

## Activity Overview

In this activity, students will use the TI-89 graphing calculator to find the area between two curves while determining the required amount of concrete needed for a winding pathway and stepping stones.

## Topic: Applications of Integration

- Calculate the area enclosed by two intersecting curves defined in Cartesian coordinates.
- Use the Solve and Integral commands to verify the computation of areas bounded by curves.

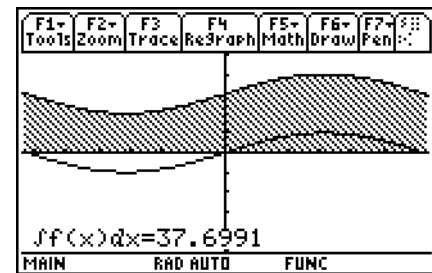
## Teacher Preparation and Notes

- The students should already be familiar with the concept of the integral as well as using an integral to find the area below a curve.
- Students should know how to use the **Integral** and **solve** commands.
- This activity is designed to be student-centered. You may use the following pages to present the material to the class and encourage discussion. Students will follow along using their calculators.
- Before starting this activity, students should go to the home screen and select **F6:Clean Up > 2:NewProb**, then press **ENTER**. This will clear any stored variables, turn off any functions and plots, and clear the drawing and home screens.
- **To download the student worksheet, go to [education.ti.com/exchange](http://education.ti.com/exchange) and enter “9983” in the keyword search box.**

## Suggested Related Activities

To download any activity listed, go to [education.ti.com/exchange](http://education.ti.com/exchange) and enter the number in the keyword search box.

- Approximating Integrals with Reimann Sums (TI-84 Plus family) — 4371
- Applications of Integrals (TI-89 Titanium) — 4253



This activity includes screen captures taken from the TI-89 Titanium.

### Compatible Devices:

- TI-89 Titanium

### Associated Materials:

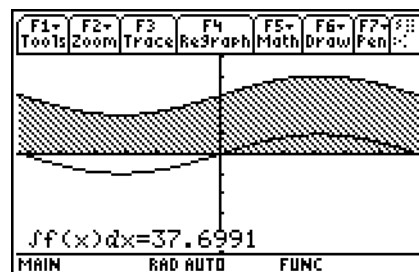
- AreaBetween\_Student.pdf
- AreaBetween\_Student.doc

Click [HERE](#) for Graphing Calculator Tutorials.

### Problem 1 – Making Pathways

The first problem involves a pathway with sine functions as the borders. Students are to graph the functions in  $y1$  and  $y2$ . Then they can use the **Integral** tool to calculate the area under each curve. Students will be asked to enter the lower and upper limits. They can enter  $-2\pi$  and  $2\pi$  directly, instead of making a guess with the arrow keys.

Students are to go to the Home screen, where they will calculate the area between the curves using the **nInt** command. Then they need to multiply their answer by  $1/3$  to find the volume of the pathway or amount of concrete needed ( $12.5664 \text{ ft}^3$ ).



```

F1+ Tools  F2+ Zoom  F3+ Trace  F4+ Re3raph  F5+ Math  F6+ Draw  F7+ Pen
■ Define f(x)=sin(.5·x)+3
  Done
■ Define g(x)=sin(.5·x)
  Done
■ nInt(f(x)-g(x),x,-2·π,2)
  37.6991
MAIN          RAD AUTO  FUNC
  
```

### Problem 2 – Finding New Pathways

The second problem involves a pathway with cubic functions as the borders. Students are to find the volume of a new pathway using the graph and the calculator. They should use the same method in the previous problem.

Remind students that when finding the area of the region, they must always take the integral of the top function minus the bottom function (this is where many mistakes occur).

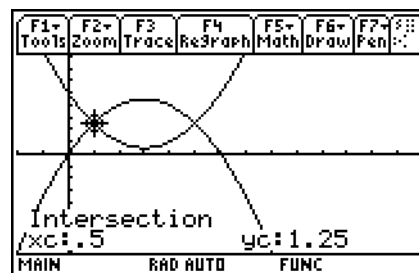
```

F1+ Tools  F2+ Algebra  F3+ Calc  F4+ Other  F5+ Pr3mID  F6+ Clean Up
■ nInt(f(x)-g(x),x,-2,2)
  17.3333
■ 17.33333333333333·1
  3
  5.77778
MAIN          RAD AUTO  FUNC  4/30
  
```

### Problem 3 – Stepping Stones

In this problem, students will find the volume of one stepping stone. Students are to graph the functions and then find the intersection points using the **Intersection** tool. These intersection points will be the lower and upper limits. Students can also use the **Solve** command on the Home screen.

Then, students can find the volume of the stepping stone using the previous method. They may think that  $g(x)$  is the top function, but  $f(x)$  is the top function in the interval.



```

F1+ Tools  F2+ Algebra  F3+ Calc  F4+ Other  F5+ Pr3mID  F6+ Clean Up
■ Define g(x)=(x-1)·(x-2)
  Done
■ nInt(f(x)-g(x),x,.5,2.5)
  2.66667
■ 2.666666666666666·1/3
  .888889
MAIN          RAD AUTO  FUNC  4/30
  
```