3.6 LOI CONTINUE 3

cours 18

Au dernier cours, nous avons vu

Loi exponentielle

Au dernier cours, nous avons vu

Loi exponentielle

$$X \sim Exp(\lambda)$$

Au dernier cours, nous avons vu

Loi exponentielle

$$X \sim Exp(\lambda) \qquad f(x) = \begin{cases} \lambda e^{-\lambda x} & 0 \leq x \\ 0 & sinon \end{cases}$$

Au dernier cours, nous avons vu

Loi exponentielle

$$X \sim Exp(\lambda) \qquad f(x) = \begin{cases} \lambda e^{-\lambda x} & 0 \leq x \\ 0 & sinon \end{cases}$$

$$F(x) = \begin{cases} -e^{-\lambda x} + 1 & 0 \leq x \\ 0 & sinon \end{cases}$$

Au dernier cours, nous avons vu

Loi exponentielle

$$X \sim Exp(\lambda)$$

$$f(x) = \begin{cases} \lambda e^{-\lambda x} & 0 \leq x \\ 0 & sinon \end{cases}$$

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$$E(X) = \frac{1}{\lambda}$$

Au dernier cours, nous avons vu

Loi exponentielle

$$X \sim Exp(\lambda)$$

$$f(x) = \begin{cases} \lambda e^{-\lambda x} & 0 \leq x \\ 0 & sinon \end{cases}$$

$$F(x) = \begin{cases} -e^{-\lambda x} + 1 & 0 \leq x \\ 0 & sinon \end{cases}$$

$$E(X) = \frac{1}{\lambda}$$

$$\mathrm{Var}(X) = \frac{1}{\lambda^2}$$

Au dernier cours, nous avons vu

Loi normale

Au dernier cours, nous avons vu

Loi normale

$$X \sim N(\mu, \sigma)$$

Au dernier cours, nous avons vu

Loi normale

$$X \sim N(\mu, \sigma) \qquad\qquad f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

Aujourd'hui, nous allons voir

✓ Loi normale

$$X \sim N(\mu, \sigma)$$

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$E(X)$

$$X \sim N(\mu, \sigma)$$

$$E(X) = \frac{1}{\sigma\sqrt{2\pi}} \int_{-\infty}^{\infty} x e^{-\frac{(x-\mu)^2}{2\sigma^2}} \, dx$$

$$X \sim N(\mu, \sigma)$$

$$E(X) \;=\frac{1}{\sigma\sqrt{2\pi}}\int_{-\infty}^{\infty} xe^{-\frac{(x-\mu)^2}{2\sigma^2}}\; dx \qquad\qquad y=\frac{(x-\mu)}{\sigma}$$

$$X \sim N(\mu, \sigma)$$

$$E(X) = \frac{1}{\sigma\sqrt{2\pi}} \int_{-\infty}^{\infty} x e^{-\frac{(x-\mu)^2}{2\sigma^2}} \, dx$$

$$y = \frac{(x-\mu)}{\sigma}$$

$$dy = \frac{dx}{\sigma}$$

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$$E(X) = \frac{1}{\sigma\sqrt{2\pi}} \int_{-\infty}^{\infty} x e^{-\frac{(x-\mu)^2}{2\sigma^2}} \, dx$$

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$$y = \frac{(x-\mu)}{\sigma}$$

$$dy = \frac{dx}{\sigma}$$

$$x = \sigma y + \mu$$

$$X \sim N(\mu, \sigma)$$

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$$x = \sigma y + \mu$$

$$= \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} (\sigma y + \mu) e^{-\frac{y^2}{2}} \, dy$$

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$$dy = \frac{dx}{\sigma}$$

$$x = \sigma y + \mu$$

$$= \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} (\sigma y + \mu) e^{-\frac{y^2}{2}} dy$$

$$= \frac{\sigma}{\sqrt{2\pi}} \int_{-\infty}^{\infty} y e^{-\frac{y^2}{2}} dy + \mu \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} e^{-\frac{y^2}{2}} dy$$

$$X \sim N(\mu, \sigma)$$

$$E(X) = \frac{1}{\sigma\sqrt{2\pi}} \int_{-\infty}^{\infty} x e^{-\frac{(x-\mu)^2}{2\sigma^2}} \, dx \qquad y = \frac{(x-\mu)}{\sigma}$$

$$= \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} x e^{-\frac{y^2}{2}} \, dy \qquad dy = \frac{dx}{\sigma}$$

$$x = \sigma y + \mu$$

$$= \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} (\sigma y + \mu) e^{-\frac{y^2}{2}} \, dy$$

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$$= \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} (\sigma y + \mu) e^{-\frac{y^2}{2}} \, dy$$

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$$X \sim N(\mu, \sigma)$$

$$E(X) \quad = \frac{\sigma}{\sqrt{2\pi}} \int_{-\infty}^{\infty} y e^{-\frac{y^2}{2}} \; dy + \mu \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} e^{-\frac{y^2}{2}} \; dy$$

$$= \frac{\sigma}{\sqrt{2\pi}} \int_{-\infty}^{\infty} y e^{-\frac{y^2}{2}} \; dy + \mu$$

$$X \sim N(\mu, \sigma)$$

$$E(X) = \frac{\sigma}{\sqrt{2\pi}} \int_{-\infty}^{\infty} y e^{-\frac{y^2}{2}}\ dy + \mu \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} e^{-\frac{y^2}{2}}\ dy$$

$$= \frac{\sigma}{\sqrt{2\pi}} \int_{-\infty}^{\infty} y e^{-\frac{y^2}{2}}\ dy + \mu$$

$$u = \frac{y^2}{2}$$

$$X \sim N(\mu, \sigma)$$

$$E(X) \quad = \frac{\sigma}{\sqrt{2\pi}} \int_{-\infty}^{\infty} y e^{-\frac{y^2}{2}} \ dy + \mu \boxed{\frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} e^{-\frac{y^2}{2}} \ dy}$$

$$= \frac{\sigma}{\sqrt{2\pi}} \int_{-\infty}^{\infty} y e^{-\frac{y^2}{2}} \ dy + \mu$$

$$u = \frac{y^2}{2}$$

$$du = y dy$$

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$$E(X) = \frac{\sigma}{\sqrt{2\pi}} \int_{-\infty}^{\infty} y e^{-\frac{y^2}{2}} \, dy + \mu \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} e^{-\frac{y^2}{2}} \, dy$$

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$$= \frac{\sigma}{\sqrt{2\pi}} \int_{-\infty}^{\infty} y e^{-\frac{y^2}{2}} \, dy + \mu$$

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$$= \frac{\sigma}{\sqrt{2\pi}} \int_{-\infty}^{\infty} y e^{-\frac{y^2}{2}} \, dy + \mu$$

$$u = \frac{y^2}{2}$$

$$du = y dy$$

$$= \frac{\sigma}{\sqrt{2\pi}} \int e^{-u} \, du + \mu$$

$$X \sim N(\mu, \sigma)$$

$$E(X) = \frac{\sigma}{\sqrt{2\pi}} \int_{-\infty}^{\infty} y e^{-\frac{y^2}{2}} \, dy + \mu \boxed{\frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} e^{-\frac{y^2}{2}} \, dy}$$

$$= \frac{\sigma}{\sqrt{2\pi}} \int_{-\infty}^{\infty} y e^{-\frac{y^2}{2}} \, dy + \mu$$

$$u = \frac{y^2}{2}$$

$$du = y\,dy$$

$$= \frac{\sigma}{\sqrt{2\pi}} \int e^{-u} \, du + \mu$$

$$= -\frac{\sigma}{\sqrt{2\pi}} e^{-\frac{y^2}{2}} \Big|_{-\infty}^{\infty} + \mu$$

$$X \sim N(\mu, \sigma)$$

$$E(X) \quad = \frac{\sigma}{\sqrt{2\pi}} \int_{-\infty}^{\infty} y e^{-\frac{y^2}{2}}\ dy + \mu \boxed{\frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} e^{-\frac{y^2}{2}}\ dy}$$

$$= \frac{\sigma}{\sqrt{2\pi}} \int_{-\infty}^{\infty} y e^{-\frac{y^2}{2}}\ dy + \mu$$

