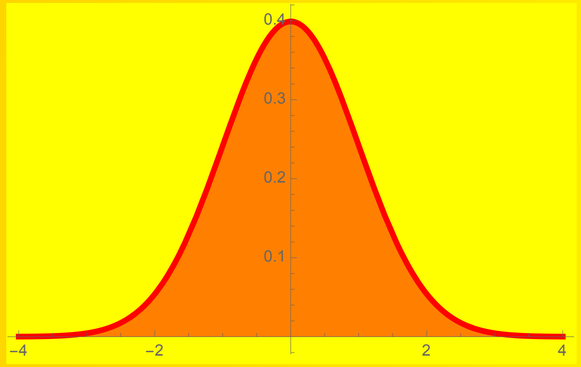
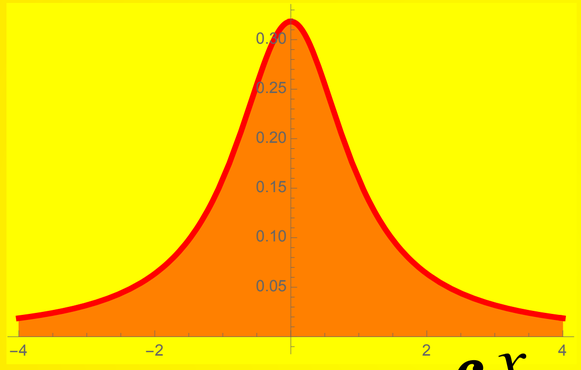
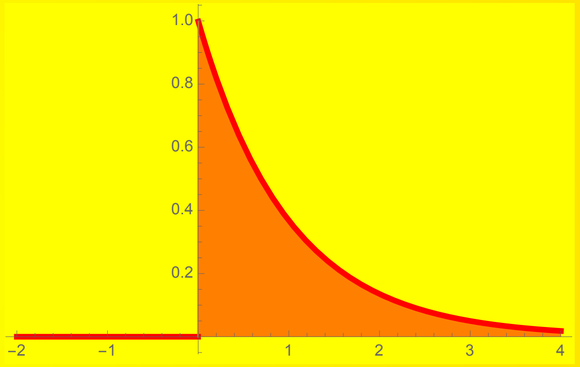
23 PDF and CDF

