NET CHANGE

In section, you will discover that this procedure applies to a variety of pratical situations in business, economics and life, social sciences

We are given the rate of the change $Q'(x)$ of a quantity $Q(x)$ and required to compute the net change $NC = Q(b) - Q(a)$ in $Q(x)$ as varies from $x = a$ to $x = b$. But since $Q(x)$ is an antiderivative of $Q'(x)$, the fundamental theorem of calculus tells us that the net change is given by the define integral

$$NC = Q(b) - Q(a) = \int_a^b Q'(x)dx$$

For example,

The promoters of a county fair estimate that t hours after the gates open at 9:00 am visitors will be en tering the fair at the rate of $-4(t+2)^3 + 54(t+2)^3$ people per hour. How many people will enter the fair between 10:00 am and noon?

Solution

Let $f(t)$ denote the numer of visitors of entering that t hours after.

Then the rate of the number of visitors $\frac{df}{dt} = -4(t+2)^3 + 54(t+2)^2$, and people will enter the fair from 9.00 am to 10.00 am and noon is given by the definite integral

$$\int_1^3 \left(-4(t+2)^3 + 54(t+2)^2\right)dt = -(t+2)^4 + 18(t+2)^3\Big|_1^3 = 1220(\,people)$$