DATE: _____

AP Riemann Problems

x	1	3	5	7	9
$h(x)$	2	3	3	4	5

1. Using the table of values shown above for the continuous function $h(x)$, which of the following is the approximation of the area under the curve $h(x)$ using midpoint sum with 2 equal subintervals?

(A) 34 **(B)** 30 **(C)** 28 **(D)** 27 **(E)** 24

$\Delta x = \frac{b-a}{n} = \frac{9-1}{2} = 4$

Area $\approx 4(3) + 4(4)$

$\approx 12 + 16$

Area ≈ 28

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2. The rate R at which a solar panel delivers electricity is a differentiable function of time t. The table below shows a sample of these rates, which can be modeled as a strictly increasing function on $4 \le t \le 16$, over an 18-hour period. Use a right Riemann sum with 6 equal subdivisions to approximate the number of amps delivered by the panel from $t = 4$ to $t = 16$. Is this approximation an overestimate or underestimate of the actual number of amps?

inc, rightsum

$\Delta t = \frac{16-4}{6} = 2$

t (hours)	4	6	8	10	12	14	16	~~18~~	~~20~~	~~22~~
$R(t)$ (amps/hour)	36	78	160	240	320	350	360	~~320~~	~~240~~	~~160~~

R

hrs amp/hr

#amps $\approx 2(360 + 350 + 320 + 240 + 160 + 78)$

$\approx 2(1508)$

#amps ≈ 3016 amps

Approximation is an overestimate of actual # of amps b/c $R(t)$ is increasing.

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3. Suppose the graph of f is decreasing on $a \le x \le b$. Then, using the same number of subdivisions, and with L, R, and M denoting, respectively, left, right and midpoint Riemann sums, it follows that:

(A) $R \le M \le L$ **(B)** $R \le L \le M$ **(C)** $L \le M \le R$ **(D)** $L \le R \le M$ **(E)** none of these

f is dec → Left over
Right under
Midpt in btn

Since f is dec on $[a,b]$, LeftSum is an overestimate of actual area on $[a,b]$
and RightSum is an underestimate
and Midpt Sum is btn LeftSum and RightSum