

Chapter 13 / Example 7

Calculating probabilities

Trains at a busy railway station are occasionally cancelled due to staff shortages, breakdowns, a lack of available trains and many other causes. Assume that there are on average 2.31 cancelled trains per day and that the number of cancelled trains C can be modelled by $C \sim \text{Po}(2.31)$.

- Find the probability that there will be 4 or more cancellations on a given day.
- Find the probability that there will be at least 81 cancellations in the month of March.
- Find, in two different ways, the probability that there are no cancellations in a working week of five days.
- In a working week of five days, find the probability that there will be 4 or more cancellations on exactly 3 of these days.

$C \sim \text{Po}(2.31)$. Find $P(C \geq 4)$.

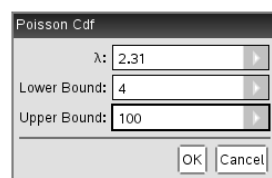
Open a new document and add a Calculator page.

Press **menu** 5:Probability | 5:Distributions | K:Poisson Cdf...

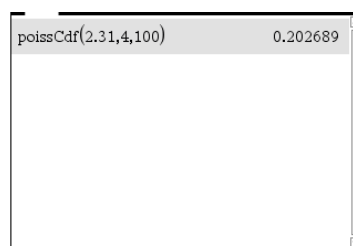
Enter 2.31 as λ , 4 as the Lower Bound and 100 as the Upper Bound.

100 is a large value of C used in place of ∞ .

Press **enter** or click OK with the touchpad.



The GDC displays the solution $P(C \geq 4) = 0.203$.



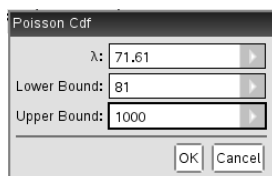
$M \sim \text{Po}(71.61)$. Find $P(M \geq 81)$.

Press **menu** 5:Probability | 5:Distributions | K:Poisson Cdf...

Enter 71.61 as λ , 81 as the Lower Bound and 1000 as the Upper Bound.

1000 is a large value of M used in place of ∞ .

Press **enter** or click OK with the touchpad.



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The GDC displays the solution $P(M \geq 81) = 0.147$.

poissCdf(2.31,4,100)	0.202689
poissCdf(71.61,81,1000)	0.147043

$C \sim Po(2.31)$. Find $(P(C = 0))^5$.

Press **menu** 5:Probability | 5:Distributions | J:Poisson Pdf...

Enter 2.31 as λ and 0 as the x value.

Press **enter** or click OK with the touchpad.

Poisson Pdf

λ : 2.31

X Value: 0

OK Cancel

Type $\wedge 5$ and press **enter**.

Since the result is a very small number you cannot see three significant figures in the default display.

poissCdf(2.31,4,100)	0.202689
poissCdf(71.61,81,1000)	0.147043
poissPdf(2.31,0)	0.099261
$(0.099261251559646)^5$	0.00001

Use the touchpad to click on the wheel icon in the page header.

Select 2:Document Settings...

Change the number of Display Digits to Float 9.

Use the touchpad to select OK or click **enter**.

Navigate up to the previous calculation and press **enter**.

Document Settings

Display Digits: Float 9

Angle: Radian

Exponential Format: Normal

Real or Complex: Real

Calculation Mode: Auto

Vector Format: Rectangular

? Restore Make Default OK Cancel

The GDC displays the solution $(P(C = 0))^5 = 0.00000964$.

poissCdf(2.31,4,100)	0.202689
poissCdf(71.61,81,1000)	0.147043
poissPdf(2.31,0)	0.099261
$(0.099261251559646)^5$	0.00001
$(0.099261251559646)^5$	0.000009636

$W \sim Po(11.55)$. Find $P(W = 0)$.

Press **menu** 5:Probability | 5:Distributions | J:Poisson Pdf...

Enter 11.55 as λ and 0 as the x value.

Press **enter** or click OK with the touchpad.

Poisson Pdf

λ : 11.55

X Value: 0

OK Cancel

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The GDC displays the solution $P(W = 0) = 0.00000964$.

poissCdf(71.61,81,1000)	0.147043
poissPdf(2.31,0)	0.099261
$(0.099261251559646)^5$	0.00001
$(0.099261251559646)^5$	0.000009636
poissPdf(11.55,0)	0.000009636

$D \sim B(5, 0.203)$. Find $P(D = 3)$.

Press **menu** 5:Probability | 5:Distributions | A:Binomial Pdf...

Enter 5 as the number of trials, 0.203 as the probability of success and 3 as the X value.

Press **enter** or click OK with the touchpad.

Binomial Pdf

Num Trials, n:	5
Prob Success, p:	0.203
X Value:	3

OK Cancel

The GDC displays the solution $P(D = 3) = 0.0531$.

poissPdf(2.31,0)	0.099261
$(0.099261251559646)^5$	0.00001
$(0.099261251559646)^5$	0.000009636
poissPdf(11.55,0)	0.000009636
binomPdf(5,0.203,3)	0.053137945