Poisson Distribution Using Excel

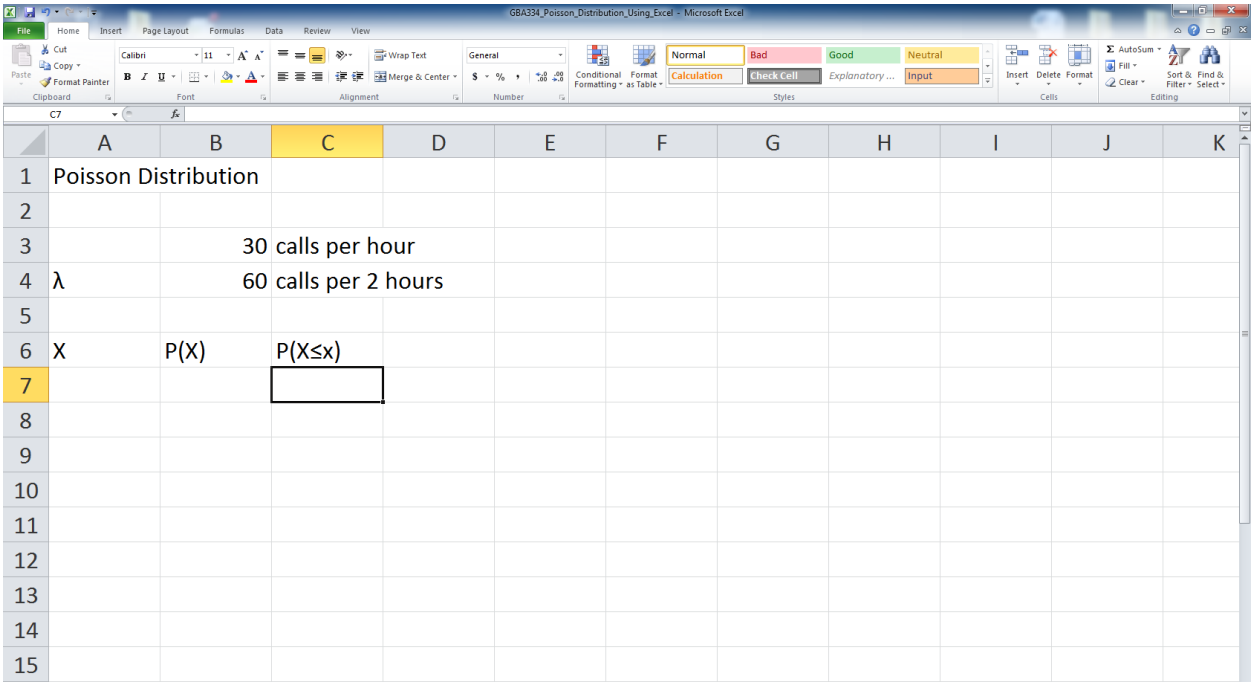
In this tutorial we will be solving Poisson Distribution problems using Excel.

In our problem, we want to suppose that we have a consulting business that receives an average of 30 phone calls per hour, and during a two-hour period, we want to determine:

