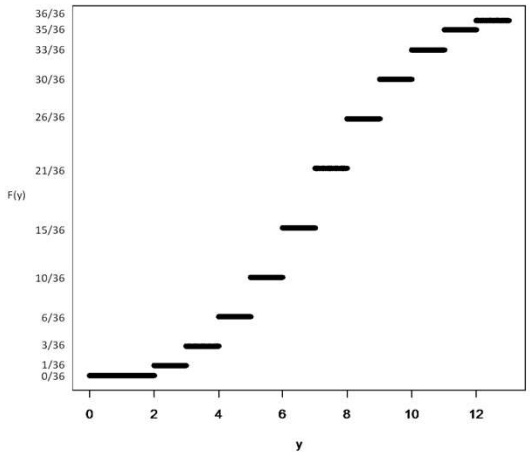
Universidad Nacional de La Plata

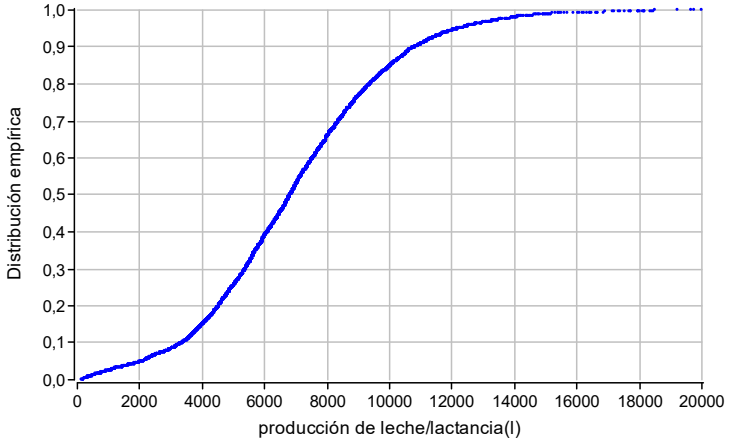
Facultad de Ciencias Agrarias y Forestales

CÁLCULO ESTADÍSTICO Y BIOMETRÍA

Distribución de variables aleatorias

- **Función de distribución de probabilidad f**(x)
- **Función de densidad f**(x)
- **Función de distribución (acumulada) F**(x)





Función de densidad

- *La función de una variable aleatoria continua (X) denotada por f(x) es una función densidad si se cumple:*

  - $f(x) \geq 0 \quad \forall\, x \in R_x$
  - $\int_{-\infty}^{+\infty} f(x) \cdot dx = 1$
  - $P(x_1 < X < x_2) = \int_{x_1}^{x_2} f(x) \cdot dx$

Función de distribución acumulada

- La **función de distribución acumulada o distribución acumulada**, denotada como F(x), asigna a cada valor de la variable un valor entre 0 y 1 que indica la probabilidad de que la variable, observada para un caso particular, asuma un valor menor o igual al valor en que se está evaluando la función.

$$F(x_0) = \int_{-\infty}^{x_0} f(x) \cdot dx$$

Esperanza y Varianza

Esperanza

$$E(X) = \mu_X = \int_{-\infty}^{+\infty} x \cdot f(x) \cdot dx$$

Variancia

$$V(X) = \int_{-\infty}^{+\infty} x^2 \cdot f(x) \cdot dx - \left[E(X)\right]^2$$

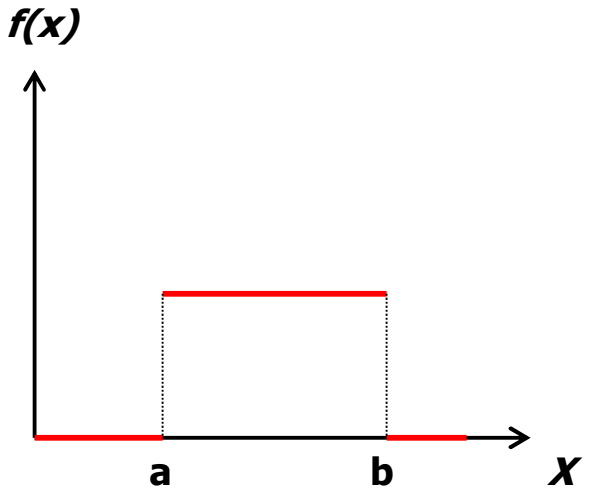
Distribuciones teóricas para V.A. continuas

- Distribución Uniforme
- Distribución Exponencial
- **Distribución Normal**
- **Distribución Normal Estándar**
- Distribución Chi-Cuadrado
- Distribución de t-Student
- Distribución F-Snedecor

1) Distribución Uniforme:

$R_X = [a;b]$ $\qquad$ $X \sim U(a;b)$

$$f(x) = \begin{cases} \dfrac{1}{b-a} & \text{si } a < X < b \\ 0 & \text{en otro caso} \end{cases}$$



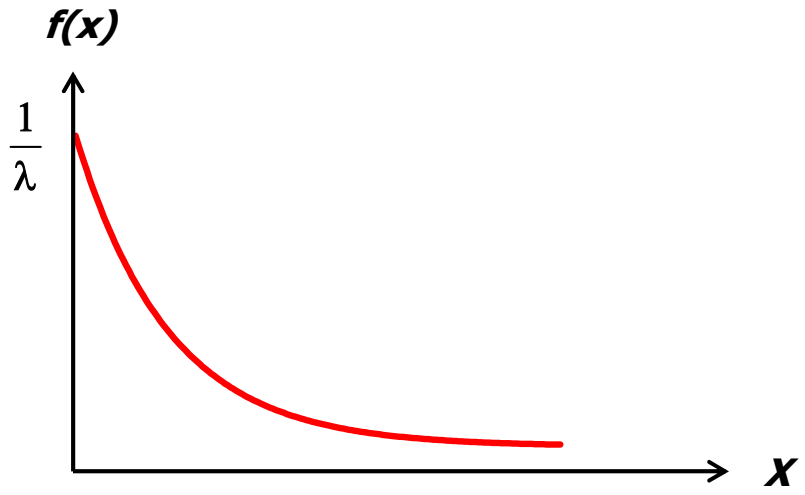
$$E(X) = \frac{a+b}{2}$$

$$V(X) = \frac{(b-a)^2}{12}$$

2) Distribución Exponencial:

