



Definite Integral

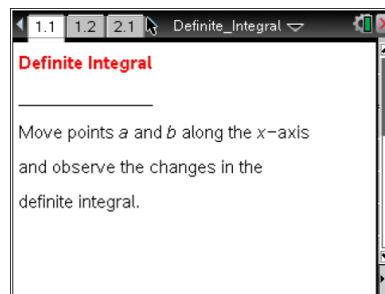
Student Activity

Name _____

Class _____

Open the TI-Nspire document *Definite_Integral*.

In this activity, you will use a graphical representation to explore the definite integral of a continuous function. You will change the upper and lower limits, a and b , of the integral $\int_a^b f(x) dx$ and observe the resulting changes in the graph and the value of the definite integral.



Move to page 1.2.

Press **ctrl** **▶** and **ctrl** **◀** to navigate through the lesson.

- The graph shown is of the function $y = f(x)$. The definite integral of $f(x)$ from a to b is given by $\int_a^b f(x) dx$. For example, $\int_0^2 f(x) dx$ is the definite integral of $f(x)$ from 0 to 2, or between $x = 0$ and $x = 2$.

Drag points a and b along the x -axis to determine the values of the following definite integrals, where f is the function shown in the graph.

- $\int_0^2 f(x) dx =$ _____
- $\int_{-3}^2 f(x) dx =$ _____
- $\int_{-3}^{-2} f(x) dx =$ _____

- Drag point a to -3 and move point b to determine the following:
 - For what values of b is $\int_{-3}^b f(x) dx$ positive? What do you observe about the shaded region and the graph of f when $\int_{-3}^b f(x) dx$ is positive?
 - For what values of b is $\int_{-3}^b f(x) dx$ negative? What do you observe about the shaded region and the graph of f when $\int_{-3}^b f(x) dx$ is negative?
 - For what values of b does $\int_{-3}^b f(x) dx = 0$? What do you observe about the shaded region and the graph of f when $\int_{-3}^b f(x) dx = 0$?



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3. For the function f pictured on page 1.2, under what conditions of a and b in $[-5, 5]$ will the definite integral $\int_a^b f(x) dx$ be positive? Negative? Zero? Explain your thinking.

Move to page 2.2.

4. The graph on page 2.2 is of a new function $f(x)$ and the definite integral $\int_a^b f(x) dx$. Drag point a to -3 (if a is not already positioned at -3).
- a. Without dragging point b , for what values of b do you think $\int_{-3}^b f(x) dx$ will be positive? Negative? Zero? Explain your predictions.
- b. Drag point b to test your predictions. Describe what you observed in the graph of f that confirmed or contradicted your prediction.
5. For the function $f(x)$ pictured on page 2.2, under what conditions of a and b in $[-5, 5]$ will the definite integral $\int_a^b f(x) dx$ be positive? Negative? Zero? Explain your thinking.
6. Based on your observations on pages 1.2 and 2.2, for any continuous function f on an interval $[c, d]$ and for a and b in $[c, d]$, when will the definite integral $\int_a^b f(x) dx$ be positive? Negative? Zero? Clearly explain your generalization.
7. The definite integral $\int_a^b f(x) dx$ is often described as “the area under the curve $y = f(x)$ between $x = a$ and $x = b$.” What problems do you see with this definition?