$f(x)$ — the probability density function of some *random variable X*
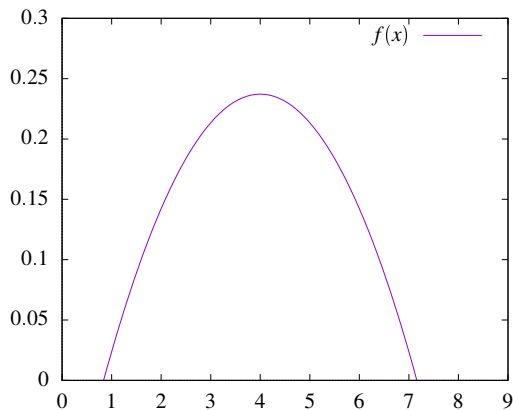
$f(x)$ is defined over its **supporting set** (domain), and $f(x) \geq 0$ over its supporting set.

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

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

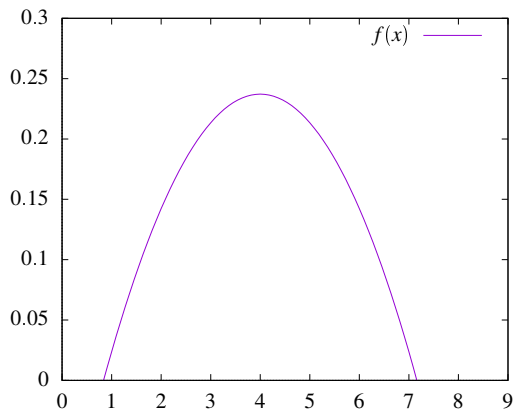$f(x)$ is defined over its **supporting set** (domain), and $f(x) \geq 0$ over its supporting set.
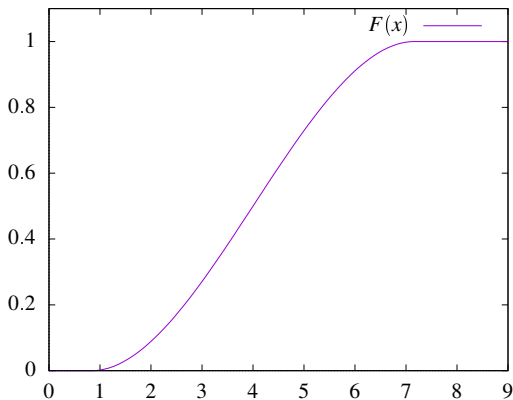

(Approximately) what is the $Pr(X = 5)$?

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

We **can say**

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

$F(x)$ — 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**.
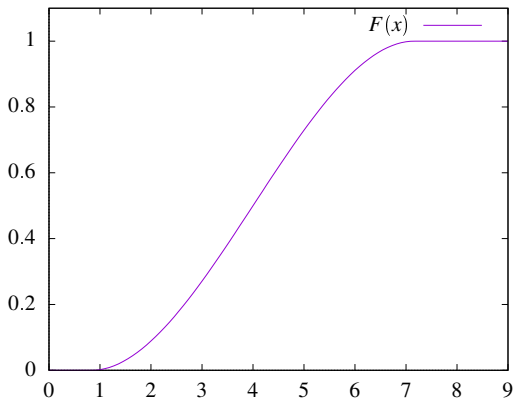
$$
\begin{aligned}
Pr(X < 5) &\equiv Pr(X \leq 5) \\
&= F(5) \\
Pr(X \geq 5) &= 1 - F(5) \\
Pr(\pi < X < 6) &= F(6) - F(\pi)
\end{aligned}
$$

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

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

$F(x)$ is important!

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

   $$u \leftarrow Random() \quad 0 < u < 1$$

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