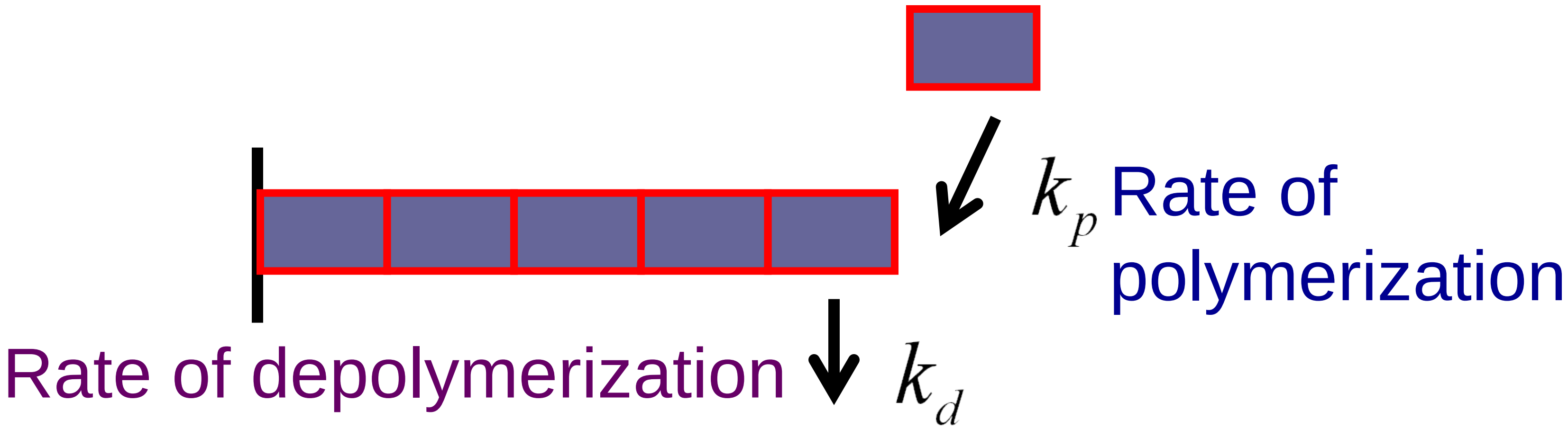
BIOMATHEMATICS

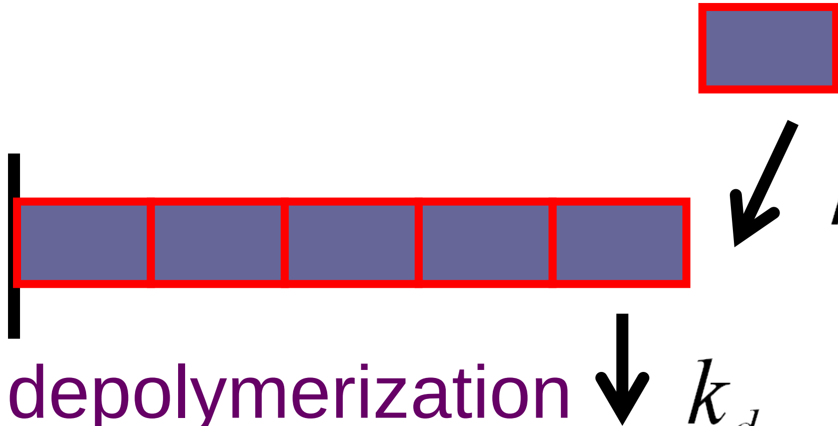
Prof. Ranjith Padinhateeri
Department of Bioscience & Bioengineering,
IIT Bombay

