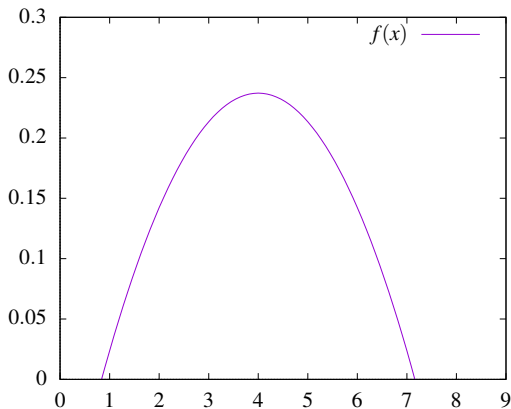


$f(x)$ — the probability density function of some *random variable* X

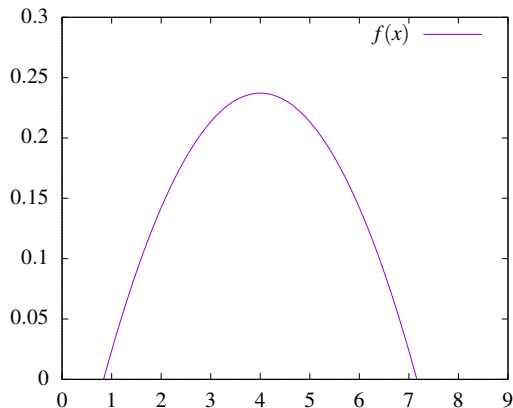
$f(x)$ is defined over its **supporting set** (domain), and $f(x) \geq 0$ over its supporting set.



(Approximately) what is the $Pr(X = 5)$?

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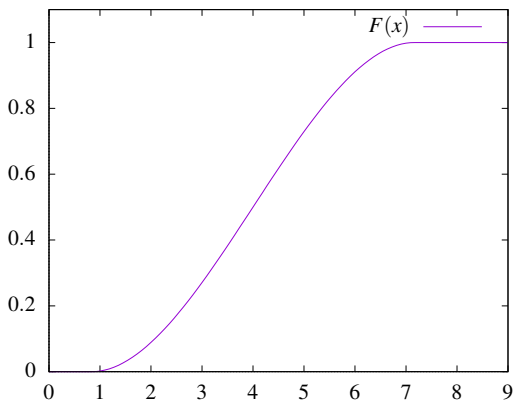
We can't answer this question for **continuous probability distributions**.

We can say

$$\begin{aligned} Pr(X < 5) &\equiv Pr(X \leq 5) \\ &= \text{Area below } f(x) \text{ up to } x = 5 \end{aligned}$$

$F(x)$ — the cumulative distribution function of $f(x)$

$F(x)$ is an **increasing function** defined over $(-\infty, +\infty)$, and its range is limited to $0 \leq F(x) \leq 1$



We use the CDF $F(x)$ to determine the probability that a random variable X falls **within some interval**.

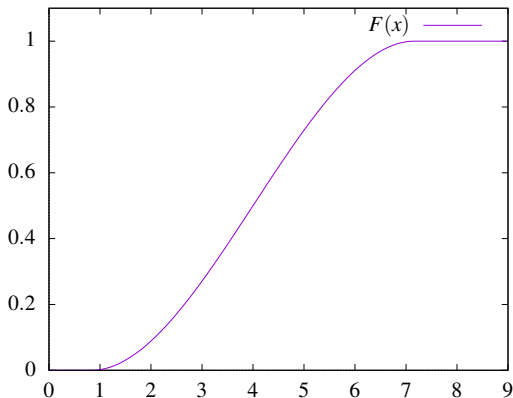
$$\begin{aligned} Pr(X < 5) &\equiv Pr(X \leq 5) \\ &= F(5) \end{aligned}$$

$$Pr(X \geq 5) = 1 - F(5)$$

$$Pr(\pi < X < 6) = F(6) - F(\pi)$$

$F(x)$ — the cumulative distribution function of $f(x)$

$F(x)$ is an **increasing function** defined over $(-\infty, +\infty)$, and its range is limited to $0 \leq F(x) \leq 1$



$F(x)$ is important!

1. Its range is $[0,1]$, which fits nicely together with pRNG routines that provide

$$u \leftarrow \text{Random}() \quad 0 < u < 1$$

2. **If $F(x)$ is invertible**, it's the best way to generate random values in the supporting set that “follow” the distribution $f(x)$.