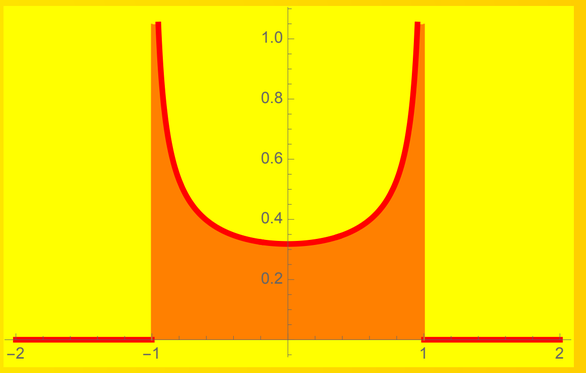
Normal Cauchy Exponential Arcsin

PDF



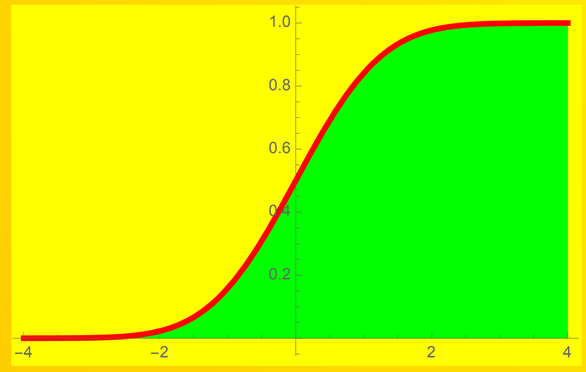


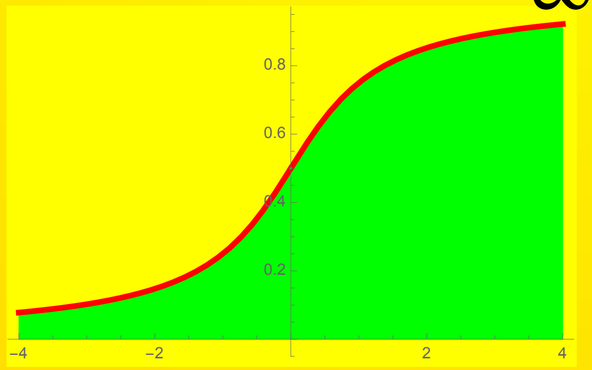


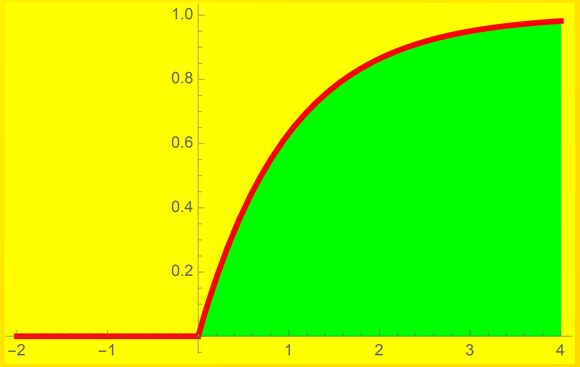


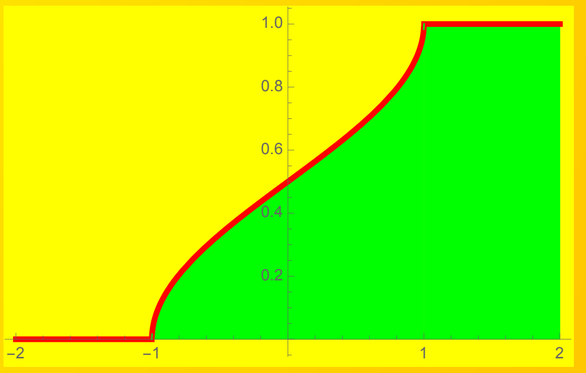
$$F(x) = \int_{-\infty}^{x} f(t)\ dt$$

CDF









PLAN

1. Poll

2. CDF's and PDF's

3. Examples

4. Expectation

5.Jam

POLL

A Have you taken a stats course before?

B If not, do you plan to take a stats course?

NEXT FRIDAY

A Project 3 Deadline

B Dress up day (also virtual)


I'M NOT
PINOCCHIO

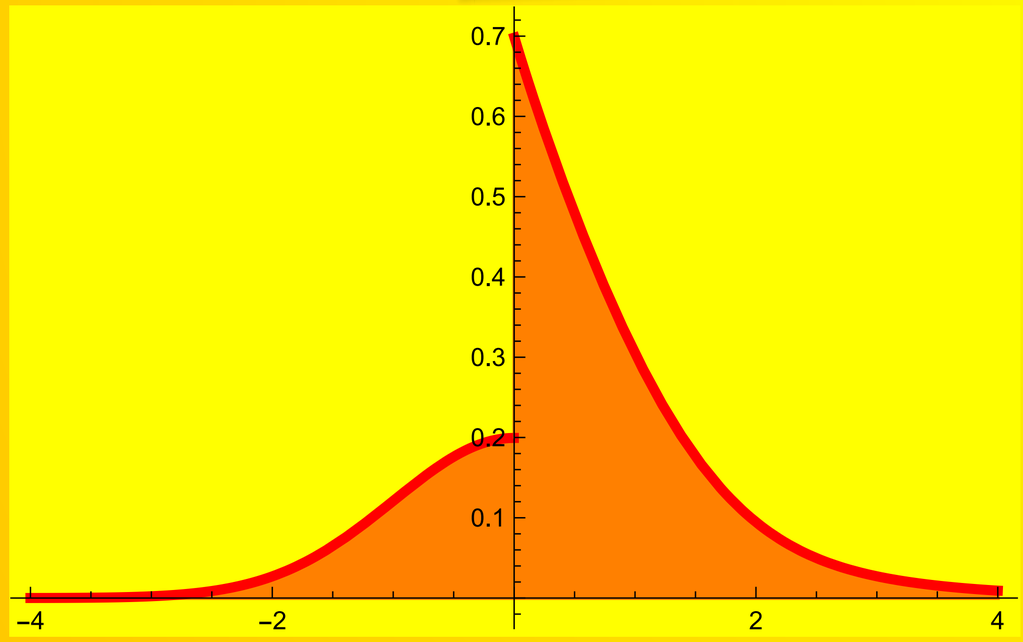

SHATNER
JUST GOT 90

PDF

Definition:

A piecewise continuous function f which is non-negative, and has total integral 1 is called a

Probability Density Function.