Integration

Polymerization of actin



Actin: Change in length



k_p Rate of polymerization

Rate of depolymerization k_d

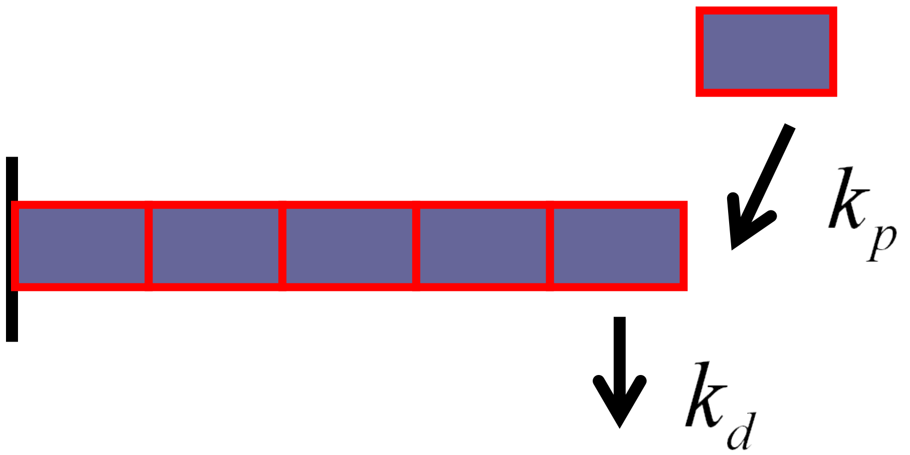
Rate of change of length

$$\frac{dl}{dt} = k_p - k_d$$

How to get length ? : Integrate

$$\frac{dl}{dt} = k_p - k_d$$

$$dl = \left(k_p - k_d\right)dt$$



$$l = \int \left(k_p - k_d\right)dt$$

If we know the derivative of a function, can we say something about the nature of the function?

If we know slope of a curve, can we say something about the nature of the curve?

Integral as “anti-derivative”

Slope $$\frac{dy}{dx} = m$$

Where m is a constant.

We can “integrate” this equation and get y(x)

$$\frac{dy}{dx} = m$$

$$dy = m\,dx$$

$$\int dy = \int m\,dx$$

$$y = mx + c$$

Where ‘c’ is an arbitrary constant

$$dy = x^n$$

$$dy = x^n dx$$

$$\int dy = \int x^n dx$$

$$y = \frac{x^{n+1}}{n+1} + c$$

Where ‘c’ is a constant

$$dy = kx^{n}$$

$$\int dy = \int kx^{n}$$

$$\int dy = k \int x^{n}$$

$$\int dy = k\frac{x^{n+1}}{n+1} + c$$

Where ‘k’ and ‘c’ are constant

Integration of exponential function

$$\frac{dy}{dx} = e^x = 1 + x + \frac{x^2}{2} + \frac{x^3}{6} + \ldots$$

$$y = \int e^x dx = x + \frac{x^2}{2} + \frac{x^3}{6} + \frac{x^4}{24} + \ldots + c$$

Where ‘c’ is an arbitrary constant

Integration of trigonometric functions

$$\frac{dy}{dx} = \cos(x) = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} \ldots$$