$$u = \frac{y^2}{2}$$

$$du = y dy$$

$$= \frac{\sigma}{\sqrt{2\pi}} \int e^{-u}\ du + \mu$$

$$0$$

$$= \boxed{-\frac{\sigma}{\sqrt{2\pi}} e^{-\frac{y^2}{2}} \Big|_{-\infty}^{\infty}} + \mu$$

$$X \sim N(\mu, \sigma)$$

$$E(X) = \frac{\sigma}{\sqrt{2\pi}} \int_{-\infty}^{\infty} y e^{-\frac{y^2}{2}} \; dy + \mu \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} e^{-\frac{y^2}{2}} \; dy$$

$$= \frac{\sigma}{\sqrt{2\pi}} \int_{-\infty}^{\infty} y e^{-\frac{y^2}{2}} dy + \mu$$

$$u = \frac{y^2}{2}$$

$$du = y dy$$

$$= \frac{\sigma}{\sqrt{2\pi}} \int e^{-u} \; du + \mu$$

$$= \cancelto{0}{-\frac{\sigma}{\sqrt{2\pi}} e^{-\frac{y^2}{2}} \Big|_{-\infty}^{\infty}} + \mu \quad = \mu$$

$$X \sim N(\mu, \sigma)$$

$\mathrm{Var}(X)$

$$X \sim N(\mu, \sigma)$$

$$\mathrm{Var}(X) = \frac{1}{\sigma\sqrt{2\pi}} \int_{-\infty}^{\infty} (x-\mu)^2 e^{-\frac{(x-\mu)^2}{2\sigma^2}} \, dx$$

$$X \sim N(\mu, \sigma)$$

$$\mathrm{Var}(X) \quad = \frac{1}{\sigma\sqrt{2\pi}} \int_{-\infty}^{\infty} (x-\mu)^2 e^{-\frac{(x-\mu)^2}{2\sigma^2}} \; dx \qquad\qquad y = \frac{x-\mu}{\sigma}$$

$$X \sim N(\mu, \sigma)$$

$$\mathrm{Var}(X) = \frac{1}{\sigma\sqrt{2\pi}} \int_{-\infty}^{\infty} (x-\mu)^2 e^{-\frac{(x-\mu)^2}{2\sigma^2}} \, dx \qquad y = \frac{x-\mu}{\sigma}$$

$$dy = \frac{dx}{\sigma}$$

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$$\mathrm{Var}(X) = \frac{1}{\sigma\sqrt{2\pi}} \int_{-\infty}^{\infty} (x-\mu)^2 e^{-\frac{(x-\mu)^2}{2\sigma^2}}\ dx$$

$$y = \frac{x-\mu}{\sigma}$$

$$dy = \frac{dx}{\sigma}$$

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$$X \sim N(\mu, \sigma)$$

$$\mathrm{Var}(X) = \frac{1}{\sigma\sqrt{2\pi}} \int_{-\infty}^{\infty} (x-\mu)^2 e^{-\frac{(x-\mu)^2}{2\sigma^2}}\ dx \qquad y = \boxed{\frac{x-\mu}{\sigma}}$$

$$= \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} (x-\mu)^2 e^{-\frac{y^2}{2}}\ dy \qquad dy = \frac{dx}{\sigma}$$

$$X \sim N(\mu, \sigma)$$

$$\mathrm{Var}(X) = \frac{1}{\sigma\sqrt{2\pi}} \int_{-\infty}^{\infty} (x-\mu)^2 e^{-\frac{(x-\mu)^2}{2\sigma^2}} \, dx \qquad y = \frac{x-\mu}{\sigma}$$

$$= \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} (x-\mu)^2 e^{-\frac{y^2}{2}} \, dy \qquad dy = \frac{dx}{\sigma}$$

$$X \sim N(\mu, \sigma)$$

$$\mathrm{Var}(X) = \frac{1}{\boxed{\sigma}\sqrt{2\pi}} \int_{-\infty}^{\infty} (x-\mu)^2 e^{-\frac{\boxed{(x-\mu)}^2}{2\boxed{\sigma}^2}} \boxed{dx}$$

$$y = \boxed{\frac{x-\mu}{\sigma}}$$

$$\boxed{dy} = \boxed{\frac{dx}{\sigma}}$$

$$= \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} (x-\mu)^2 e^{-\frac{y^2}{2}} \boxed{dy}$$

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$$\mathrm{Var}(X) = \frac{1}{\sigma\sqrt{2\pi}} \int_{-\infty}^{\infty} (x-\mu)^2 e^{-\frac{(x-\mu)^2}{2\sigma^2}}\, dx$$

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$$= \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} (x-\mu)^2 e^{-\frac{y^2}{2}} dy$$

$$x - \mu = \sigma y$$

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$$\mathrm{Var}(X) = \frac{1}{\sigma\sqrt{2\pi}} \int_{-\infty}^{\infty} (x-\mu)^2 e^{-\frac{(x-\mu)^2}{2\sigma^2}}\, dx$$

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$$x - \mu = \sigma y$$

$$= \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} (\sigma y)^2 e^{-\frac{y^2}{2}}\, dy$$

$$X \sim N(\mu, \sigma)$$

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$$y = \frac{x-\mu}{\sigma}$$

$$dy = \frac{dx}{\sigma}$$

$$x - \mu = \sigma y$$

$$= \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} (x-\mu)^2 e^{-\frac{y^2}{2}}\, dy$$

$$= \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} (\sigma y)^2 e^{-\frac{y^2}{2}}\, dy$$

$$= \frac{\sigma^2}{\sqrt{2\pi}} \int_{-\infty}^{\infty} y^2 e^{-\frac{y^2}{2}}\, dy$$

$$X \sim N(\mu, \sigma)$$

$$\mathrm{Var}(X) = \frac{1}{\sigma\sqrt{2\pi}} \int_{-\infty}^{\infty} (x-\mu)^2 e^{-\frac{(x-\mu)^2}{2\sigma^2}}\, dx$$

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$$dy = \frac{dx}{\sigma}$$

$$x - \mu = \sigma y$$

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$$= \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} (\sigma y)^2 e^{-\frac{y^2}{2}}\, dy$$

$$= \frac{\sigma^2}{\sqrt{2\pi}} \int_{-\infty}^{\infty} y^2 e^{-\frac{y^2}{2}}\, dy$$

$$X \sim N(\mu, \sigma)$$

$$\mathrm{Var}(X) = \frac{\sigma^2}{\sqrt{2\pi}} \int_{-\infty}^{\infty} y^2 e^{-\frac{y^2}{2}} \, dy$$

$$X \sim N(\mu, \sigma)$$

$$\mathrm{Var}(X) = \frac{\sigma^2}{\sqrt{2\pi}} \int_{-\infty}^{\infty} y^2 e^{-\frac{y^2}{2}} \, dy$$

$$u = y$$

$$X \sim N(\mu, \sigma)$$

$$\mathrm{Var}(X) \ = \frac{\sigma^2}{\sqrt{2\pi}} \int_{-\infty}^{\infty} y^2 e^{-\frac{y^2}{2}} \ dy$$

$$u = y \qquad\qquad dv = ye^{-\frac{y^2}{2}} dy$$

$$X \sim N(\mu, \sigma)$$

$$\mathrm{Var}(X) = \frac{\sigma^2}{\sqrt{2\pi}} \int_{-\infty}^{\infty} y^2 e^{-\frac{y^2}{2}} \, dy$$

