One Type of Integral

Description: Students explore the concept of definite integral by using a velocity graph to estimate the distance a car travels. They count grid squares beneath the graph, and then make the squares smaller to improve the accuracy of their approximation. They use the same method to approximate definite integrals for several different functions.

Technology Strength: By using the given dynamic square grid to subdivide an area under a curve, students can easily use these squares to approximation the area under a graph and then use even smaller squares to improve the accuracy of their approximation.

Objectives: Explore the concept of definite integral; use the velocity function and a grid to approximate total distance traveled; estimate the definite integral for various functions over a given domain

Prerequisites: Understanding of the relationship between rate, time, and distance traveled; familiarity with graphs of velocity as a function of time

Suggested Grade Level: 11 to 12

Sketchpad Level: Beginning

Suggested Duration: 45 minutes

Suggested Classroom Setting: Whole Class, Student Pairs. This activity, designed for use by student pairs, can be easily modified for whole-class use.

Preparation: Review the Activity Notes. Preview the student sketch. Work through the steps on the worksheet and make a copy of the worksheet for each student.

Materials: None

Student Worksheet(s): One Type of Integral

Student Sketch: Definite Integral.gsp

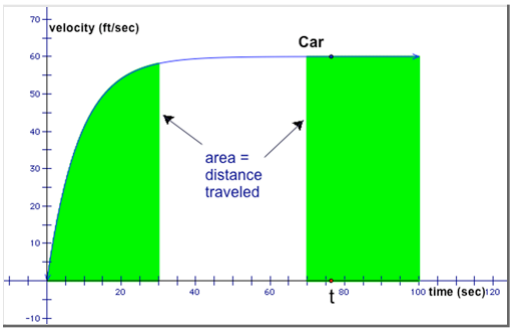
Presentation Sketch: None

Vocabulary: Velocity, definite integral

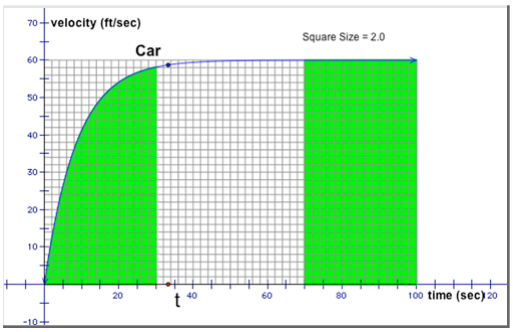
Sketchpad Version: GSP5

Using the Sketch:

On page 1 of this sketch, students are given the plot of a function that represents the velocity of a car. They use a square grid to subdivide the area between the function's plot and the *time* axis and to find an approximation for the total distance the object travels. First, they use the fact that on the interval (70, 100), the function is constant to find the exact total distance traveled by using a rectangle. Then, students looked at the shaded region on the interval (0, 30) and count the number of squares that are more than half shaded to approximate the area under the curve on that interval. They then make the squares in the grid smaller and repeat the process to get a more accurate approximation.



On pages 2-3, students look at other functions and use the same procedure to estimate the definite integral for these given functions over a specified domain. On page 4, students are challenged to plot their own functions and estimate their definite integrals and to decide what they should do with squares below the *x*-axis.



Sketch Tips:

Sketch Tips show skills needed in this activity, and the step at which the skill is first used.

Sketch Tip	**Tip Sheet or Tip Video**
Step 5: Change the value of a number (parameter)	Changing Parameters
Plot a function using **Graph | Plot New Function**	Plotting Functions