$R_X = [0;+\infty]$ $\qquad$ $X \sim Exp(\lambda)$

$$f(x) = \lambda \cdot e^{-\lambda} \quad \text{para } \forall\, x \geq 0$$

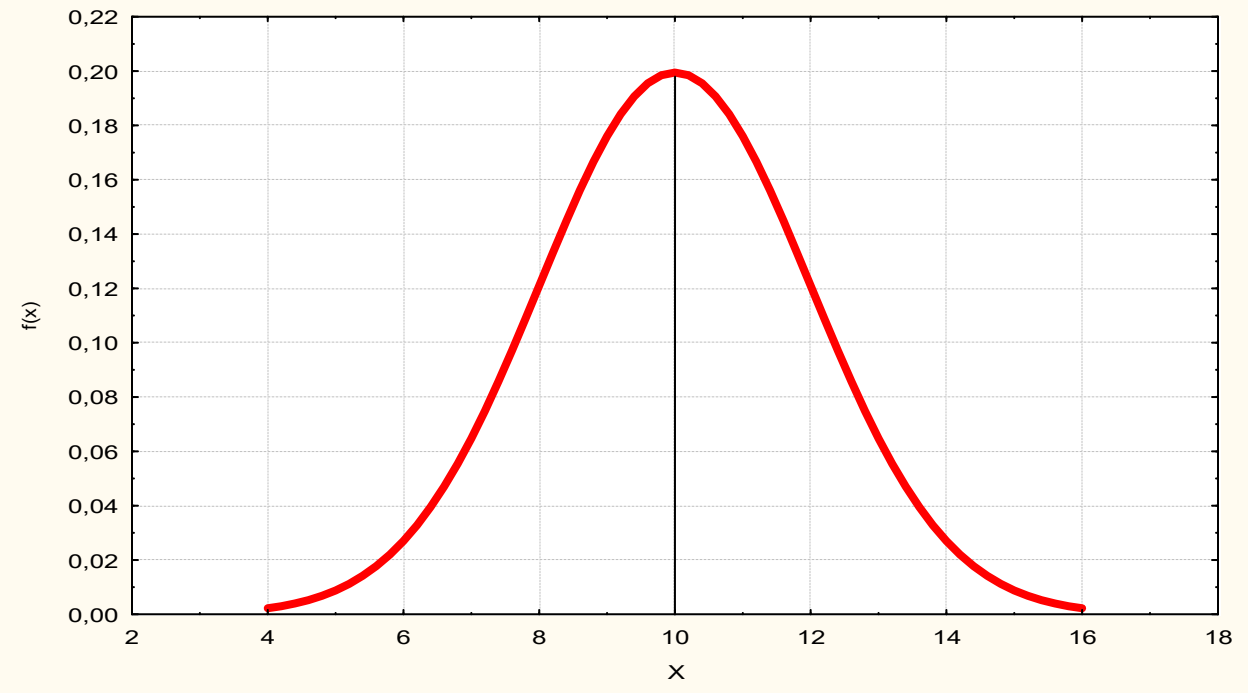


$E(X) = 1 / \lambda$ $\qquad$ $V(X) = 1 / \lambda^2$

3) Distribución Normal:

$R_x = [-\infty ; +\infty]$ $\qquad$ $X \sim N(\mu ; \sigma^2)$

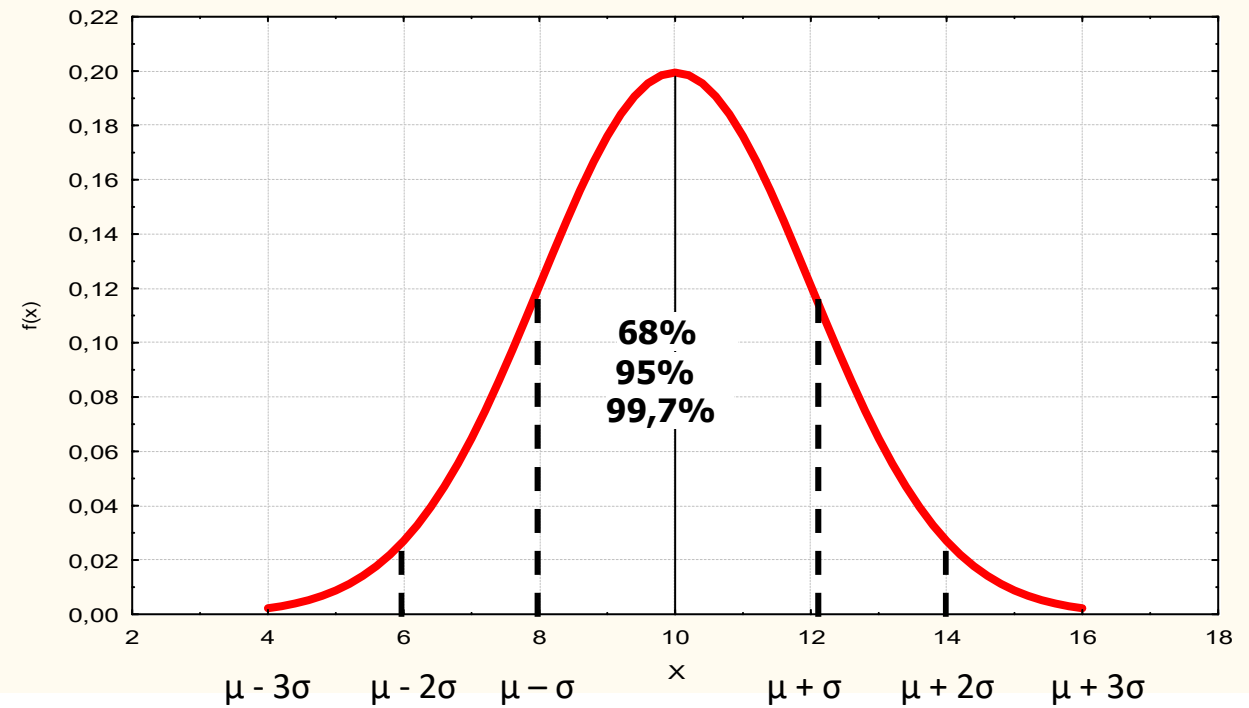
$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} \cdot e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}$$

