Average Value of a Function (Section 6.5) and Applications to Biology (Section 6.7)

Intro

Computing the average value of a list of numbers is a natural way to understand the data. Computing the average value of a function is similar, except we need a new formula.

Averages

We know how to calculate the average value of a list of numbers. Data:

$$(1, 2, 5, 5, 2, 3, 4)$$

Average:

$$\frac{1 + 2 + 5 + 5 + 2 + 3 + 4}{7}$$

Average value of a function

For a function, there are infinitely many y-values. Instead of a sum, we use an integral. On the interval $[a, b]$, the average value of a function f is:

$$f_{ave} = \frac{1}{b-a}\int_a^b f(x)\,dx$$

Average value of a function

On the interval $[a, b]$, the average value of a function f is:

$$f_{ave} = \frac{1}{b-a} \int_a^b f(x)\,dx$$

The denominator $b - a$ is the length of the interval – analogous to the number of terms in a list.
The integral is analogous to the sum of all the terms in the list.

Example

Find the average value of the function $f(x)$ on the interval $[2, 8]$.

$$f(x) = x^2 - 3x$$

Example

Find the average value of the function $f(x)$ on the interval $[0, 2]$.

$$f(x) = \sqrt{12x + 1}$$

Try it!

Find the average value of $f(x)$ on the interval $[-2, 2]$.

$$f(x) = 6x(x^2 - 5)^3$$

Example

Find the x-value c such that the average value of $f(x)$ on the interval $[0, 6]$ equals $f(c)$.

$$f(x) = x^2 - 5x + 1$$

Try it!

Find the x-value c such that the average value of $f(x)$ on the interval $[0, 8]$ equals $f(c)$.

$$f(x) = 3x^2 - 4x - 7$$

Example

Let

$$f(x) = 2x - 3$$

Find a value of b such that the average value of $f(x)$ on the interval $[0, b]$ is equal to 10.

Section 6.7: Poiseuille's Law

You need this formula which gives the blood flow in a blood vessel for the homework:

$$F = \frac{\pi P R^4}{8 \eta l}$$

Just plug the numbers in.