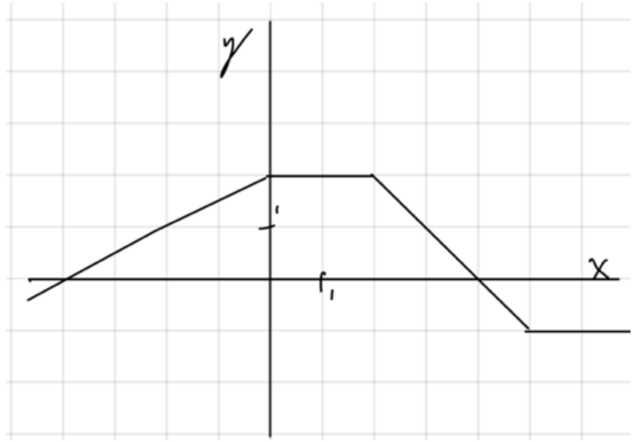
(1) Consider the function graphed below.



(a) Evaluate $\int_{-4}^{6} f(x)\, dx$

(b) Evaluate $\int_{6}^{-4} f(x)\, dx$

(c) Write a left Riemann sum with $n = 5$ subdivisions for $\int_{-4}^{6} f(x)\, dx$

(d) Wrie a Riemann sum using midpoints with $n = 5$ subdivisions for $\int_{-4}^{6} f(x)\, dx$ subdivisions.

(2) Consider the integral

$$\int_{-2}^{2} \frac{1}{1+x^2}\, dx$$

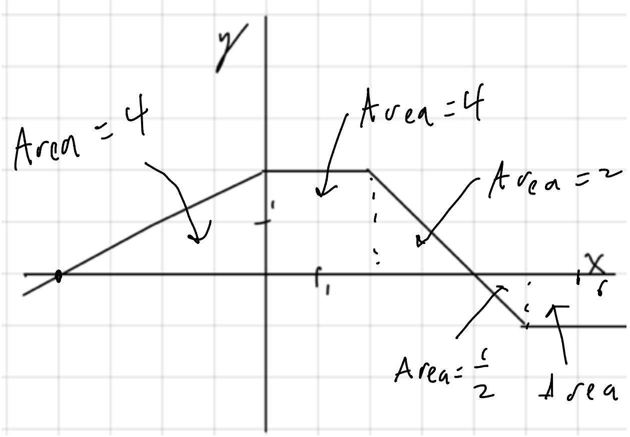
(a) Write out the Riemann sum with $n = 8$ subdiisions using left sample points for the above integral. You do not need to evaluate or simplify the sum. ~~Is this sum greater than or less than the integral?~~

(b) Write out the Riemann sum with $n = 8$ subdiisions using right sample points for the above integral. You do not need to evaluate or simplify the sum. ~~Is this sum greater than or less than the integral?~~

(c) Write out the Riemann sum with $n = 8$ subdiisions using midpoint sample points for the above integral. You do not need to evaluate or simplify the sum.

(d) Write out the limit definiion for the above integral. You may use left or right hand sums, whichever you like.

(1) Consider the function graphed below.



(a) Evaluate $\int_{-4}^{6} f(x)\,dx$

$$4+4+2-\tfrac{1}{2}-1 = 8\tfrac{1}{2}$$

(b) Evaluate $\int_{6}^{-4} f(x)\,dx$

$$-8\tfrac{1}{2}$$

(c) Write a left Riemann sum with $n=5$ subdivisions for $\int_{-4}^{6} f(x)\,dx$

$\Delta x = \frac{10}{5} = 2$

$$(0+1+2+2+0)2 = 10$$

$-4 \quad -2 \quad 0 \quad 2 \quad 4 \quad 6$

$-3 \quad -1 \quad 1 \quad 3 \quad 5$

(d) Write a Riemann sum using midpoints with $n=5$ subdivisions for $\int_{-4}^{6} f(x)\,dx$ subdivisions.

$$\left(\tfrac{1}{2}+1\tfrac{1}{2}+2+1-1\right)2 = 8$$

(2) Consider the integral

$$\int_{-2}^{2} \frac{1}{1+x^2}\,dx$$

(a) Write out the Riemann sum with $n=8$ subdiisions using left sample points for the above integral. You do not need to evaluate or simplify the sum. ~~Is this sum greater than or less than the integral?~~

$$\left(\frac{1}{1+(-2)^2}+\frac{1}{1+(-1.5)^2}+\frac{1}{1+(-1)^2}+\frac{1}{1+(-0.5)^2}+\frac{1}{1+0^2}+\frac{1}{1+(0.5)^2}+\frac{1}{1+1^2}+\frac{1}{1+(1.5)^2}\right)\cdot\frac{1}{2}$$

(b) Write out the Riemann sum with $n=8$ subdiisions using right sample points for the above integral. You do not need to evaluate or simplify the sum. ~~Is this sum greater than or less than the integral?~~

$$\left(\frac{1}{1+(-1.5)^2}+\frac{1}{1+(-1)^2}+\frac{1}{1+(-0.5)^2}+\frac{1}{1+0^2}+\frac{1}{1+0.5^2}+\frac{1}{1+1^2}+\frac{1}{1+1.5^2}+\frac{1}{1+2^2}\right)\cdot\frac{1}{2}$$

