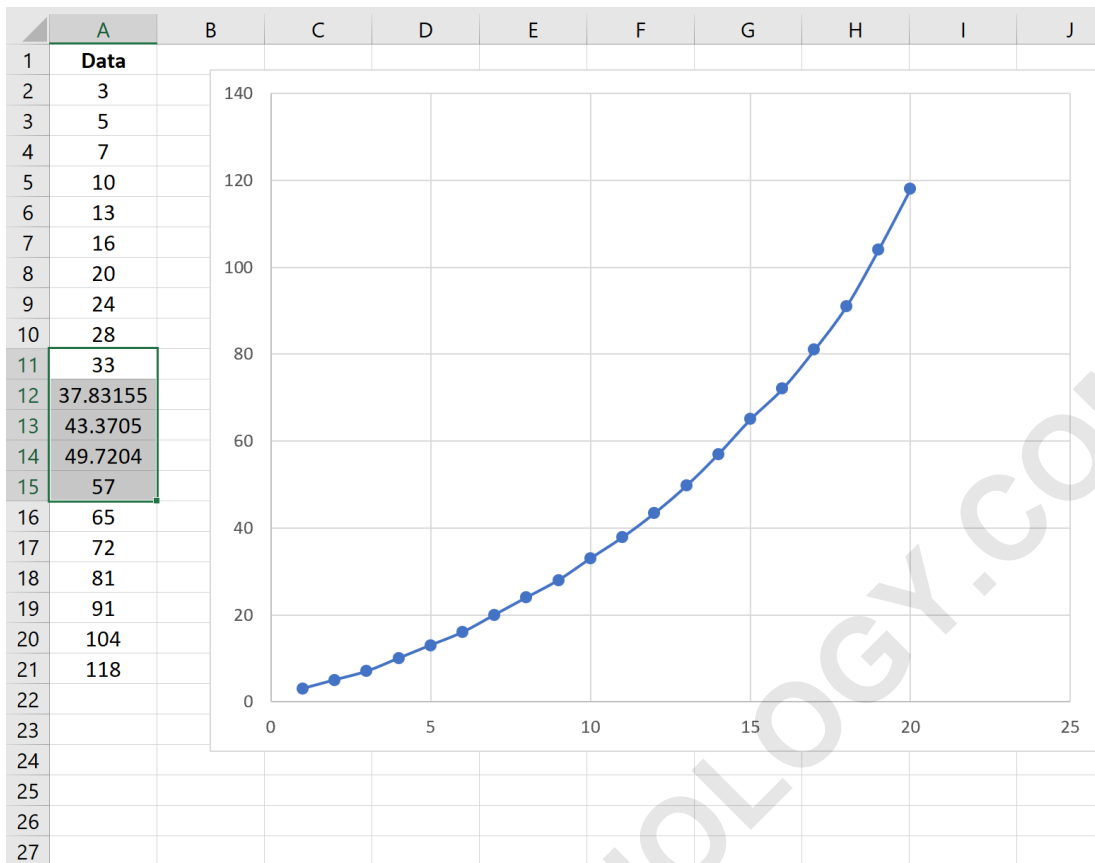
The procedure for the growth fill begins identically to the linear case: highlight the entire range, including the start, the missing values, and the end point. Next, access the **Series** dialog box via **Home > Editing > Fill > Series**.



In the dialog box, select the **Type** as **Growth**. Crucially, in this case, ensure you check the box next to **Trend**. By checking **Trend** in conjunction with the **Growth** type, Excel leverages a geometric progression calculation. It determines the multiplicative factor (growth rate) needed across the missing observations to hit the final known value.

For our example, the calculated growth factor is applied repeatedly. If the factor is, for instance, 1.3, the calculation sequence would be: Start Value, Start Value * 1.3, (Start Value * 1.3) * 1.3, and so on, until the sequence reaches the End Value.

Once you click **OK**, Excel automatically fills in the missing cells, producing values that align perfectly with the exponential curve.



Reviewing the corresponding plot confirms that the filled-in values are smoothly integrated, matching the general growth trend of the original data points quite well. This demonstrates the power of the **Fill Series** tool for both linear and non-linear interpolation.

Alternative Methods: Utilizing LINEST and TREND for Precision

While **Fill Series** is excellent for quick visual interpolation when the trend is clearly defined by the endpoints, more robust statistical analysis often requires the explicit use of regression functions such as LINEST and TREND function. These functions are particularly useful when you have many known data points surrounding the missing segment, and you want the interpolation to be based on the overall best fit line (linear regression) derived from all known data, rather than just the immediate start and end points of the gap.

The TREND function predicts values along a linear trend. Its syntax is `=TREND(known_y's, known_x's, new_x's,)`. To interpolate, you would define all existing non-missing Y values (known_y's) and their corresponding X values (known_x's, e.g., week numbers). For the `new_x's` argument, you provide the X values corresponding to the empty cells. This function then projects the expected Y value based on the established linear relationship.

The **LINEST** function, while more complex as it returns an array of regression statistics (slope, intercept, R-squared), provides the core coefficients needed to manually construct the interpolation equation $Y = mX + b$. Once you calculate the slope (m) and intercept (b) using LINEST on the known data, you can input the X-values for the missing values into this equation to derive highly precise Y estimates. This method grants greater control and access to statistical metrics for validating the quality of the interpolation.

Summary and Best Practices for Data Handling

Successfully handling missing values in Excel involves choosing the right tool for the job. For simple, contiguous gaps in sequential data, the **Fill Series** tool offers a fast, robust solution for both linear and exponential trends.

Key takeaways for effective interpolation:

Assess the Trend: Always visualize your data first (e.g., using a line chart) to determine if the trend is linear, exponential, or something more complex. This dictates whether you choose the **Linear** or **Growth** series type.

Select Accurately: Ensure the selection range includes the known start point, all empty cells, and the known end point. Errors in selection are the most common cause of failed interpolation.

Document the Method: When interpolating, it is best practice to mark or document the interpolated cells, perhaps by using a distinct cell color or adding a note. This reminds future analysts that these are estimated, not empirical, values.

For situations requiring formal linear regression based on a large sample of known data points, relying on the **TREND function** provides a statistically derived estimate that considers the overall pattern, not just the two bounding points of the gap. Mastering these techniques ensures your datasets are clean, complete, and ready for accurate reporting and modeling.

You can find more advanced Excel tutorials on data manipulation and analysis in our resource center.