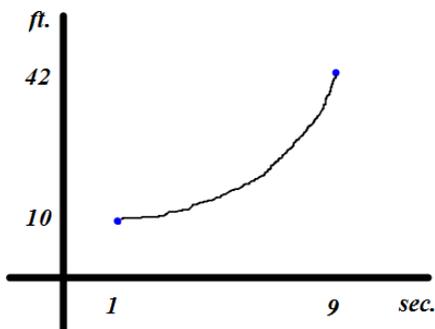


The Mean Value Theorem(MVT) for Integrals with Application

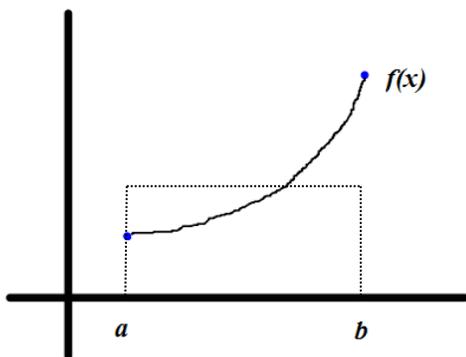
w-up: Given the **position** function of an object over the interval $[1,9]$ find the average velocity over this time interval.



The Mean Value Theorem for Integrals

If $f(x)$ is continuous over $[a, b]$ there exists a rectangle with height $f(c)$ and base “ $b-a$ ” such that the area of the rectangle EQUALS the area between the curve and the x-axis over that same interval

$$\int_a^b f(x)dx = f(c) \cdot (b-a)$$



The Average Value: The height of the rectangle “ $f(c)$ ” from the MVT

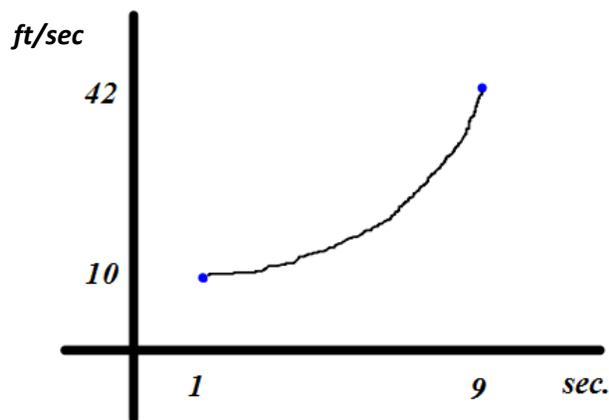
$$\text{Average Value} = \frac{1}{b-a} \int_a^b f(x)dx$$

EX) Find the average value for $f(x) = x^2 - 2x + 4$ on the interval $[1,4]$

Average Value Application

Average Value represents **average accumulation** for rate of change functions! The integral finds the accumulation and dividing it by " $b-a$ " gives average accumulation.

EX) Given the **velocity** function of an object over the interval $[1,9]$. Write an expression which finds the average velocity over this time interval.



Finding the average value for a given velocity function yields average velocity!

Summary

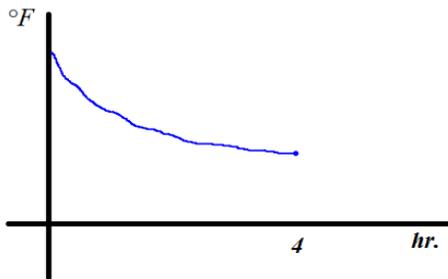
To find average rate of change **for a function** (such as a position function) find the **slope** across the interval.

To find the average rate of change **for a rate of change function** (such as a velocity function) find the **average value**.

AP Application of Average Value

EX) Given the **temperature** function " $T(t)$ " of a pool over the time interval $[0,4]$ and $\int_0^4 T(t) dt = 280$ where T is measured in $^{\circ}F$ and t is measured in hours.

Find the average value of this function on this time interval, label your answer and explain what you have found.



EX) Given the **temperature change** function " $T'(t)$ " of a pool over the time interval $[0,4]$ and $\int_0^4 T'(t) dt = 20$ where T is measured in $^{\circ}F$ and t is measured in hours.

Find the average value of this function on this time interval, label your answer and explain what you have found.

