GUÍA 8

CyN

8.1) X = "precio del kilo de asado" $\sim N(\mu, 4)$

\$ positivos → Con $X \sim N(3,4)$ el modelo no es válido porque los p[...] pueden tomar valores negativos

→ Con $X \sim N(8,4)$ es más aceptable pero toma e[...]

→ Con $X \sim N(14,4)$ es válido

8.2) $X = S + N$, $S \sim Be(3/4)$, $N \sim N(0, 1/4)$ S y N indep

X = "amplitud de la señal recibida"

ERROR → cuando la señal no pasa teniendo info útil o cu[...] pasa teniendo info inútil

Si $X > c \Rightarrow$ la señal pasa $S = 0$, info inútil

Si $X \leq c \Rightarrow$ la señal no pasa $S = 1$, info útil

$P(\text{ERROR}) = P((X \leq c, S=1) \cup (X > c, S=0)) = P(X \leq c \mid S=1)$
$P(S=1) + P(X > c \mid S=0) P(S=0) = *$

$X_1 = X|_{S=1} \sim N(1, 1/4)$, $X_2 = X|_{S=0} \sim N(0, 1/4)$

$*$ $P(X_1 \leq c) P(S=1) + P(X_2 > c) P(S=0) = \frac{3}{4} \phi\left(\frac{c-1}{1/2}\right) +$
$\frac{1}{4}\left(1 - \phi\left(\frac{c-0}{1/2}\right)\right) = \frac{3}{4}\phi(2c-2) + \frac{1}{4} - \frac{1}{4}\phi(2c)$

$\Rightarrow$ derivo e igualo a cero

$$\frac{3}{\cancel{4}_2}\phi'(2c-2).\cancel{2} - \frac{1}{4}\phi'(c) = \frac{3}{2}\phi'(2c-2) - \frac{1}{\cancel{4}_2}\phi'(c).\cancel{2} = 0$$

$$\frac{3}{2}\frac{1}{\sqrt{2\pi}}e^{-\frac{1}{2}(2c-2)^2} = \frac{1}{2}\frac{1}{\sqrt{2\pi}}e^{-\frac{1(2c)^2}{2}}$$

$$3e^{-\frac{1}{2}(2c-2)^2} = e^{-\frac{1(2c)^2}{2}}$$

$$\ln(3) - \frac{1}{2}(2c-2)^2 = -2c^2$$

$$\ln(3) - \frac{1}{2}(4c^2 - 8c + 4) = -2c^2$$

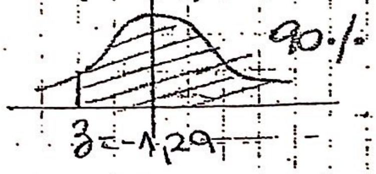
$$\ln(3) - \cancel{2c^2} + 4c - 2 = -\cancel{2c^2} \Rightarrow 4c = 2 - \ln(3)$$

$$c = \frac{1}{2} - \frac{1}{4}\ln(3) \Rightarrow c = 0{,}22534$$

8.3) $X =$ "duración de una lámpara" $\sim N(100; \sigma^2)$

$P(X > 80) \geq 0{,}9$

$$P\left(\frac{X-100}{\sigma} > \frac{80-100}{\sigma}\right) \geq 0{,}9 = P\left(Z > \frac{-20}{\sigma}\right) \geq 0{,}9$$



$$\frac{-20}{\sigma} = -1{,}29 \Rightarrow \sigma = \frac{20}{1{,}29} \Rightarrow \sigma = 15{,}5$$

8.4) $X =$ "peso de los novillos" $X \sim N(\mu, \sigma)$

$P(X > 500) = 0{,}1$; $P(X \leq 410) = 0{,}07$

a) $P\left(\frac{X-\mu}{\sigma} > \frac{500-\mu}{\sigma}\right) = 0{,}1$ $\quad P\left(\frac{X-\mu}{\sigma} < \frac{410-\mu}{\sigma}\right) = 0{,}07$

$P\left(Z > \frac{500-\mu}{\sigma}\right) = 0{,}1$ $\quad P\left(Z < \frac{410-\mu}{\sigma}\right) = 0{,}07$

