

Chapter 14 / **Example 10**

Calculating normal probabilities

Given that $Z \sim N(0,1)$, sketch the required area under the standard normal curve, then find the probability using your GDC:

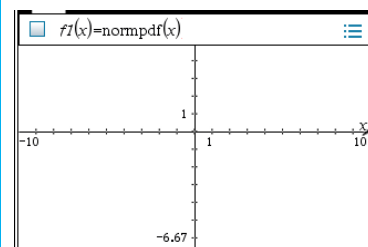
- a** $P(-2 < Z < 1)$ **b** $P(Z < 1)$ **c** $P(Z > -1.5)$
d $P(Z < 0)$ **e** $P(|Z| > 0.8)$

Open a new document and add a Graphs page.

The entry line is displayed at the top of the work area.

The default graph type is function, so $f1(x)=$ is displayed.

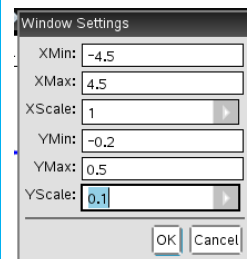
Type `normpdf(x)` and press `enter`.



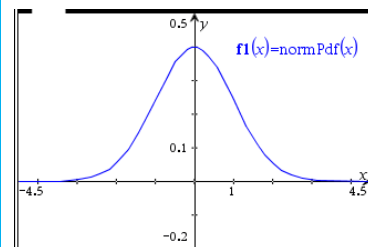
Press `menu` 4:Window/Zoom | 1:Window Settings...

Set the axes to show $-4.5 \leq x \leq 4.5$ and $-0.2 \leq y \leq 0.5$ with scales of 1 and 0.1.

You can leave y-values as they are and the scales set to Auto.



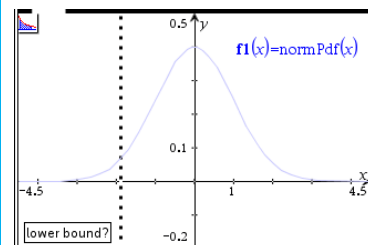
Press `enter` when you have finished.



To show the area press `menu` 6:Analyze Graph | 6:Integral

You need to give the lower and upper bounds of the region that includes the intersection.

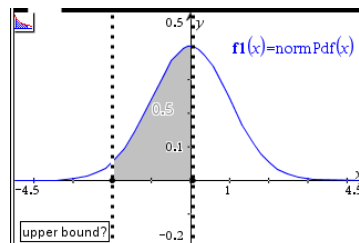
The GDC shows a line and asks you to set the lower bound.



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Do not use the line to set the lower bound as you need to enter an exact value.

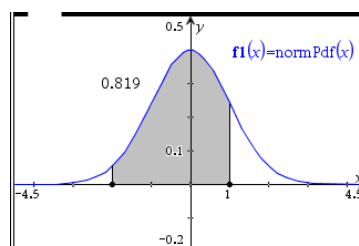
Type -2 and press **enter**.



Type 1 , the upper bound, and press **enter**.

The GDC shows the area defined by the integral and its value.

$$P(-2 < Z < 1) = 0.819$$

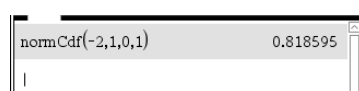


Add a new Calculator page by pressing **ctrl** **doc** (**+page**)

Press **menu** 5:Probability | 5:Distributions | 2:Normal Cdf...

Set the Lower Bound to -2 , the Upper Bound to 1 and leave the other variables unchanged.

$$P(-2 < Z < 1) = 0.819$$



Return to the Graph page by pressing **ctrl** **left arrow**

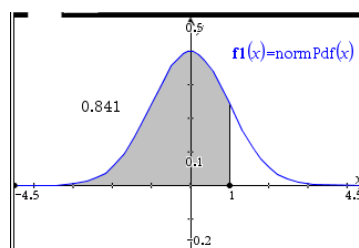
Press **ctrl** **esc** (**undo**) to undo the previous area.

To show the area press **menu** 6:Analyze Graph | 6:Integral

Set the lower bound to -4.5 and the upper bound to 1 .

(-4.5 is the lowest value of x in the window.)

$$P(Z < 1) = 0.841$$



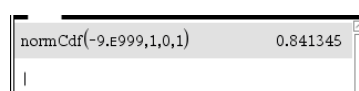
Return to the Calculator page by pressing **ctrl** **right arrow**

Press **menu** 5:Probability | 5:Distributions | 2:Normal Cdf...