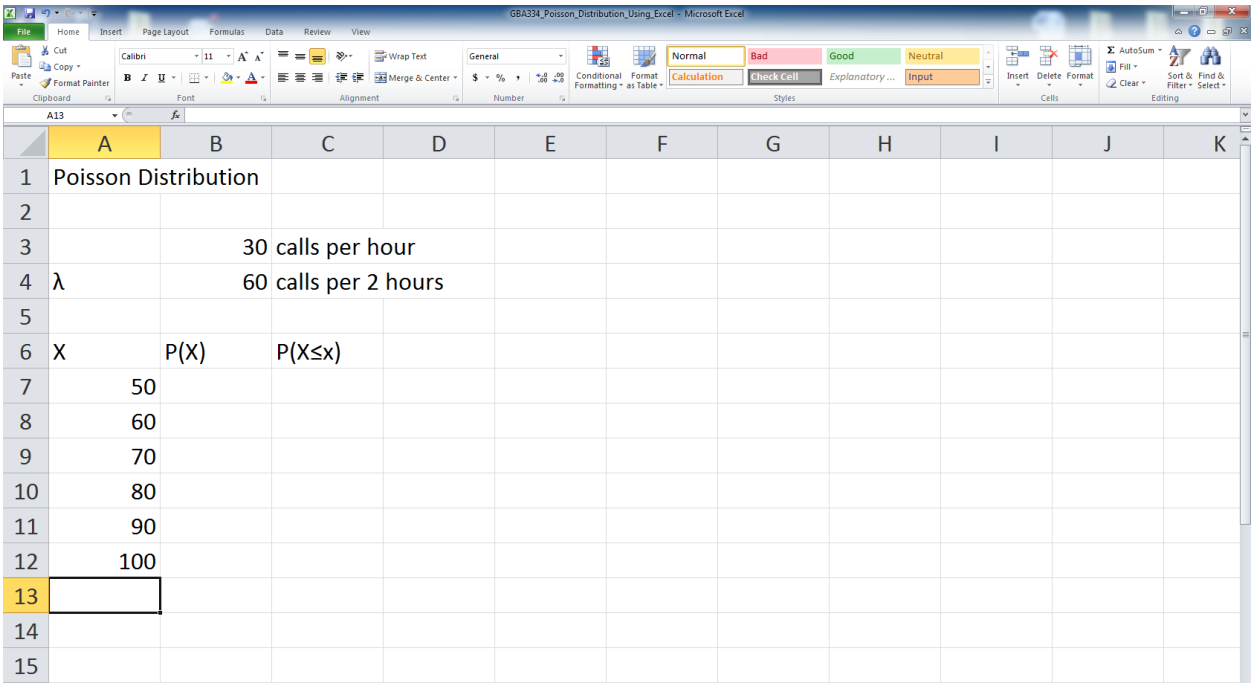
- the probability that exactly 50 calls will be received in the next two hours
- the probability that fewer than or equal to 50 will be received in the next two hours
- the probability that 50-100 calls will be received in the next two hours

The first thing we need to do is set up a table for entering the number of calls per hour, the mean, the probability X equals 50, the probability X is less than or equal to 50 and the probability X is between 50 and 100.

Here is our table area in Microsoft Excel we set up for entries for calls per hour that, in this problem, will be 30 and our mean (which is 30 calls per hour times 2 hours), so we will put 60 in cell B4. We also put in cells for X, P(X), and P(X≤x).

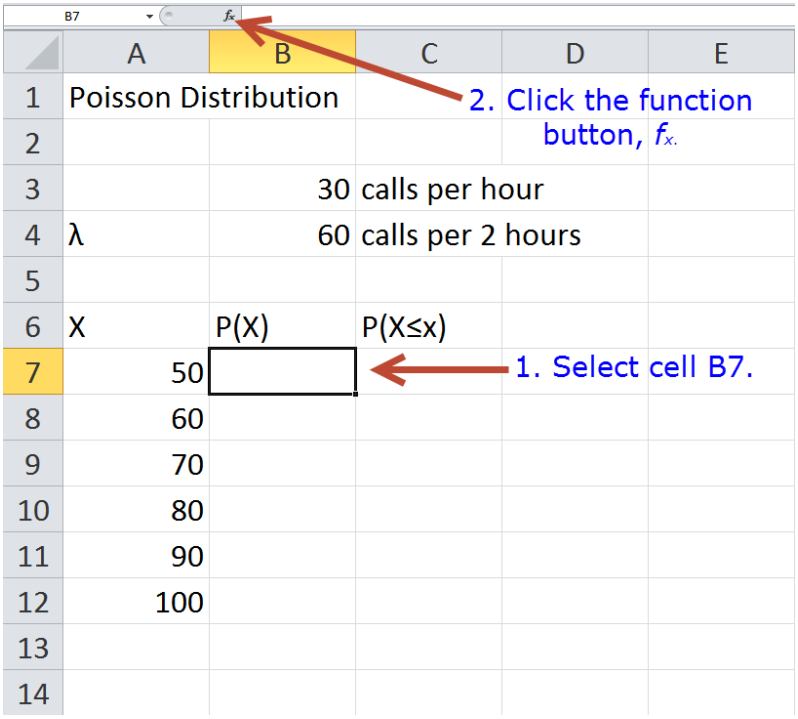


Now we want to set-up the table area with formulas for the probability X equals 50 and then calculate the probability that X is less than or equal to 50. Once we have those, we can simply copy them to the lower cells to fill in for x = or x ≤ 60, 70, 80, and so on. First, we enter our X values as shown below.