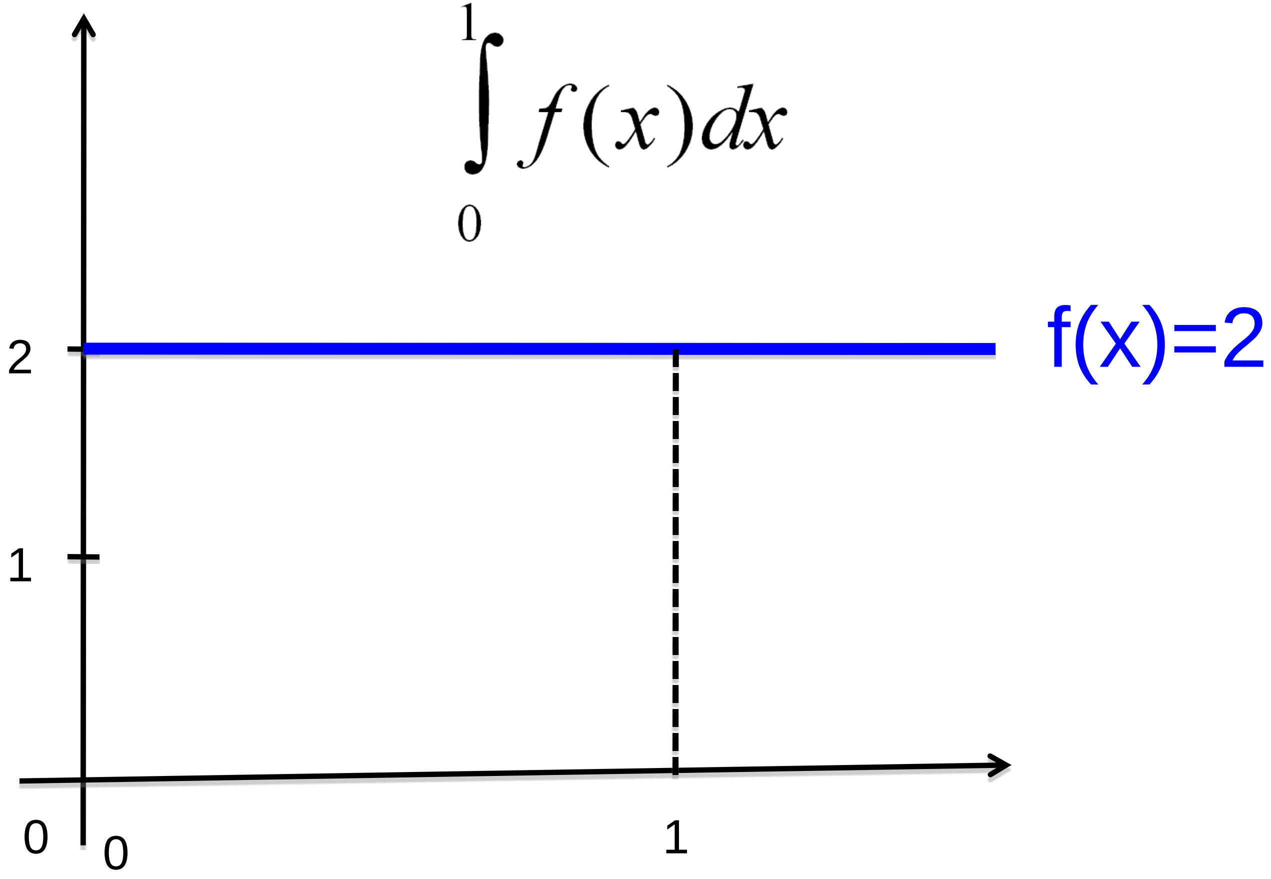
$$y = \int \cos(x)dx = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \ldots + c$$

$$\frac{dy}{dx} = \sin(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} \ldots$$

$$y = \int \sin(x)dx = \frac{x^2}{2!} - \frac{x^4}{4!} + \frac{x^6}{6!} - \frac{x^8}{8!} + \ldots + c$$