(c) Write out the Riemann sum with $n=8$ subdiisions using midpoint sample points for the above integral. You do not need to evaluate or simplify the sum.

$$\left(\frac{1}{1+(-1.75)^2}+\frac{1}{1+(-1.25)^2}+\frac{1}{1+(-.75)^2}+\frac{1}{1+(-.25)^2}+\frac{1}{1+.25^2}+\frac{1}{1+.75^2}+\frac{1}{1+1.25^2}+\frac{1}{1+1.75^2}\right)\cdot\frac{1}{2}$$

(d) Write out the limit definiion for the above integral. You may use left or right hand sums, whichever you like.

$$\Delta x = \frac{2-(-2)}{n} = \frac{4}{n}$$

$$\lim_{n\to\infty}\sum_{k=1}^{n}\left(\frac{1}{1+\left(-2+\frac{4k}{n}\right)^2}\right)\frac{4}{n}$$

$$x_k = -2 + k\Delta x = -2 + k\frac{4}{n}$$

$$\sum_{k=0}^{n-1} a_k = \sum_{k=1}^{n} a_{k-1}$$

(3) A bicycle travels along a straight road. Let

$$p(t) = \text{The position of the bicycle (in feet) at time } t \text{ (in seconds)}$$
$$v(t) = \text{The velocity of the bicycle (in feet/sec) at time } t \text{ (in seconds)}$$

(a) Suppose $\int_{30}^{60} v(t)\, dt = 400$. What does this mean? Give a complete sentence using units as appropriate.

(b) Suppose $p(20) = 200$. What does this mean? Give a complete sentence using units as appropriate.

(c) Suppose $p(40) - p(10) = 300$.What does this mean? Give a complete sentence using units as appropriate.

(d) Write an expression using the function $p(t)$ (and no other variables) that represents the displacement of the bike from $t = 20$ seconds to $t = 30$ seconds.

(e) Write an expression using the function $v(t)$ (and no other variables) that represents the displacement of the bike from $t = 20$ seconds to $t = 30$ seconds.

(4) Water flows into a pool. We have

$f(t) =$ The rate at which water flows into the pool (in gallons/minute) at time t (in minutes)

A table of values for $f(t)$ is given below:

t	0	2	4	6	8	10	12	14	16
$f(t)$	0.5	1	2	3.5	4.5	5	5.5	6.5	7

Write a Riemann sum with $n = 6$ subdivisions using left sample points estimating the amount of water that flowed into the pool from $t = 2$ minutes to $t = 14$ minutes. You do not need to evaluate or simplify your sum.

(5) Suppose

$$f(t) = \text{The rate the temperature is increasing (in}^\circ\text{F/hour) at time } t$$

Where t here represents the number of hours after midnight. So for example, $f(8) = 1.2$ means that at 8:00 AM, the temperature is increasing at a rate of 1.2 $^\circ F$/hour. What does

$$\int_6^{10} f(t)\, dt$$

represent? Answer in english, giving units as appropriate.

(3) A bicycle travels along a straight road. Let

$$p(t) = \text{The position of the bicycle (in feet) at time } t \text{ (in seconds)}$$
$$v(t) = \text{The velocity of the bicycle (in feet/sec) at time } t \text{ (in seconds)}$$

(a) Suppose $\int_{30}^{60} v(t)\, dt = 400$. What does this mean? Give a complete sentence using units as appropriate.

The displacement of the bicycle from 30 seconds to 60 seconds is 400ft

(b) Suppose $p(20) = 200$. What does this mean? Give a complete sentence using units as appropriate.

The position of the bicycle at 20 seconds is 200ft.

(c) Suppose $p(40) - p(10) = 300$.What does this mean? Give a complete sentence using units as appropriate.

The displacement of the bicycle from 10 seconds to 40 seconds is 300ft.

(d) Write an expression using the function $p(t)$ (and no other variables) that represents the displacement of the bike from $t = 20$ seconds to $t = 30$ seconds.

$p(30) - p(20)$

(e) Write an expression using the function $v(t)$ (and no other variables) that represents the displacement of the bike from $t = 20$ seconds to $t = 30$ seconds.

$\int_{20}^{30} v(t)\, dt$

(4) Water flows into a pool. We have

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Write a Riemann sum with $n = 6$ subdivisions using left sample points estimating the amount of water that flowed into the pool from $t = 2$ minutes to $t = 14$ minutes. You do not need to evaluate or simplify your sum.

$\Delta t = \frac{14-2}{6} = 2$

$(1 + 2 + 3.5 + 4.5 + 5 + 5.5) \cdot 2$

(5) Suppose

$$f(t) = \text{The rate the temperature is increasing (in°F/hour) at time } t$$

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represent? Answer in english, giving units as appropriate.

The net amount the temperature increased in °F from 6:00 AM to 10:00 AM