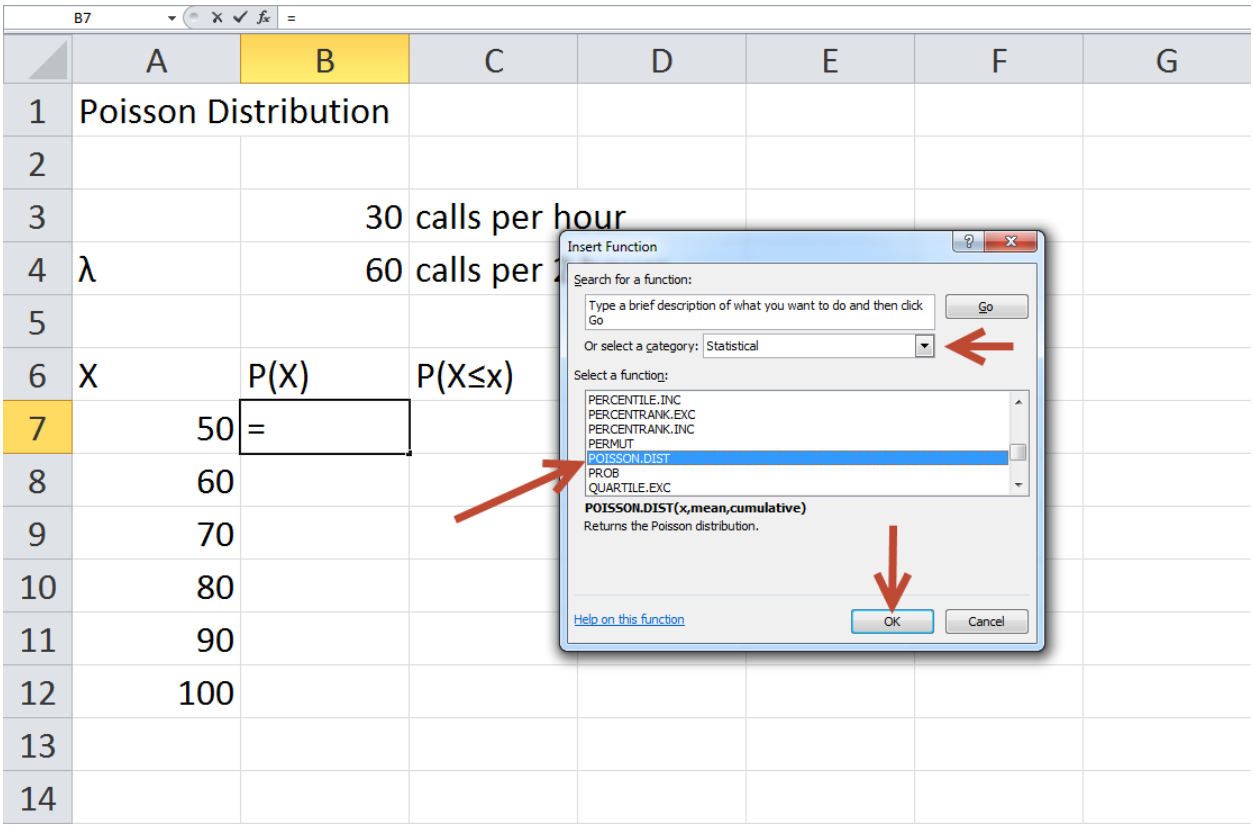
	A	B	C	D	E	F	G	H	I	J	K
1	Poisson Distribution										
2											
3			30	calls per hour							
4	λ		60	calls per 2 hours							
5											
6	X	P(X)	P(X≤x)								
7	50										
8	60										
9	70										
10	80										
11	90										
12	100										
13											
14											
15											

Now to calculate the probability that X or P(X) equals 50, we are going to use the POISSON.DIST function. To do so, select cell **B7** and click the function button (***f*x**).