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$$u = y \qquad dv = y e^{-\frac{y^2}{2}} dy$$

$$du = dy \qquad v = \int y e^{-\frac{y^2}{2}} dy$$

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$$u = y \qquad dv = ye^{-\frac{y^2}{2}} dy$$

$$du = dy \qquad v = \int ye^{-\frac{y^2}{2}} dy \qquad w = \frac{y^2}{2}$$

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$$\mathrm{Var}(X) = \frac{\sigma^2}{\sqrt{2\pi}} \int_{-\infty}^{\infty} y^2 e^{-\frac{y^2}{2}} \, dy$$

$$u = y \qquad dv = ye^{-\frac{y^2}{2}} dy$$

$$du = dy \qquad v = \int ye^{-\frac{y^2}{2}} dy \qquad w = \frac{y^2}{2}$$

$$dw = ydy$$

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$$\mathrm{Var}(X) = \frac{\sigma^2}{\sqrt{2\pi}} \int_{-\infty}^{\infty} y^2 e^{-\frac{y^2}{2}} \, dy$$

$$u = y \qquad dv = y e^{-\frac{y^2}{2}} dy$$

$$w = \frac{y^2}{2}$$

$$du = dy \qquad v = \int y e^{-\frac{y^2}{2}} dy$$

$$dw = y dy$$

$$= \int e^{-w} dw$$

$$X \sim N(\mu, \sigma)$$

$$\mathrm{Var}(X) = \frac{\sigma^2}{\sqrt{2\pi}} \int_{-\infty}^{\infty} y^2 e^{-\frac{y^2}{2}} \, dy$$

$$u = y \qquad dv = ye^{-\frac{y^2}{2}} dy$$

$$du = dy \qquad v = \int ye^{-\frac{y^2}{2}} dy \qquad w = \frac{y^2}{2}$$

$$dw = ydy$$

$$= \int e^{-w} dw$$

$$= -e^{-w}$$

$$X \sim N(\mu, \sigma)$$

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$$u = y \qquad dv = ye^{-\frac{y^2}{2}} dy$$

$$w = \frac{y^2}{2}$$

$$du = dy \qquad v = \int ye^{-\frac{y^2}{2}} dy$$

$$dw = ydy$$

$$= \int e^{-w} dw$$

$$= -e^{-w} \quad = -e^{-\frac{y^2}{2}}$$

$$X \sim N(\mu, \sigma)$$

$$\mathrm{Var}(X) = \frac{\sigma^2}{\sqrt{2\pi}} \int_{-\infty}^{\infty} y^2 e^{-\frac{y^2}{2}} \, dy$$

$$= \frac{\sigma^2}{\sqrt{2\pi}} \left(-ye^{-\frac{y^2}{2}} \Big|_{-\infty}^{\infty} + \int_{-\infty}^{\infty} e^{-\frac{y^2}{2}} \, dy \right)$$

$$u = y \qquad dv = ye^{-\frac{y^2}{2}} dy$$

$$du = dy \qquad v = \int ye^{-\frac{y^2}{2}} dy \qquad w = \frac{y^2}{2}$$

$$dw = ydy$$

$$= \int e^{-w} dw$$

$$= -e^{-w} \quad = -e^{-\frac{y^2}{2}}$$

$$X \sim N(\mu, \sigma)$$

$$\mathrm{Var}(X) = \frac{\sigma^2}{\sqrt{2\pi}} \int_{-\infty}^{\infty} y^2 e^{-\frac{y^2}{2}} \, dy$$

$$= \frac{\sigma^2}{\sqrt{2\pi}} \left(-y e^{-\frac{y^2}{2}} \Big|_{-\infty}^{\infty} + \int_{-\infty}^{\infty} e^{-\frac{y^2}{2}} \, dy \right)$$

$$u = y \qquad dv = y e^{-\frac{y^2}{2}} dy$$

$$du = dy \qquad v = \int y e^{-\frac{y^2}{2}} dy \qquad w = \frac{y^2}{2}$$

$$dw = y\,dy$$

$$= \int e^{-w} dw$$

$$= -e^{-w} = -e^{-\frac{y^2}{2}}$$

$$X \sim N(\mu, \sigma)$$

$$\text{Var}(X) = \frac{\sigma^2}{\sqrt{2\pi}} \int_{-\infty}^{\infty} y^2 e^{-\frac{y^2}{2}} \, dy$$

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$$X \sim N(\mu, \sigma)$$

$$E(X) = \mu \qquad \mathrm{Var}(X) = \sigma^2$$

$$X \sim N(\mu, \sigma)$$

Comment faire pour calculer

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$$P(X \leq a)$$

$$X \sim N(\mu, \sigma)$$

Comment faire pour calculer

$$P(X \leq a) = \frac{1}{\sigma\sqrt{2\pi}} \int_{-\infty}^{a} e^{-\frac{(x-\mu)^2}{2\sigma^2}} \, dx$$

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Mais la fonction n'a pas de primitive analytique

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Il faut donc utiliser les séries de Taylor!

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Ouin…

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$$E(Z) = 0 \qquad\qquad \text{Var}(Z) = 1$$

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$$Z \sim N(0, 1)$$

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c'est-à-dire

$$E(Z) = 0 \qquad\qquad \mathrm{Var}(Z) = 1$$

et donc

$$Z \sim N(0, 1)$$

Il suffit donc de calculer les séries de Taylor pour une seule loi normale

Mais on ne fera pas ça…

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Quelqu'un l'a déjà
fait pour nous.

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On va utiliser une table de
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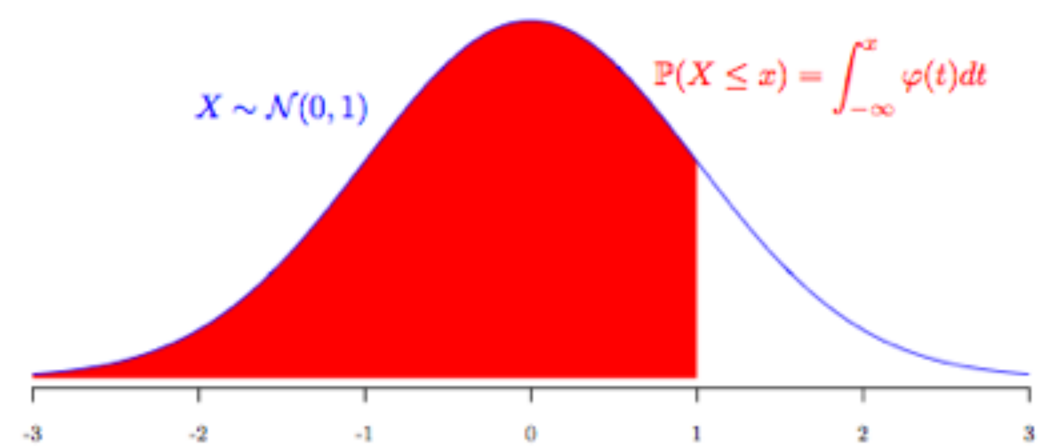
Mais on ne fera pas ça…

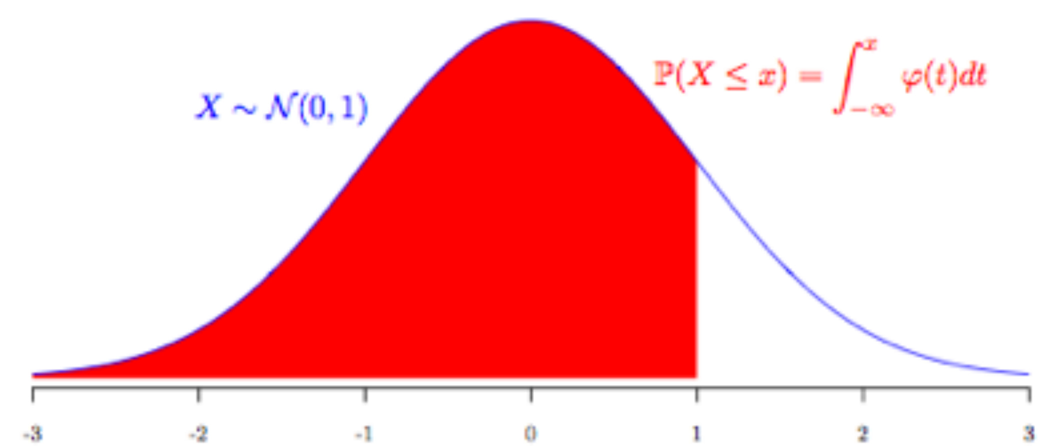


Quelqu'un l'a déjà fait pour nous.

