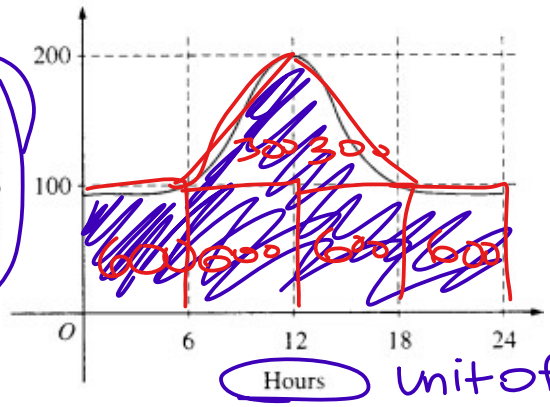
Reimman Sum and Average Value Practice

Name

1.



The flow of oil, in barrels per hour, through a pipeline on July 9 is given by the graph shown above. Of the following, which best approximates the total number of barrels of oil that passed through the pipeline that day?

(A) 500

(B) 600

(C) 2,400

(D) 3,000

(E) 4,800

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2. Let f be the function given by $f(x) = 9^x$. If four subintervals of equal length are used, what is the value of the right Riemann sum approximation for $\int_0^2 f(x)\,dx$?

x	0	$\frac{1}{2}$	1	$\frac{3}{2}$	2
y	$9^0 = 1$	$9^{\frac{1}{2}} = 3$	$9^1 = 9$	$9^{\frac{3}{2}} = 27$	$9^2 = 81$

Reimman Sum and Average Value Practice

(A) 20

(B) 40

(C) 60

(D) 80

(E) 120

$\left(\frac{1}{2}\right)(3)+\frac{1}{2}(9)+\frac{1}{2}(27)$

$+\frac{1}{2}(81)$

$\frac{1}{2}(90+30)=\frac{1}{2}(126)=60$

3.

x	2	3	5	8	13
$f(x)$	6	−2	−1	3	9

The function f is continuous on the closed interval [2,13] and has values as shown in the table above. Using the intervals [2,3], [3,5], [5,8], and[8,13] what is the approximation of $\int_2^{13} f(x)\ dx$ obtained from a left Riemann sum?

(A) 6

(B) 14

(C) 28

(D) 32

(E) 50

$(1)(6)\rightarrow 6$

$+$

$(2)(-2)\rightarrow -4$

$+$

$(3)(-1)\rightarrow -3$

$+$

$(5)(3)\rightarrow 15$

14

Reimman Sum and Average Value Practice

4. $\int_0^{10} \text{Level}$ / $10-0$

Time (weeks)	0	2	6	10
Level	210	200	190	180

The table above gives the level of a person's cholesterol at different times during a 10-week treatment period. What is the average level over this 10-week period obtained by using a trapezoidal approximation with the subintervals [0, 2], [2, 6], and [6, 10] ?

(A) 188

(B) 193

(C) 195

(D) 198

$\frac{1}{10-10}\int_0^{10} \text{Level} \approx \frac{1}{2}(210+200)(2) = 410$

$+\frac{1}{2}(200+190)(4) = 390\times 2 = 780$

$+\frac{1}{2}(190+180)(4) = 370\times 2 = 740$

1930

$\frac{1}{10}(1930) = 193$

5. liters / hr $\times$ hr

t (hours)	4	7	12	15
$R(t)$ (liters/hour)	6.5	6.2	5.9	5.6

A tank contains 50 liters of oil at time $t = 4$ hours. Oil is being pumped into the tank at a rate $R(t)$, where $R(t)$ is measured in liters per hour, and t is measured in hours. Selected values of $R(t)$ are given in the table above. Using a right Riemann sum with three subintervals and data from the table, what is the approximation of the number of liters of oil that are in the tank at time $t = 15$ hours?