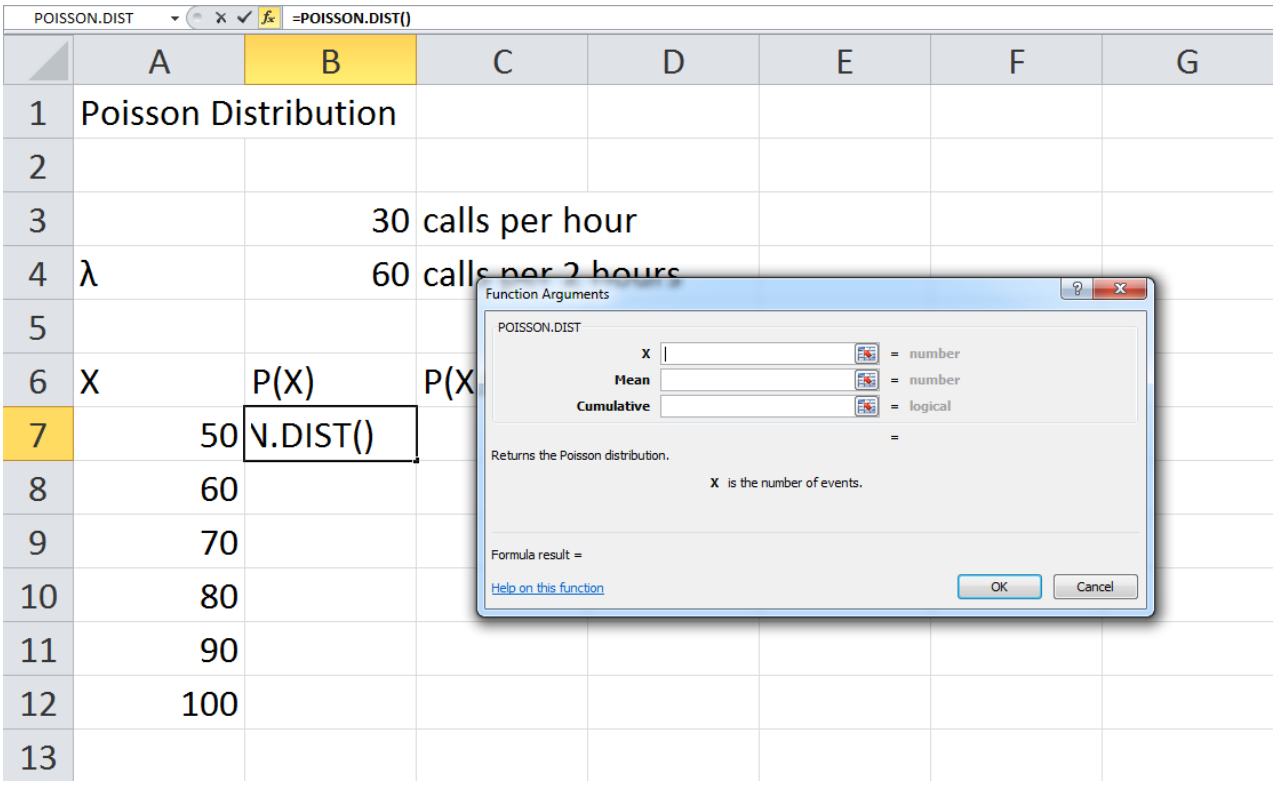


	A	B	C	D	E
1	Poisson Distribution				
2					
3		30	calls per hour		
4	λ	60	calls per 2 hours		
5					
6	X	P(X)	P(X≤x)		
7	50				
8	60				
9	70				
10	80				
11	90				
12	100				
13					
14					

An **Insert Function** window will display. Select **Statistical** from the dropdown menu next to “Or select a category:”, and then scroll down under “Select a function” to locate and select POISSON.DIST, as shown here.