$P\left(Z \leq \frac{500-\mu}{\sigma}\right) = 0{,}9$

$1{,}2816 = \frac{500-\mu}{\sigma}$ $\quad \frac{410-\mu}{\sigma} = 0 \Rightarrow \mu = 410$

$$\sigma = \frac{500-410}{1{,}2816} \cong 70 \Rightarrow X \sim N(410, 70)$$

$$P(a < X < b) = 0{,}95 = P\left(\frac{a-\mu}{\sigma} < X < \frac{b-\mu}{\sigma}\right) = P\left(\frac{a-410}{70} < Z < \frac{b-410}{70}\right) \quad -a = b \Rightarrow P\left(-\frac{b-410}{70} < Z < \frac{b-410}{70}\right) = 0{,}95$$

$$\phi\left(\frac{b-410}{70}\right) - \phi\left(-\frac{b-410}{70}\right) = \phi\left(\frac{b-410}{70}\right) - \left(1 - \phi\left(\frac{b-410}{70}\right)\right)$$

$$= 2\phi\left(\frac{b-410}{70}\right) - 1 = 0{,}95 \Rightarrow \phi\left(\frac{b-410}{70}\right) = \frac{1{,}95}{2} = 0{,}975$$

$$\frac{b-410}{70} = 1{,}96 \Rightarrow b - 410 = 137{,}2 \Rightarrow b = 547{,}2$$

$$\Rightarrow I_C = [-547{,}2 ; 547{,}2]$$

b) $Y =$ "cantidad de novillos que pesan menos de 400kg en 25 novillos" $\sim Bi(25, p)$

$$p = P(X < 400) = P\left(\frac{X-410}{70} < \frac{400-410}{70}\right) = P\left(Z < -\frac{1}{7}\right)$$

$$= \phi(-1/7) = 1 - \phi(1/7) = 1 - 0{,}5557 = 0{,}4443$$

$Y \sim Bi(25; 0{,}4443)$

$P(Y \geq 1) = 1 - P(Y<1) = 1 - P(Y=0) = 1 - \binom{25}{0}(0,4443)^{0}(1-0,444$

$1 - (0,5557)^{25} = 0,9999$

8.5) E = "diámetro de los ejes" $\sim N\left(0,75 ; \sigma^2 = \frac{1}{30000}\right)$

B = "diámetro de los bujes" $\sim N\left(0,77 ; \sigma^2 = \frac{1}{30000}\right)$

ajustan si: $0,005 < B - E < 0,035$

$X = B - E \Rightarrow X \sim N\left(0,02 ; \frac{1}{15000}\right)$

$P(0,005 < X < 0,035) = P\left(\frac{0,005 - 0,02}{\sqrt{1/15000}} < Z < \frac{0,035 - 0,02}{\sqrt{1/15000}}\right) =$

$\phi(1,837) - \phi(-1,837) = \phi(1,837) - (1 - \phi(1,837)) = 2\phi(1,8$

$-1 = 2 \cdot 0,9664 - 1 \Rightarrow P(0,005 < X < 0,035) = 0,9328$

8.6) X_1, X_2, X_3 independientes

$X_1 \sim N(1, 1/9)$; $X_2 \sim N(2 ; 1/3)$, $X_3 \sim N(3 ; 1/2)$

$P(X_1 - \frac{1}{2}X_2 > 2 - \frac{1}{3}X_3)$

$Y = X_1 - \frac{1}{2}X_2 + \frac{1}{3}X_3 \sim N(1 ; 1/4)$

$P(Y > 2) = 1 - P(Y \leq 2) = 1 - P\left(Z \leq \frac{2-1}{1/2}\right) = 1 - \phi(2$

$= 1 - 0,9772 \Rightarrow P(Y>2) = 0,0228$

8.7) A = "longitud de la sección A" $\sim N(50, 0,25)$

B = "longitud de la sección B" $\sim N(30, 0,0025)$

C = "longitud de la sección C" $\sim N(65, 0,25)$

$Y = A + B + C - 10\text{ cm} \sim N(135 ; 9/16)$

$P(139 < Y < 141) = P\left(\frac{139 - 135}{3/4} < Z < \frac{141 - 135}{3/4}\right) =$

$P(16/3 < Z < 8) = \phi(8) - \phi(16/3) = 1 - 1 = 0$

8.8) X_i = "peso del paquete i de café" $X_i \sim N(500, \sigma^2)$

$\overline{X} \sim N\left(500 ; \frac{\sigma^2}{12}\right)$

$P(490 < \overline{X} < 510) = 0,99 = P\left(\frac{490 - 500}{\sigma/\sqrt{12}} < Z < \frac{510 - 500}{\sigma/\sqrt{12}}\right)$