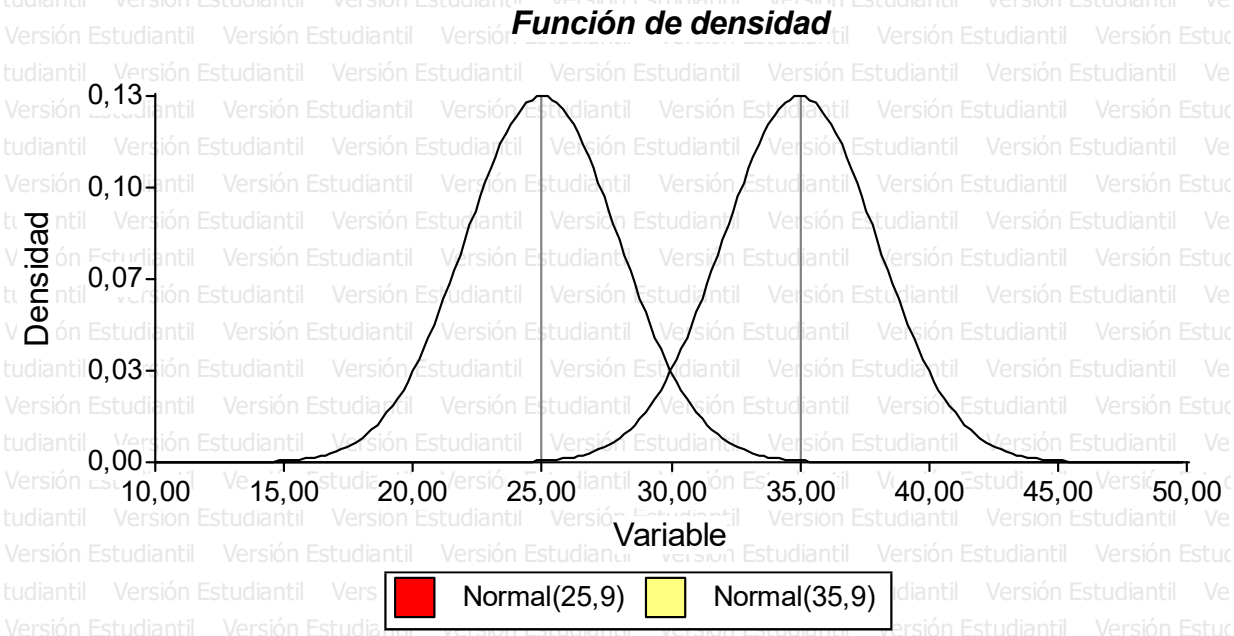


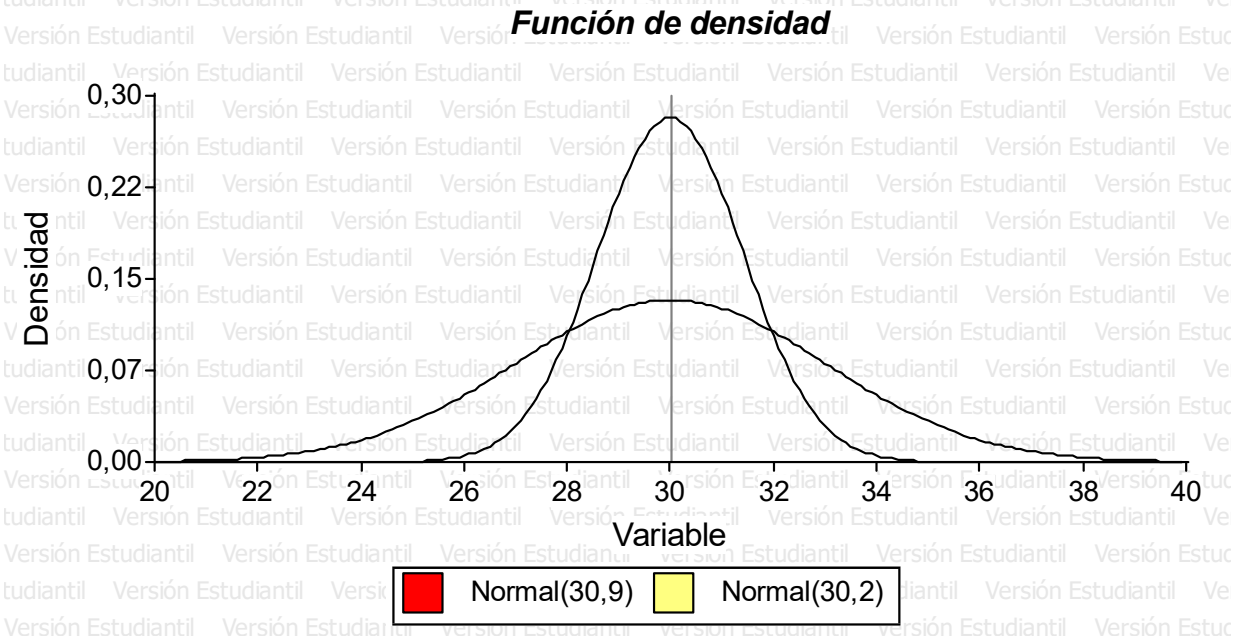
Características:

- Máximo en μ
- Dos puntos de inflexión en $\mu \pm \sigma$
- Simétrica respecto a μ
- Área bajo la curva = 1
- Asintótica con respecto al eje X cuando x $\rightarrow \pm \infty$
- Mesocúrtica

$X \sim N(10;4)$




Función de densidad
Densidad
0,13
0,10
0,07
0,03
0,00
10,00
15,00
20,00
25,00
30,00
35,00
40,00
45,00
50,00
Variable
Normal(25,9)
Normal(35,9)

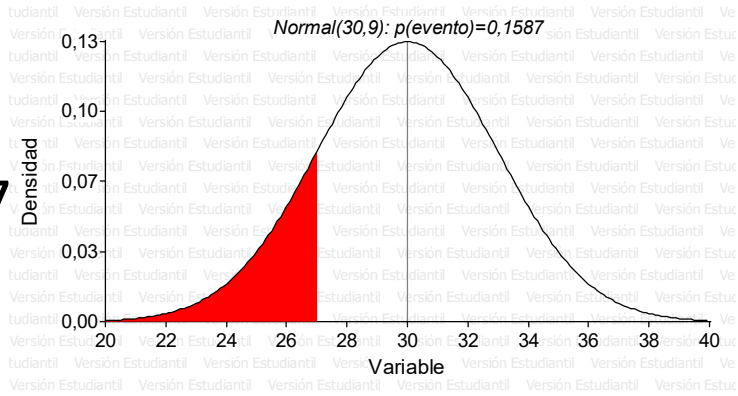

Función de densidad
Densidad
0,30
0,22
0,15
0,07
0,00
20
22
24
26
28
30
32
34
36
38
40
Variable
Normal(30,9)
Normal(30,2)

Sabiendo que la producción de leche diaria de las vacas de un tambo se distribuyen siguiendo un modelo normal, con esperanza 30 litros y varianza 9.

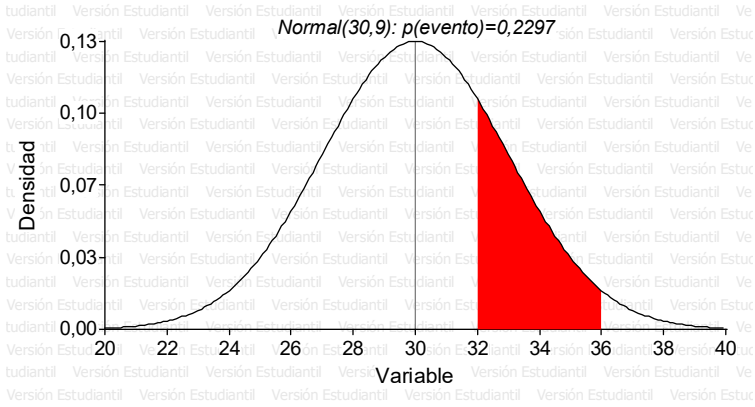
a) ¿ Calcular la probabilidad de obtener una producción de leche diaria menor a 27 litros?

b) ¿Calcular la probabilidad de obtener una producción diaria comprendida entre 32 y 36 litros ?

$$P(X \leq 27) = \int_{-\infty}^{27} \frac{1}{3\sqrt{2\pi}} \cdot e^{-\frac{1}{2}\left(\frac{x-30}{3}\right)^2} . dx = 0{,}1587$$



$$P(32 \leq X \leq 36) = \int_{32}^{36} \frac{1}{3\sqrt{2\pi}} \cdot e^{-\frac{1}{2}\left(\frac{x-30}{3}\right)^2} . dx = 0{,}2297$$