Set the Upper Bound to 1 and leave the other variables unchanged.

$-9E999$ means -9×10^{999} - a very small number.

$$P(Z < 1) = 0.841$$



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Return to the Graph page by pressing **ctrl** ◀

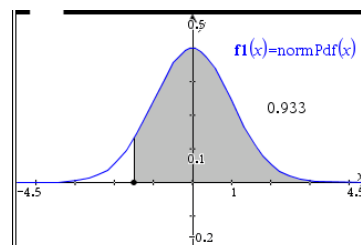
Press **ctrl** **esc** (**↶**) to undo the previous area.

To show the area press **menu** 6:Analyze Graph | 6:Integral

Set the lower bound to -1.5 and the upper bound to 4.5.

(4.5 is the highest value of x in the window.)

$$P(Z > -1.5) = 0.933$$



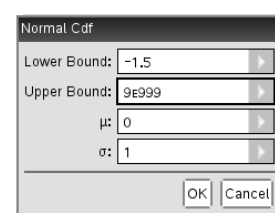
Return to the Calculator page by pressing **ctrl** ▶

Press **menu** 5:Probability | 5:Distributions | 2:Normal Cdf...

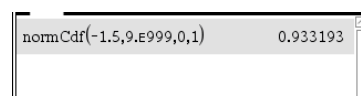
Set the Lower Bound to -1.5, the Upper Bound to 9E999 and leave the other variables unchanged.

9E999 means 9×10^{999} - a very large number.

To enter E press **EE**.



$$P(Z > -1.5) = 0.933$$



Return to the Graph page by pressing **ctrl** ◀

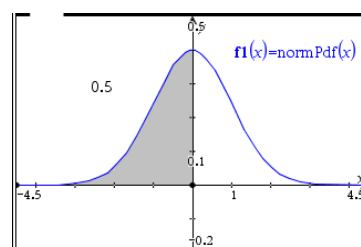
Press **ctrl** **esc** (**↶**) to undo the previous area.

To show the area press **menu** 6:Analyze Graph | 6:Integral

Set the lower bound to -4.5 and the upper bound to 0.

(-4.5 is the lowest value of x in the window.)

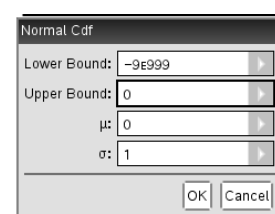
$$P(Z < 0) = 0.5$$



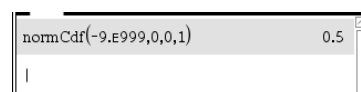
Return to the Calculator page by pressing **ctrl** ▶

Press **menu** 5:Probability | 5:Distributions | 2:Normal Cdf...

Set the Upper Bound to 0 and leave the other variables unchanged.



$$P(Z < 0) = 0.5$$



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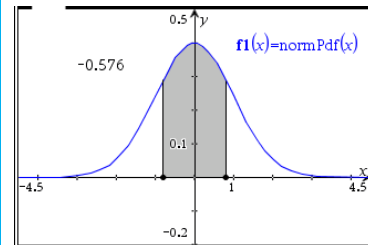
Calculating normal probabilities

Return to the Graph page by pressing **ctrl** ◀

Press **ctrl** **esc** (**↶**) to undo the previous area.

To show the area press **menu** 6:Analyze Graph | 6:Integral

Set the lower bound to -0.8 and the upper bound to 0.8.



Return to the Calculator page by pressing **ctrl** ▶

$$P(|Z| > 0.8) = 1 - P(-0.8 < Z < 0.8)$$

Type 1 **=** and press **menu** 5:Probability | 5:Distributions | 2:Normal Cdf...

Set the Lower Bound to -0.8, the Upper Bound to 0.8 and leave the other variables unchanged.

A screenshot of the 'Normal Cdf' dialog box on a TI-Nspire CX calculator. The fields are: Lower Bound: -0.8, Upper Bound: 0.8, μ : 0, and σ : 1. There are 'OK' and 'Cancel' buttons at the bottom right.

$$P(|Z| > 0.8) = 0.424$$

A screenshot of the TI-Nspire CX calculator screen. The expression $1-\text{normCdf}(-0.8,0.8,0,1)$ is entered, and the result 0.423711 is displayed.