$\phi(1{,}05) - \phi(-1{,}803) = 1 - \phi(1{,}05) - 1 + \phi(1{,}803) = 0{,}8599 - 0{,}8531 = 6{,}8 \cdot 10^{-3} \approx 0{,}0068$

8.12) $\longrightarrow$ PP(3000) x hora $N(a,b)$ = " cantidad de partículas que arriban en el intervalo (a,b)" $\sim Po(3000(b-a))$ $X = N(0,1/6) \mid_{N(0,1/2)=1500} \sim Bi(1500, 1/3)$

$P(N(0,1/6) > 450 \mid N(0,1/2) = 1500) =$ $X \simeq N\left(1500 \frac{1}{3}, \frac{1500}{3}(1-1/3)\right)$

$P(X > 450) = P\left(Z > \dfrac{450-500}{\frac{10\sqrt{30}}{3}}\right) =$ $X \simeq N\left(500, \frac{1000}{3}\right)$

$1 - P\left(Z \leq -\dfrac{\sqrt{30}}{2}\right) = 1 - \phi\left(-\dfrac{\sqrt{30}}{2}\right) = 1 - \left(1 - \phi\left(\dfrac{\sqrt{30}}{2}\right)\right)$

$= \phi\left(\dfrac{\sqrt{30}}{2}\right) = 0{,}9969$

$\Rightarrow P(N(0,1/6) > 450 \mid N(0,1/2) = 1500) = 0{,}9969$

3) Los plazos $P(\text{una persona cancele}) = 0{,}1$

$N \equiv$ "número máximo de reservas que se pueden aceptar"

$A \equiv$ "# personas que asisten"

$A \sim Bi(n, 0{,}9) \simeq N\left(n \cdot 0{,}9 ; \sqrt{n(0{,}9 \cdot 0{,}1)}\right)$

$A \sim N\left(n 0{,}9 ; \sqrt{n}\, 0{,}3\right)$

$P(A > 100) = 1 - P(A \leq 100) \leq 0{,}01$

$1 - P\left(\underbrace{\frac{A - n0{,}9}{\sqrt{n}\,0{,}3}}_{Z} \leq \frac{100 - n0{,}9}{\sqrt{n}\,0{,}3}\right) \leq 0{,}01$

$P\left(Z \leq \frac{100 - n0{,}9}{\sqrt{n}\,0{,}3}\right) \geq 0{,}99 \qquad \phi\left(\frac{100 - n0{,}9}{\sqrt{n}\,0{,}3}\right) \geq 0{,}99$

$\frac{100 - n0{,}9}{\sqrt{n}\,0{,}3} \geq 2{,}3263 \Rightarrow 100 - 0{,}9n \geq 0{,}69789\sqrt{n}$

$\sqrt{n} = x \Rightarrow 0{,}9x^2 + 0{,}69789x - 100 \leq 0 \qquad x = 10{,}16$

$\sqrt{n} > 10{,}16 \Rightarrow n > 103{,}22 \Rightarrow n = 103{,}22$

8.14) n = # de individuos elegidos al azar

N = # fumadores

$N = \sum_{i=1}^{n} N_i \qquad N_i \sim Be(p)$ 1825741858

N_i son iid

$N = S_n = \sum_{i=1}^{n} N_i \Rightarrow P\left(\left|\frac{S_n}{n} - p\right| \leq 0{,}01\right) \geq 0{,}95$

$\Rightarrow$ por el teorema del límite de Demoivre-Laplace

$\mathbb{P}\left(\left|\frac{S_n}{n} - p\right| \leq \frac{a\sqrt{p(1-p)}}{\sqrt{n}}\right) \approx 2\phi(a) - 1$

(*) $\frac{1{,}96}{2\sqrt{n}} \leq 0{,}01 \Rightarrow \boxed{n \geq 9604}$

p desconocido pero $\sqrt{(1-p)p} \leq 1/2$

$P\left(\left|\frac{S_n}{n} - p\right| \leq \frac{a}{2\sqrt{n}}\right) \geq P\left(\left|\frac{S_n}{n} - p\right| \leq \frac{a\sqrt{p(1-p)}}{\sqrt{n}}\right) \approx 2\phi(a) - 1$

