

How do I calculate hours between two times after midnight in Excel?

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The necessity of calculating the duration between a starting time and an ending time is a frequent task in data analysis and scheduling within Excel. This calculation becomes uniquely complex when the duration spans across **midnight**, causing the standard subtraction method to yield an incorrect, often negative, result. This guide addresses precisely this challenge: how to accurately calculate the number of hours elapsed between two times when **midnight rollover** has occurred.

The core issue stems from how Excel stores time as a fractional **serial number** of a single day. When the end time is numerically smaller than the start time (e.g., 4:00 AM compared to 10:00 PM), it signals that the time frame has wrapped around the 24-hour cycle. To correct this, a specific adjustment must be incorporated into the formula, effectively adding a full day's duration to the end time before subtraction.

You can utilize the following powerful and concise formula to perform this calculation. This particular structure is optimized for scenarios where you know for certain that the **midnight rollover** has taken place between the start time (for instance, in cell **A2**) and the ending time (in cell **B2**).

=(B2-A2+TRUE)*24

This calculation calculates the elapsed time, assuming **midnight** occurs between the start and end points. The multiplication by 24 is necessary to convert the fractional day result into the total number of hours. The following sections will explain the mechanics behind this **formula** and provide a detailed, step-by-step example of its implementation.

Understanding How Excel Stores Time Values

Grasping Excel's internal system for handling time is essential for troubleshooting duration calculations. Excel does not store time as a simple hour/minute value; rather, it utilizes a sophisticated **serial number** system. Dates are stored as integers counting the days from January 1, 1900, while time is stored as the decimal fraction of a single day. For instance, 6:00 AM is stored as the **serial number** 0.25, representing one quarter of a 24-hour cycle, and 6:00 PM is stored as 0.75.

When only time values are entered without an associated date, Excel defaults to assuming they fall on the same arbitrary day. Therefore, if a task starts at 10:00 PM (a high fraction, close to 1) and ends at 2:00 AM (a low fraction, close to 0), the chronological flow is disrupted mathematically. Standard subtraction (End Time minus Start Time) results in a large negative fractional number because the low end time **serial number** is being subtracted by the high start time **serial number**.

This requirement for specialized calculation arises because the duration calculation must cross the numerical discontinuity at **midnight** (the point where the fraction resets from nearly 1 back to 0).

The solution requires manually increasing the value of the end time by 1--which numerically represents the addition of 24 hours--whenever the subtraction itself yields a negative result. This adjustment bridges the gap created by the internal **serial number** representation, allowing the elapsed time to be calculated correctly as a positive duration.

The Challenge of Midnight Rollover

The **midnight rollover** condition is defined as any period calculation where the physical elapsed time crosses from one day into the next. Consider an essential business process that runs from 9:00 PM to 5:00 AM. In chronological reality, 8 hours have passed. However, in Excel's eyes (assuming identical dates), 5:00 AM (approx. 0.2083) is numerically smaller than 9:00 PM (approx. 0.875). The operation $0.2083 - 0.875$ results in -0.6667 , which cannot be converted directly into a meaningful duration.

To resolve this, we must conceptually or literally add one day to the end time when the start time is greater than the end time. By adding 1 to the end time's **serial number** ($0.2083 + 1 = 1.2083$), we effectively place the end time onto the next day. The subtraction then becomes $1.2083 - 0.875 = 0.3333$. This result, 0.3333, correctly represents 8 hours as a fraction of a day ($8/24 = 1/3$ or 0.3333).

The core formula $= (B2 - A2 + TRUE) * 24$ leverages the fact that **TRUE** is automatically converted to the numerical value 1 when used in an arithmetic operation in Excel. When the subtraction $B2 - A2$ yields a negative result, adding 1 (or **TRUE**) performs the necessary mathematical correction to restore the calculation to a positive duration.

Step-by-Step Implementation Example

Let us apply this knowledge using a real-world dataset. Suppose we are monitoring several overnight processes, with the start times listed in Column A and the end times listed in Column B. Our objective is to calculate the total elapsed time in hours for each process in Column C.

The dataset clearly shows durations spanning across **midnight** in every row, confirming the need for the specialized overnight calculation formula.

	A	B	C	D	E
1	Start Time	End Time			
2	4:15 PM	4:13 AM			
3	5:19 PM	5:00 AM			
4	6:00 PM	5:15 AM			
5	8:34 PM	7:39 AM			
6	10:15 PM	10:15 AM			
7	10:19 PM	10:33 AM			
8	10:45 PM	1:14 AM			
9	11:15 PM	12:04 AM			
10	11:59 PM	12:57 AM			
11					
12					
13					
14					
15					
16					
17					

To begin, select the calculation cell for the first task, **C2**. This cell will house the formula that accounts for the **midnight rollover**. We reference the end time (B2) first, subtract the start time (A2), add the correction factor (**TRUE**, which equals 1), and then scale the result to hours by multiplying by 24.

Enter the following into cell **C2**:

=(B2-A2+TRUE)*24

Once the formula is entered, press Enter. The resulting value in C2 should represent the total hours for the first row. We can then efficiently apply this calculation to the entire dataset by using Excel's fill handle to drag the **formula** down through the remaining cells in Column C.

Applying the Formula and Analyzing Results

After applying the **formula** across the range, Column C will populate with the elapsed time for each row. The accurate results generated confirm that the **+TRUE** component successfully compensated for the negative values produced by the initial subtraction, converting them into valid, positive duration measurements in hours.