It has a statistical interpretation

in that $\int_a^b f(x)\,dx$ is the probability

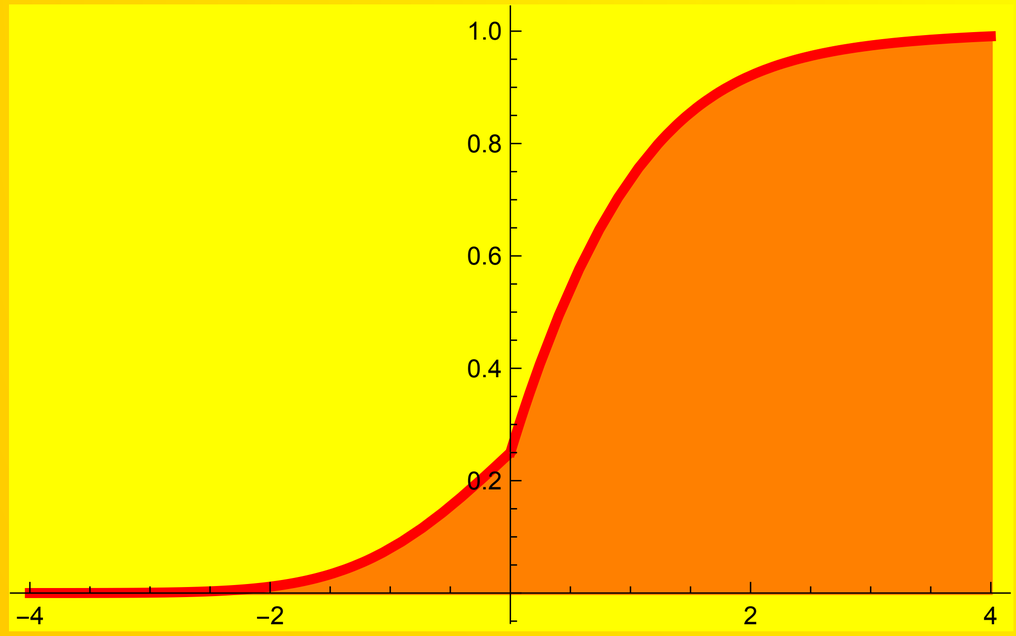
that the data under consideration are in the interval [a,b]

CDF

Definition:

If f is a PDF, then $F(x) = \int_{-\infty}^{x} f(t)\,dt$ is called the

Cumulative Distribution Function

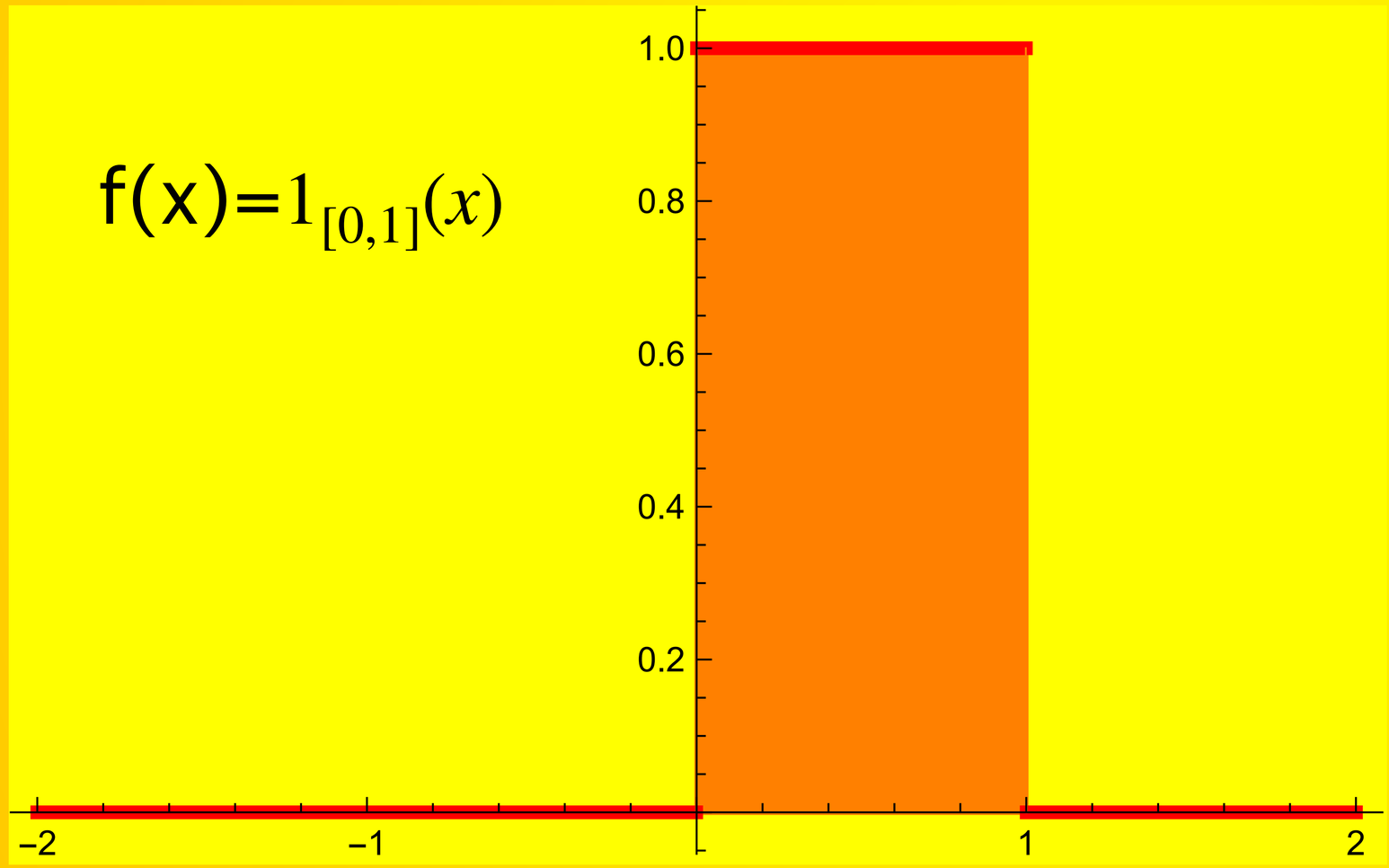


F(b)-F(a) is is the probability that the data under consideration are in the interval [a,b]

Remarks

- Improper integrals appear naturally
- Calculus is pivotal in stats!
- We will see how to get from data to the PDF

