Reimann Sums HWK name ____________________

1) Which of the following is the midpoint Riemann sum approximation of $\int_4^6 \sqrt{x^3+1}\,dx$ using 4 subintervals of equal width?

A $\frac{1}{4}\left(\sqrt{4.25^3+1}+\sqrt{4.75^3+1}+\sqrt{5.25^3+1}+\sqrt{5.75^3+1}\right)$

B $\frac{1}{2}\left(\sqrt{4.25^3+1}+\sqrt{4.75^3+1}+\sqrt{5.25^3+1}+\sqrt{5.75^3+1}\right)$

C $\frac{1}{4}\left(\frac{\sqrt{4^3+1}+\sqrt{4.5^3+1}}{2}+\frac{\sqrt{4.5^3+1}+\sqrt{5^3+1}}{2}+\frac{\sqrt{5^3+1}+\sqrt{5.5^3+1}}{2}+\frac{\sqrt{5.5^3+1}+\sqrt{6^3+1}}{2}\right)$

D $\frac{1}{2}\left(\frac{\sqrt{4^3+1}+\sqrt{4.5^3+1}}{2}+\frac{\sqrt{4.5^3+1}+\sqrt{5^3+1}}{2}+\frac{\sqrt{5^3+1}+\sqrt{5.5^3+1}}{2}+\frac{\sqrt{5.5^3+1}+\sqrt{6^3+1}}{2}\right)$

2) Approximate the area of the region bounded by f(x) from x = 2 to x = 18 using 6 subintervals as indicated in the chart. Assume the function is an increasing function.

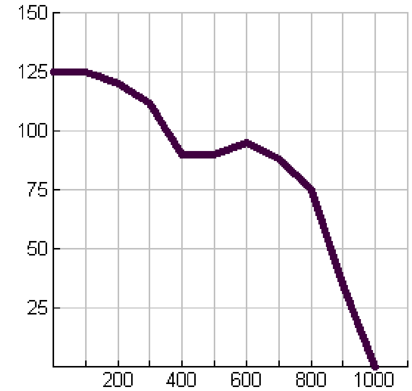
x	2	5	9	12	14	17	18
f(x)	0	2	6	9	13	18	21

a) Left Riemann sum:

b) Right Riemann sum:

c) Trapezoid sum:

3) Use the graph and chart to the right.



x	y
0	125
100	125
200	120
300	112
400	90
500	90
600	95
700	88
800	75
900	35
1000	0

a) Estimate the area using right Riemann sums with 5 equal width rectangles.

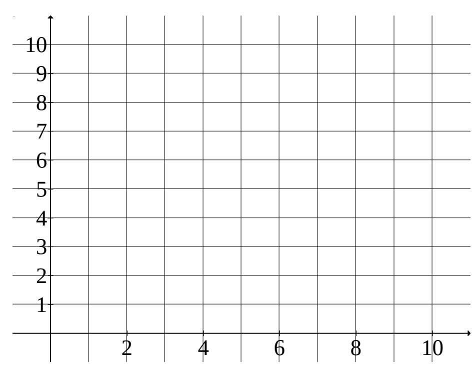
b) Estimate the area using left Riemann sums with 5 equal width rectangles.

c) Estimate the area using midpoint Riemann sums with 5 subintervals of equal length.

d) Estimate the area using the Trapezoid Rule with 5 intervals of equal length.

4) You jump out of an airplane. Before your parachute opens you fall faster and faster, but your acceleration decreases as you fall because of air resistance. The table below gives your acceleration in m/sec^2 after t seconds.

Time (sec)	0	2	4	6	8	10
Acceleration (m/sec^2)	9.81	8.03	6.53	5.38	4.41	3.61



a. Give upper and lower estimates of your speed at t=10 (use Δt=2).

b. Use the trapezoid method to estimate your speed at t=10. What does the concavity of the graph of acceleration tell you about your estimate?

5) In order to determine the average temperature for the day, a meteorologist decides to record the temperature at eight times during the day. She further decides that these recordings do not have to be equally spaced during the day because she does not need to make several readings during those periods when the temperature is not changing much (as well as not wanting to get up in the middle of the night.) She decides to make one reading at some time during each of the intervals in the table below.

Time	12AM-5AM	5AM-7AM	7AM-9AM	9AM-1PM	1PM-4PM	4PM-7PM	7PM-9PM	9PM-12AM
Temp	42°	57°	72°	84°	89°	75°	66°	52°

a. Using a Riemann sum, calculate the average temperature for the day.

6)

x	0	a^2	$3a$	$6a$	$7a$
$f(x)$	1	-1	-3	-7	-9

The continuous function f is decreasing for all x. Selected values of f are given in the table above, where a is a constant with $0 < a < 3$. Let R be the right Riemann sum approximation for $\int_0^{7a} f(x)\, dx$ using the four subintervals indicated by the data in the table. Which of the following statements is true?

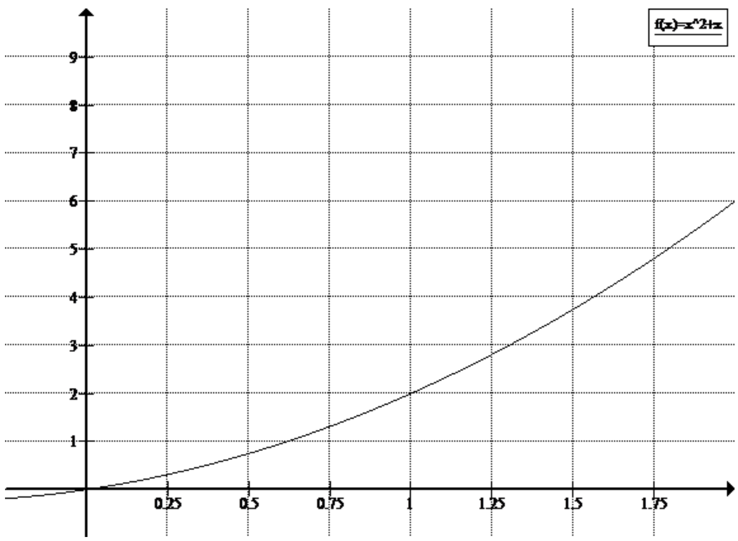
A $R = (a^2 - 0) \cdot 1 + (3a - a^2) \cdot (-1) + (6a - 3a) \cdot (-3) + (7a - 6a) \cdot (-7)$ and is an underestimate for $\int_0^{7a} f(x)\, dx$

B $R = (a^2 - 0) \cdot 1 + (3a - a^2) \cdot (-1) + (6a - 3a) \cdot (-3) + (7a - 6a) \cdot (-7)$ and is an overestimate for $\int_0^{7a} f(x)\, dx$

C $R = (a^2 - 0) \cdot (-1) + (3a - a^2) \cdot (-3) + (6a - 3a) \cdot (-7) + (7a - 6a) \cdot (-9)$ and is an underestimate for $\int_0^{7a} f(x)\, dx$

D $R = (a^2 - 0) \cdot (-1) + (3a - a^2) \cdot (-3) + (6a - 3a) \cdot (-7) + (7a - 6a) \cdot (-9)$ and is an overestimate for $\int_0^{7a} f(x)\, dx$

7) Let $f(x)=x^2+x$. Consider the region bounded by the graph of f, the x-axis and the line x=2. Divide the interval [0,2] into 4 equal subintervals.



a. Obtain a lower estimate for the area of the region by using left endpoints.

b. Obtain an upper estimate by using right endpoints.

c. Find an approximation for the area using trapezoids. Is your estimate too big or too small. Why?

d. Obtain an estimate for the area using midpoints.