$\int_4^{15} R(t)\,dt \rightarrow$ accumulation of liters from 4 to 15

$(3)(6.2) + (5)(5.9) + (3)(5.6)$

$18.6 + 29.5 + 16.8$

29.5

16.8

64.9

(64.9) change from $t = 4$ to $t = 15$

Reimman Sum and Average Value Practice

(A) 64.9

(B) 68.2

(C) 114.9

(D) 116.6

(E) 118.2

$\#$ Liters at 15 $= L(4) + \int_4^{15} R(t)\,dt$

6.

x	0	2	4	6
$f(x)$	4	k	8	12

The function f is continuous on the closed interval [0,6] and has the values given in the table above. The trapezoidal approximation for $\int_0^6 f(x)dx$ found with 3 subintervals of equal length is 52. What is the value of k ?

(A) $52 = \left(\frac{1}{2}\right)(4+k)(2) + \frac{1}{2}(k+8)(2) + \frac{1}{2}(8+12)(2)$

(B) 6

$52 = 4+k+k+8+20$

(C) 7

$52 = 32+2k$
$-32 \quad -32$

(D) 10

$\frac{20}{2} = \frac{2k}{2}$

(E) 14

$k = 10$

Reimman Sum and Average Value Practice

7.

x	0	1	2	3	4	5	6
$f(x)$	0	5	2	−1	−2	0	3

The function f is continuous on the closed interval [0, 6] and has values as shown in the table above. Using the intervals [0,2], [2,4], and [4,6], what is the approximation of $\int_0^6 f(x)dx$ obtained from a midpoint Riemann sum? base x height

$(2)(5)+(2)(-1)+(2)(0)$

$10 + -2 + 0$

(A) 0

(B) 3

(C) 4

(D) 6

(E) 8

8.

Which of the following limits is equal to $\int_2^5 x^2\,dx$?

$\Delta x = 5-2 = 3$

n (infinite) rectangles $\frac{3}{n}$

(A) $\lim_{x\to\infty}\sum_{k=1}^{n}\left(2+\frac{k}{n}\right)^2\frac{1}{n}$

(B) $\lim_{x\to\infty}\sum_{k=1}^{n}\left(2+\frac{k}{n}\right)^2\frac{3}{n}$

(C) $\lim_{x\to\infty}\sum_{k=1}^{n}\left(2+\frac{3k}{n}\right)^2\frac{1}{n}$

(D) $\lim_{x\to\infty}\sum_{k=1}^{n}\left(2+\frac{3k}{n}\right)^2\frac{3}{n}$

Reimman Sum and Average Value Practice

9. Which of the following is a left Riemann sum approximation of $\int_1^7 (4\ln x + 2)\,dx$ with n subintervals of equal length?

(A) $\sum_{k=1}^{n} \left(4\ln\left(1+\frac{k-1}{n}\right)+2\right)\frac{1}{n}$

(B) $\sum_{k=1}^{n} \left(4\ln\left(\frac{6k}{n}\right)+2\right)\frac{6}{n}$

(C) $\sum_{k=1}^{n} \left(4\ln\left(1+\frac{6(k-1)}{n}\right)+2\right)\frac{6}{n}$

(D) $\sum_{k=1}^{n} \left(4\ln\left(1+\frac{6k}{n}\right)+2\right)\frac{6}{n}$

10. Which of the following is a left Riemann sum approximation of $\int_2^8 \cos\left(x^2\right)\,dx$ with n subintervals of equal length?

(A) $\sum_{k=1}^{n} \left(\cos\left(2+\frac{k-1}{n}\right)^2\right)\frac{1}{n}$

(B) $\sum_{k=1}^{n} \left(\cos\left(\frac{6k}{n}\right)^2\right)\frac{6}{n}$

(C) $\sum_{k=1}^{n} \left(\cos\left(2+\frac{6(k-1)}{n}\right)^2\right)\frac{6}{n}$

(D) $\sum_{k=1}^{n} \left(\cos\left(2+\frac{6k}{n}\right)^2\right)\frac{6}{n}$

11. Which of the following definite integrals are equal to $\lim_{n\to\infty} \sum_{k=1}^{n} \sin\left(-1+\frac{5k}{n}\right)\frac{5}{n}$?

