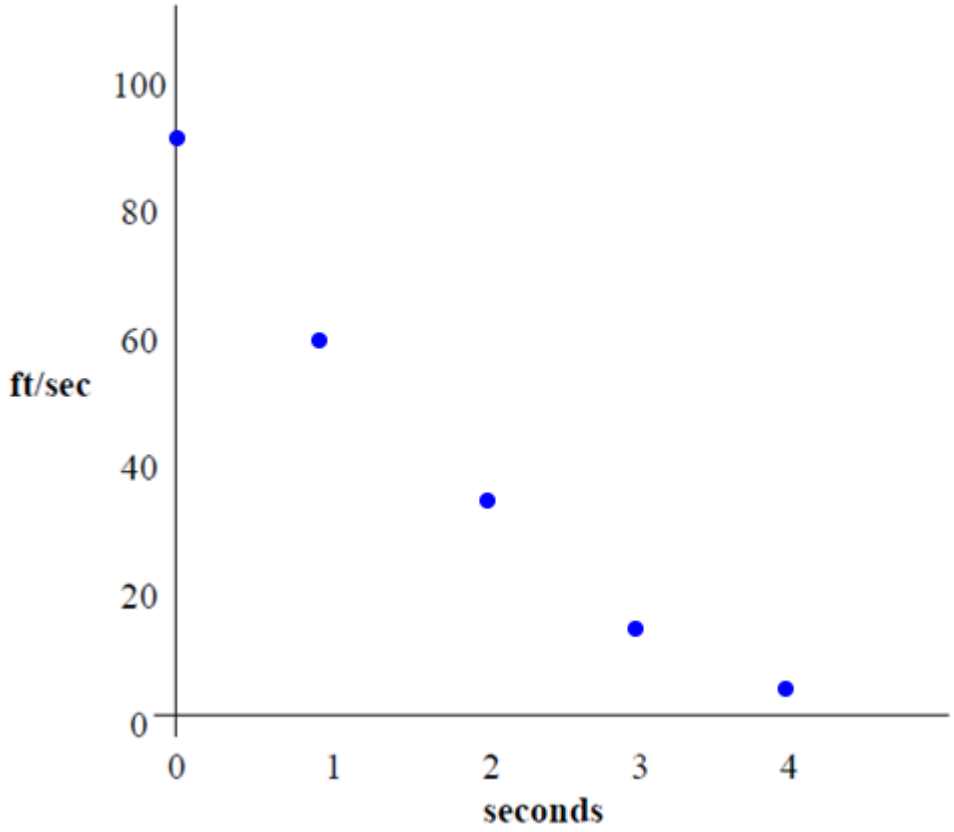
Applications of the Definite Integral

Distance from Velocity Application

The velocity of a car while stopping is measured at one-second intervals: the results are given in the following table. Graph each as ordered pairs (velocity over time) and connect to create a curve for the velocity function.

Time(sec)	0	1	2	3	4
Velocity(ft/sec)	90	60	35	15	5

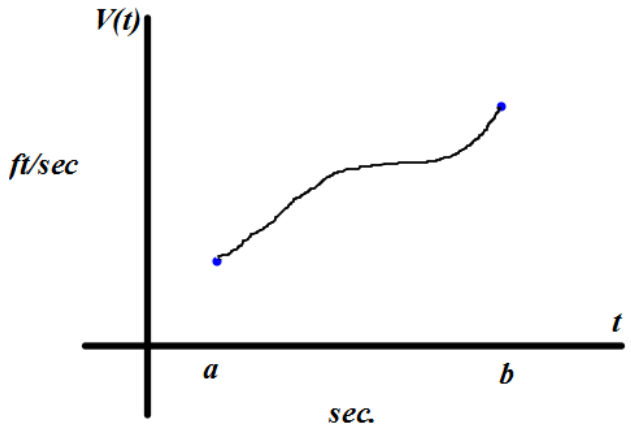


Find an estimate for the area under the curve using a left and right approximation for this region. What have you found? Label your answer!

AP Application of finding integrals

In general, when a rate of change function is given and graphed over time, the integral gives us TOTAL ACCUMULATION. Hint: multiply units(since finding area results in multiplication) from the y-axis with those from the x-axis to see "what is accumulating"

EX:



$\int_a^b V(t)dt$ gives the total feet traveled from a to b

AP APPLICATION OF AN OBJECT IN MOTION

Use your graphing calculator to help answer the following questions.

If $V(t)=3t^2-12t+9$ represents the ***velocity*** of an object(in ft/sec) moving left and right whose original position is the origin.

