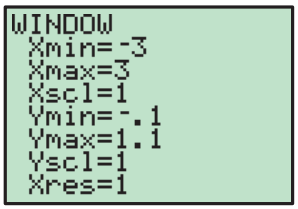
CHAPTER 18 - ESTIMATING $\int_{-3}^{3} e^{-\frac{x^2}{2}}\,dx$

TI-84 Plus

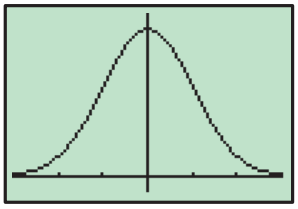
Find upper and lower rectangular sums for the area under $y = e^{-\frac{x^2}{2}}$ for $-3 \leqslant x \leqslant 3$ and $n = 4500$.

Step 1 Enter $y = e^{-\frac{x^2}{2}}$ into **Y1** .

Set the view window as shown.



Step 2 Press GRAPH to draw the graph.



Step 3 We will now find the upper sum. The **TI-84 Plus** is unable to handle data lists of size 2250, so we instead find the upper sum in 3 sections of 750 rectangles.

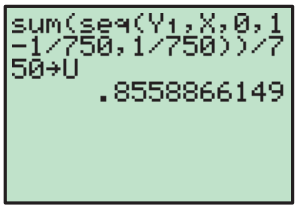
Press 2nd STAT (**LIST**) ▶ ▶ to select the **STAT MATH** menu, then select **5:sum(** .

Now create a sequence using 2nd STAT (**LIST**) ▶ to select the **STAT OPS** menu, then select **5:seq(** .

The syntax for the **seq** command is
seq(function, variable, start, end, step size).

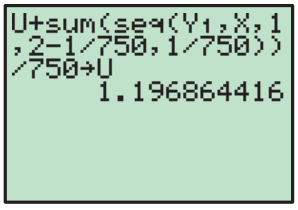
So, press VARS ▶ to select the **Y-VARS** menu, then **1** to select **1:Function**, then **1** to select **1:Y1** , X,T,θ,n , 0 , 1 − 1 ÷ 750 , 1 ÷ 750)) ÷ 750.

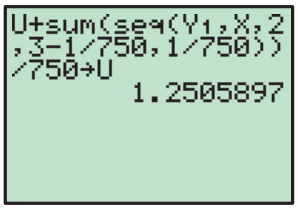
Store the result in U by pressing STO▶ ALPHA **5** (**U**) ENTER .



Step 4 Repeat *Step 3* with starting points $x = 1$ and $x = 2$, and add those results to U.

U now contains an upper estimate of the area for $0 \leqslant x \leqslant 3$ using 2250 rectangles.





Step 5 To find a lower estimate for the area:

Press [2nd] [STAT] (**LIST**) [▶] [▶] to select the **STAT MATH** menu, then select **5:sum(** .

Now create a sequence using [2nd] [STAT] (**LIST**) [▶] to select the **STAT OPS** menu, then select **5:seq(** .

Press [VARS] [▶] to select the **Y-VARS** menu, then **1** to select **1:Function**, then **1** to select **1:Y_1** [,] [X,T,θ,n] [,] 0 [+] 1 [÷] 750 [,] 1 [,] 1 [÷] 750 [)] [)] [÷] 750.

Store the result in L by pressing [STO▶] [ALPHA] [)] (**L**) [ENTER] .

```
sum(seq(Y1,X,0+1
/750,1,1/750))/7
50→L
      .8553619891
```

Step 6 Repeat *Step 5* with starting points $x = 1 + \frac{1}{750}$ and $x = 2 + \frac{1}{750}$, and add those results to L.

L now contains a lower estimate of the area for $0 \leqslant x \leqslant 3$ using 2250 rectangles.

```
L+sum(seq(Y1,X,1
+1/750,2,1/750))
/750→L
      1.19571153
```

```
L+sum(seq(Y1,X,2
+1/750,3,1/750))
/750→L
      1.249271179
```

Step 7 Since $y = e^{-\frac{x^2}{2}}$ is symmetrical, lower and upper estimates of the area for $-3 \leqslant x \leqslant 3$ can now be easily found.

```
2L
      2.498542358
2U
      2.501179401
√(2π)
      2.506628275
```