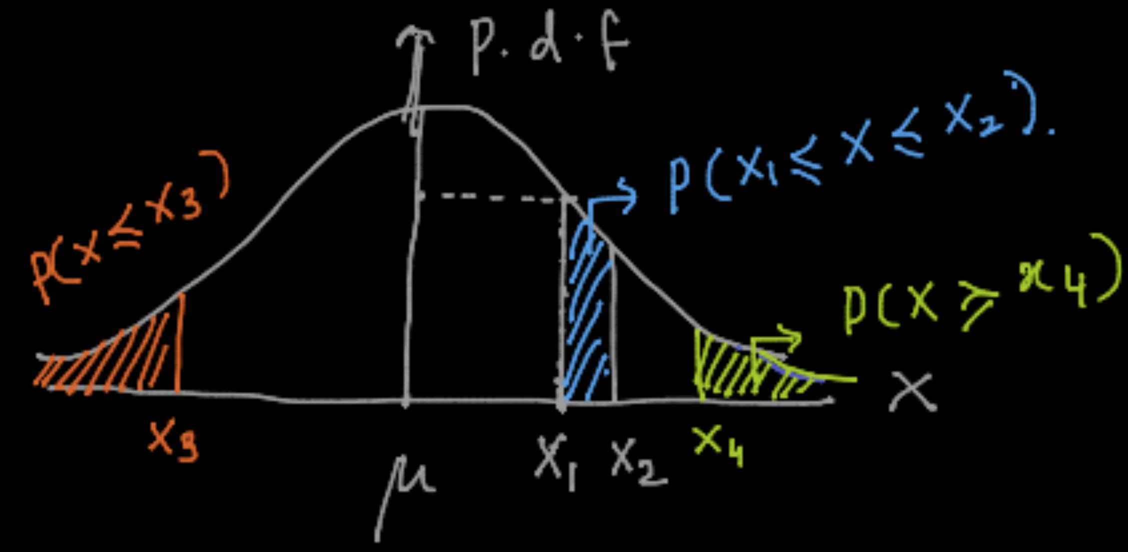
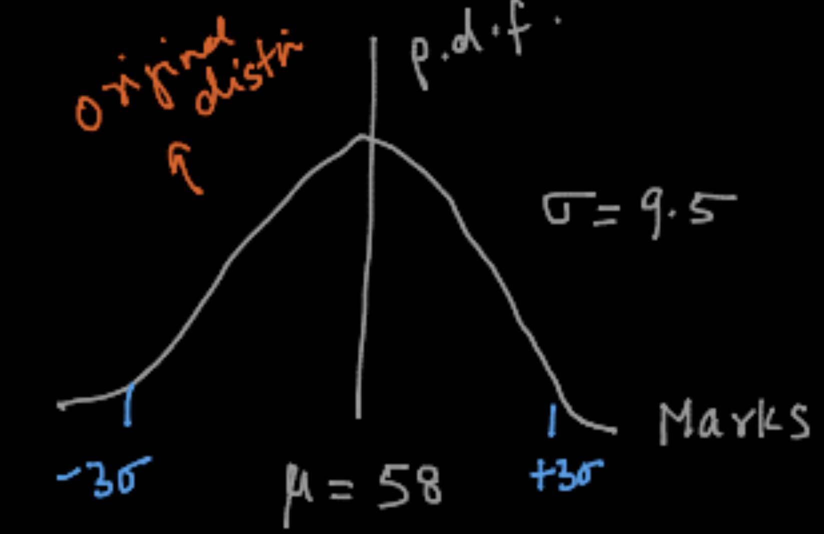
1. Normal distribution