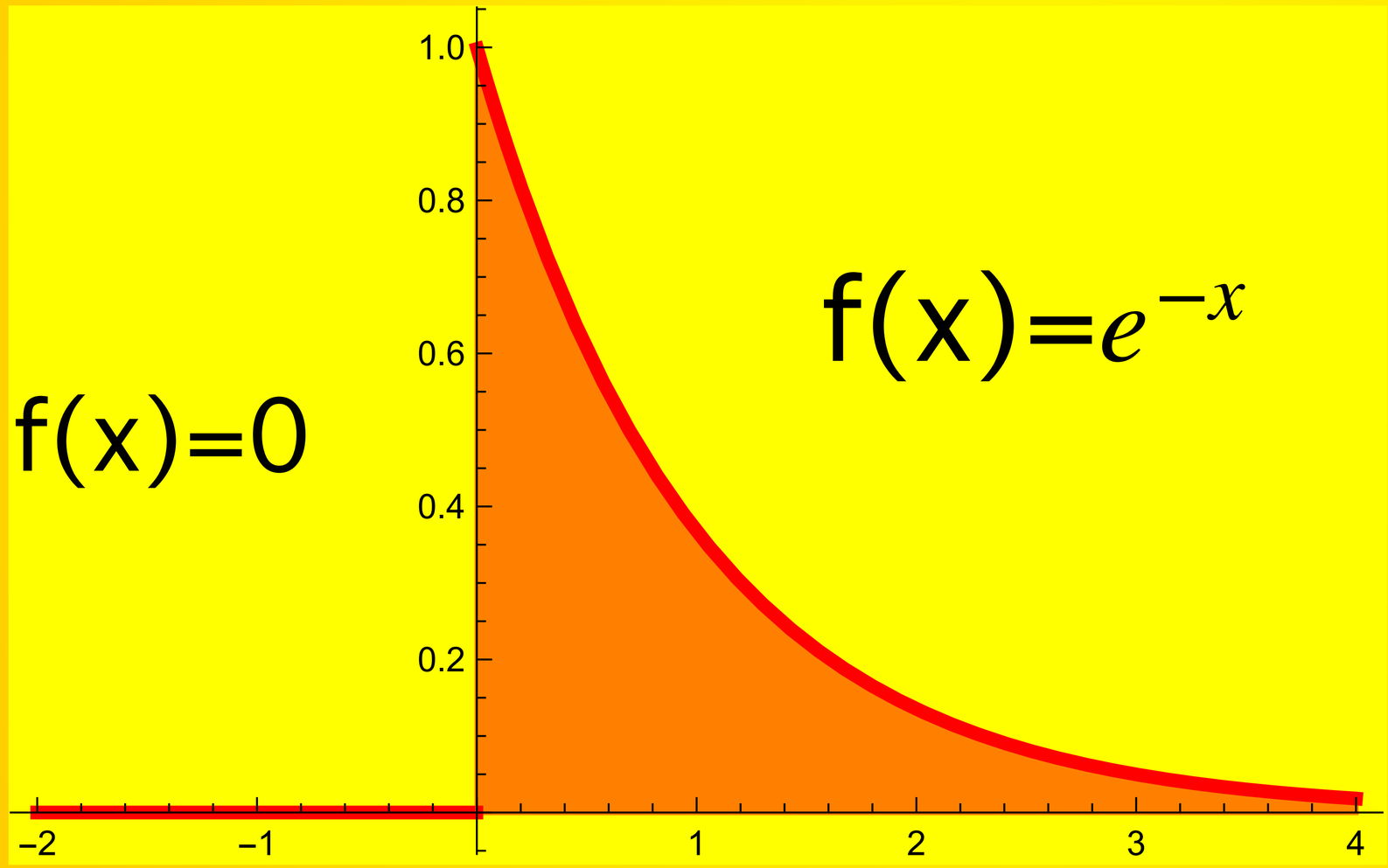
UNIFORM



Random[]
gives random
numbers in
[0,1].

Check the conditions.
What is the CDF?

