Chapter 14 / **Example 13**

Goodness of fit to Poisson distribution

Flaws in a length of material are thought to be modelled by a Poisson distribution with a mean of two flaws per metre.
Fifty 1 m lengths of material are inspected and the number of flaws in each are recorded in the table below.

Number of flaws	0	1	2	3	≥4
Frequency	5	10	18	11	6

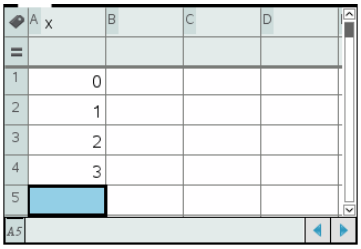
a If $X \sim \text{Po}(2)$ find $P(X = 0)$, $P(X = 1)$, $P(X = 2)$, $P(X = 3)$ and $P(X \geq 4)$.
b Hence find the expected values if the number of flaws follows a Poisson distribution with a mean of two flaws per metre.
c Write down the null and alternative hypotheses and the degrees of freedom for the test.
d Find the *p*-value.
e State the conclusion for this test.

Open a new document and add a Lists & Spreadsheet page.

Type 'x' in the first cell.

Type the numbers 0, 1, 2, 3 in the first column.

Press enter or ▼ after each number to move to the next cell.

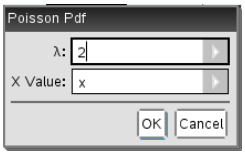


Type 'p' in the cell to the right of 'x'

In the cell below type = and press menu 4:Statistics | 2:Distributions | J:Poisson Pdf…

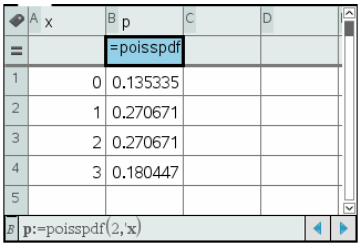
Enter 2 as the value of λ and x as the Upper Bound.

Press enter or click OK with the touchpad.



Press enter

The GDC displays the first four probabilities.



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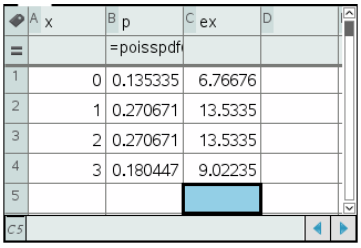
Type 'ex' in the cell to the right of 'p'

Type =50×B1, =50×B2, =50×B3, =50×B4 in the column.

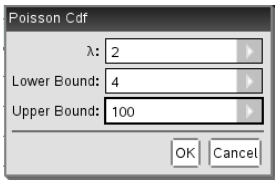


	A x	B p	C ex	D
=		=poisspdf		
1	0	0.135335	6.76676	
2	1	0.270671	13.5335	
3	2	0.270671	13.5335	
4	3	0.180447	9.02235	
5				

In the cell below type =50× and press menu 4:Statistics | 2:Distributions | K:Poisson Cdf…

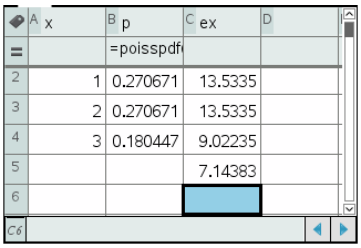
Enter 2 as the value of λ, 4 as the Lower Bound and 100 as the Upper Bound.

Press enter or click OK with the touchpad.



Press enter

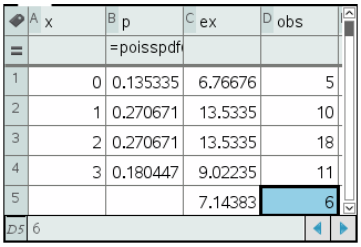
The GDC displays the five expected values.



	A x	B p	C ex	D
=		=poisspdf		
2	1	0.270671	13.5335	
3	2	0.270671	13.5335	
4	3	0.180447	9.02235	
5			7.14383	
6				

Type 'obs' in the cell to the right of 'ex'

Enter the expected values in the column.



	A x	B p	C ex	D obs
=		=poisspdf		
1	0	0.135335	6.76676	5
2	1	0.270671	13.5335	10
3	2	0.270671	13.5335	18
4	3	0.180447	9.02235	11
5			7.14383	6

To calculate the *p*-value

Press menu 4:Statistics | 4:Stat Tests | 7: χ^2 GOF…

Open the drop down lists with ▶ and select using ▼ and enter

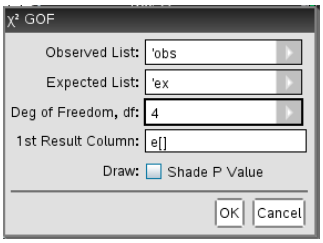
Observed List: obs

Expected List: ex

For this test you must enter the degrees of freedom yourself.

Enter df: 4

Click the touchpad on OK or press enter



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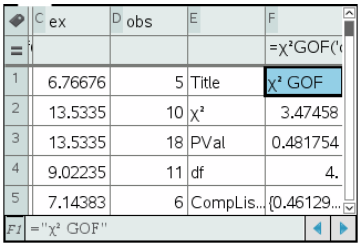
Goodness of fit to Poisson distribution

p-value = 0.482

0.482 > 0.05

This result is not significant so no reason to reject H_0 that the number of flaws follows a Poisson distribution**.**

Note that the p-value found is more accurate than the value in the example as the expected values have not been rounded.



	C ex	D obs	E	F
=				=χ²GOF("
1	6.76676	5	Title	χ² GOF
2	13.5335	10	χ²	3.47458
3	13.5335	18	PVal	0.481754
4	9.02235	11	df	4.
5	7.14383	6	CompLis...	{0.46129...

F1 ="χ² GOF"