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## Day 14

## Continuous Random Variables

Can take any real number ( $\mathbb{R}$ ) value within any given interval.

We cannot use a probability mass function so we will instead use a probability **density** function (PDF) denoted as  $f(x)$

### Properties

- The probability of being in an interval  $(a, b]$  is:

$$\int_a^b f(x)dx = \int_{-\infty}^b f(x) - \int_{-\infty}^a f(x)dx$$

- This is considered the area under the curve between  $a$  and  $b$
- $P(X = x) = 0 \forall x$ 
  - $P(X \leq x) = P(X < x)$
  - $P(X \geq x) = P(X > x)$

$f(x)$  is displayed graphically as a density curve

### Properties of $f(x)$

- $\forall x \in \mathbb{R}, f(x) \geq 0$ 
  - Density never goes below x-axis
- $\int_{-\infty}^{\infty} f(x)dx = 1$

Mean of continuous random variable:  $\mu_x = \int_{-\infty}^{\infty} x \times f(x)dx$

Variance of continuous random variable is  $\sigma^2 = \int_{-\infty}^{\infty} (X - \mu_x)^2 f(x)dx$