* $P\left(\left|\frac{S_n}{n} - p\right| \leq \frac{a}{2\sqrt{n}}\right) \geq 0{,}95 \quad , \quad 2\phi(a) - 1 = 0{,}95$

$\phi(a) = 0{,}975$

$\Rightarrow P\left(\left|\frac{S_n}{n} - p\right| \leq \frac{1{,}96}{2\sqrt{n}}\right) \geq 0{,}95 \quad a = 1{,}96$

b) $E[C_i] = 50E(Y) + 100(E(X)E(Y)) = 50 \times 500 + 100 \times 500 \times 0{,}1 = 30000$

$V[C_i] = E[C_i^2] - E[C_i]^2 = E[(50Y + 100XY)^2] - (30000)^2 = E(2500Y^2 + 10000XY^2 + 10000X^2Y^2) - (30000)$

$2500E(Y^2) + 10000E(X)E(Y^2) + 10000E(X^2)E(Y^2) - (30000)^2 =$

$2500 \cdot 264400 + 10000 \times 0{,}1 \times 264400 + 10000 \times 0{,}0109 \times 264400 - (30000)^2 = 54219600$

$$\Rightarrow \frac{\sum_{i=1}^{90} C_i - 90E[C_i]}{\sqrt{nVar[C_i]}} \xrightarrow{D} N(0,1)$$

$$P(C > x) \geq 0{,}95 \Rightarrow P\left(Z \leq \frac{x - 90.30000}{\sqrt{90.54219600}}\right) = 0{,}05$$

$$P\left(Z \leq \frac{x - 2700000}{69855{,}3076}\right) \geq 0{,}05$$

$$\phi\left(\frac{x - 2700000}{69855{,}3076}\right) \geq 0{,}05$$

$$\frac{x - 2700000}{69855{,}3076} \leq -\phi^{-1}(0{,}95)$$

$$x - 2700000 \leq -1{,}6449 \times 69855{,}3076$$

$$x < 2585095{,}005$$

8.15) $\lim_{n\to\infty} e^{-n}\sum_{k=0}^{n}\frac{n^k}{k!}=\frac{1}{2}$

$X_i \sim Po(\mu=1)$

$P_X(x)=\frac{e^{-1}}{x!},\ x\in\mathbb{N}_0$

$Y=\sum_{i=0}^{n}X_i\sim Po\left(\mu=\sum_{i=0}^{n}1=n\right)$

$P_Y(y)=\frac{e^{-n}}{y!}n^y,\ y\in\mathbb{N}_0$

$P(Y\leq n)=\sum_{i=0}^{n}\frac{e^{-n}n^i}{i!}$

$\lim_{n\to\infty}P(Y\leq n)=\lim_{n\to\infty}P\left(\frac{Y-n}{\sqrt{n^2}}\leq\frac{n-n}{\sqrt{n^2}}\right)=$

$\lim_{n\to\infty}(Z\leq 0)=\lim_{n\to\infty}\phi(0)=\frac{1}{2}$

8.16) X_i = "long de la varilla i"

$X_i\sim N(30;4)$

Y_i = "precio de venta $ i" $Y\sim N(30,4)$

G = "Ganancia total"

$G=\underbrace{\sum_{i=1}^{50}Y_i}_{Y}-1000\$$

$P(G>460)=P(Y>1460)\overset{TCL}{\downarrow}P\left(Z>\frac{1460-}{\sqrt{50}}\right.$

$=P(Z>-2\sqrt{2})=1-P(Z\leq-2\sqrt{2})=1-$

$=1-(1-\phi(2\sqrt{2}))=1-1+0{,}9977$

$\Rightarrow P(G>460)=0{,}9977$

8.17) X = "duración en min de una telefónica" $X \sim N(\mu; 0{,}04)$

\$2/min

G = "costo de llamada"

$$P(G < 190) \geq 0{,}99$$

$$G = 2 \underbrace{\sum_{i=1}^{100} X_i}_{Y}$$

$$P(2Y < 190) \geq 0{,}99 = P(Y < 95) \geq 0{,}99$$

$$P\left(Z < \frac{95 - 100 \cdot \mu}{\sqrt{100} \cdot 0{,}2}\right) \geq 0{,}99$$

$$\Phi\left(\frac{95 - 100\mu}{2}\right) \geq 0{,}99$$

$$\frac{95 - 100\mu}{2} \geq 2{,}33 \rightarrow 95 - 100\mu \geq 4{,}66$$

$$95 - 4{,}66 \geq 100\mu$$

$$0{,}9034 \geq \mu$$

8.19) X = "unidad defectuosa"

