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.

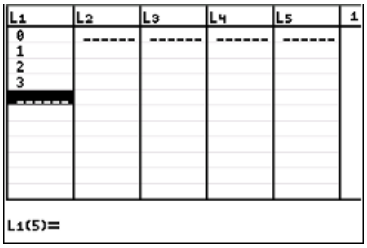
Number of flaws	0	1	2	3	≥4
Frequency	5	10	18	11	6

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.

Press [STAT] 1:Edit and press [ENTER]

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

Press [ENTER] or [▼] after each number to move to the next cell.



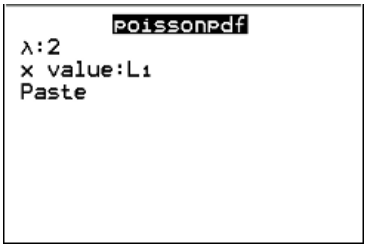
Press [▶] to move to the next column and press [▲] to move up to the cell labelled L_2.

Press [2nd] [VARS] [DISTR] C:poissonpdf(

Enter λ = 2 and x value L_1

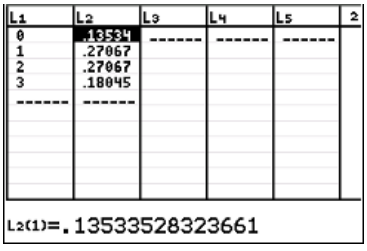
Navigate down to Paste and press [ENTER].

To enter L1, press [2nd] [1] [L1]



Press [ENTER].

The GDC displays the first four probabilities.



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Goodness of fit to Poisson distribution

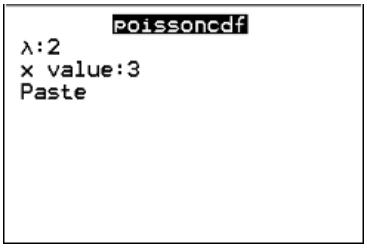
Press ▼ to move down to cell $L_2(5)$

Type 1 –

Press 2nd VARS ([DISTR]) D:poissoncdf(

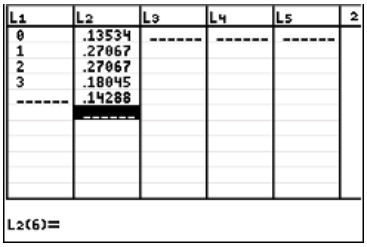
Enter 2 as the value of λ and 3 as the x value.

Navigate down to Paste and press ENTER.



Press ENTER.

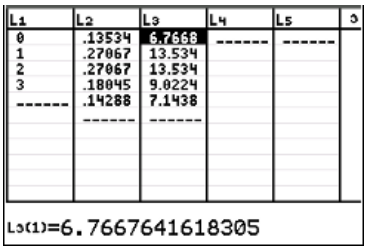
The GDC displays the five probabilities.



Press ▶ to move to the next column and press ▲ to move up to the cell labelled L_3.

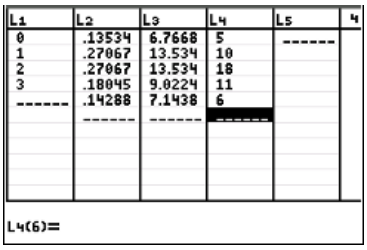
Type $L_2 \times 50$ and press ENTER.

To enter L_2, press 2nd 2 [L2]



Press ▶ to move to the next column.

Enter the expected values in L_4.



Press STAT. Press ▶ ▶ to access the TESTS menu.

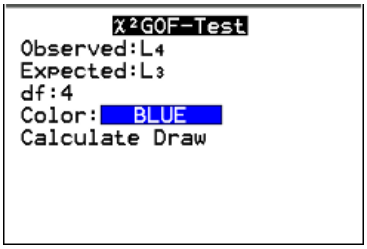
Select D: χ^2GOF-Test…

Observed : L_4

Expected: L_3

Enter df: 4

Use ▼ to navigate down to Calculate. 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.