On va utiliser une table de la loi normale

	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990

$$P(Z \leq 1,64)$$



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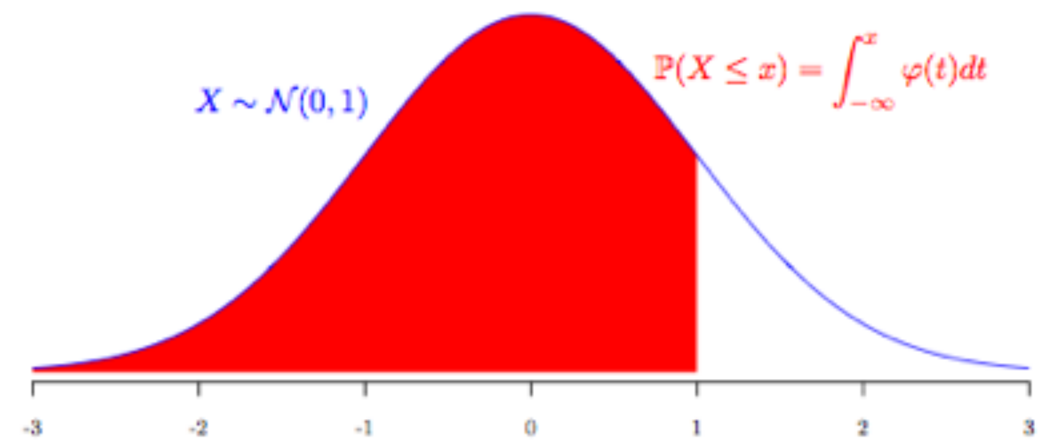

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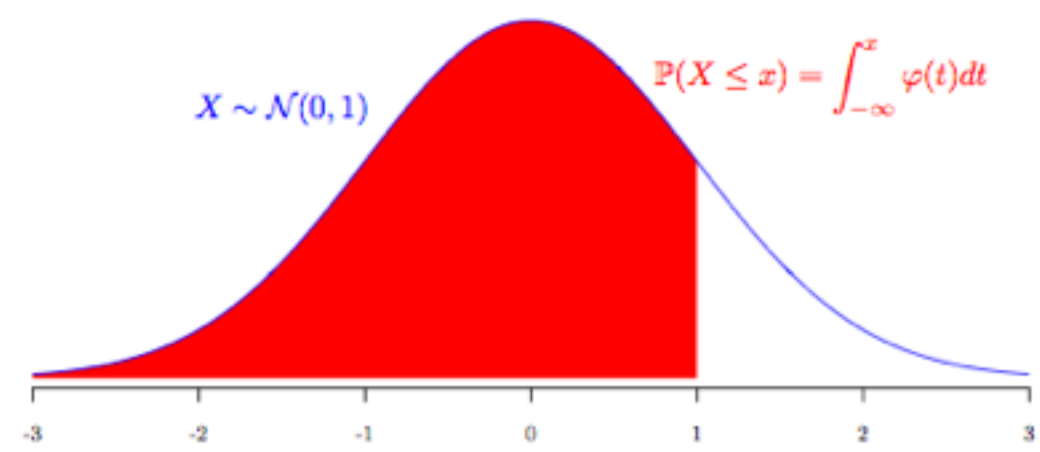
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990

$$P(Z \leq 1,64)$$



	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
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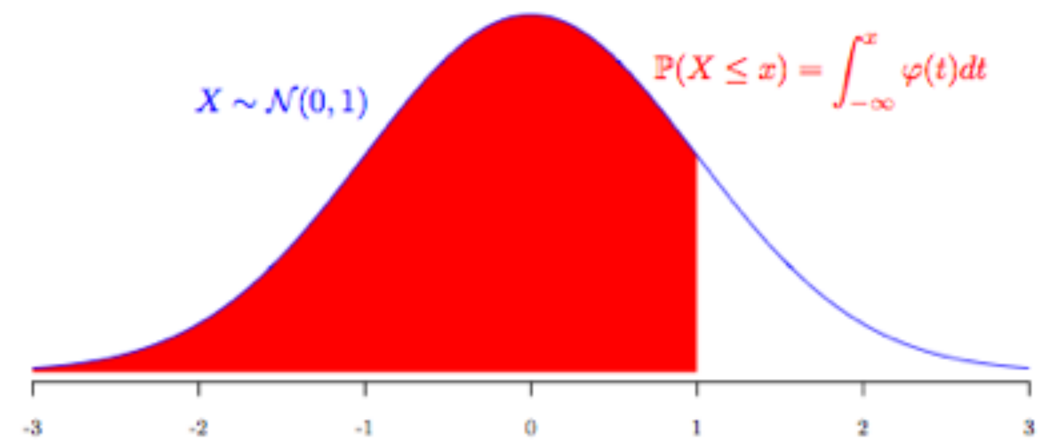
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990

$$P(Z \leq 1,64) \approx 0,9495$$



	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
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2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
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2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990

$$P(Z \leq a)$$

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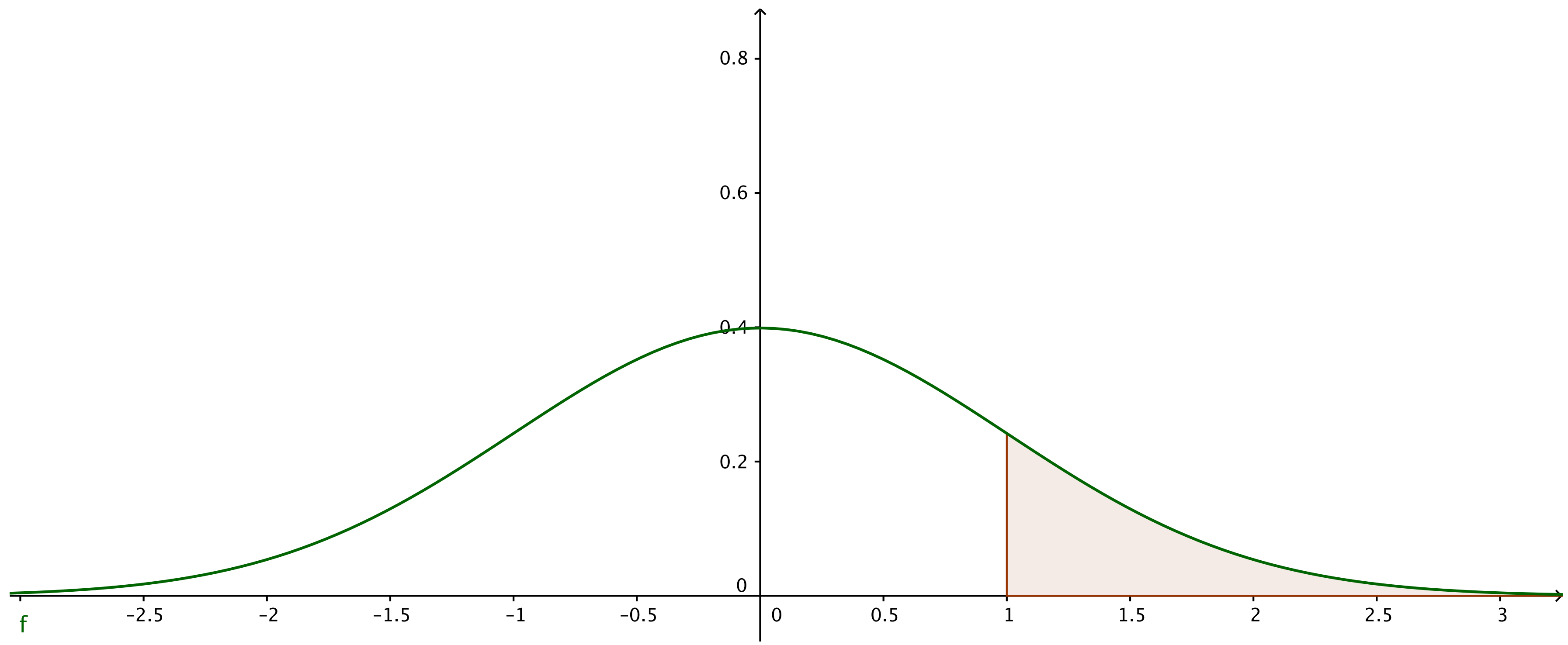
$$P(Z \geq a)$$

