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Lesson 6.5: Approximation Using Riemann Sums and Trapezoids

Riemann Sums

Sometimes, you are given a function that cannot be integrated, and sometimes you are given data or a graph- but not an actual function.

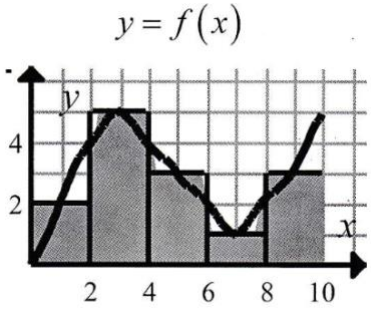
It is still possible to _____ areas. One method of approximating a definite integral is to add areas of rectangles.

This is called a _____ .

Example:

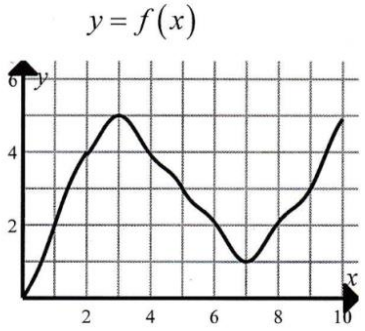
1. Approximate $\int_0^{10} f(x)\,dx$ by adding the areas of the five rectangles shown.

   This is called a _____ .

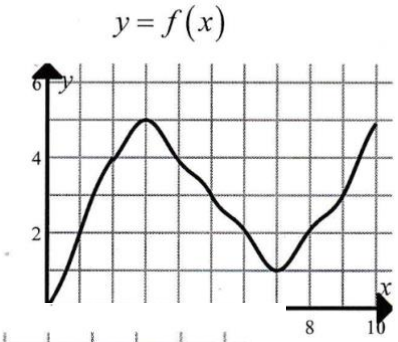


x	$f(x)$
0	0
1	2
2	4
3	5
4	4
5	3
6	2
7	1
8	2
9	3
10	5

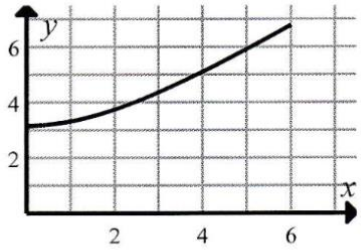
2. Approximate $\int_0^{10} f(x)\,dx$ by using 5 rectangles of equal width $(n = 5)$. And an Upper (Circumscribed) Riemann Sum. Draw rectangles on the figure.



3. Approximate $\int_0^{10} f(x)\,dx$ by using a Lower (Inscribed) Riemann Sum with $n = 5$. Draw rectangles on the figure.

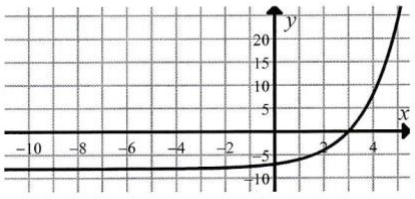


4. Approximate $\int_0^6 \sqrt{x^2 + 10}\,dx$ using a Midpoint Riemann Sum with 3 equal subdivisions.

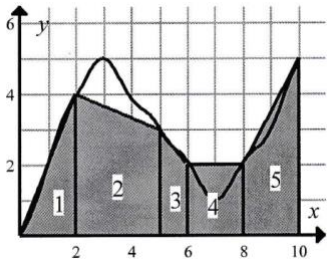


5. Approximate $\int_{-10}^{5} (2^x - 8)\,dx$ by using five Right hand rectangles whose widths are determined by the intervals separating the following x-values:

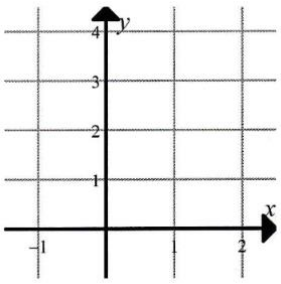
$$x = -10, x = -4, x = 0, x = 2, x = 3 \;\&\; x = 5$$



6. Approximate $\int_0^{10} f(x)\,dx$ by adding the areas of the 5 "trapezoids" shown in the graph at right.



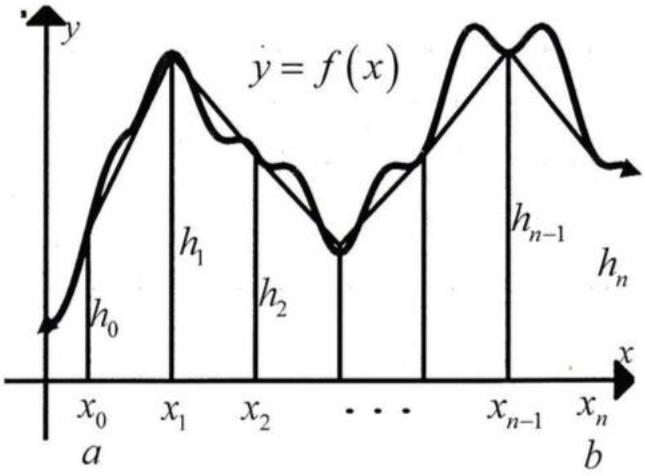
7. Use four trapezoids of equal width to find an approximation for the area under the curve $y = x^2$, bounded below the x-axis, on the left by $x = 0$, and on the right by $x = 2$. Sketch the curve and draw the trapezoids first.



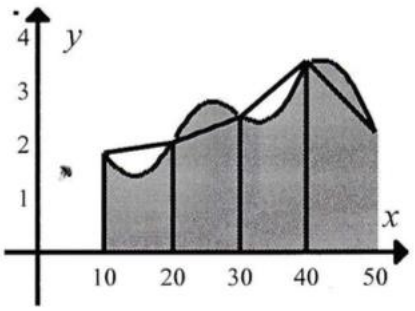
Approximating Using Trapezoids

When using trapezoids for approximation, if the subdivisions produce equal widths (see the figure below), then:

This formula is called the _____ .



Example: Use the Trapezoidal Rule with four equal subdivisions to approximate the area shown.



x	y
10	1.8
20	2
30	2.5
40	3.5
50	2.2