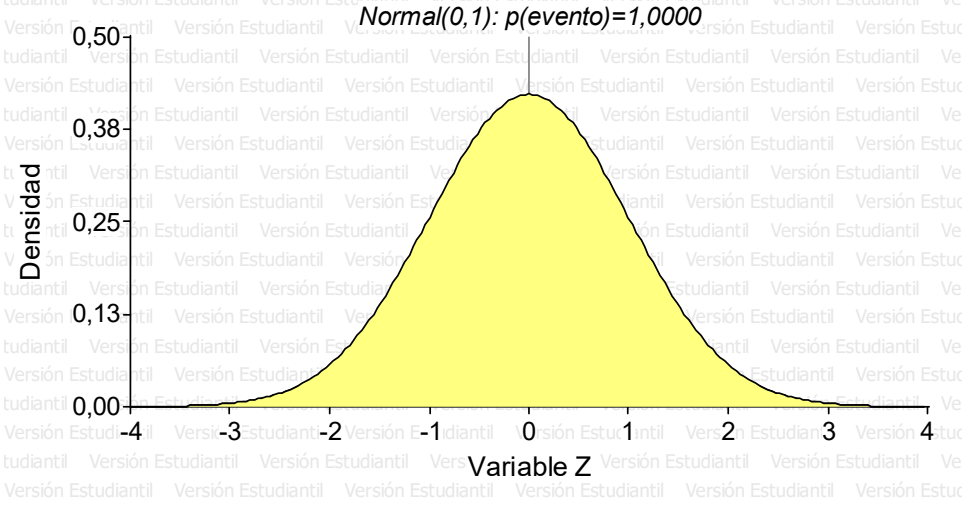


4) Distribución Normal Estándar: surge de una transformación (estandarización) de la variable X en una nueva variable Z.

La transformación, estandarización, tiene la siguiente forma:

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

La variable aleatoria Z se distribuye normalmente con $\mu = 0$ y $\sigma^2 = 1$.



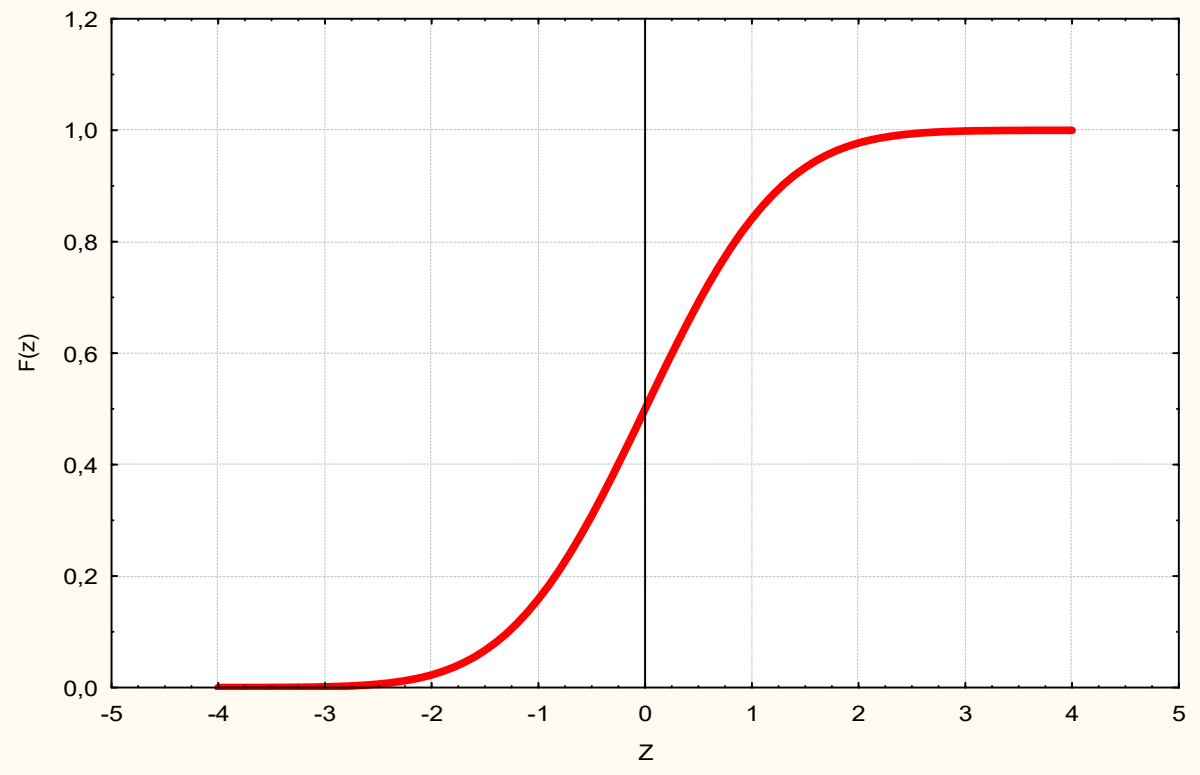
La función densidad de la variable Z es:

$$f(z) = \frac{1}{\sqrt{2\pi}} \cdot e^{-\frac{z^2}{2}}$$

Esta transformación (estandarización) de la variable X en una nueva variable Z, hace que variables aleatorias continuas distribuidas normalmente con funciones de densidad normal diferentes, se distribuyan de la misma manera, facilitando así los cálculos de probabilidad bajo cualquier combinación de μ y σ^2.

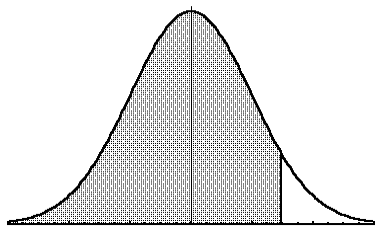
Afortunadamente, las integrales de la función de distribución acumulada de la función densidad de la Distribución Normal Estándar están tabuladas, lo cual facilita el cálculo de probabilidades.

$$F(z) = \int_{-\infty}^{z} \frac{1}{\sqrt{2\pi}} \cdot e^{-\frac{z^2}{2}} \cdot dz$$



$$P(z_1 < Z < z_2) = \int_{z_1}^{z_2} \frac{1}{\sqrt{2\pi}} \cdot e^{-\frac{z^2}{2}} \cdot dz = P(Z < z_2) - P(Z < z_1)$$

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
.7	.7580	.7611	.7642	.7673	.7703	.7734	.7764	.7794	.7823	.7852
.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.90147
1.3	.90320	.90490	.90658	.90824	.90988	.91149	.91309	.91466	.91621	.91774
1.4	.91924	.92073	.92220	.92364	.92507	.92647	.92785	.92922	.93056	.93189
1.5	.93319	.93448	.93574	.93699	.93822	.93943	.94062	.94179	.94295	.94408
1.6	.94520	.94630	.94738	.94845	.94950	.95053	.95154	.95254	.95352	.95449
1.7	.95543	.95637	.95728	.95818	.95907	.95994	.96080	.96164	.96246	.96327
1.8	.96407	.96485	.96562	.96638	.96712	.96784	.96856	.96926	.96995	.97062
1.9	.97128	.97193	.97257	.97320	.97381	.97441	.97500	.97558	.97615	.97670
2.0	.97725	.97778	.97831	.97882	.97932	.97982	.98030	.98077	.98124	.98169
2.1	.98214	.98257	.98300	.98341	.98382	.98422	.98461	.98500	.98537	.98574
2.2	.98610	.98645	.98679	.98713	.98745	.98778	.98809	.98840	.98870	.98899
2.3	.98928	.98956	.98983	.$9^2$0097	.$9^2$0358	.$9^2$0613	.$9^2$0863	.$9^2$1106	.$9^2$1344	.$9^2$1 576
2.4	.$9^2$1802	.$9^2$2024	.$9^2$2240	.$9^2$2451	.$9^2$2656	.9^2 2857	.$9^2$3053	.$9^2$3244	.$9^2$3431	.$9^2$3613
2.5	.$9^2$3790	.$9^2$3963	.$9^2$4132	.$9^2$4297	.$9^2$4457	.$9^2$4614	.$9^2$4766	.$9^2$4915	.$9^2$5060	.$9^2$5201
2.6	.$9^2$5339	.$9^2$5473	.$9^2$5604	.$9^2$5731	.$9^2$5855	.$9^2$5975	.$9^2$6093	.$9^2$6207	.$9^2$6319	.$9^2$6427
2.7	.$9^2$6533	.$9^2$6636	.$9^2$6736	.$9^2$6833	.$9^2$6928	.$9^2$7020	.$9^2$7110	.$9^2$7197	.$9^2$7282	.$9^2$7365
2.8	.$9^2$7445	.$9^2$7523	.$9^2$7599	.$9^2$7673	.$9^2$7744	.$9^2$7814	.$9^2$7882	.$9^2$7948	.$9^2$8012	.$9^2$8074
2.9	.9^2 8134	.9^2 8193	.9^2 8250	.9^2 8305	.9^2 8359	.9^2 8411	.9^2 8462	.$9^2$8511	.$9^2$8559	.$9^2$8605