1. $\int_{-1}^{4} \sin x\,dx$
2. $\int_{0}^{5} \sin(-1+x)\,dx$
3. $5\int_{0}^{1} \sin(-1+5x)\,dx$

Reimman Sum and Average Value Practice

(A) I only

(B) II only

(C) III only

(D) I, II, and III

* I & II

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12. For a certain continuous function f, the right Riemann sum approximation of $\int_0^2 f(x)\,dx$ with n subintervals of equal length is $\frac{2(n+1)(3n+2)}{n^2}$ for all n. What is the value of $\int_0^2 f(x)\,dx$?

(A) 2

(B) 6

(C) 12

(D) 20

$\lim_{n\to\infty} \frac{2(n+1)(3n+2)}{n^2}$

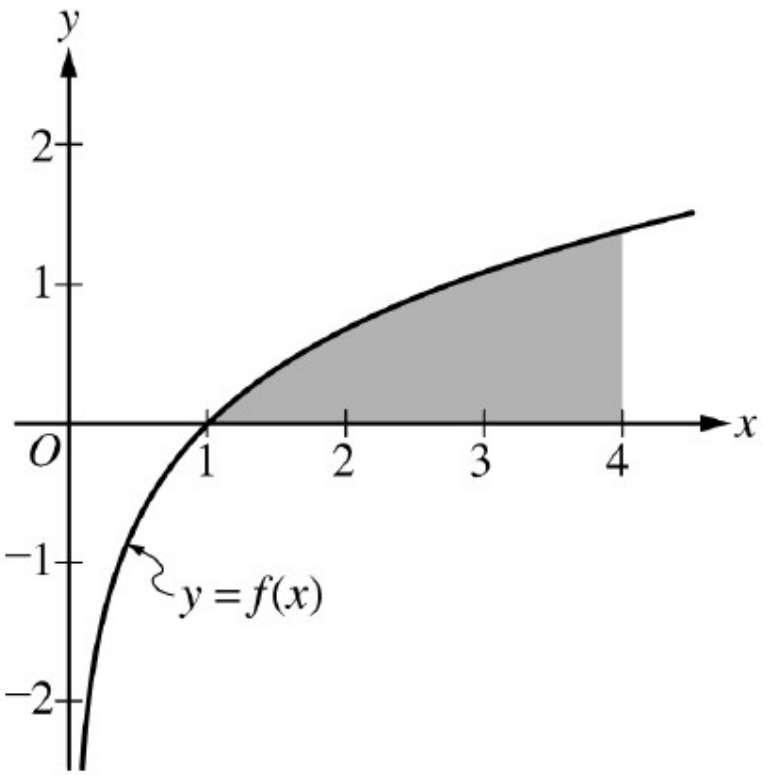
$3n^2 \to \times 2 = 6n^2$

$\frac{6n^2}{n^2} = 6$

EBM

Reimman Sum and Average Value Practice

13.



The function f is given by $f(x) = \ln x$. The graph of f is shown above. Which of the following limits is equal to the area of the shaded region?

A $\lim_{x\to\infty} \sum_{k=1}^{n} \left(1 + \ln\left(\frac{3k}{n}\right)\right) \frac{3}{n}$

B $\lim_{x\to\infty} \sum_{k=1}^{n} \ln\left(1 + \left(\frac{3k}{n}\right)\right) \frac{3}{n}$

C $\lim_{x\to\infty} \sum_{k=1}^{n} \ln\left(\frac{4}{n}\right)\left(1 + \frac{4k}{n}\right)$

D $\lim_{x\to\infty} \sum_{k=1}^{n} \ln\left(1 + \frac{4k}{n}\right)\left(\frac{4}{n}\right)$

$\int_1^4 \ln x \, dx$