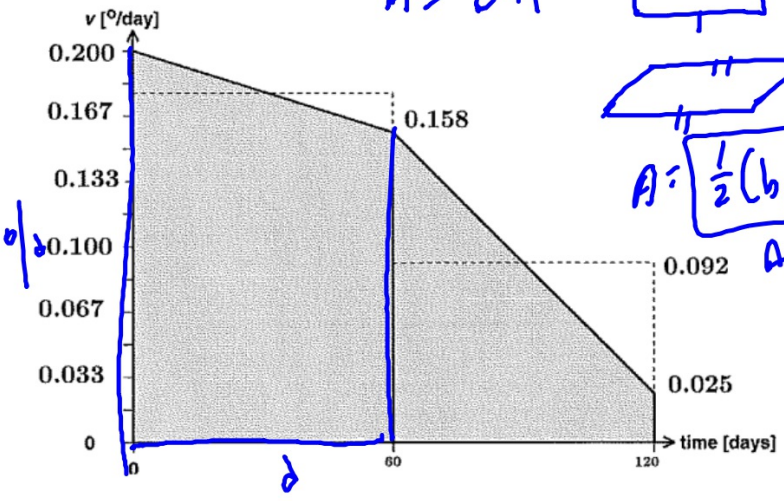
AP Calculus AB

Warm up: answer the Jupiter travel problem from the Cuneiform tablets on Wednesday

Ancient Babylonians measured the change in location of Jupiter over 120 days. They measured the change in degrees per day along its path in the sky. Here is their data transcribed from their Cuneiform tablets dating back to ~300BCE.

Through how many degrees did Jupiter travel during the 120 days?

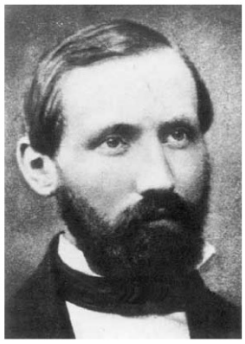


$A = B \cdot H$

$A = \frac{1}{2}(b_1 + b_2) \cdot h$

Avg B

AP Calculus AB



Riemann Sum Hw solutions

25. Left: 13 Right: 15

26. L: 37/3 12.333
    R: 35/3 11.667

27. L: 55
    R: 74.5

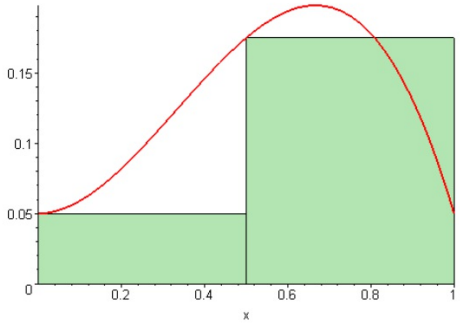
28. L: 9.688
    R: 11.688

Riemann integral

From Wikipedia, the free encyclopedia

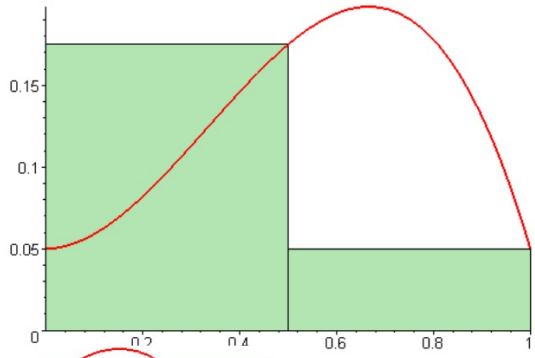
In the branch of mathematics known as real analysis, the **Riemann integral**, created by Bernhard Riemann, was the first rigorous definition of the integral of a function on an interval.[1] For many functions and practical applications, the Riemann integral can be evaluated by the fundamental theorem of calculus or approximated by numerical integration.

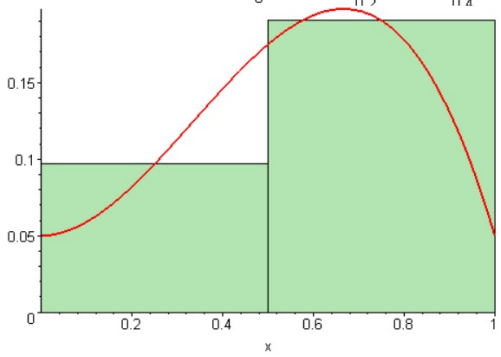
Visuals of Riemann Sums



http://webspace.ship.edu/msrenault/GeoGebraCalculus/integration_riemann_sum.html

CIM





MRAM

Cleaned up version on next pg

Staple to notes

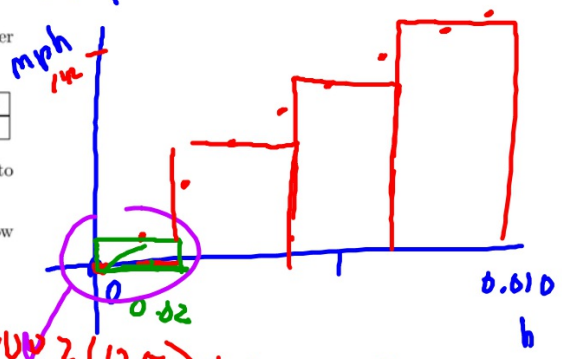
921. The table shows the velocity of a vintage sports car accelerating from 0 to 142 miles per hour in 36 seconds (0.01 hours).

hours	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	0.010
mph	0	40	62	82	96	108	116	125	132	137	142

midpoint

a) Use a Riemann sum to estimate how far the car traveled during the 36 seconds it took to reach 142 mph.

b) Roughly how many seconds did it take the car to reach the halfway point? About how fast was the car going then?