P(Z<1)

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
.7	.7580	.7611	.7642	.7673	.7703	.7734	.7764	.7794	.7823	.7852
.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
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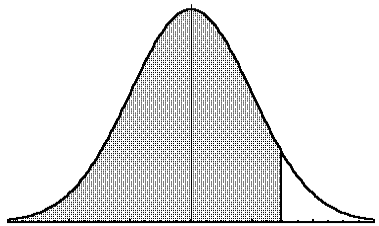
1.4	.91924	.92073	.92220	.92364	.92507	.92647	.92785	.92922	.93056	.93189
1.5	.93319	.93448	.93574	.93699	.93822	.93943	.94062	.94179	.94295	.94408
1.6	.94520	.94630	.94738	.94845	.94950	.95053	.95154	.95254	.95352	.95449
1.7	.95543	.95637	.95728	.95818	.95907	.95994	.96080	.96164	.96246	.96327
1.8	.96407	.96485	.96562	.96638	.96712	.96784	.96856	.96926	.96995	.97062
1.9	.97128	.97193	.97257	.97320	.97381	.97441	.97500	.97558	.97615	.97670
2.0	.97725	.97778	.97831	.97882	.97932	.97982	.98030	.98077	.98124	.98169
2.1	.98214	.98257	.98300	.98341	.98382	.98422	.98461	.98500	.98537	.98574
2.2	.98610	.98645	.98679	.98713	.98745	.98778	.98809	.98840	.98870	.98899
2.3	.98928	.98956	.98983	.9^{2}0097	.9^{2}0358	.9^{2}0613	.9^{2}0863	.9^{2}1106	.9^{2}1344	.9^{2}1 576
2.4	.9^{2}1802	.9^{2}2024	.9^{2}2240	.9^{2}2451	.9^{2}2656	.9^{2} 2857	.9^{2}3053	.9^{2}3244	.9^{2}3431	.9^{2}3613
2.5	.9^{2}3790	.9^{2}3963	.9^{2}4132	.9^{2}4297	.9^{2}4457	.9^{2}4614	.9^{2}4766	.9^{2}4915	.9^{2}5060	.9^{2}5201
2.6	.9^{2}5339	.9^{2}5473	.9^{2}5604	.9^{2}5731	.9^{2}5855	.9^{2}5975	.9^{2}6093	.9^{2}6207	.9^{2}6319	.9^{2}6427
2.7	.9^{2}6533	.9^{2}6636	.9^{2}6736	.9^{2}6833	.9^{2}6928	.9^{2}7020	.9^{2}7110	.9^{2}7197	.9^{2}7282	.9^{2}7365
2.8	.9^{2}7445	.9^{2}7523	.9^{2}7599	.9^{2}7673	.9^{2}7744	.9^{2}7814	.9^{2}7882	.9^{2}7948	.9^{2}8012	.9^{2}8074
2.9	.9^{2} 8134	.9^{2} 8193	.9^{2} 8250	.9^{2} 8305	.9^{2} 8359	.9^{2} 8411	.9^{2} 8462	.9^{2}8511	.9^{2}8559	.9^{2}8605

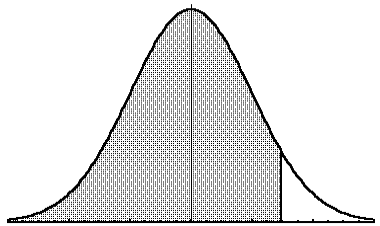


P(Z<1)

P(Z<1,06)

P(Z<1,23)

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
.7	.7580	.7611	.7642	.7673	.7703	.7734	.7764	.7794	.7823	.7852
.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.90147
1.3	.90320	.90490	.90658	.90824	.90988	.91149	.91309	.91466	.91621	.91774
1.4	.91924	.92073	.92220	.92364	.92507	.92647	.92785	.92922	.93056	.93189
1.5	.93319	.93448	.93574	.93699	.93822	.93943	.94062	.94179	.94295	.94408
1.6	.94520	.94630	.94738	.94845	.94950	.95053	.95154	.95254	.95352	.95449
1.7	.95543	.95637	.95728	.95818	.95907	.95994	.96080	.96164	.96246	.96327
1.8	.96407	.96485	.96562	.96638	.96712	.96784	.96856	.96926	.96995	.97062
1.9	.97128	.97193	.97257	.97320	.97381	.97441	.97500	.97558	.97615	.97670
2.0	.97725	.97778	.97831	.97882	.97932	.97982	.98030	.98077	.98124	.98169
2.1	.98214	.98257	.98300	.98341	.98382	.98422	.98461	.98500	.98537	.98574
2.2	.98610	.98645	.98679	.98713	.98745	.98778	.98809	.98840	.98870	.98899
2.3	.98928	.98956	.98983	.9^{2}0097	.9^{2}0358	.9^{2}0613	.9^{2}0863	.9^{2}1106	.9^{2}1344	.9^{2}1 576
2.4	.9^{2}1802	.9^{2}2024	.9^{2}2240	.9^{2}2451	.9^{2}2656	.9^{2} 2857	.9^{2}3053	.9^{2}3244	.9^{2}3431	.9^{2}3613
2.5	.9^{2}3790	.9^{2}3963	.9^{2}4132	.9^{2}4297	.9^{2}4457	.9^{2}4614	.9^{2}4766	.9^{2}4915	.9^{2}5060	.9^{2}5201
2.6	.9^{2}5339	.9^{2}5473	.9^{2}5604	.9^{2}5731	.9^{2}5855	.9^{2}5975	.9^{2}6093	.9^{2}6207	.9^{2}6319	.9^{2}6427
2.7	.9^{2}6533	.9^{2}6636	.9^{2}6736	.9^{2}6833	.9^{2}6928	.9^{2}7020	.9^{2}7110	.9^{2}7197	.9^{2}7282	.9^{2}7365
2.8	.9^{2}7445	.9^{2}7523	.9^{2}7599	.9^{2}7673	.9^{2}7744	.9^{2}7814	.9^{2}7882	.9^{2}7948	.9^{2}8012	.9^{2}8074
2.9	.9^{2} 8134	.9^{2} 8193	.9^{2} 8250	.9^{2} 8305	.9^{2} 8359	.9^{2} 8411	.9^{2} 8462	.9^{2}8511	.9^{2}8559	.9^{2}8605



P(Z<1)

P(Z<1,06)

P(Z<1,23)

P(Z<-1) ???