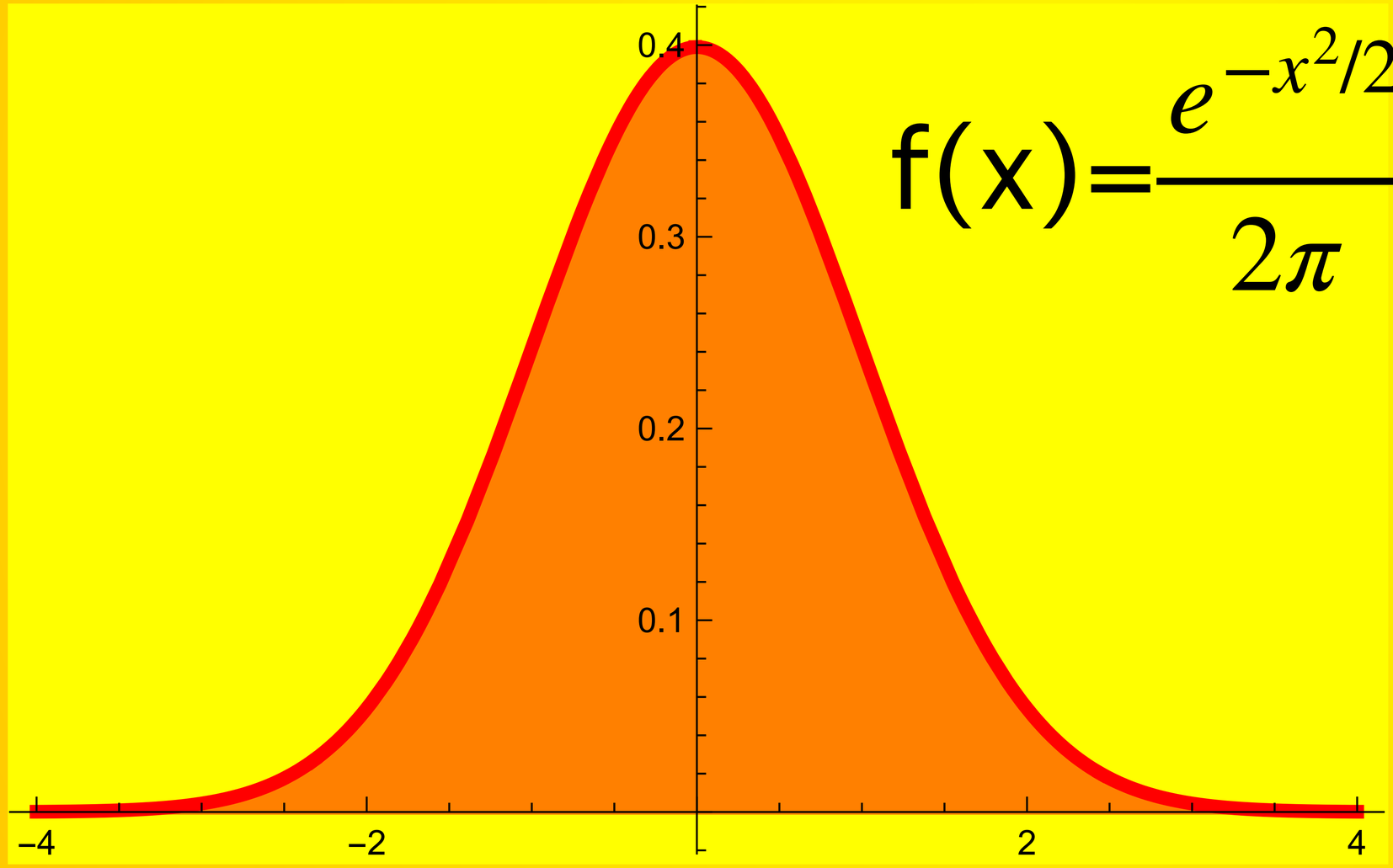
EXPONENTIAL



Waiting time for
a phone call.

Check the conditions
What is the CDF?

