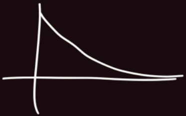
$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\frac{(x-\mu)^2}{\sigma^2}}$$

$$\begin{cases} X \sim \mathcal{N}(0,1) \\ Y \sim \mathcal{N}(0,1) \end{cases}$$

$$f(x,y) = e^{-\frac{x^2}{2\sigma^2}} \times e^{-\frac{y^2}{2\sigma^2}} = e^{-\frac{x^2+y^2}{2\sigma^2}}$$

$$\lambda e^{-\lambda x}$$

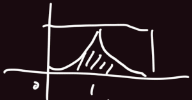


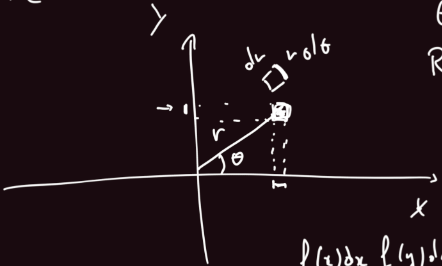
$$\Theta \sim \mathcal{U}[0, 2\pi]$$

$$R_2 \sim \mathcal{E}\left(\frac{1}{\sqrt{2}}\right)$$

↳ $X =$

$Y =$





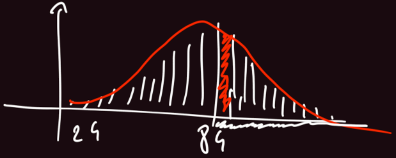
$f(x)dx\, f(y)dy$

$$e^{-\frac{(x^2+y^2)}{2\sigma^2}} \underline{dx\,dy}$$

$$e^{-\frac{r^2}{2\sigma^2}} r\,dr\,d\theta$$

$X \sim \mathcal{U}\{1, \dots, 6\}$ $\quad \underbrace{\mathbb{E}(X)}_{\mu} = \frac{7}{2}$ $\quad \mathrm{Var}(X) = \mathbb{E}(X^2) - \mathbb{E}(X)^2 = \frac{35}{12}$

$S_{24} = X_1 + \dots + X_{24}$ $\quad \mathbb{E}(S_{24}) = 84$ $\quad \mathrm{Var}(S_{24}) = 70$



S_{24} "$\approx$" $\mathcal{N}(84, 70)$ $\quad N \sim \mathcal{N}(84, 70)$

$\mathbb{P}(S_{24} = 84) \approx \underbrace{\mathbb{P}(N \in [84, 85])}$

$\mathbb{P}(N \leq 85) - \mathbb{P}(N \leq 84)$

pnorm(85) - pnorm(84)

rnorm
dnorm
pnorm
q

$\mathbb{P}(S_{24} \geq 84) = 1 -$ pnorm(84, ...)

$$Y = \begin{cases} 1 \text{ si } S_{24} = 84 & (\text{avec probabilité } p) \\ 0 \text{ sinon} & 1-p \end{cases}$$

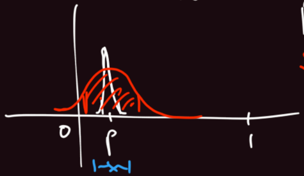
$$\mathbb{E}(Y) = p \qquad Var(Y) = \mathbb{E}(Y^2) - \mathbb{E}(Y)^2 = p - p^2 = p(1-p)$$

$N = 10^6$

$$S_N^Y \sim \mathcal{N}\left(p, \frac{p(1-p)}{N}\right)$$

$$\mathbb{E}(S_N^Y) = p \qquad Var(S_N^Y) = \frac{N(p(1-p))}{N^2}$$

$$S_N^Y = \frac{Y_1 + \dots + Y_N}{N}$$



$$S_N^Y \pm \frac{1}{\sqrt{N}}$$

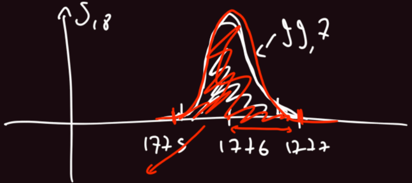
$$\mathbb{P}\left(S_N^Y \in \left[p - 2\sqrt{\frac{p(1-p)}{N}}, p + 2\sqrt{\frac{p(1-p)}{N}}\right]\right) = 0.95$$

$$\leq \mathbb{P}\left[S_N^Y \in \left[p - \frac{1}{\sqrt{N}}, p + \frac{1}{\sqrt{N}}\right]\right) =$$

$$\mathbb{P}\left[p \in \left[S_N^Y - \frac{1}{\sqrt{N}}, S_N^Y + \frac{1}{\sqrt{N}}\right]\right]$$

$$X \sim \mathcal{U}[-2,2] + 1776 \qquad \mathbb{E}(X) = 1776 \qquad Var(X) = \frac{(b-a)^2}{12} = \frac{4}{3}$$

$$S_{18} = \frac{X_1 + \dots + X_{18}}{18} \qquad \mathbb{E}(S_{18}) = 1776 \qquad Var(S_{18}) = \frac{Var(X)}{18} = 0{,}\underbrace{074}$$



$$\sigma \approx 0{,}27$$

$$S_{18} \text{ "}\sim\text{" } \mathcal{N}(1776, \sigma = 0{,}27)$$

$$\mathbb{P}(S_{18} \in [1775, 1776]) = 0{,}99\dots$$