LESSON MAKER PRO

Area Estimate Lab

Approximate accumulated change from formulas, graphs, and tables.

HIGH SCHOOL · MA.912.C.4.2

MA.912.C.4.2 "Apply Riemann sums, the Trapezoidal Rule and technology to approximate definite integrals of functions represented algebraically, geometrically and by tables of values."

NAME _____ DATE _____

BUILD AREA ESTIMATES

For a Riemann sum, multiply each rectangle width by a chosen height, then add the rectangle areas. For the Trapezoidal Rule, each strip has area equal to its width times the average of its two endpoint heights, then add the strip areas.

WORKED EXAMPLE

Use the Trapezoidal Rule to estimate the integral from 100 to 126 using this table: x: 100, 113, 126; f(x): 29, 31, 37.

1. The widths are 13, so use 13[(29 + 31)/2 + (31 + 37)/2].
2. The average heights are 30 and 34.
3. Multiply and add: 13(30 + 34) = 832.

Answer: 832 square units

PRACTICE 6 problems

1 Use a left Riemann sum with 3 equal subintervals to approximate the integral of f(x) = x + 14 from 0 to 6.

ANSWER _____

2 Use a right Riemann sum with 4 equal subintervals to approximate the integral of f(x) = 12 - x from 0 to 8.

ANSWER _____

3 The graph of f is made of line segments joining (0, 4), (4, 10), and (8, 10). Use trapezoids to find the integral of f from 0 to 8.

ANSWER _____

4 Use the Trapezoidal Rule on this table to approximate the integral from 1 to 14: x: 1, 4, 10, 14; f(x): 2, 8, 4, 10.

ANSWER _____

5 Use a midpoint Riemann sum with 4 equal subintervals to approximate the integral of f(x) = x^2 from 0 to 8.

ANSWER _____

6 The graph of f is made of line segments joining (0, -2), (4, 2), and (8, -2). Find the signed integral of f from 0 to 8.

ANSWER _____

APPLY IT Show your work

1 A student records a scooter's speed during a test run. The times, in seconds, are 0, 2, 4, and 6. The speeds, in meters per second, are 4, 10, 12, and 8. Use the Trapezoidal Rule to estimate the distance traveled.

WORK SPACE

ANSWER _____

2 At a school esports event, the rate at which viewers enter is recorded each minute. At times 0, 1, 2, and 3 minutes, the rates are 40, 52, 44, and 38 viewers per minute. Use the Trapezoidal Rule to estimate how many viewers enter during the first 3 minutes.

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

Use the Trapezoidal Rule to approximate the integral from 0 to 9 from this table: x: 0, 2, 5, 9; f(x): 18, 14, 8, 2. Explain how you chose the width of each trapezoid.

_____

_____

ANSWER KEY

Area Estimate Lab

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Use a left Riemann sum with 3 equal subintervals to approximate the integral of f(x) = x + 14 from 0 to 6.	**96 square units**
2	Use a right Riemann sum with 4 equal subintervals to approximate the integral of f(x) = 12 - x from 0 to 8.	**56 square units**
3	The graph of f is made of line segments joining (0, 4), (4, 10), and (8, 10). Use trapezoids to find the integral of f from 0 to 8.	**68 square units**
4	Use the Trapezoidal Rule on this table to approximate the integral from 1 to 14: x: 1, 4, 10, 14; f(x): 2, 8, 4, 10.	**79 square units**
5	Use a midpoint Riemann sum with 4 equal subintervals to approximate the integral of f(x) = x^2 from 0 to 8.	**168 square units**
6	The graph of f is made of line segments joining (0, -2), (4, 2), and (8, -2). Find the signed integral of f from 0 to 8.	**0 square units**

PART 2 · APPLY IT

1. **Approximately 56 meters** Each time interval has width 2. Add the trapezoid areas: 2[(4 + 10)/2 + (10 + 12)/2 + (12 + 8)/2] = 56.
2. **Approximately 135 viewers** Each interval is 1 minute wide. The estimated total is (40 + 52)/2 + (52 + 44)/2 + (44 + 38)/2 = 135.

CHALLENGE

85 square units. Use widths 2, 3, and 4 from consecutive x-values: 2(16) + 3(11) + 4(5) = 85.

Accept equivalent arithmetic forms and correct units. Riemann-sum answers must use the requested left, right, or midpoint sample points, and trapezoidal work must use each consecutive interval width.