Definite integral

$$\int_0^1 f(x)\,dx$$



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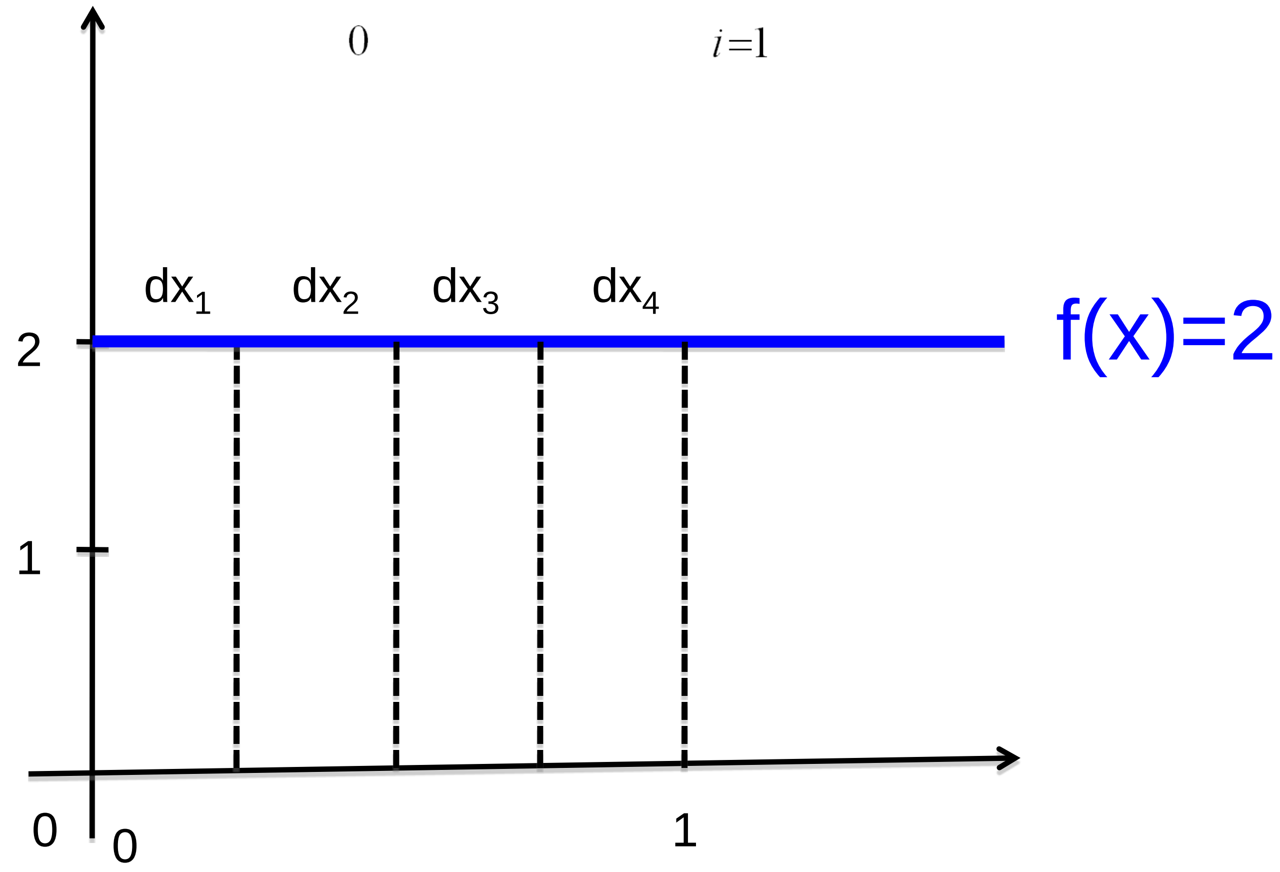