	A	B	C	D	E
1	Start Time	End Time	Difference in Hours		
2	4:15 PM	4:13 AM	11.96666667		
3	5:19 PM	5:00 AM	11.68333333		
4	6:00 PM	5:15 AM	11.25		
5	8:34 PM	7:39 AM	11.08333333		
6	10:15 PM	10:15 AM	12		
7	10:19 PM	10:33 AM	12.23333333		
8	10:45 PM	1:14 AM	2.483333333		
9	11:15 PM	12:04 AM	0.816666667		
10	11:59 PM	12:57 AM	0.966666667		
11					
12					
13					
14					
15					
16					

The final results in Column C provide clean, decimal representations of the duration. For clarity, we can inspect specific row results:

The task starting at 4:15 PM and ending at 4:13 AM spans **11.97** hours.

The task starting at 5:19 PM and ending at 5:00 AM spans **11.68** hours.

The task starting at 6:00 PM and ending at 5:15 AM spans exactly **11.25** hours.

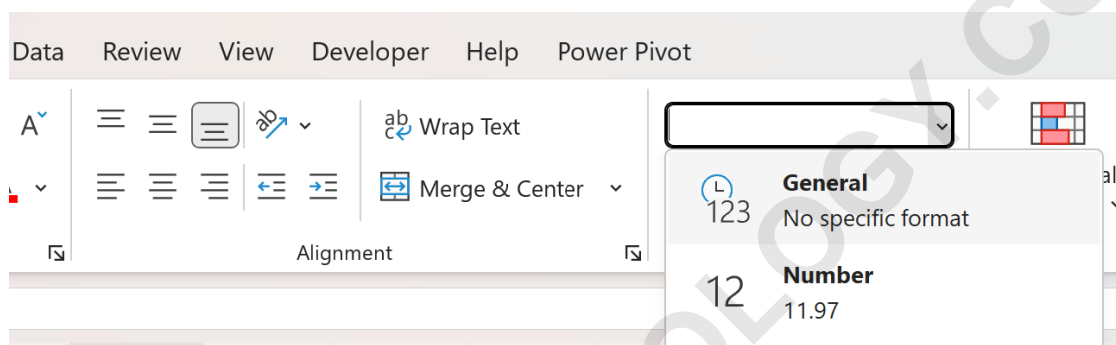
These calculations showcase the reliability of the `=(B2-A2+TRUE)*24` technique when addressing the specific challenge of overnight time calculations in Excel.

Formatting Considerations: Displaying Results as Decimal Hours

A crucial post-calculation step is verifying the cell formatting. When Excel works with time, it often attempts to maintain a time format even when the resulting number represents total hours. Because we multiplied the fractional result by 24, the output is a standard number (e.g., 11.97) representing hours, not a time **serial number** that should be displayed as 11:58:12 AM. If the output appears as a time (e.g., 11:58:12 AM instead of 11.97), the cell must be explicitly reformatted.

To ensure the durations are displayed in a clean **decimal number format**, select the entire range of calculated results in Column C. Access the "Format Cells" dialog box (usually via right-click or Ctrl+1). Under the "Number" tab, select **General** or **Number**. Choosing the **Number** category allows for specifying the exact level of decimal precision required for the hours calculation.

This step is vital for ensuring the calculated values are ready for further aggregation, summation, or payroll processing, which typically require a straightforward decimal value for total hours worked or elapsed. Failing to change the format will lead to misinterpretation of the results, as Excel will try to interpret the 11.97 numerical hour value as 11.97 days worth of time, leading to highly inaccurate visual representations.



This simple formatting change will convert all values currently represented in a time format back into the desired **decimal number format**, making the calculated durations immediately understandable and usable.

Alternative Scenarios: Using the IF or MOD Function

While the $= (B2 - A2 + TRUE) * 24$ method is excellent for guaranteed overnight calculations, data sets often contain mixed durations--some spanning **midnight** and some occurring entirely within the same day. For these mixed scenarios, relying solely on $+TRUE$ would inaccurately add 24 hours to the same-day calculations. Therefore, more conditional or universal **formula** structures are needed.

The **IF** function provides the necessary conditionality. We can explicitly instruct Excel to check for the **midnight rollover**: $=IF(B2 < A2, B2 + 1 - A2, B2 - A2) * 24$. This formula evaluates whether the End Time (B2) is numerically smaller than the Start Time (A2). If this condition is met (TRUE), indicating a rollover, it calculates the duration using the $B2 + 1 - A2$ correction. If the condition is not met (FALSE), it uses the standard $B2 - A2$ subtraction.

The most robust and mathematically elegant solution, however, uses the **MOD** function, which handles positive and negative differences seamlessly by calculating the remainder after division by

1 (one day). The formula `=MOD(B2-A2, 1)*24` is universally applicable. If the subtraction `B2-A2` is positive, `MOD` returns the fraction itself. If the subtraction is negative (due to **midnight rollover**), `MOD(negative fraction, 1)` automatically calculates the correct positive fractional difference by cycling it through the modulo 1 constraint, thus always providing the correct duration as a fraction of a day.

Conclusion

Overcoming the challenge of calculating time durations that span across **midnight** in Excel is straightforward once the concept of the **serial number** system is understood. The crucial adjustment involves manually accounting for the 24-hour cycle when the end time numerically precedes the start time.

For datasets where the overnight duration is guaranteed, the concise **formula** `=(B2-A2+TRUE)*24` offers a fast and effective solution. Alternatively, for more variable data, the `MOD` function provides the most robust single-line calculation, eliminating the need for conditional checks.

Regardless of the method chosen, always confirm that the final result cell is formatted as **General** or **Number**. This ensures that the output is correctly interpreted as total elapsed decimal hours, rather than being erroneously displayed as a time stamp, making the analysis ready for reporting and integration into other calculations.