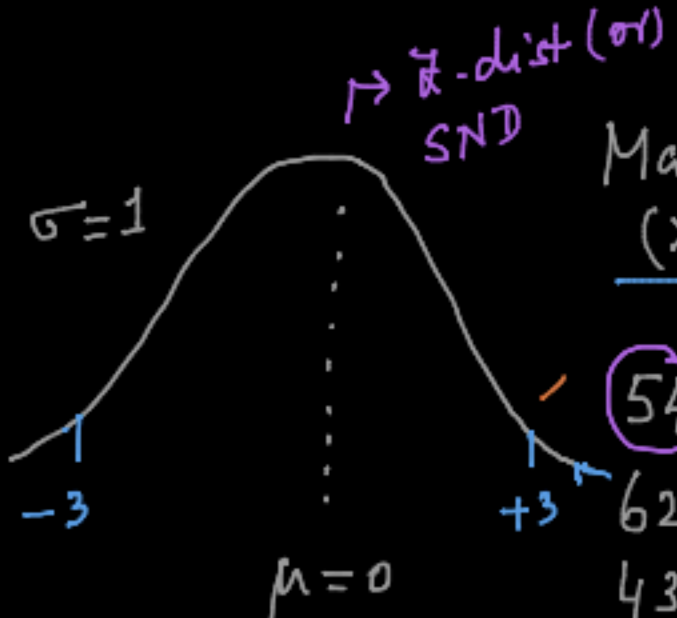
$$X \sim N(\mu, \sigma)$$



2. Standardized Normal Distribution (z-distribution)

— Scaled down version ND

— Scaling done by calculating z score



$58 + 0.1 \times 9.5$ ←

$58 + 0.95$

$= 59$

$$Z_{score} = \frac{x - \mu}{\sigma}$$

Marks (x)	$(x - \bar{x})$	$(x - \bar{x})^2$	Zscore	Zscore
54	-4	16	$-4/9.5 = -0.42$	$-0.42 \times \sigma$ ⇒
62	+4	16	$+4/9.5 = 0.42$	0.42
43	-15	225	$-15/9.5 = -1.57$	-1.57
59	1	1	$1/9.5 = 0.1$	0.1
72	14	196	$14/9.5 = 1.47$	1.47
$\mu = 58$		454		$\mu = 0$