$X \sim N(0{,}1; (0{,}03)^2)$

Y = "producción diaria" $Y \sim N(500; (120)^2)$

Todas las V.A son indep C_i = "costo del día"

C = "costo total en 90 días"

$C_i = 50\$ Y_i + 100\$ X_i Y_i$ C_i = "costo del día i"

$$C = \sum_{i=1}^{90} 50 Y_i + 100 X_i Y_i \Rightarrow C = \sum_{i=1}^{90} C_i$$

$$C = 50 \sum_{i=1}^{90} Y_i + 100 \sum_{i=1}^{90} X_i Y_i$$

8.19) W = " peso en toneladas que puede resistir un puente"

$W \sim N(1400, 10000)$

C = " peso de un camión de arena" $\sim N(20, (0,25)^2)$

P("ocurran daños") > 0,1

$P\left(\sum_{i=1}^{n} C_i \geq W\right) \Rightarrow Y = \sum_{i=1}^{n} C_i \Rightarrow E[Y] = nE[C_i] = n \cdot 20$

$Var[Y] = n^2 Var[C_i] = n\,0,2$

$Y \sim N(20n, (n0,25)^2)$

$P(Y > W) = P(Y - W > 0) \Rightarrow Y - W = X \sim N(20n - 1400, (n0,2$ $10000)$

$P(X > 0) = 1 - P(X \leq 0) \overset{TLC}{\approx} 1 - P\left(Z \leq \frac{0 - (20n - 1400)}{n0,25 + 100}\right) > 0,1$

$P\left(Z \leq \frac{1400 - 20n}{n0,25 + 100}\right) < 0,9 \Rightarrow \frac{1400 - 20n}{n0,25 + 100} < 1,2816$

$1400 - 20n < n0,3204 + 128,16$

$1271,84 < 20,03204\,n \Rightarrow n > 39695,38$

8.20) $\longmapsto$ P.P (2,5/mes) $N(a,b)$ = " cantidad de fallos en el intervalo (a,b)" $\sim Po(2,5(b-a))$

T_i = " tiempo hasta la falla i" $T_i \overset{iid}{\sim} Exp(2,5)$

T = " tiempo total hasta la falla 196

$T = \sum_{i=1}^{196} T_i \Rightarrow T \sim \gamma(196; 2,5)$

$T \underset{TCL}{\approx} N\left(196 \cdot \frac{1}{2,5}; \frac{196}{(2,5)^2}\right)$

$P(T < 67,2) \approx P\left(Z < \frac{67,2 - 78,4}{28/5}\right) = P(Z < -2) = \phi(-2)$

$= 1 - \phi(2) = 1 - 0,9772$

$P(T < 67,2) = 0,0228$

8.21) D_{Ai} = " diámetro de la ciruela i de clase A" $\sim$ 4

D_i = " diámetro de la ciruela i" $\sim U(3,5)$

P_i = " peso de la ciruela i" $P_i = D_i^3$

$F_P(p) = P(P \leq p) = P(D_A^3 \leq p) = P(D_A \leq (p)^{1/3}) =$

$\int_4^{(p)^{1/3}} 1\, dd_A = (d_A)\Big|_4^{(p)^{1/3}} = p^{1/3} - 4 \Rightarrow F_P(p) = p^{1/3} - 4$

4 $f_P(p) = \frac{1}{3} p^{-2/3}$

$E[P] = \int_{4^3}^{5^3} p \frac{1}{3} p^{-2/3} dp = \frac{1}{3} \int_{4^3}^{5^3} p^{1/3} dp = \left(\frac{1}{\cancel{3}} \frac{p^{4/3}}{\frac{4}{\cancel{3}}}\right)\Bigg|_{4^3}^{5^3} = \frac{(125)^{4/3} - (64)^{4/3}}{4}$

$\frac{369}{4} \Rightarrow E[P] = 92{,}25$

$Var[P] = E[P^2] - E[P]^2$

$E[P^2] = \int_{4^3}^{5^3} p^2 \frac{1}{3} p^{-2/3} dp = \frac{1}{3} \int_{64}^{125} p^{4/3} dp = \left(\frac{1}{\cancel{3}} \frac{p^{7/3}}{\frac{7}{\cancel{3}}}\right)\Bigg|_{64}^{125} =$