1-P(Z<1)

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
- .0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641
- .1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
- .2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
- .3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
- .4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
- .5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
- .6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
- .7	.2420	.2389	.2358	.2327	.2297	.2266	.2236	.2206	.2177	.2148
- .8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
- .9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
- 1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
- 1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
- 1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.09853
- 1.3	.09680	.09510	.09342	.09176	.09012	.08851	.08691	.08534	.08379	.08226
- 1.4	.08076	.07927	.07780	.07636	.07493	.07353	.07215	.07078	.06944	.06811
- 1.5	.06681	.06552	.06426	.06301	.06178	.06057	.05938	.05821	.05705	.05592
- 1.6	.05480	.05370	.05262	.05 155	.05050	.04947	.04846	.04746	.04648	.04551
- 1.7	.04457	.04363	.04272	.04182	.04093	.04006	.03920	.03836	.03754	.03673
- 1.8	.03593	.03515	.03438	.03362	.03288	.03216	.03144	.03074	.03005	.02938
- 1.9	.02872	.02807	.02743	.02680	.02619	.02559	.02500	.02442	.02385	.02330
- 2.0	.02275	.02222	.02169	.02118	.02068	.02018	.01970	.01923	.01876	.01831
- 2.1	.01786	.01743	.01700	.01659	.01618	.01578	.01539	.01500	.01463	.01426
- 2.2	.01390	.01355	.01321	.01287	.01255	.01222	.01191	.01160	.01130	.01101
- 2.3	.01072	.01044	.01017	$.0^{2}9903$	$.0^{2}9642$	$.0^{2}9387$	$.0^{2}9137$	$.0^{2}8894$	$.0^{2}8656$	$.0^{2}8424$
- 2.4	$.0^{2}8198$	$.0^{2}7976$	$.0^{2}7760$	$.0^{2}7549$	$.0^{2}7344$	$.0^{2}7143$	$.0^{2}6947$	$.0^{2}6756$	$.0^{2}6569$	$.0^{2}6387$
- 2.5	$.0^{2}6210$	$.0^{2}6037$	$.0^{2}5868$	$.0^{2}5703$	$.0^{2}5543$	$.0^{2}5386$	$.0^{2}5234$	$.0^{2}5085$	$.0^{2}4940$	$.0^{2}4799$
- 2.6	$.0^{2}4661$	$.0^{2}4527$	$.0^{2}4396$	$.0^{2}4269$	$.0^{2}4145$	$.0^{2}4025$	$.0^{2}3907$	$.0^{2}3793$	$.0^{2}3681$	$.0^{2}3573$
- 2.7	$.0^{2}3467$	$.0^{2}3364$	$.0^{2}3264$	$.0^{2}3167$	$.0^{2}3072$	$.0^{2}2980$	$.0^{2}2890$	$.0^{2}2803$	$.0^{2}2718$	$.0^{2}2035$
- 2.8	$.0^{2}2555$	$.0^{2}2477$	$.0^{2}2401$	$.0^{2}2327$	$.0^{2}2256$	$.0^{2}2186$	$.0^{2}2118$	$.0^{2}2052$	$.0^{2}1988$	$.0^{2}1926$
- 2.9	$.0^{2}1866$	$.0^{2}1807$	$.0^{2}1750$	$.0^{2}1695$	$.0^{2}1641$	$.0^{2}1589$	$.0^{2}1538$	$.0^{2}1489$	$.0^{2}1441$	$.0^{2}1395$

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
- .0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641
- .1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
- .2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
- .3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
- .4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
- .5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
- .6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
- .7	.2420	.2389	.2358	.2327	.2297	.2266	.2236	.2206	.2177	.2148
- .8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
- .9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
- 1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
- 1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
- 1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.09853
- 1.3	.09680	.09510	.09342	.09176	.09012	.08851	.08691	.08534	.08379	.08226
- 1.4	.08076	.07927	.07780	.07636	.07493	.07353	.07215	.07078	.06944	.06811
- 1.5	.06681	.06552	.06426	.06301	.06178	.06057	.05938	.05821	.05705	.05592
- 1.6	.05480	.05370	.05262	.05 155	.05050	.04947	.04846	.04746	.04648	.04551
- 1.7	.04457	.04363	.04272	.04182	.04093	.04006	.03920	.03836	.03754	.03673
- 1.8	.03593	.03515	.03438	.03362	.03288	.03216	.03144	.03074	.03005	.02938
- 1.9	.02872	.02807	.02743	.02680	.02619	.02559	.02500	.02442	.02385	.02330
- 2.0	.02275	.02222	.02169	.02118	.02068	.02018	.01970	.01923	.01876	.01831
- 2.1	.01786	.01743	.01700	.01659	.01618	.01578	.01539	.01500	.01463	.01426
- 2.2	.01390	.01355	.01321	.01287	.01255	.01222	.01191	.01160	.01130	.01101
- 2.3	.01072	.01044	.01017	.$0^2$9903	.$0^2$9642	.$0^2$9387	.$0^2$9137	.$0^2$8894	.$0^2$8656	.$0^2$8424
- 2.4	.$0^2$8198	.$0^2$7976	.$0^2$7760	.$0^2$7549	.$0^2$7344	.$0^2$7143	.$0^2$6947	.$0^2$6756	.$0^2$6569	.$0^2$6387
- 2.5	.$0^2$6210	.$0^2$6037	.$0^2$5868	.$0^2$5703	.$0^2$5543	.$0^2$5386	.$0^2$5234	.$0^2$5085	.$0^2$4940	.$0^2$4799
- 2.6	.$0^2$4661	.$0^2$4527	.$0^2$4396	.$0^2$4269	.$0^2$4145	.$0^2$4025	.$0^2$3907	.$0^2$3793	.$0^2$3681	.$0^2$3573
- 2.7	.$0^2$3467	.$0^2$3364	.$0^2$3264	.$0^2$3167	.$0^2$3072	.$0^2$2980	.$0^2$2890	.$0^2$2803	.$0^2$2718	.$0^2$2035
- 2.8	.$0^2$2555	.$0^2$2477	.$0^2$2401	.$0^2$2327	.$0^2$2256	.$0^2$2186	.$0^2$2118	.$0^2$2052	.$0^2$1988	.$0^2$1926
- 2.9	.$0^2$1866	.$0^2$1807	.$0^2$1750	.$0^2$1695	.$0^2$1641	.$0^2$1589	.$0^2$1538	.$0^2$1489	.$0^2$1441	.$0^2$1395

P(-1,5<Z<0,8)

Ejercicio

- La distribución de los diámetros de los árboles sigue una distribución normal, con media 60 cm y varianza 144 cm. A partir de estos datos obtener:

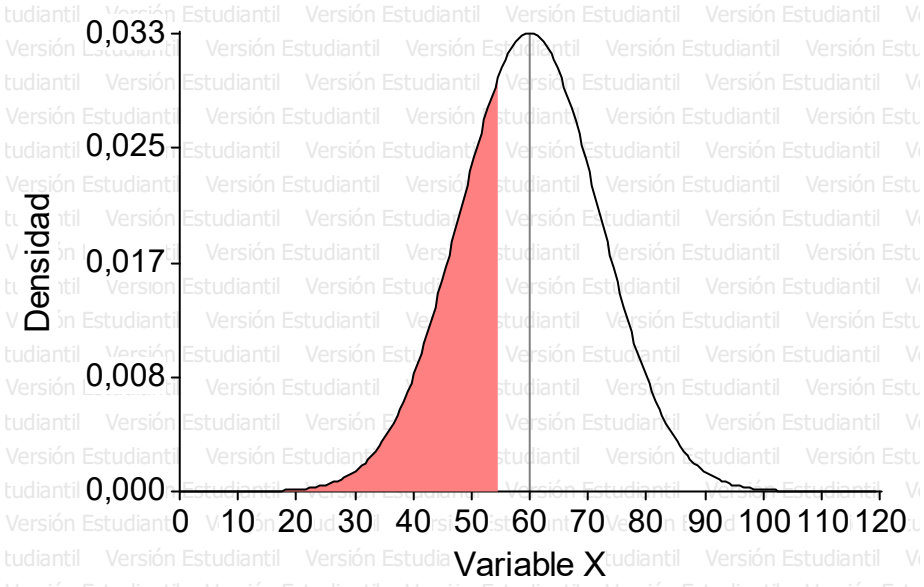
a) ¿el porcentaje de árboles con menos de 55 cm de diámetro?

b) ¿el porcentaje de árboles que se removerá si se talan todos los árboles con más de 70 cm de diámetro?

c) ¿el porcentaje árboles comprendido entre 70 y 80 cm?

d) Si se quiere remover el 30% de los árboles con mayor diámetro, ¿cuál será el diámetro mínimo para cortar el árbol?

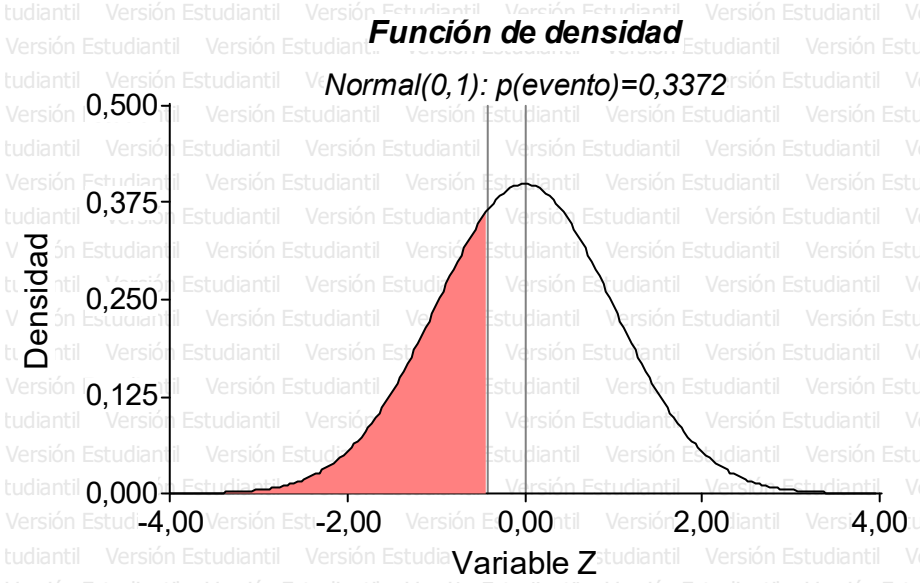
Item a) P (X ≤ 55)= ???



$$Z = \frac{(x-\mu)}{\sigma} = \frac{(55-60)}{12} = -0{,}417$$

$$\Downarrow$$

$$Z \cong -0{,}42$$

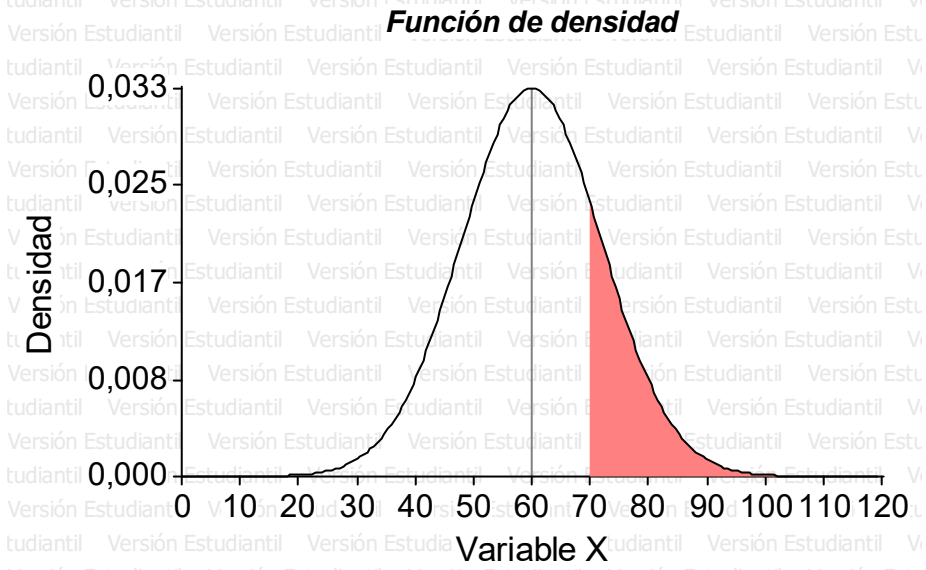


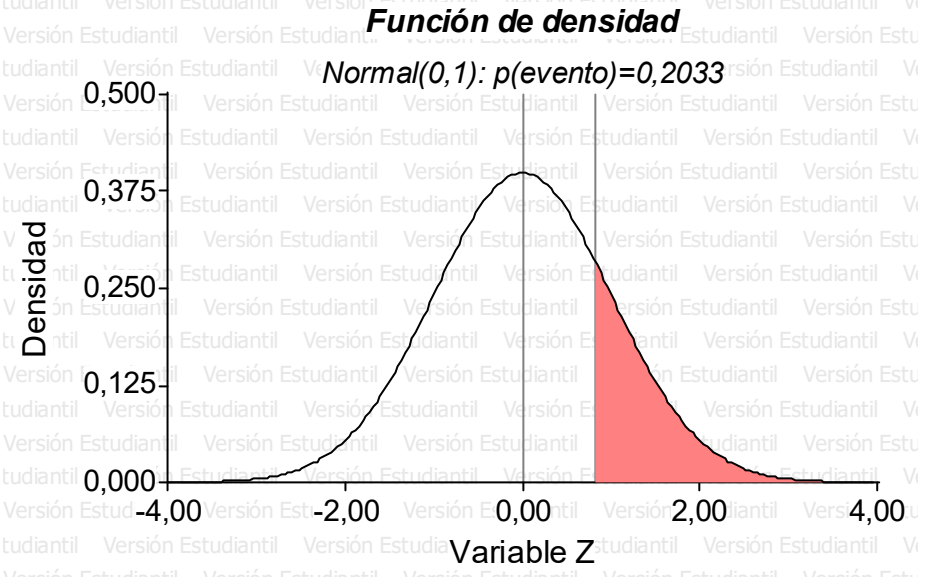
$$P(Z \leq -0{,}42) = 0{,}3372$$

$$\Downarrow$$

$$P(X \leq 55) = 0{,}3372 = 33{,}72\%$$

Item b) P (X > 70)= ???