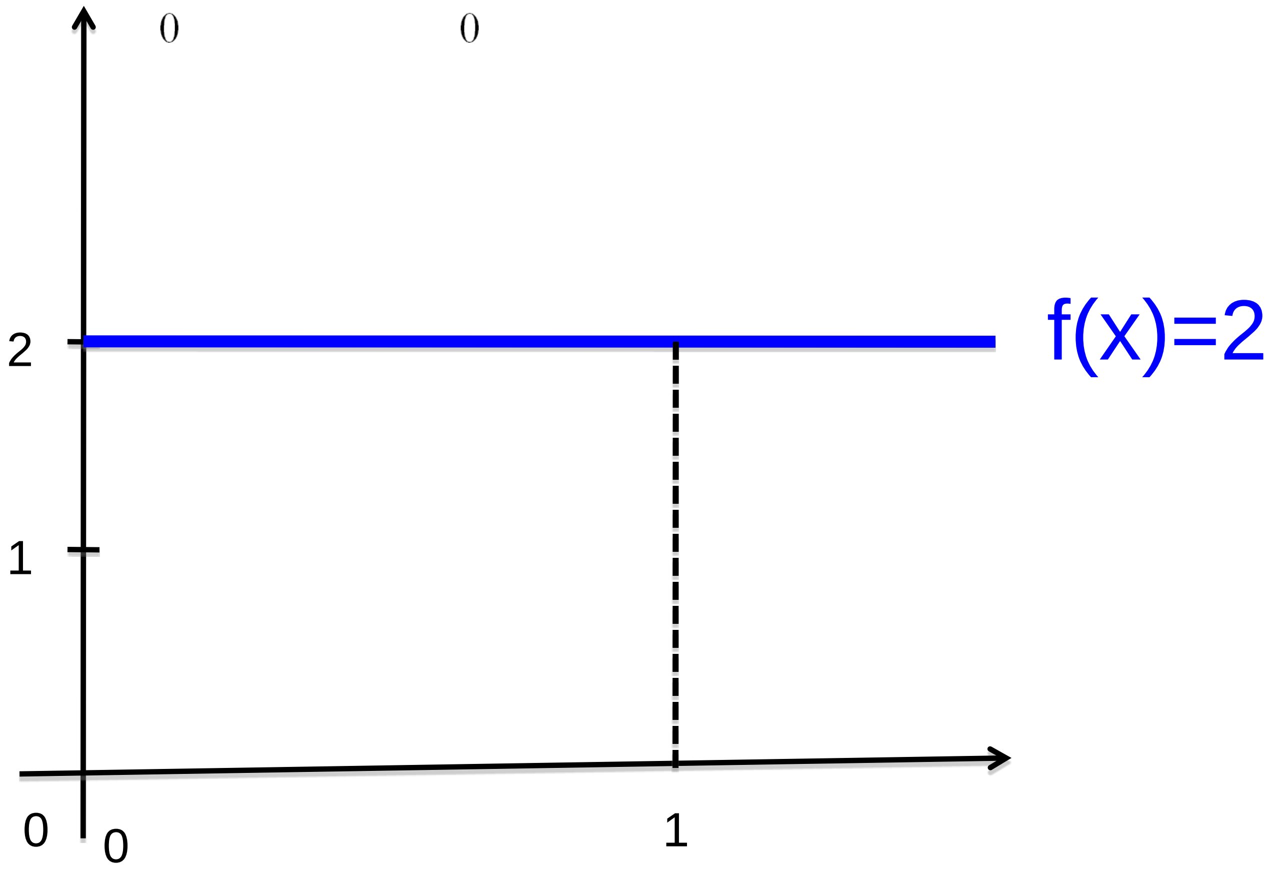
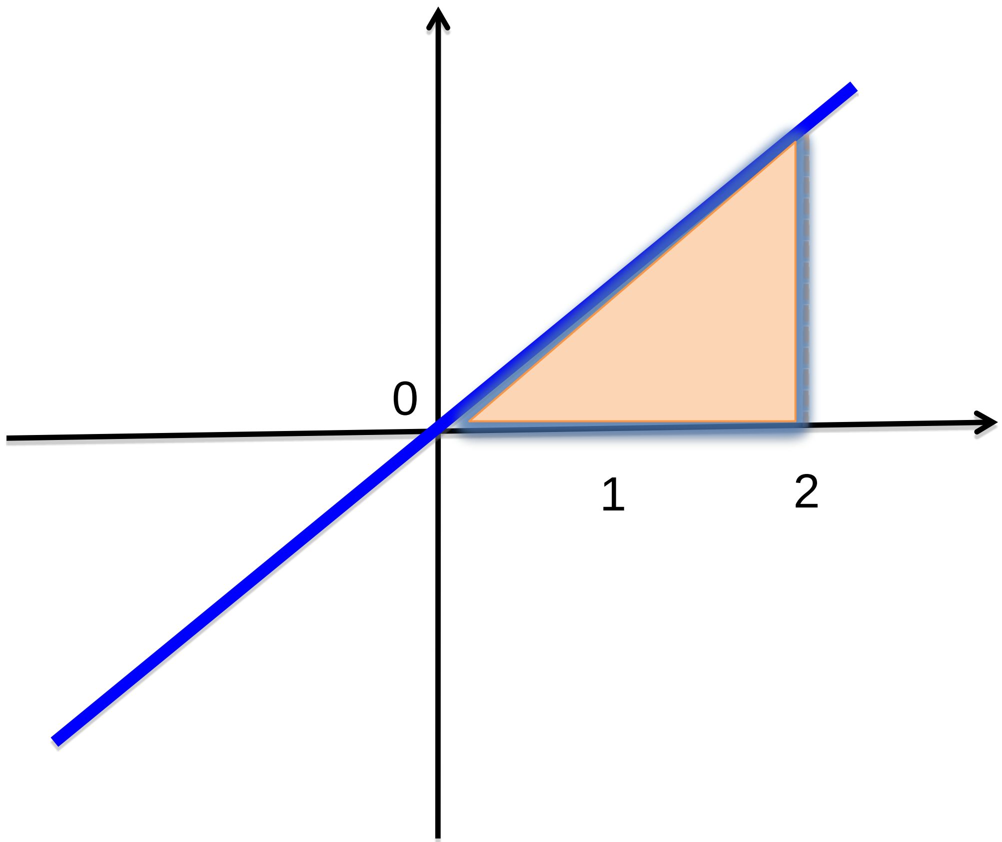
$$\int_0^1 f(x)dx = \sum_{i=1}^{4} f(x_i)dx_i$$