$\frac{(125)^{7/3} - (64)^{7/3}}{7} = 8820{,}14.$

$Var[P] = 8820{,}14 - (92{,}25)^2 \Rightarrow Var[P] = 310$

A = " peso de una caja con 100 ciruelas del tipo A"

$P(A > 9600) = ?$ $A = \sum_{i=1}^{100} P_i + 100$ TLC

$P\left(\sum_{i=1}^{100} P_i + 100 > 9600\right) = P\left(\sum_{i=1}^{100} P_i > 9500\right) \approx P\Bigg(Z >$

$\frac{9500 - 100 \cdot 92{,}25}{\sqrt{100 \cdot 310}}\Bigg) = P(Z > 1{,}56) = 1 - \Phi(1{,}56)$

$= 1 - 0{,}9406 \Rightarrow P(A > 9600) = 0{,}0594$

8.22) $1 \longrightarrow PP(50) \times min$ $N(a,b)$ = " cantidad de pasajeros que arriban a la estación en el intervalo (a,b)" $\sim Po(50(b-a))$

T = "cantidad de tiempo que esperan los pasajeros en 15 min" $T = \sum_{i=1}^{N} (15 - T_i)$

por 7.8) $E[T] = 5625$ y $Var[T] = 56250$

T_T = "cantidad total de tiempo que esperan los pasajeros en el día"

$T_T = \sum_{i=1}^{72} T_i$, T_T es una c.L de V.A iid ⇒ TCL

$$\frac{\sum_{i=1}^{72} T_i - nE[T_i]}{\sqrt{n Var[T_i]}} \longrightarrow N(0,1)$$

$P(T_T > 6400\,h) = P(T_T > 384000\,min) = P\left(Z > \frac{384000 - 72 \cdot 5625}{\sqrt{72 \cdot 56\ldots}}\right) = P(Z > -10{,}4) = \phi(10{,}4) \approx 1$

8.23) $P(M) = 0{,}7$ $P(L) = 0{,}3$

X_{L_i} = "volumen en dm^3 de la palada i de Lucas"

X_{M_i} = "volumen en dm^3 de la palada i de Martín"

$X_{L_i} \sim \mathcal{U}(2,4)$, $X_{M_i} \sim \mathcal{U}(1,3)$, n = # de paladas

V = "volumen total" , Y_i = "volumen de la palada i"

$P(V > 4000) > 0{,}95$

$$Y_i = \begin{cases} X_{L_i} & \text{si } L \\ X_{M_i} & \text{si } M \end{cases} \Rightarrow V = \sum_{i=1}^{n} Y_i$$, V es una c.L de VA iid ⇒ TCL

$$\frac{\sum_{i=1}^{n} Y_i - nE(Y_i)}{\sqrt{n V(Y_i)}} \to N(0;1)$$

$E[Y_i] = E[X_L]\,P(L) + E[X_M]\,P(M) = 3 \times 0{,}3 + 2 \times 0{,}7 = 2{,}3$

$Var[Y_i] = Var[X_L]\,P(L) + Var[X_M]\,P(M) - (3-2)^2\, 0{,}7 \times 0{,}3 = 0.$

$P(T>4000) \geq 0,95 = P\left(Z \geq \frac{4000 - n2,3}{\sqrt{n0,54}}\right) = 1 - P\left(Z \leq \frac{4000 - \ldots}{\sqrt{n \ldots}}\right)$

$\geq 0,95 \Rightarrow P\left(Z \leq \frac{4000 - n2,3}{\sqrt{n0,54}}\right) \leq 0,05$

$\phi\left(\frac{4000 - n2,3}{\sqrt{n0,54}}\right) \leq 0,05$

$\frac{4000 - n2,3}{\sqrt{n0,54}} \leq z_{0,05} = -1,6449$

$4000 - n2,3 + 1,6449\sqrt{0,54}\sqrt{n} \leq 0 \quad x = \sqrt{n}, \; x^2 = n$

$\Rightarrow 2,3x^2 - 1,2087x - 4000 \geq 0 \quad x = 41,96 \; ; \; x = -41,44$ (no)

$\Rightarrow \sqrt{n} \geq 41,96 \Rightarrow n \geq 1761$