$$Z = \frac{(x-\mu)}{\sigma} = \frac{(70-60)}{12} = 0{,}833$$

$$\Downarrow$$

$$Z \cong 0{,}83$$

$$P(Z \leq 0{,}83) = P(X \leq 70) = 0{,}7967$$

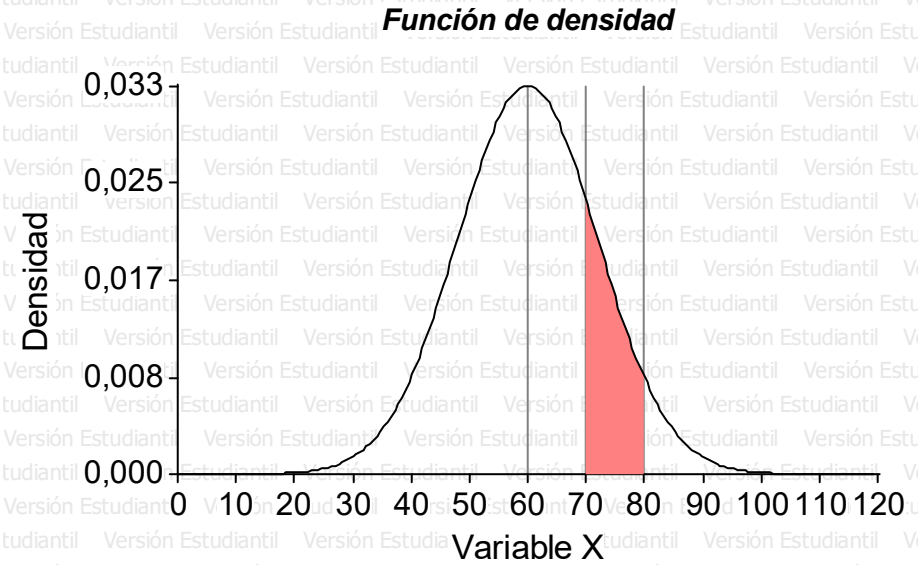
$$\Downarrow$$

$$P(X \geq 70) = 1 - 0{,}7967 = 0{,}2033$$

$$\Downarrow$$

$$\boxed{P(X \geq 70) = 20{,}33\%}$$

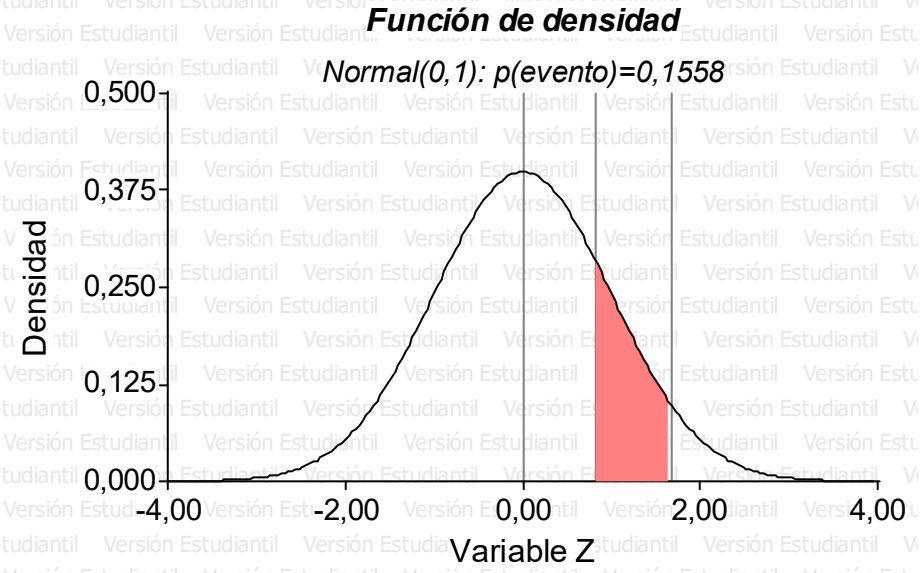
Item c) P (70 ≤ X ≤ 80)= P(X≤80) - P(X≤70)



$$Z = \frac{(x-\mu)}{\sigma} = \frac{(80-60)}{12} = 1{,}666$$

$$\Downarrow$$

$$Z \cong 1{,}67$$



$$P(Z \le 1{,}67) = P(X \le 80) = 0{,}9525$$

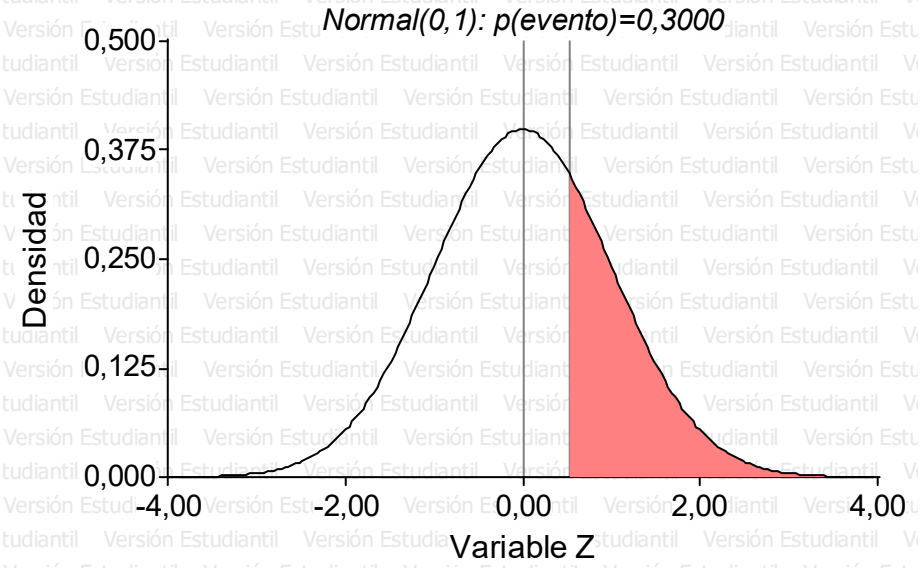
$$\Downarrow$$

$$P(70 \le X \le 80) = 0{,}9525 - 0{,}7967$$

$$\Downarrow$$

$$P(70 \le X \le 80) = 0{,}1558 = 15{,}58\%$$

Item d) Valor del diámetro de corta que abarca el 30% de los árboles de mayor diámetro.



$$Z = \frac{(x-\mu)}{\sigma} = \frac{(x-60)}{12} = 0{,}52$$

$$\Downarrow$$

$$x = 60 + 0{,}52\,.\,12$$

$$\Downarrow$$

$$\boxed{x = 66{,}24}$$