

## 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  $P(C \geq 4)$ .

The Poisson CDF function on the TI-84 Plus C finds the probability that  $G$  is less or equal to the given value.

To find  $P(C \geq 4)$  calculate  $1 - P(C \leq 3)$ .

Type 1 – and press **2nd** **vars** (**[distr]**) D:poissoncdf(.

Enter 2.31 as  $\lambda$  and 3 as the  $x$  value.

Navigate down to Paste and press **enter**.

```
poissoncdf
λ:2.31
x value:3
Paste
```

Press **enter**.

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

```
1-poissoncdf(2.31,3)
.....2026891087
```

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

To find  $P(M \geq 81)$  calculate  $1 - P(M \leq 80)$ .

Type 1 – and press **2nd** **vars** (**[distr]**) D:poissoncdf(.

Enter 71.61 as  $\lambda$  and 80 as the  $x$  value.

Navigate down to Paste and press **enter**.

```
poissoncdf
λ:71.61
x value:80
Paste
```

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Press **enter**.

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

```
1-Poissoncdf(2.31,3)
.....2026891087
1-Poissoncdf(71.61,80)
.....1470434188
```

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

Press **2nd** **vars** (**distr**) C:poissonpdf(.

Enter 2.31 as  $\lambda$  and 0 as the x value.

Navigate down to Paste and press **enter**.

```
PoissonPdf
λ:2.31
x value:0
Paste
```

Type ^5 and press **enter**.

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

```
1-Poissoncdf(2.31,3)
.....2026891087
1-Poissoncdf(71.61,80)
.....1470434188
PoissonPdf(2.31,0)^5
.....9.636043104E-6
```

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

Press **2nd** **vars** (**distr**) C:poissonpdf(.

Enter 11.55 as  $\lambda$  and 0 as the x value.

Navigate down to Paste and press **enter**.

```
PoissonPdf
λ:11.55
x value:0
Paste
```

Press **enter**.

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

```
1-Poissoncdf(2.31,3)
.....2026891087
1-Poissoncdf(71.61,80)
.....1470434188
PoissonPdf(2.31,0)^5
.....9.636043104E-6
PoissonPdf(11.55,0)
.....9.636043104E-6
```

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

Press **2nd** **vars** (**distr**) A:binompdf(.

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

Navigate down to Paste and press **enter**.

```
binomPdf
trials:5
p:0.203
x value:3
Paste
```

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Press `enter`.

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

```

1-Poissoncdf(71.61,80)
.....1470434188
PoissonPdf(2.31,0)
.....9.636043104E-6
PoissonPdf(11.55,0)
.....9.636043104E-6
binomPdf(5,0.203,3)
.....0531379452

```