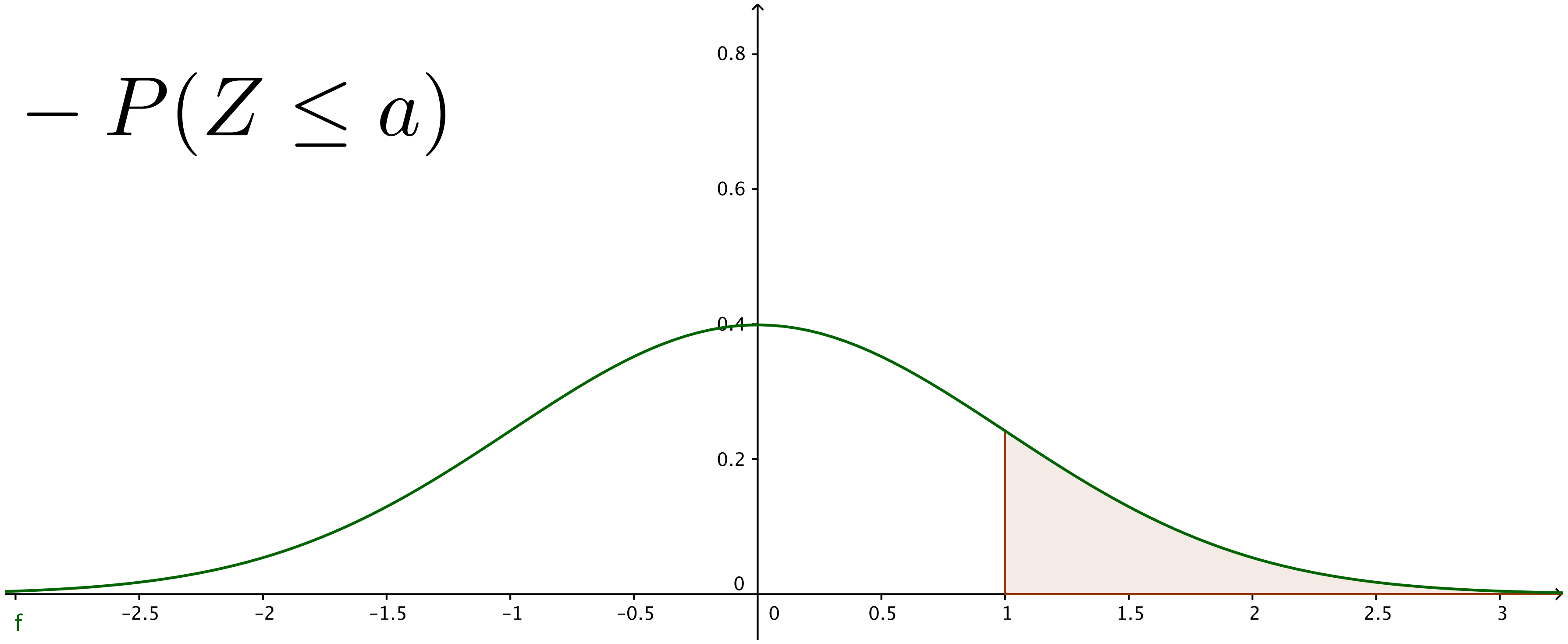
$$P(Z \leq a)$$

$$P(Z \geq a)$$



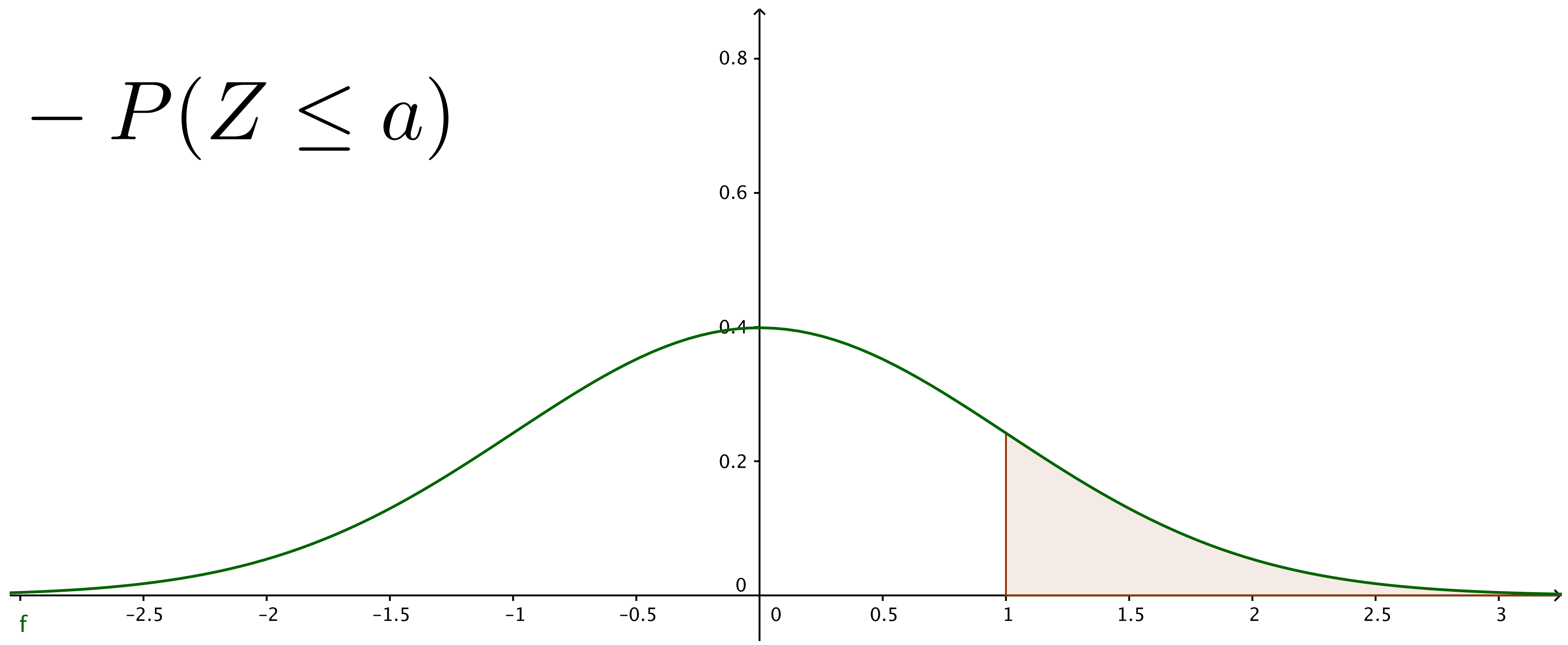
$$P(Z \leq a)$$

$$P(Z \geq a) = 1 - P(Z \leq a)$$



$$P(Z \leq a)$$

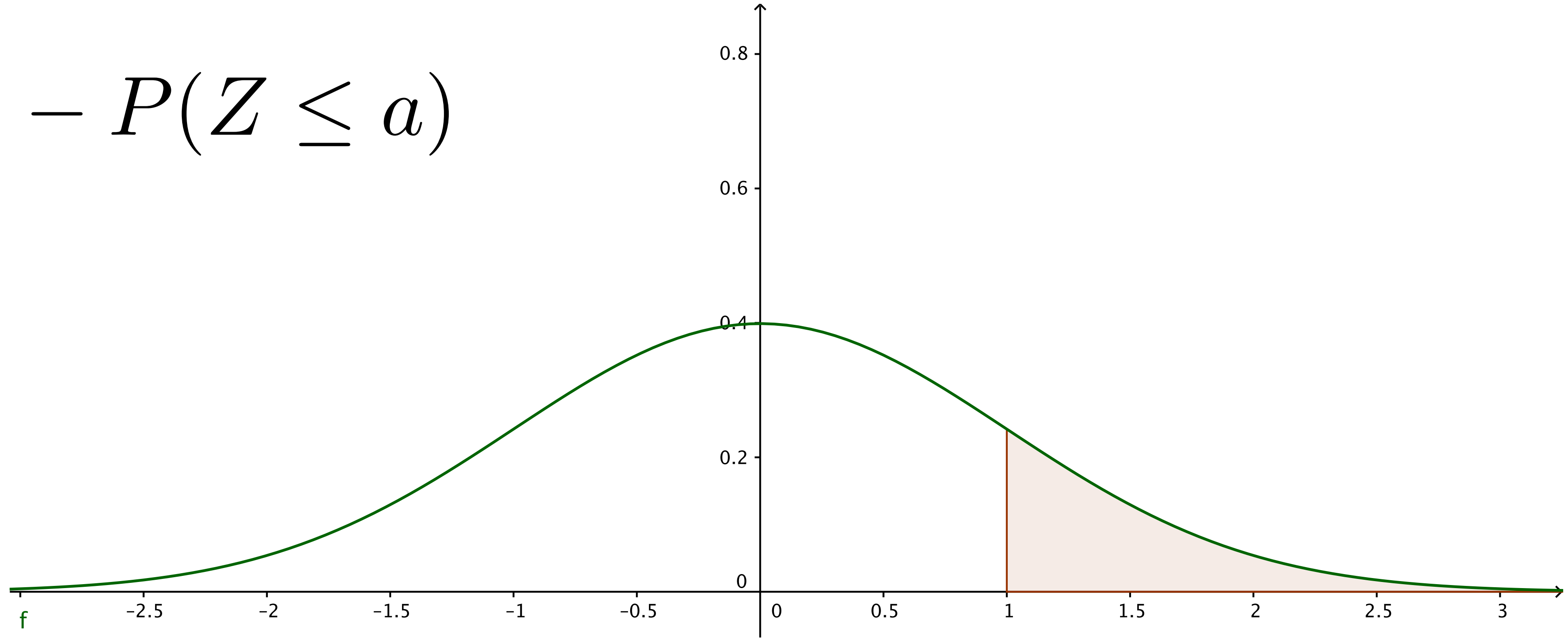
$$P(Z \geq a) = 1 - P(Z \leq a)$$



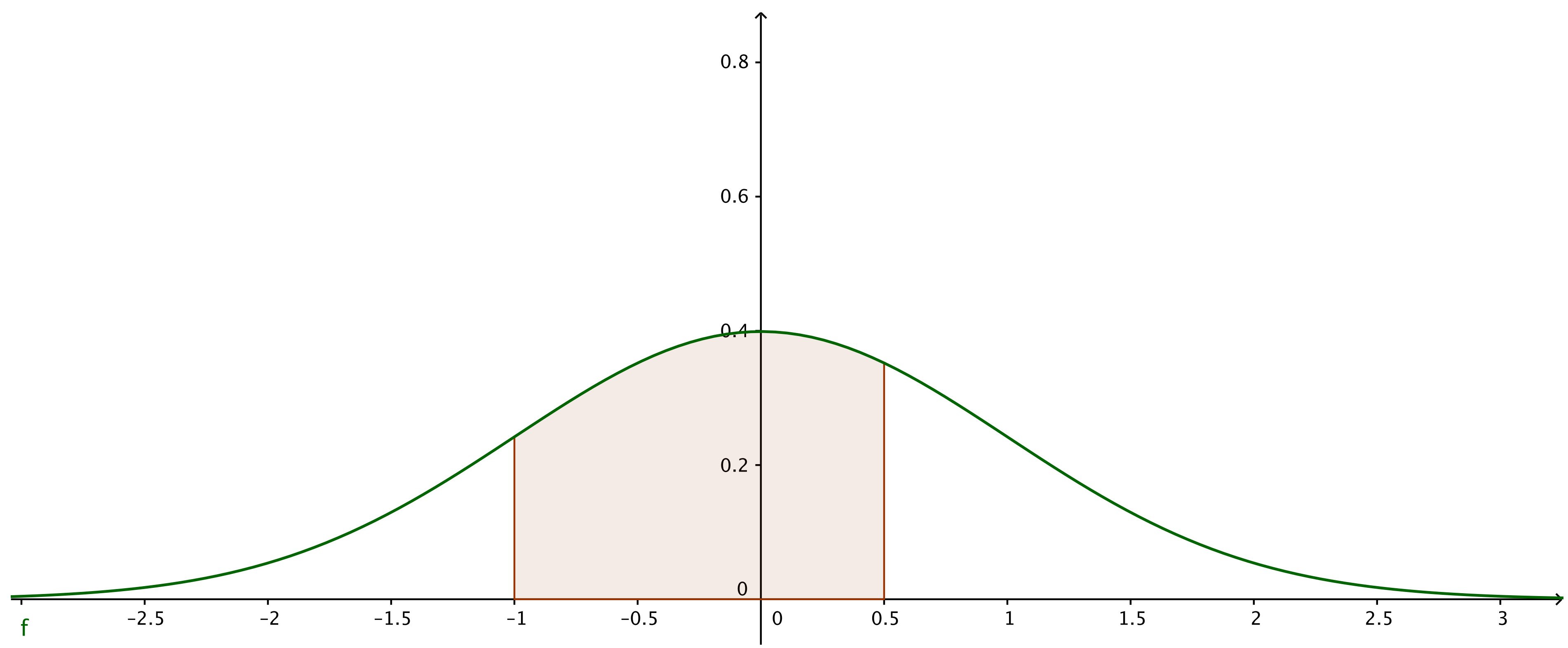
$$P(a \leq Z \leq b)$$

$$P(Z \leq a)$$

$$P(Z \geq a) = 1 - P(Z \leq a)$$

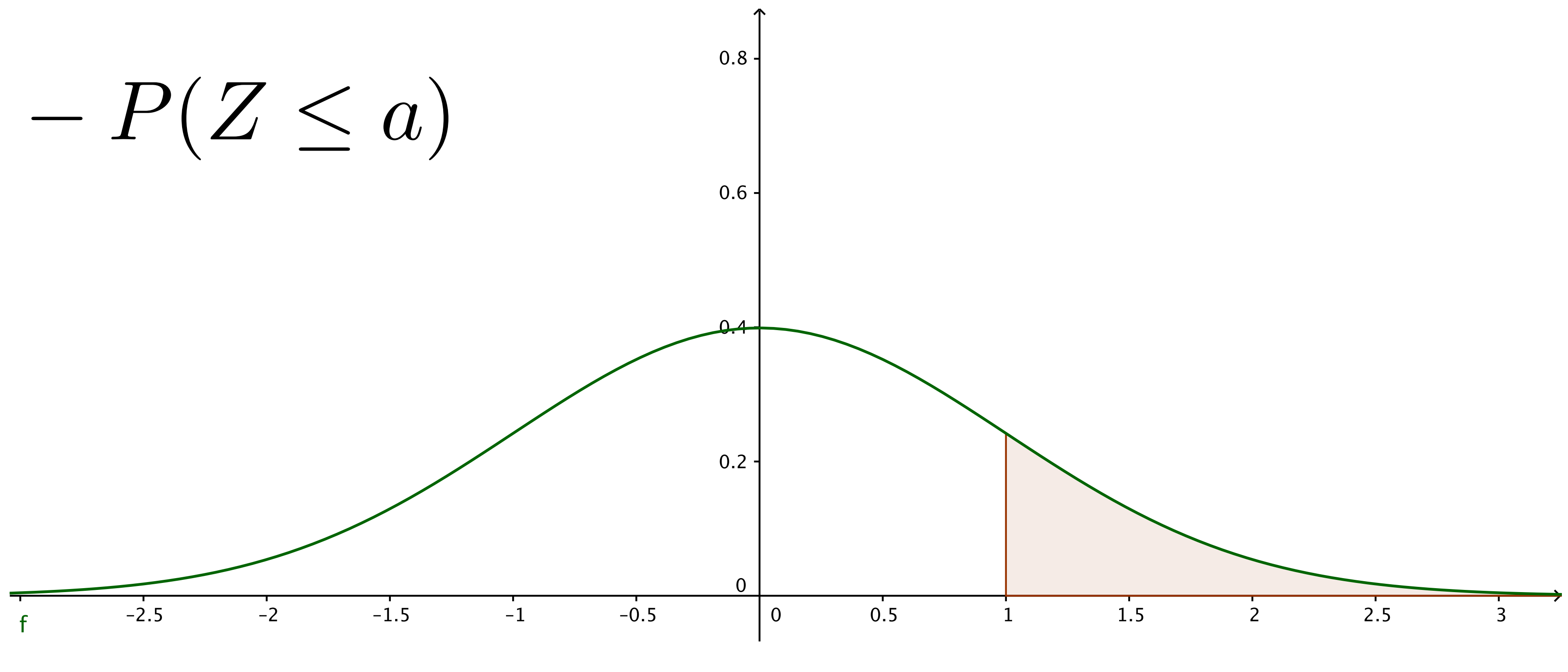


$$P(a \leq Z \leq b)$$

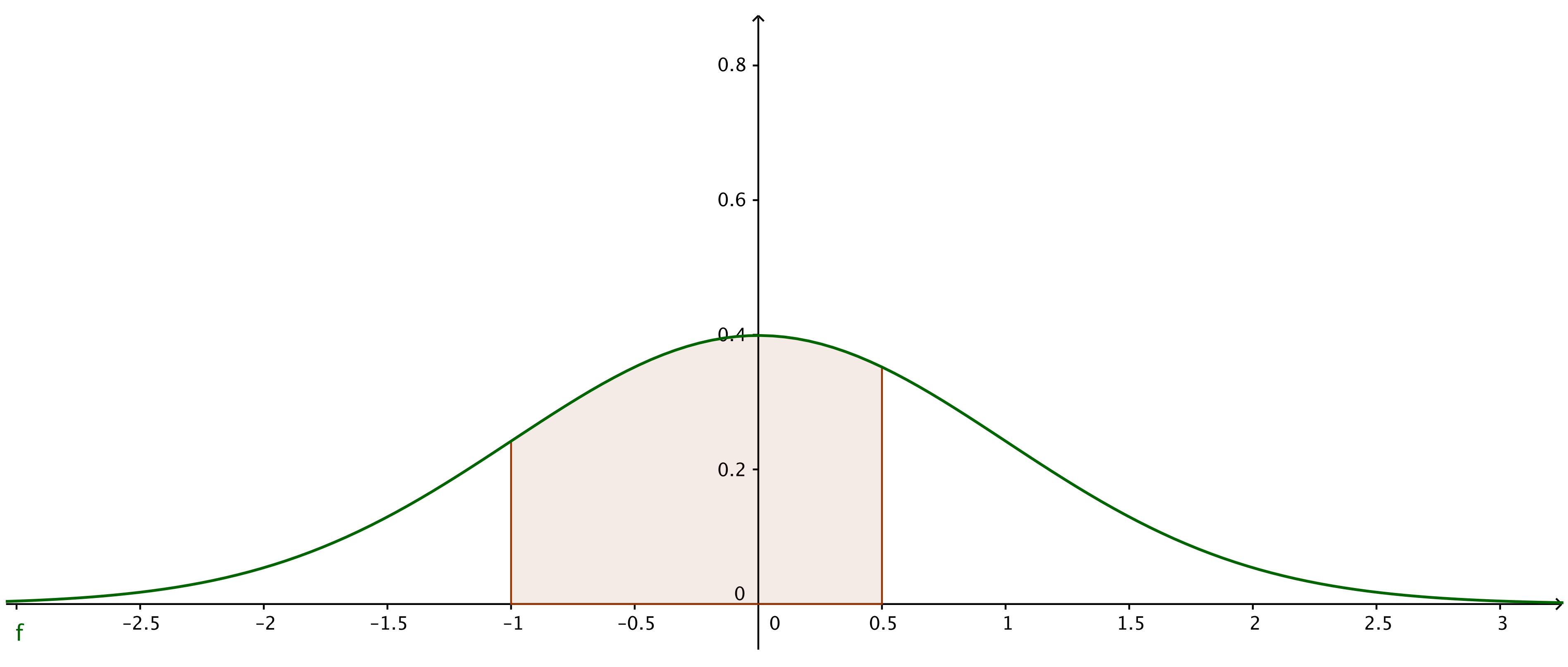


$$P(Z \leq a)$$

$$P(Z \geq a) = 1 - P(Z \leq a)$$



$$P(a \leq Z \leq b) = P(Z \leq b) - P(Z \leq a)$$



Exemple On achète une citrouille au marché. Son poids en livre suit une loi normale $X \sim N(5, 3)$

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Quelle est la probabilité qu'une citrouille prise au hasard ait un poids entre 6 et 7 livres?

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Quelle est la probabilité qu'une citrouille prise au hasard ait un poids entre 6 et 7 livres?

$$P(6 \leq X \leq 7)$$

Exemple On achète une citrouille au marché. Son poids en livre suit une loi normale $X \sim N(5,3)$

Quelle est la probabilité qu'une citrouille prise au hasard ait un poids entre 6 et 7 livres?

$$P(6 \leq X \leq 7) = P\left(\frac{6-5}{3} \leq \frac{X-5}{3} \leq \frac{7-5}{3}\right)$$

Exemple On achète une citrouille au marché. Son poids en livre suit une loi normale $X \sim N(5, 3)$

Quelle est la probabilité qu'une citrouille prise au hasard ait un poids entre 6 et 7 livres?

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$$P(6 \leq X \leq 7) = P\left(\frac{6-5}{3} \leq \frac{X-5}{3} \leq \frac{7-5}{3}\right)$$

