

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** $P(|Z| > 0.8)$

First you are going to set up a suitable window to show the normal probability curve.

Press $[F2]$ $[window]$

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 the last three items as they are.

```
WINDOW
Xmin=-4.5
Xmax=4.5
Xscl=1
Ymin=-.2
Ymax=.5
Yscl=.1
Xres=1
ΔX=.0340909090909
TraceStep=.0681818181818
```

Press $[F1]$ $[Y=]$ to display the equation entry screen.

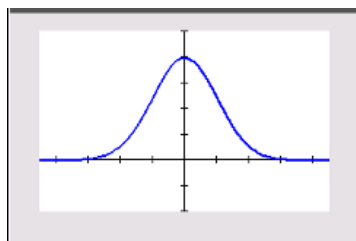
Press $[2nd]$ $[vars]$ ($[distr]$) 1:normalpdf(

Set the x value to X and leave the other variables unchanged.

Navigate to Paste and press $[enter]$.

```
Plot1 Plot2 Plot3
Y1=normalpdf(X,0,1)
Y2=
Y3=
Y4=
Y5=
Y6=
Y7=
Y8=
Y9=
```

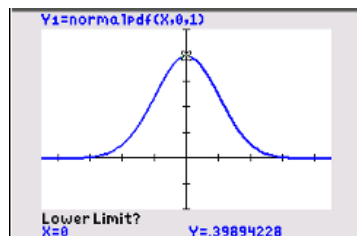
Press $[enter]$ and press $[F5]$ $[graph]$.



To show the area press $[2nd]$ $[F4]$ $[calc]$ 7: $\int f(x)dx$

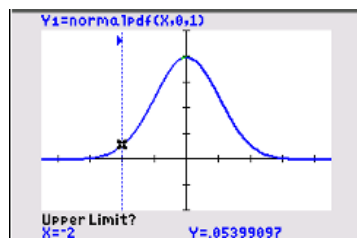
You need to give the lower and upper limits of the region that includes the intersection.

The GDC asks you to set the lower limit.



Type -2 and press $[enter]$.

The GDC asks you to set the upper limit.



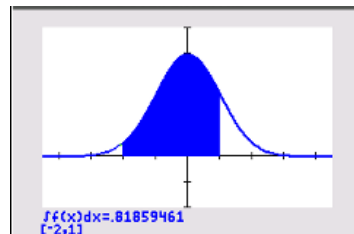
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Type 1, the upper limit, and press **[enter]**.

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

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



Press **[2nd]** **[quit]**.

Press **[2nd]** **[vars]** (**[distr]**) 2:normalcdf(

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

Navigate to Paste and press **[enter]**.

```
normalcdf
lower: -2
upper: 1
μ: 0
σ: 1
Paste
```

Press **[enter]**.

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

```
normalcdf(-2,1,0,1)
.....8185946784
```

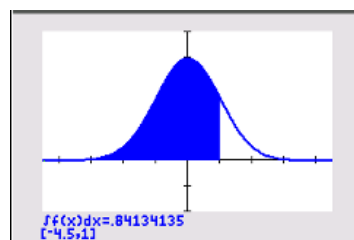
Press **[enter]** and press **[f5]** **[graph]**.

Press **[2nd]** **[prgm]** (**[draw]**) 1:ClrDraw.

To show the area press **[2nd]** **[f4]** **[calc]** 7:∫f(x)dx

Enter the lower bound as -4.5 and the upper bound as 1.

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



Press **[2nd]** **[quit]**.

Press **[2nd]** **[vars]** (**[distr]**) 2:normalcdf(

Set the Lower Bound to -1E99, the Upper Bound to 1 and leave the other variables unchanged.

-1E99 means -1×10^{99} - a very small number.

To enter E press **[2nd]** **[,]** (**[EE]**).

Navigate to Paste and press **[enter]**.

```
normalcdf
lower: -1E99
upper: 1
μ: 0
σ: 1
Paste
```

Press **[enter]**.

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

Press **[2nd]** **[prgm]** (**[draw]**) 1:ClrDraw and press **[enter]**.

Press **[enter]**.

```
normalcdf(-1E99,1,0,1)
.....8413447404
```

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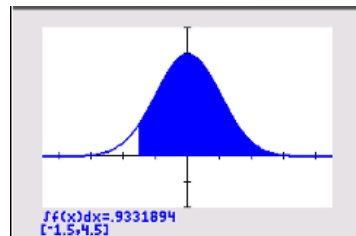
Press **[enter]** and press **[f5]** **[graph]**.

Press **[2nd]** **[prgm]** (**[draw]**) 1:ClrDraw.

To show the area press **[2nd]** **[f4]** **[calc]** 7: $\int f(x)dx$

Enter the lower bound as -1.5 and the upper bound as 4.5.

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



Press **[2nd]** **[quit]**.

Press **[2nd]** **[vars]** (**[distr]**) 2:normalcdf(

Set the Lower Bound to -1.5, the Upper Bound to 1E99 and leave the other variables unchanged.

1E99 means 1×10^{99} - a very large number.

To enter E press **[2nd]** **[,]** (**[EE]**).

Navigate to Paste and press **[enter]**.

```
normalcdf
lower: -1.5
upper: 1E99
μ: 0
σ: 1
Paste
```

Press **[enter]**.

$P(Z > -1.5) = 0.933$

```
normalcdf(-1.5,1E99,0,1)
.9331927713
```

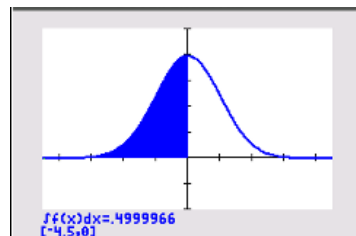
Press **[enter]** and press **[f5]** **[graph]**.

Press **[2nd]** **[prgm]** (**[draw]**) 1:ClrDraw.

To show the area press **[2nd]** **[f4]** **[calc]** 7: $\int f(x)dx$

Enter the lower bound as -4.5 and the upper bound as 0.

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



Press **[2nd]** **[quit]**.

Press **[2nd]** **[vars]** (**[distr]**) 2:normalcdf(

Set the Lower Bound to -1E99, the Upper Bound to 0 and leave the other variables unchanged.

-1E99 means -1×10^{99} - a very small number.

To enter E press **[2nd]** **[,]** (**[EE]**).

Navigate to Paste and press **[enter]**.

```
normalcdf
lower: -1E99
upper: 0
μ: 0
σ: 1
Paste
```

Press **[enter]**.

$P(Z < 0) = 0.5$

```
normalcdf(-1E99,0,0,1)
.5000000005
```

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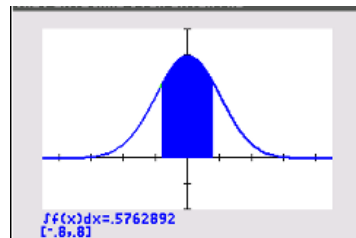
Press **[enter]** and press **[f5]** **[graph]**.

Press **[2nd]** **[prgm]** (**[draw]**) 1:ClrDraw.

To show the area press **[2nd]** **[f4]** **[calc]** 7:∫f(x)dx

Enter the lower bound as -4.5 and the upper bound as 0.

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



Press **[2nd]** **[quit]**.

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

Type 1 **[=]** and press **[2nd]** **[vars]** (**[distr]**) 2:normalcdf(

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

Navigate to Paste and press **[enter]**.

```
normalcdf
lower: -0.8
upper: 0.8
μ: 0
σ: 1
Paste
```

Press **[enter]**.

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

```
1-normalcdf(-0.8,0.8,0,1)
.4237106673
```