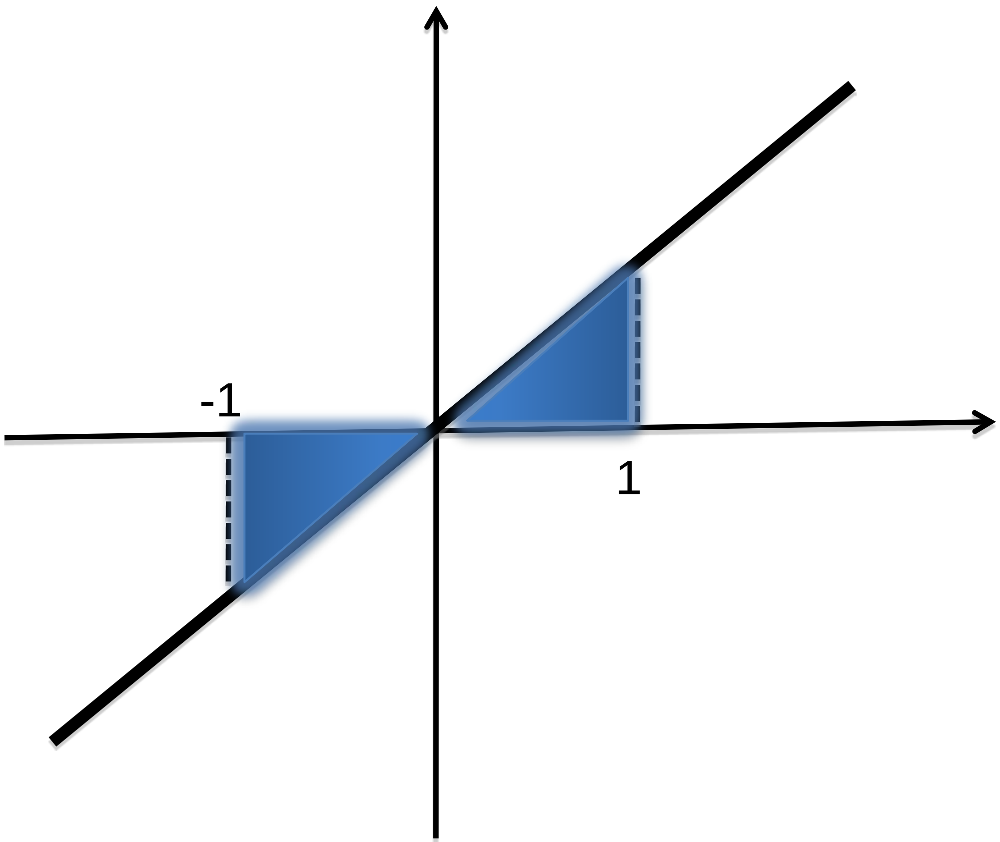
$$\int_0^1 2dx = 2\int_0^1 dx = 2x\Big|_0^1 = (2*1 - 2*0) = 2$$



f(x)=x



$$\int_0^2 x\,dx = 2$$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