$$= P\left(\frac{1}{3} \leq Z \leq \frac{2}{3}\right)$$

Exemple On achète une citrouille au marché. Son poids en livre suit une loi normale $X \sim N(5, 3)$

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$$= P\left(\frac{1}{3} \leq Z \leq \frac{2}{3}\right)$$

$$= P\left(Z \leq \frac{2}{3}\right) - P\left(Z \leq \frac{1}{3}\right)$$

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$$P(6 \leq X \leq 7) = P\left(\frac{6-5}{3} \leq \frac{X-5}{3} \leq \frac{7-5}{3}\right)$$

$$= P\left(\frac{1}{3} \leq Z \leq \frac{2}{3}\right)$$

$$= P\left(Z \leq \frac{2}{3}\right) - P\left(Z \leq \frac{1}{3}\right)$$

$$= P\left(Z \leq 0,67\right) - P\left(Z \leq 0,33\right)$$

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$$= P\left(Z \le 0,67\right) - P\left(Z \le 0,33\right)$$

$$= 0,7486 - 0,6293$$

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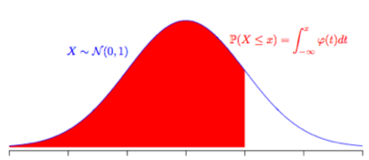
$$= P\left(\frac{1}{3} \leq Z \leq \frac{2}{3}\right)$$

$$= P\left(Z \leq \frac{2}{3}\right) - P\left(Z \leq \frac{1}{3}\right)$$

$$= P\left(Z \leq 0,67\right) - P\left(Z \leq 0,33\right)$$

$$= 0,7486 - 0,6293$$



	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
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0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
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1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990

Exemple On achète une citrouille au marché. Son poids en livre suit une loi normale $X \sim N(5, 3)$