NORMAL

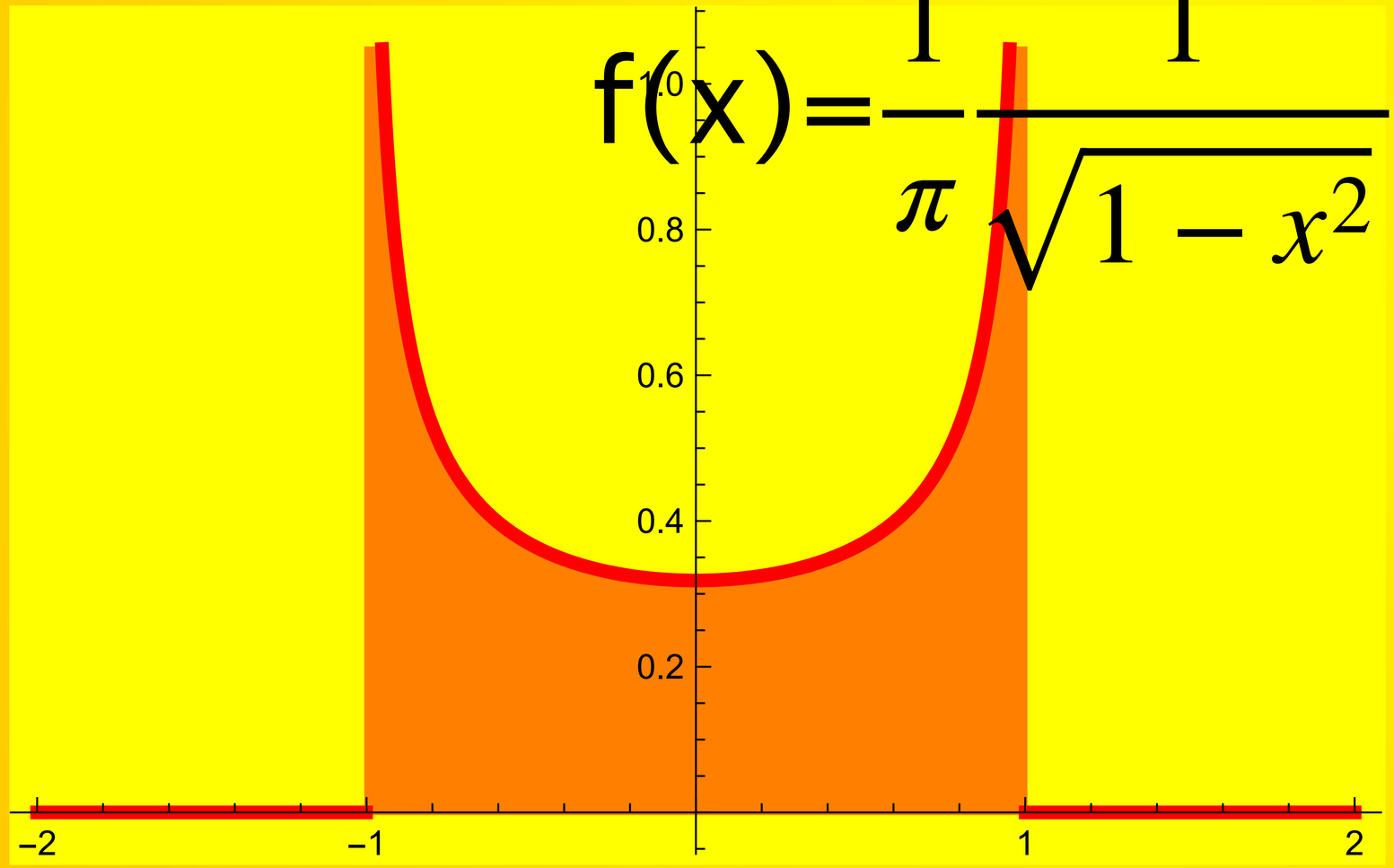


$$f(x)=\frac{e^{-x^2/2}}{2\pi}$$

Errors in measurement

Check the conditions.
What is the CDF?

