This handout will guide you through the steps involved in using a TI-83 graphing calculator to approximate the area under the curve:

$$y \; = \; f(x) \; = \; x \cdot (x - 1) \cdot (x - 2)$$

between $x \; = \; 0$ and $x \; = \; 1$ using 20 rectangles to do the approximation.   The area approximated is shown in Figure 1 (see below).
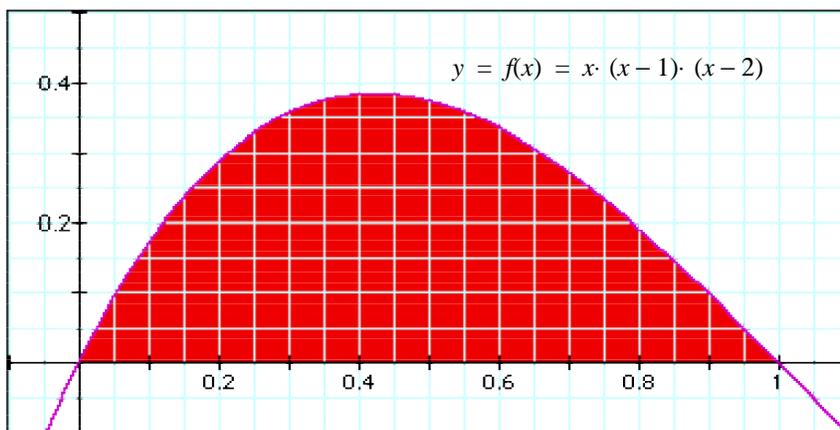

Figure 1:   The area under the curve from x=0 to x=1 has been shaded.

The area that your calculator will actually evaluate is the area of the rectangles shown in Figure 2 (below).
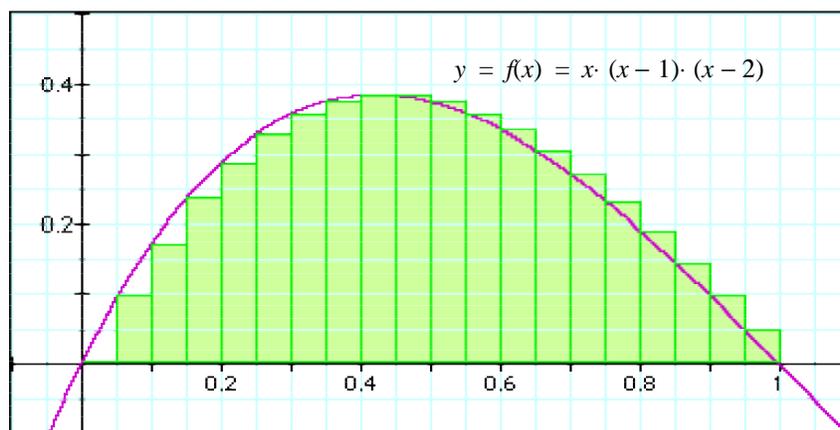

Figure 2:   The commands that you will execute on a TI-83 will actually calculate the total area of all of the shaded rectangles.

The first part of the calculation is to determine the width (often written using the symbol Δx) of the rectangles. Remember that you are finding the area between $x = 0$ and $x \; = \; 1$, and that you are using 20 rectangles to do this. The width of each rectangle, Δx will be:

$$\Delta x \; = \; \frac{1 - 0}{20} = 0.05 \,.$$

The total area of all of the rectangles shown in Figure 2 is given (in sigma notation) by the series:

$$Total\ Area\ of\ Rectangles\ =\ \sum_{k=0}^{19}[f(k\cdot\Delta x)]\cdot[\Delta x].$$

Figure 3 (below) shows you how to use a TI-83 calculator to work out the sum of this series. Note that in Figure 3, the symbol **W** has been used instead of Δx (because a TI-83 cannot show the symbol Δx).
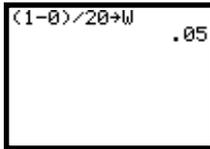
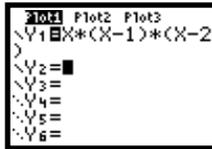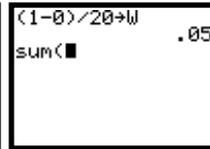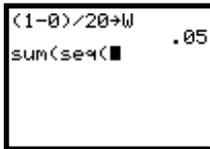| Figure 3(a): Store the width of the rectangles in W.	Figure 3(b): Enter the equation of the function into Y1.	Figure 3(c): After returning to the main screen, use the LIST menu to obtain the sum(command.	Figure 3(d): The main screen of your calculator should now look something like this.	Figure 3(e): Use the list menu to obtain the seq(command.

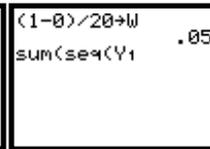| Figure 3(f): The main screen of your calculator should now look something like this.	Figure 3(g): Press the VARS button and select the Y-VARS menu. Press ENTER to select the "Function" option.	Figure 3(h): Press ENTER to choose Y1.	Figure 3(i): The main screen of your calculator should now look something like this.	Figure 3(j): Enter the appropriate symbols into your calculator so that the calculator will sum: $f(k*\ \Delta x)*\Delta x$

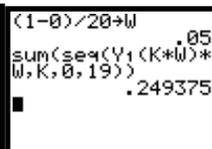| Figure 3(k): Enter the appropriate limits of summation (here they are 0 and 19) for the number of rectangles added.	Figure 3(l): Press ENTER and the calculator will work out the total area of all of the rectangles.

The total area of the twenty rectangles shown in Figure 2 is therefore: 0.249375.

- **Adapt the method shown above to approximate the area under the following curves using the number of rectangles indicated.**

Function	Area between ...	# Rectangles	Calculator result
$y = 2\cdot x$	x = 0 and x = 10	200	
$y = x^2$	x = 0 and x = 2	10	
$y = e^x$	x = 0 and x = 1	100	
$y = x\cdot(x-1)\cdot(x-2)$	x = 0 and x = 2	20	