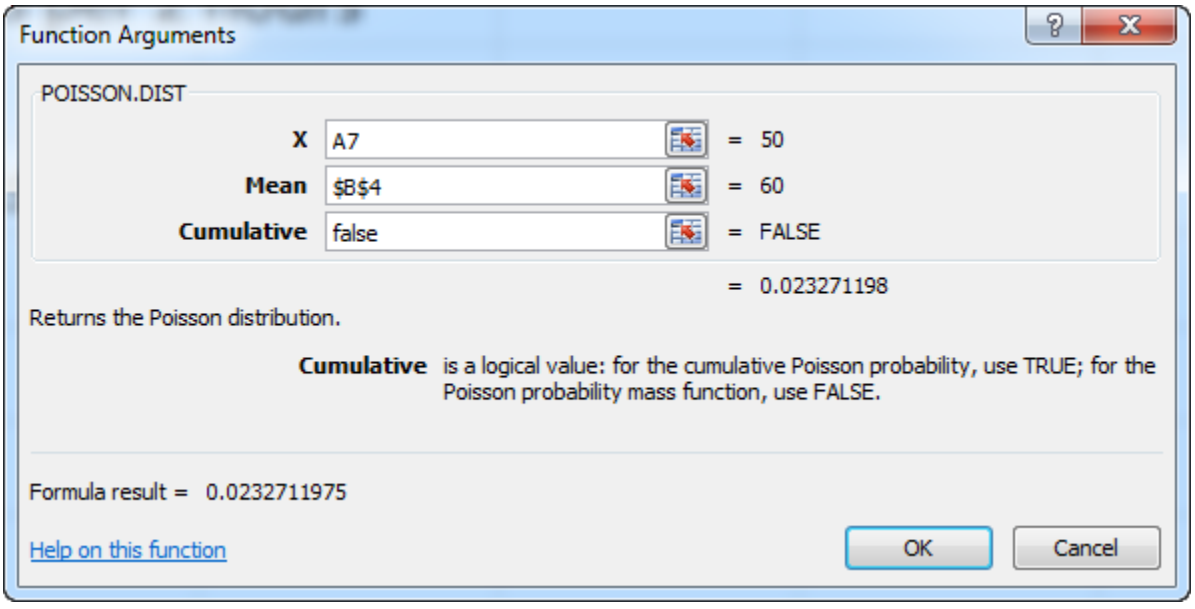


Now click **OK**. The **Function Arguments** window will appear as shown on the next page.

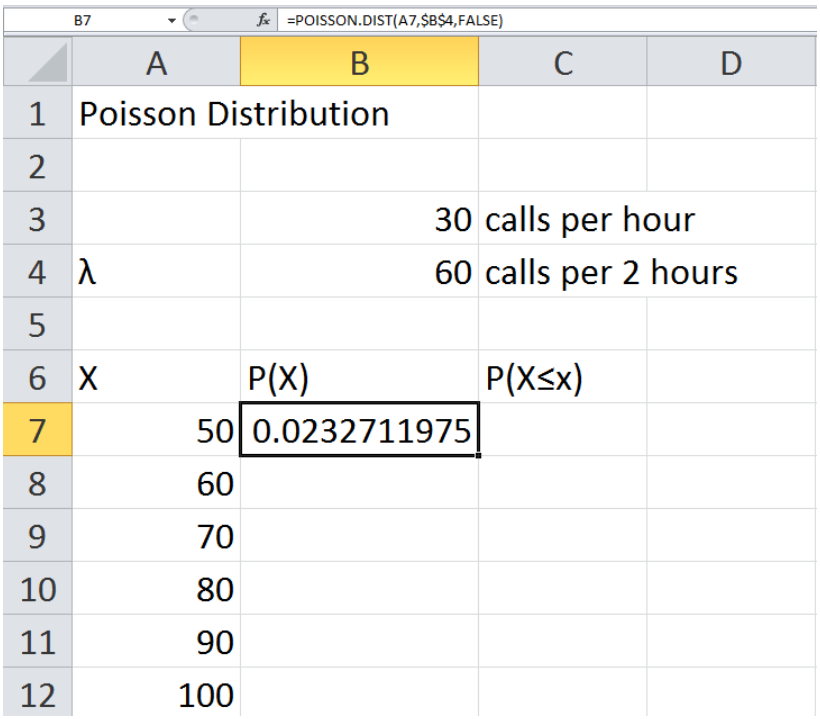


NOTE: *The POISSON.DIST is used for Excel 2007 or 2010 and the PLAN POISSION is used in 2003 and earlier versions of Excel*.

In the Function Arguments window, we will enter our values for X, Mean, and Cumulative as shown below. Our X value is 50 so enter **A7**, our mean is in cell B4 so enter **B4**, and for cumulative, we are going to say **false** because we only want the probability at 50.