A) What is the position of the object(with respect to the origin) after 5 seconds?

B) How far total has the object travelled during the 5 seconds?

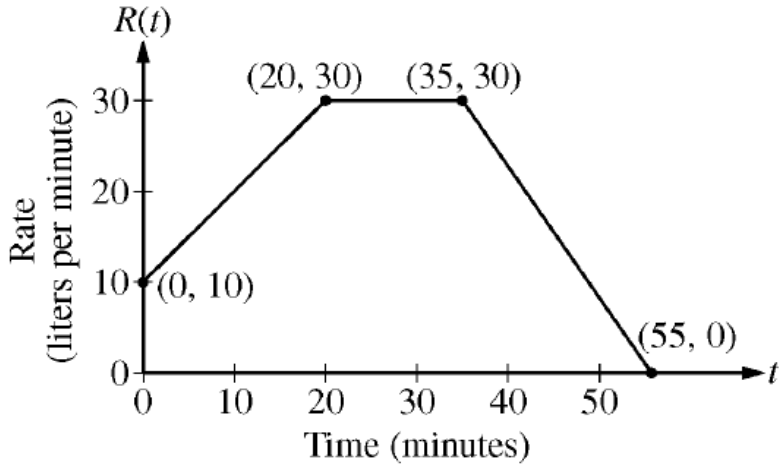
AP APPLICATION FOR ACCUMULATION OF VARIABLE FUNCTIONS

A hive contains 35 hundred bees at time $t = 0$. During the time interval $0 \le t \le 4$ hours, bees enter the hive at a rate modeled by $E(t) = 16t - 3t^2$, where $E(t)$ is measured in hundreds of bees per hour. During the same time interval, bees leave the hive at a rate modeled by $L(t) = -2t + 15$, where $L(t)$ is measured in hundreds of bees per hour.

(a) How many bees leave the hive during the time interval $0 \le t \le 2$?

(b) Write an expression involving one or more integrals for the total number of bees, in hundreds, in the hive at time t for $0 \le t \le 4$. Find the total number of bees in the hive at $t = 4$.

AP APPLICATION FOR ACCUMULATION OF A GRAPHICAL FUNCTION



At time $t = 0$ minutes, a tank contains 100 liters of water. The piecewise-linear graph above shows the rate $R(t)$, in liters per minute, at which water is pumped into the tank during a 55-minute period.

Use the graph to answer the following question

(a) How many liters of water have been pumped into the tank from time $t = 0$ to time $t = 55$ minutes? Show the work that leads to your answer.

(b) How many liters of water are in the tank at the 30 minute mark?

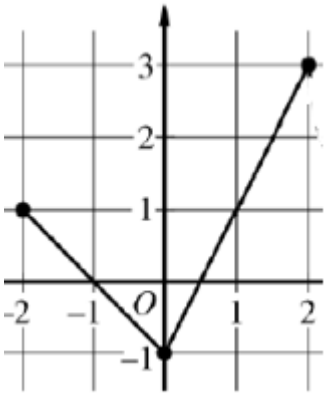
AP APPLICATION FOR ACCUMULATION USING A TABLE OF VALUES

t (minutes)	0	12	20	24	40
$v(t)$ (meters per minute)	0	200	240	–220	150

Johanna jogs along a straight path. For $0 \le t \le 40$, Johanna's velocity is given by a differentiable function v. Selected values of $v(t)$, where t is measured in minutes and $v(t)$ is measured in meters per minute, are given in the table above.

Use a Right Riemann Sum to find an estimate for $\int_0^{40} v(t)\,dt$ and $\int_0^{40} |v(t)|\,dt$. Label your answers and explain what each represents in context of the situation.

Using a Derivative Graph to Find Change in Position of the Function



$f'(x)$

EX) If $f(-1)=6$ find $f(2)$.

Since integrating $f'(x)$ gives accumulated change of $f(x)$, we can use integrals to find any position of $f(x)$.

$$f(-1) + \int_{-1}^{2} f'(x)\,dx = f(2)$$

Original position on the $f(x)$ graph + **Position change on the $f(x)$ graph from x = -1 to x = 2** = **Position at x = 2**

EX) If $f(-1)=6$ find $f(-2)$.

AP Question

GRAPHING CALCULATOR NEEDED!

Let f be a differentiable function such that $f(0) = 5.420$ and $f'(x) = \sqrt{\sin^2 x + x}$. What is the value of $f(2\pi)$?

(A) 7.927

(B) 11.449

(C) 13.295

(D) 16.869