Quelle est la probabilité qu'une citrouille prise au hasard ait un poids entre 6 et 7 livres?

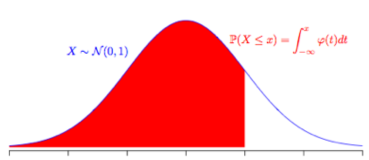
$$P(6 \leq X \leq 7) = P\left(\frac{6-5}{3} \leq \frac{X-5}{3} \leq \frac{7-5}{3}\right)$$

$$= P\left(\frac{1}{3} \leq Z \leq \frac{2}{3}\right)$$

$$= P\left(Z \leq \frac{2}{3}\right) - P\left(Z \leq \frac{1}{3}\right)$$

$$= P\left(Z \leq 0,67\right) - P\left(Z \leq 0,33\right)$$

$$= 0,7486 - 0,6293 = 0,1193$$



	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
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2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990

Faites les exercices suivants

3.49 à 3.59

Approximation d'une loi binomiale à l'aide de la loi normale.

$X \sim B(n,p)$

Approximation d'une loi binomiale à l'aide de la loi normale.

$X \sim B(n, p)$ avec n suffisamment grand

Approximation d'une loi binomiale à l'aide de la loi normale.

$X \sim B(n, p)$ avec n suffisamment grand

$E(X) = np$

Approximation d'une loi binomiale à l'aide de la loi normale.

$X \sim B(n, p)$ avec n suffisamment grand

$E(X) = np$ $\quad$ $\mathrm{Var}(X) = npq$

Approximation d'une loi binomiale à l'aide de la loi normale.

$X \sim B(n, p)$ avec n suffisamment grand

$E(X) = np = \mu$ $\mathrm{Var}(X) = npq$

Approximation d'une loi binomiale à l'aide de la loi normale.

$X \sim B(n, p)$ avec n suffisamment grand

$E(X) = np = \mu$ $\mathrm{Var}(X) = npq = \sigma^2$

Approximation d'une loi binomiale à l'aide de la loi normale.

$X \sim B(n, p)$ avec n suffisamment grand

$E(X) = np = \mu$

$\mathrm{Var}(X) = npq = \sigma^2$

Le théorème central limite.