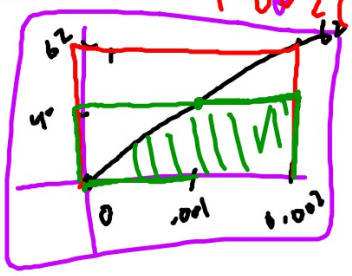


Base: height

$0.002 \cdot 40 + 0.002 \cdot 82 + 0.002(108) + 0.002(125) + 0.002(137)$

Δx $f(\text{Midpoint})$

one rectangle



Midpoint Riemann Sum with a table

921. The table shows the velocity of a vintage sports car accelerating from 0 to 142 miles per hour in 36 seconds (0.01 hours).

hours	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	0.010
mph	0	40	62	82	96	108	116	125	132	137	142

midpoint

a) Use a Riemann sum to ~~estimate how far the car traveled during the 36 seconds~~ it took to reach 142 mph.

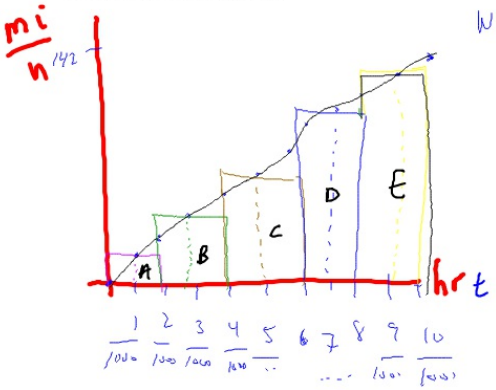
b) Roughly how many seconds did it take the car to reach the halfway point? About how fast was the car going then?

If we use 5 intervals, midpoint will be easy to find.

f(mid points)

each interval's width is 0.002 seconds long (base of rectangle

$$\sum \underbrace{0.002}_{\Delta t} \cdot f(\text{midpoint of each interval})$$



Width of intervals

Area of A: Area of B C D E

$0.002 \text{ hr} \cdot [40 \text{ mi/hr}] + 0.002[82] + 0.002(108) + 0.002(125) + 0.002(137)$

base · height

Since Δx is all 0.002, can factor that out!

$$0.002(40 + 82 + 108 + 125 + 137)$$

$$0.002(492) \text{ mi/hr}$$

0.984 miles

921. The table shows the velocity of a vintage sports car accelerating from 0 to 142 miles per hour in 36 seconds (0.01 hours).

hours	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	0.010
mph	0	40	62	82	96	108	116	125	132	137	142

midpoint

a) Use a Riemann sum to estimate how far the car traveled during the 36 seconds it took to reach 142 mph.

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$\frac{0.984}{2} = 0.492$ miles

Distance = time · rates

$\frac{0.492}{.002} = \frac{.002(\sum f(\quad))}{.002}$

$246 = \sum f(\text{midpoints})$

$40+82+108 < 230$

$40+82+108+125 < 355$

So, between 0.005 hr and 0.007 hr

probably 0.006 hr

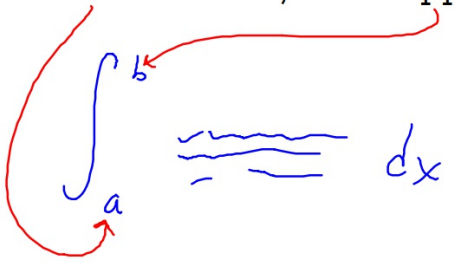
$0.006 \text{ hr} \cdot \frac{3600 \text{ sec}}{1 \text{ hr}} = 21.6 \text{ sec}$

Area under derivative gives anti-derivative

http://webspace.ship.edu/msrenault/GeoGebraCalculus/integration_area_function.html

Calculator Methods

- put function you want definite integral of in y1
- graph it
- 2nd TRACE (calc menu) choice 7 is definite integral
- enter lower bound, enter upper bound, hit enter



Can you make the calculator give you a negative answer?

either use:
- area below x-axis
- invert bounds so that $a > b$

$$\int_0^3 e^x \cdot dx = 19.\ldots$$

$$e^3 - e^0 = e^3 - 1$$

$$\int_a^b f(x)\,dx$$

Practice with both Riemann Sums and Definite Integration

Back of snowfall handout from Wednesday

(Just like hw due today)

Back of stapled packet from last Friday

See mcalc. videos

Integrals Test Study Guide

→ letter answers on mcalc.weebly.com.

HW due ~~Wed~~ Fri.

p. 274:

#47

p. 288

#5-30 (x3), 67