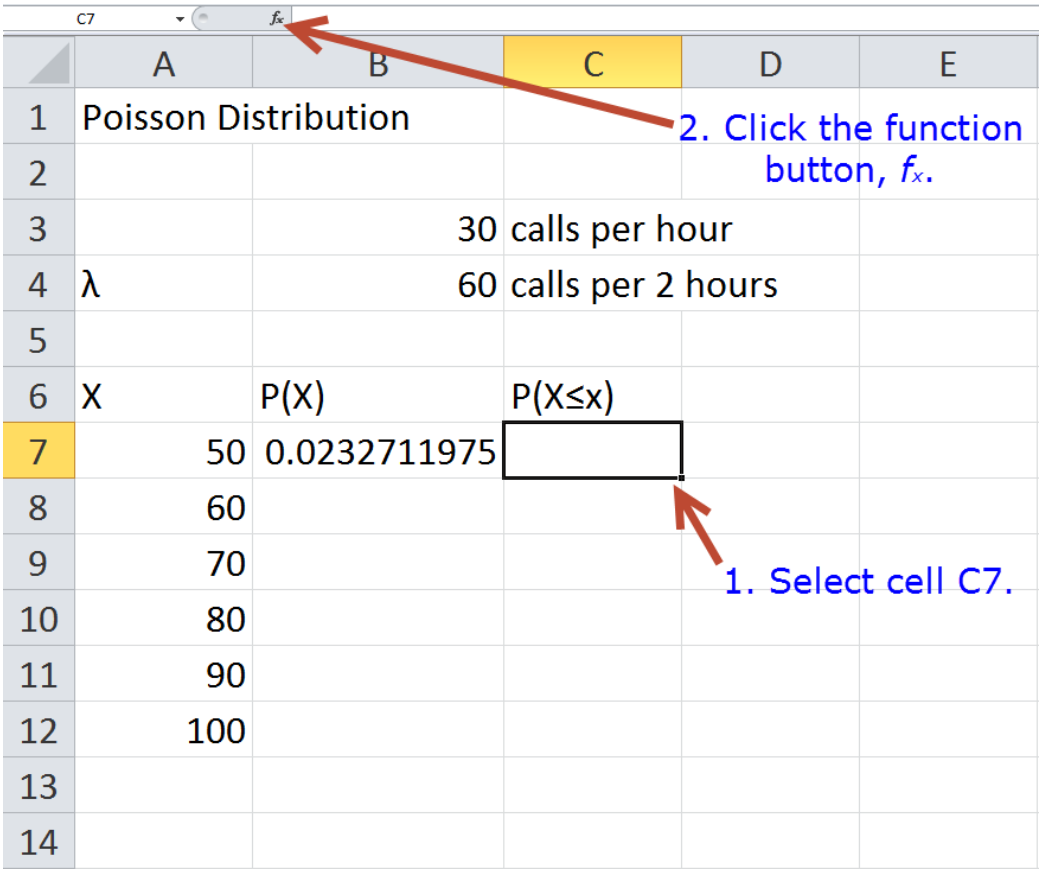
Click **OK** and that gives us a probability of 0.02327119575 for the number of calls being exactly 50. If you see ######### in cell B7, just simply widen the B column to see the result.



	A	B	C	D
1	Poisson Distribution			
2				
3		30	calls per hour	
4	λ	60	calls per 2 hours	
5				
6	X	P(X)	P(X≤x)	
7	50	0.0232711975		
8	60			
9	70			
10	80			
11	90			
12	100			

To determine the number of causes less than or equal to 50, we will once again use the POISSON.DIST function.

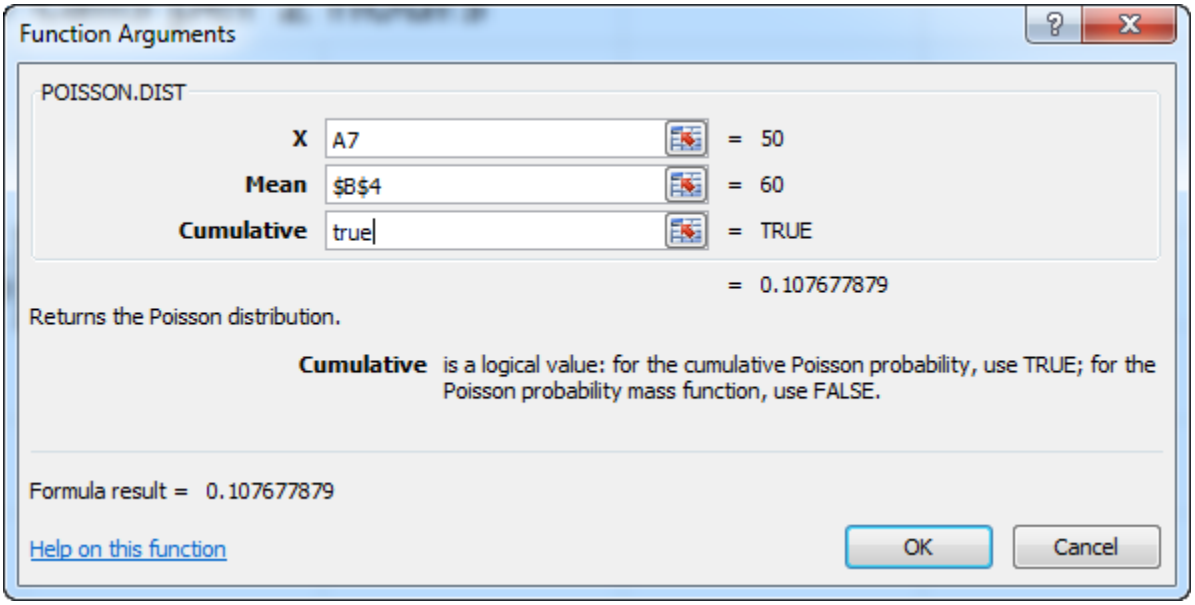
To do so, select cell **C7** and click the function button (***fx***).