Approximation d'une loi binomiale à l'aide de la loi normale.

$X \sim B(n,p)$ avec n suffisamment grand

$E(X) = np = \mu$ $\mathrm{Var}(X) = npq = \sigma^2$

Le théorème central limite.

$$X \approx N(np, \sqrt{npq})$$

$X \sim B(n, p)$ avec n suffisamment grand

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Habituellement on utilise cette approximation si

$X \sim B(n, p)$ avec n suffisamment grand

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$$n \geq 30$$

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Habituellement on utilise cette approximation si

$$n \geq 30$$

$$np \geq 5$$

$X \sim B(n, p)$ avec n suffisamment grand

Habituellement on utilise cette approximation si

$$n \geq 30$$

$$np \geq 5$$

$$nq \geq 5$$

$X \sim B(n, p)$ avec n suffisamment grand

Habituellement on utilise cette approximation si

$$n \geq 30$$

$$np \geq 5$$

$$nq \geq 5$$

$$X \approx N(np, \sqrt{npq})$$

Correction de continuité.

$$X \sim B(n, p) \qquad\qquad Y \sim N(np, \sqrt{npq})$$

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$$X \sim B(n, p) \qquad\qquad Y \sim N(np, \sqrt{npq})$$

$$P(X = a) \approx P\left(a - \frac{1}{2} \leq Y \leq a + \frac{1}{2}\right)$$

Correction de continuité.

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$$P(X = a) \approx P\left(a - \frac{1}{2} \leq Y \leq a + \frac{1}{2}\right)$$

$$P(X \leq a) \approx P\left(Y \leq a + \frac{1}{2}\right)$$

Correction de continuité.

$$X \sim B(n, p) \qquad\qquad Y \sim N(np, \sqrt{npq})$$

$$P(X = a) \approx P\left(a - \frac{1}{2} \leq Y \leq a + \frac{1}{2}\right)$$

$$P(X \leq a) \approx P\left(Y \leq a + \frac{1}{2}\right)$$

$$P(X < a) \approx P\left(Y \leq a - \frac{1}{2}\right)$$

Exemple

Une variable aléatoire compte le nombre de piles lors d'une série de 40 jets. On veut la probabilité d'obtenir 20 piles.

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$$X \sim B(40; 0,5)$$

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$$X \sim B(40; 0,5) \qquad\qquad E(X) = np = 20$$

Exemple Une variable aléatoire compte le nombre de piles lors d'une série de 40 jets. On veut la probabilité d'obtenir 20 piles.

$$X \sim B(40; 0,5)$$

$$E(X) = np = 20$$

$$\mathrm{Var}(X) = npq = 10$$

Exemple Une variable aléatoire compte le nombre de piles lors d'une série de 40 jets. On veut la probabilité d'obtenir 20 piles.

$$X \sim B(40; 0,5)$$

$$E(X) = np = 20$$

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$$X \sim N(20, \sqrt{10})$$

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$$X \sim B(40; 0,5)$$

$$E(X) = np = 20$$

$$\mathrm{Var}(X) = npq = 10$$

$$X \sim N(20, \sqrt{10})$$

$$P(X = 20) = P(19,5 \leq X \leq 20,5)$$

Exemple Une variable aléatoire compte le nombre de piles lors d'une série de 40 jets. On veut la probabilité d'obtenir 20 piles.

$$X \sim B(40; 0,5)$$

$$E(X) = np = 20$$

$$\mathrm{Var}(X) = npq = 10$$

$$X \sim N(20, \sqrt{10})$$

$$P(X = 20) = P(19,5 \leq X \leq 20,5)$$

$$= P\left(\frac{19,5 - 20}{\sqrt{10}} \leq \frac{X - 20}{\sqrt{10}} \leq \frac{20,5 - 20}{\sqrt{10}}\right)$$

Exemple Une variable aléatoire compte le nombre de piles lors d'une série de 40 jets. On veut la probabilité d'obtenir 20 piles.

$$X \sim B(40; 0,5)$$

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$$P(X = 20) = P(19,5 \leq X \leq 20,5)$$

$$= P\left(\frac{19,5 - 20}{\sqrt{10}} \leq \frac{X - 20}{\sqrt{10}} \leq \frac{20,5 - 20}{\sqrt{10}}\right)$$

$$= P\left(-0,16 \leq Z \leq 0,16\right)$$

Exemple Une variable aléatoire compte le nombre de piles lors d'une série de 40 jets. On veut la probabilité d'obtenir 20 piles.

$$X \sim B(40; 0,5)$$

$$E(X) = np = 20$$

$$\mathrm{Var}(X) = npq = 10$$

$$X \sim N(20, \sqrt{10})$$

$$P(X = 20) = P(19,5 \leq X \leq 20,5)$$

$$= P\left(\frac{19,5 - 20}{\sqrt{10}} \leq \frac{X - 20}{\sqrt{10}} \leq \frac{20,5 - 20}{\sqrt{10}}\right)$$

$$= P\left(-0,16 \leq Z \leq 0,16\right)$$

$$= P\left(Z \leq 0,16\right) - P\left(Z \leq -0,16\right)$$

Exemple Une variable aléatoire compte le nombre de piles lors d'une série de 40 jets. On veut la probabilité d'obtenir 20 piles.

$$X \sim B(40; 0,5)$$

$$E(X) = np = 20$$

$$\mathrm{Var}(X) = npq = 10$$

$$X \sim N(20, \sqrt{10})$$

$$P(X = 20) = P(19,5 \leq X \leq 20,5)$$

$$= P\left(\frac{19,5 - 20}{\sqrt{10}} \leq \frac{X - 20}{\sqrt{10}} \leq \frac{20,5 - 20}{\sqrt{10}}\right)$$

$$= P\left(-0,16 \leq Z \leq 0,16\right)$$

$$= P\left(Z \leq 0,16\right) - P\left(Z \leq -0,16\right) = 0,1272$$

Faites les exercices suivants

3.60 et 3.61

Aujourd'hui, nous avons vu

Aujourd'hui, nous avons vu

$$X \sim N(\mu, \sigma)$$

Aujourd'hui, nous avons vu

$$X \sim N(\mu, \sigma)$$

$$E(X) = \mu$$

Aujourd'hui, nous avons vu

$$X \sim N(\mu, \sigma)$$

$$E(X) = \mu \qquad\qquad \mathrm{Var}(X)$$

Aujourd'hui, nous avons vu

$$X \sim N(\mu, \sigma)$$

$$E(X) = \mu \qquad\qquad \mathrm{Var}(X) = \sigma^2$$

Aujourd'hui, nous avons vu

$$X \sim N(\mu, \sigma)$$

$$E(X) = \mu \qquad \text{Var}(X) = \sigma^2$$

$$Z = \frac{X - \mu}{\sigma}$$

Aujourd'hui, nous avons vu

$$X \sim N(\mu, \sigma)$$

$$E(X) = \mu \qquad \mathrm{Var}(X) = \sigma^2$$

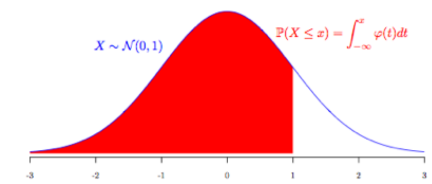
$$Z = \frac{X - \mu}{\sigma} \qquad Z \sim N(0, 1)$$

Aujourd'hui, nous avons vu

$$X \sim N(\mu, \sigma)$$

$$E(X) = \mu$$

$$\mathrm{Var}(X) = \sigma^2$$



$$Z = \frac{X - \mu}{\sigma}$$

$$Z \sim N(0,1)$$

	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
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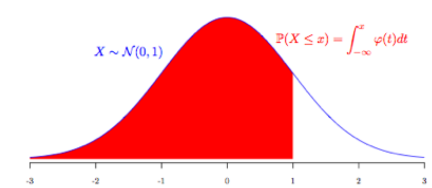
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990

Aujourd'hui, nous avons vu

$$X \sim N(\mu, \sigma)$$

$$E(X) = \mu \qquad \mathrm{Var}(X) = \sigma^2$$



$$Z = \frac{X - \mu}{\sigma} \qquad Z \sim N(0,1)$$

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0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990

$$X \sim B(n,p) \implies X \approx N(np, \sqrt{npq})$$

Devoir: 3.49 à 3.61