WARM UP

1. $\displaystyle\int \sec\theta(\tan\theta - \sec\theta)\ d\theta$

2. Find the value of $f(-1)$ when $f'(x) = 6xe^{-2x^2}$, $f(0) = 1$.

(A) $\frac{5}{2} - \frac{3}{2}e^{-2}$ (B) $-\frac{3}{2}e^{2}$ (C) $-\frac{3}{2}e^{-2}$

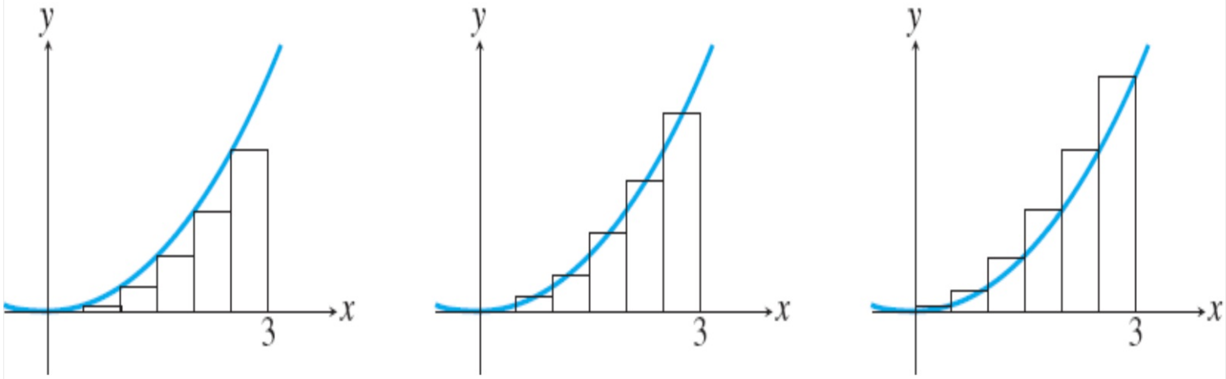
(D) $\frac{5}{2} - \frac{3}{2}e^{2}$ (E) $\frac{5}{2} + \frac{3}{2}e^{-2}$

Riemann Sums and Trapezoid Approximation

Objective:

- Approximate definite integrals using the Rectangular Approximation Method (RAM) - also known as Riemann Sums.
- Approximate definite integrals using trapezoids.

Rectangular Approximation Methods (RAM)



Example 1: If f(x) is a continuous function such that f(x) $\geq$ 0 for x, given selected values of f below. Use three equal intervals to approximate the given integral.

$$\int_0^3 f(x)\,dx$$

x		0	0.5	1	1.5	2	2.5	3
$f(x)$		2	4	6	7	4	1	5

A. Midpoint (MRAM)

B. Right Endpoint (RRAM)

Example 2: Approximate the integral using LRAM with 3 intervals.

$$\int_{1}^{4} (x^2 - 3x + 4)dx$$

Example 3: A car comes to stop 5 seconds after the driver slams on the brakes. While the brakes are on, the following velocities are recorded. Estimate the total distance the car took to stop. RRAM

Time since brakes applied (sec)	0	2	3	5	6.5	7
Velocity (ft/sec)	88	60	40	25	10	0

If a function is increasing, then

RRAM will ________ the area and

LRAM will ________ the area.

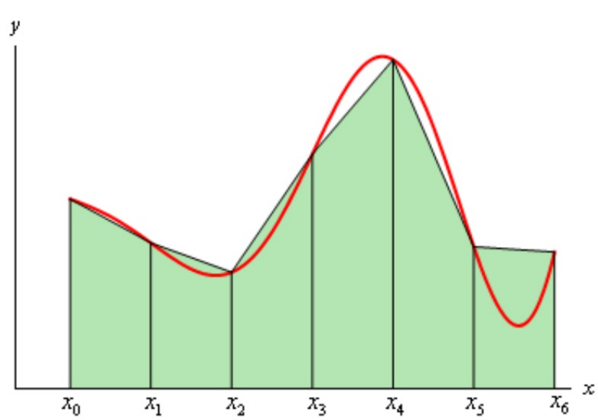
If a function is decreasing, then

RRAM will _________the area and

LRAM will _________the area

The trapezoid rule uses trapezoid, instead of rectangles, to approximate the area under the curve.

$$A = \frac{1}{2}h(a + b)$$



Example 4: Use the trapezoid rule to approximate the definite integral. Use as many intervals as the data allows.

x	1	2.5	4	6	8	8.8	9.6	10.4
$f(x)$	4	3	1	3	5	6	4	7

$$\int_{1}^{9.6} f(x)\,dx$$

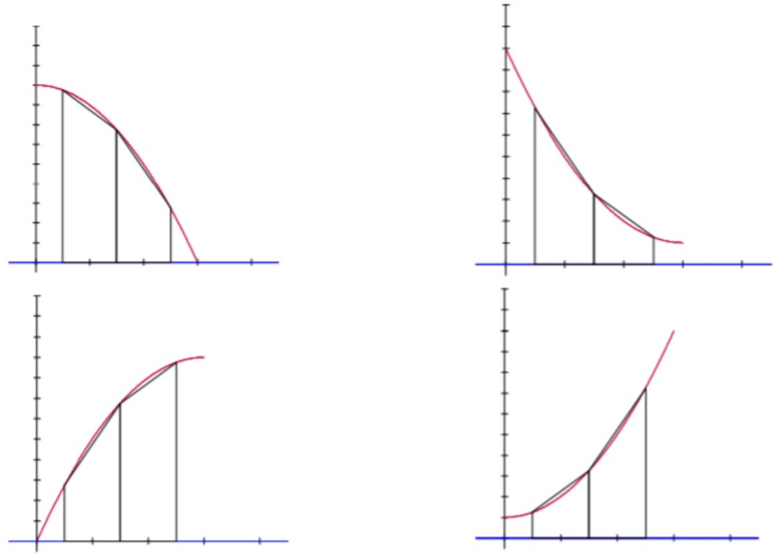
Ex. 5: FRQ - 2006

t (seconds)	0	10	20	30	40	50	60	70	80
$v(t)$ (feet per second)	5	14	22	29	35	40	44	47	49

A rocket has positive velocity *v(t)* after being launched upward from an initial height of 0 feet at time *t* = 0.

A. Using correct units, explain the meaning $\int_{10}^{60} v(t)dt$ in terms of the rocket's flight. Use trapezoid method with 5 intervals to approximate $\int_{10}^{60} v(t)dt$

Overestimate or Underestimate?



Riemann Sums were based on whether *f(x)* was increasing/decreasing. Trapezoids are based on the concavity of *f(x)*.