	A	B	C	D	E
1	Poisson Distribution				
2					
3		30	calls per hour		
4	λ	60	calls per 2 hours		
5					
6	X	P(X)	P(X≤x)		
7	50	0.0232711975			
8	60				
9	70				
10	80				
11	90				
12	100				
13					
14					

Like before, an **Insert Function** window will display. Select **Statistical** from the dropdown menu next to “Or select a category:”, and then scroll down under “Select a function” to locate and select POISSON.DIST. Once again, the **Function Arguments** window will appear.

In the Function Arguments window, we will enter our values for X, Mean, and Cumulative as shown below. Our X value is 50 so enter **A7**, our mean is in cell B4 so enter **B4**, and for cumulative we are going to say **true** because we want the entire distribution up to 50.

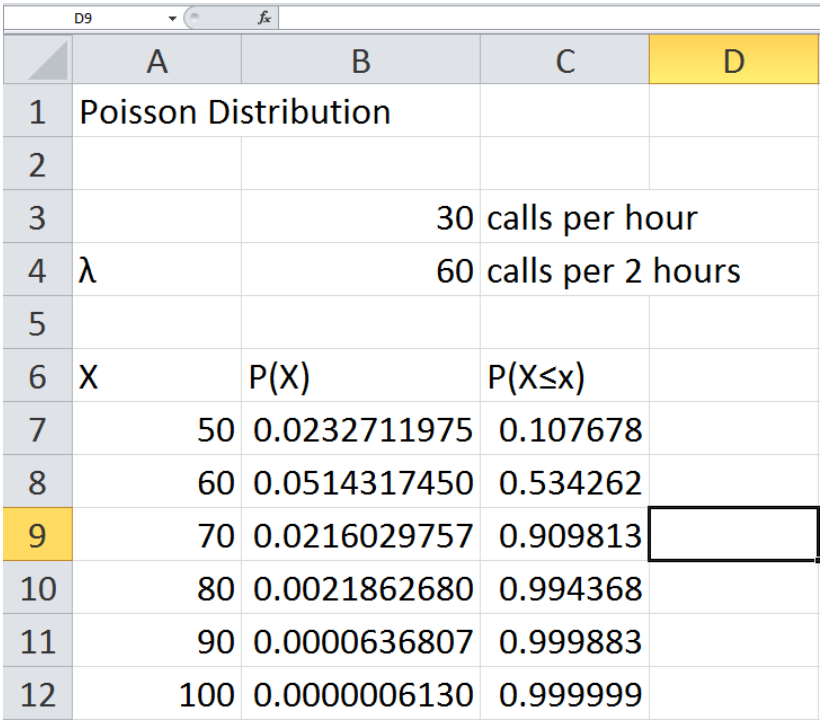


Click **OK** and that gives us a probability of 0.107678.

C7 =POISSON.DIST(A7,B4,TRUE)

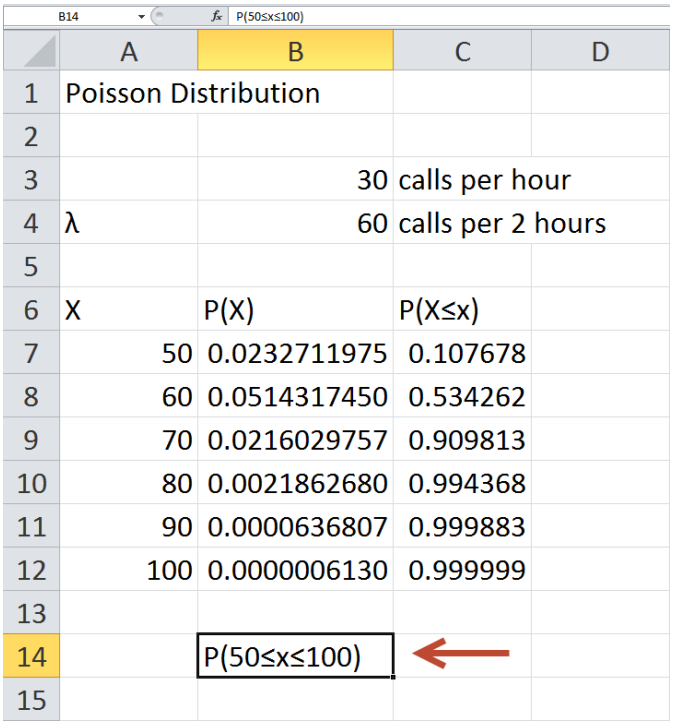
	A	B	C	D
1	Poisson Distribution			
2				
3		30	calls per hour	
4	λ	60	calls per 2 hours	
5				
6	X	P(X)	P(X≤x)	
7	50	0.0232711975	0.107678	
8	60			
9	70			
10	80			
11	90			
12	100			
13				
14				

Finally, to find the probabilities that X will be less than or equal to 60, 70, 80, etc., simply copy and paste the cells from **B7/C7** to **B8/C8** through **B12/C12**.



