The Area Between

AreaBetween.tns

Name _____

Class _____

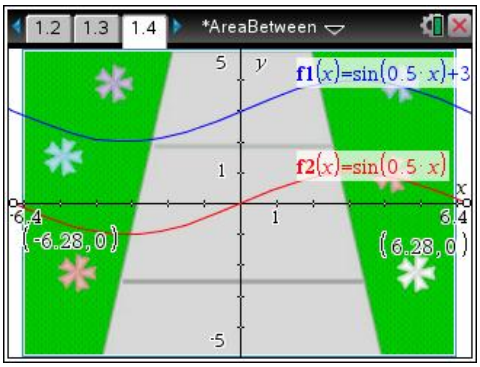
Problem 1 – Making Pathways

While integrals can be used to find the area under a curve, they can also be used to find the area between curves through subtraction (just make sure the subtraction order is the equation of the top curve minus the equation of the bottom curve.)

Suppose you are a building contractor and need to know how much concrete to order to create a pathway that is 1/3 foot deep. The sidewalk borders can be modeled by $f(x) = \sin(0.5x) + 3$ and $g(x) = \sin(0.5x)$ from -2π to 2π.

To find the volume, all that is needed is to multiply the area of the sidewalk by the depth of the sidewalk.

On page 1.4, graph the functions and then calculate the integrals of **f1** and **f2** (**Menu > Analyze Graph > Integral**).



- What is the value of the integral of **f1**? Of **f2**?

Now use the **Text** and **Calculate** tools to find the volume of the pathway.

- What is the formula for the volume of the sidewalk?

- How much concrete is needed for the pathway?

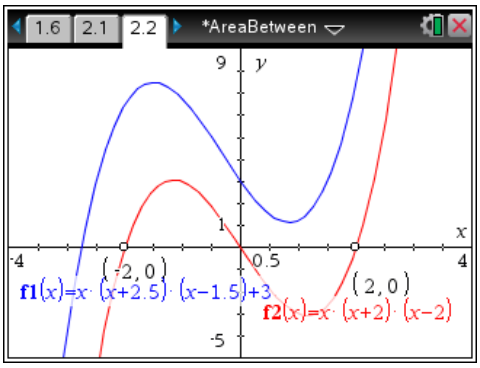
Verify your calculations on page 1.6. Use the Numerical Integral command (**nInt**) in the Numerical Calculations menu to find the area.

Note: The **nInt** command has the following syntax **nInt**(expression, variable, lower bound, upper bound). *Hint:* The expression is the difference of the functions.

Problem 2 – Finding New Pathways

The owners have changed the design of the pathway. It will now be modeled by $f(x) = x(x + 2.5)(x – 1.5) + 3$ and $g(x) = x(x + 2)(x – 2)$ from –2 to 2.

On page 2.2, graph the functions and then calculate the integrals of **f1** and **f2**.



- What is the value of the integral of **f1**? Of **f2**?

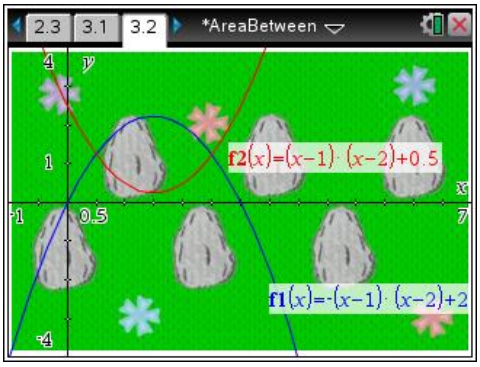
Now use the **Text** and **Calculate** tools to find the volume of the pathway.

- How much concrete is needed for the pathway? Verify your calculations on page 2.3.

Problem 3 – Stepping Stones

The owners also want stepping stones, which can be modeled by $f(x) = – (x – 1)(x – 2) + 2$ and $g(x) = (x – 1)(x – 2) + 0.5$. This situation different because the starting and stopping points are not given. Assume that the stepping stones are 1/3 foot thick.

On page 3.2, graph the functions. Use the **Intersection Point(s)** tool, to display the coordinates of the intersection points of **f1** and **f2**.



- What are the coordinates of the two intersection points?

Store the *x*-value of the left point as **a** and the *x*-value of the right point as **b**. To do this, click on the value, press ctrl + var, type the letter, and then press enter.

Note: All variables and values linked to variables appear in bold type.

Calculate the integrals of **f1** and **f2**. Then use the **Text** and **Calculate** tools to find the volume of the pathway.

- What is the value of the integral of **f1**? Of **f2**?

- How much concrete is needed for the pathway? Verify your calculations on page 3.3.