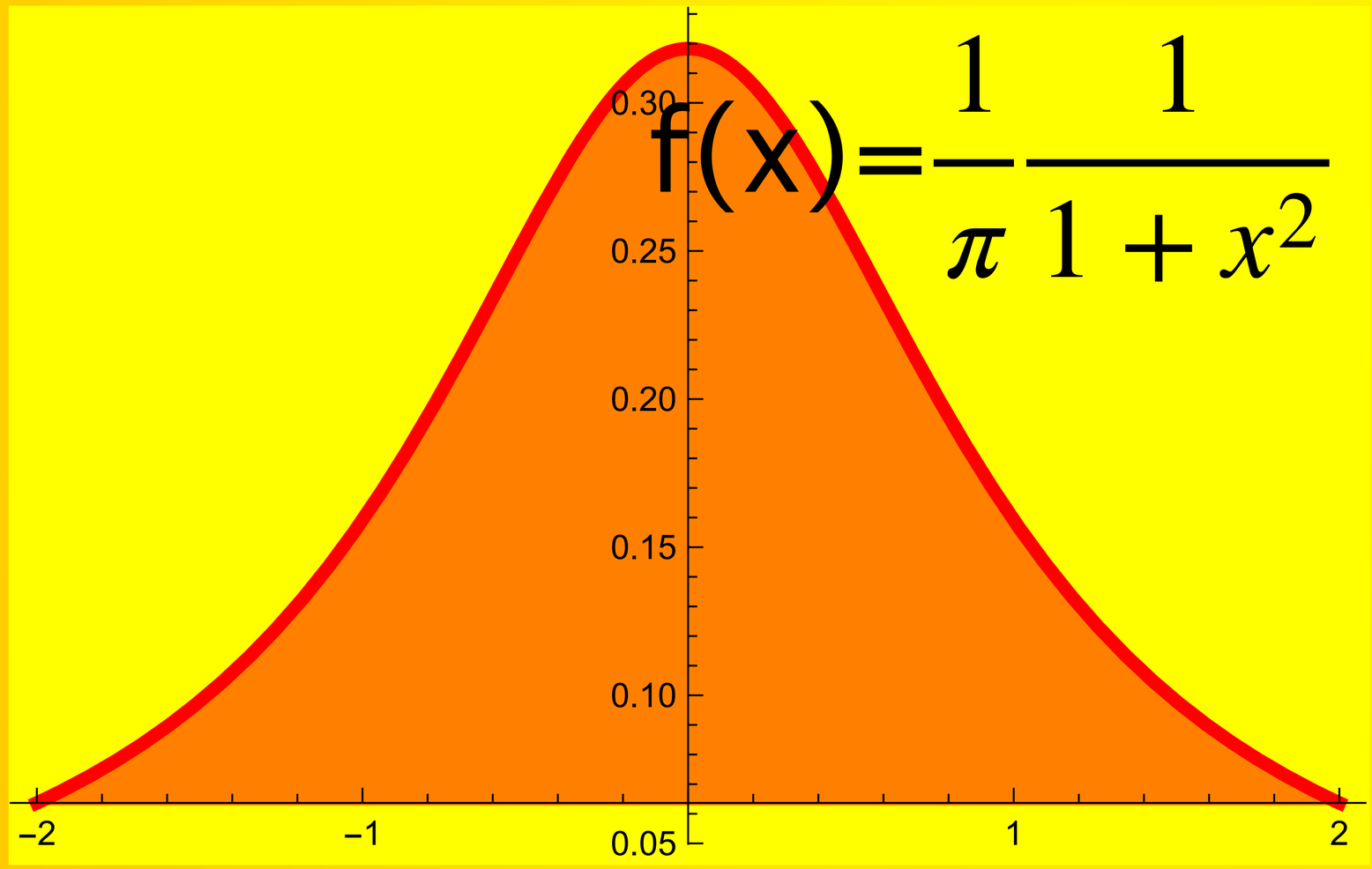
ARC SIN



spectral
density functions
in solid state
physics

Check the conditions.
What is the CDF?

CAUCHY



High risk probability

Check the conditions.
What is the CDF?

EXPECTATION

Definition:

$$m = \int_{-\infty}^{\infty} xf(x)\,dx$$

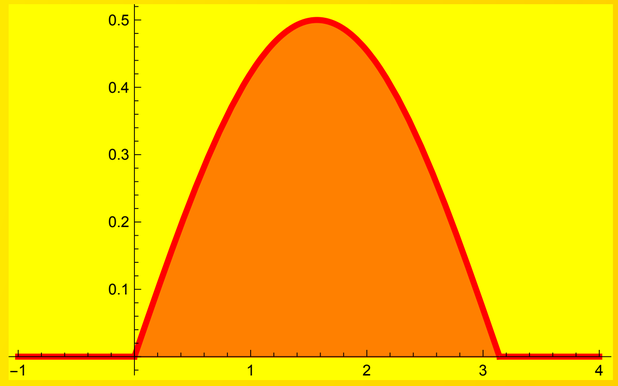
is the =

(also called expectation of f)

Task: find the expectation of the uniform distribution!

Data are distributed according to

$$f(x)=\frac{1}{2}\sin(x) \quad \text{on } [0,\pi] \text{ , otherwise } f(x)=0$$



A) check that f is a PDF (three conditions)

B) What is the CDF

C) What is probability that the data are in $[\pi/4,\pi/2]$

DEMO

Random[ExponentialDistribution[1]]

Random[CauchyDistribution[0, 1]]

Random[NormalDistribution[0,1]]

SmoothHistogram[Table[Random[NormalDistribution[0, 1]], {100000}]]

The End