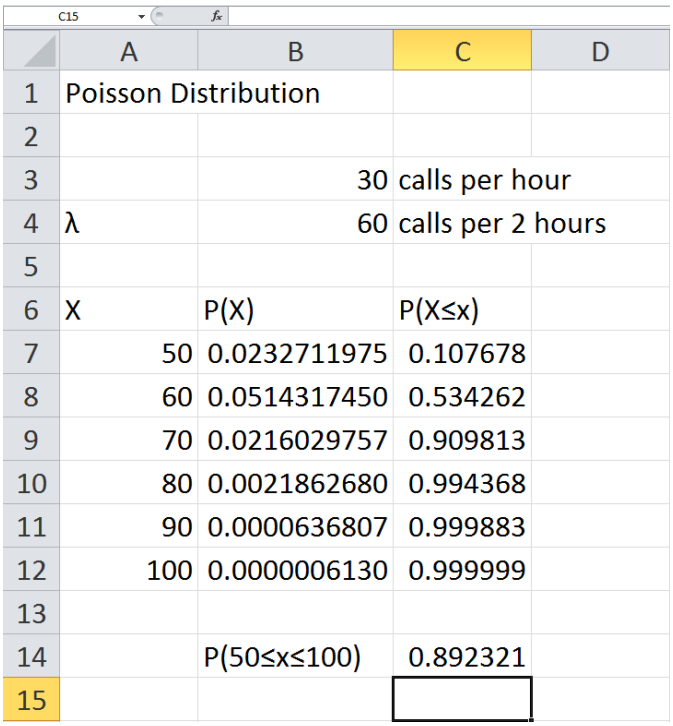
	A	B	C	D
1	Poisson Distribution			
2				
3		30	calls per hour	
4	λ	60	calls per 2 hours	
5				
6	X	P(X)	P(X≤x)	
7	50	0.0232711975	0.107678	
8	60	0.0514317450	0.534262	
9	70	0.0216029757	0.909813	
10	80	0.0021862680	0.994368	
11	90	0.0000636807	0.999883	
12	100	0.0000006130	0.999999	

We want to know the probability that X lies between 50 and 100. To do so, we need to add a cell for this on our spreadsheet as shown below.



	A	B	C	D
1	Poisson Distribution			
2				
3		30	calls per hour	
4	λ	60	calls per 2 hours	
5				
6	X	P(X)	P(X≤x)	
7	50	0.0232711975	0.107678	
8	60	0.0514317450	0.534262	
9	70	0.0216029757	0.909813	
10	80	0.0021862680	0.994368	
11	90	0.0000636807	0.999883	
12	100	0.0000006130	0.999999	
13				
14		P(50≤x≤100)	←	
15				

We are going to have to use two formulas and subtract one from the other: take the probability that X≤100 from C12 and subtract the probability that X≤50 from C7. So in our spreadsheet, we will type =+C12-C7 in cell **C14**, hit the **Enter** key or click the checkmark icon, and we get a probability of .892321.



	A	B	C	D
1	Poisson Distribution			
2				
3		30	calls per hour	
4	λ	60	calls per 2 hours	
5				
6	X	P(X)	P(X≤x)	
7	50	0.0232711975	0.107678	
8	60	0.0514317450	0.534262	
9	70	0.0216029757	0.909813	
10	80	0.0021862680	0.994368	
11	90	0.0000636807	0.999883	
12	100	0.0000006130	0.999999	
13				
14		P(50≤x≤100)	0.892321	
15				

Click here to download the completed spreadsheet so you can compare it to yours.

In summary, we setup the tables for entering calls per hour, the mean, the probability X equals 50, the probability X is less than or equal to 50, and the probability X is between 50 and 100. The next thing we did was setup the table with formulas for the probability X equals 50, the probability X is less than or equal to 50, and the probability X is between 50 and 100. After we entered the formulas, we can view the results in the table.

This concludes the tutorial on solving Poisson Distribution problems using Excel.