Mean = 0

$\sigma = 1$

$\sigma = 9.53$

$\sigma^2 = 90.8$

$\sigma = \sqrt{90.8}$

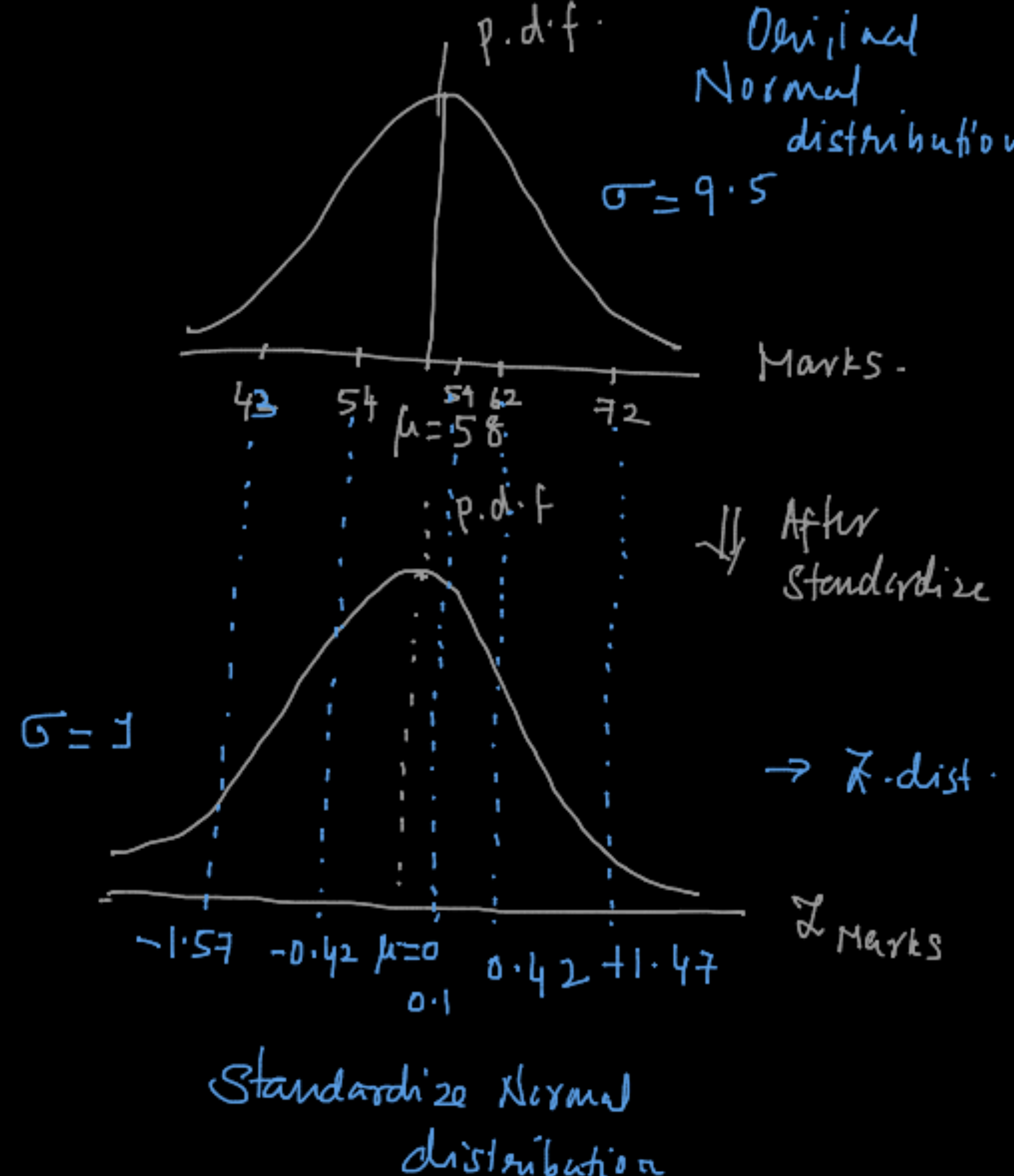
$= 9.53$

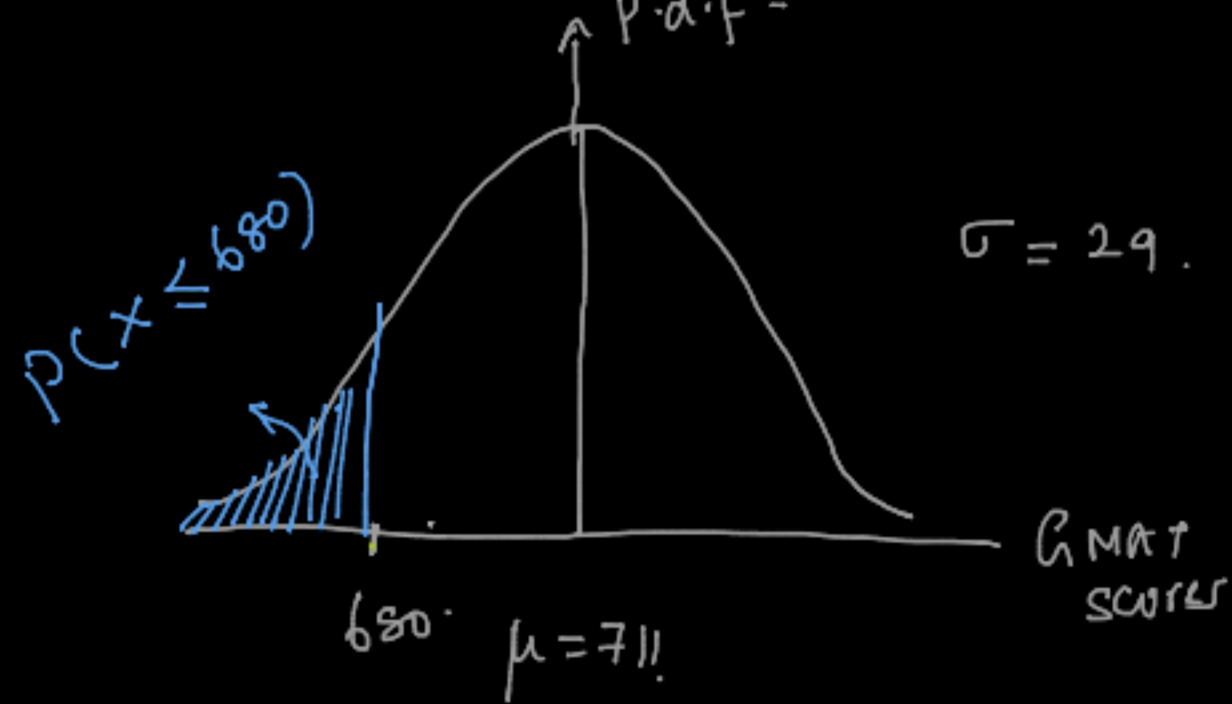
X. — How many standard deviations away the Mean value.

Marks	Zscore
54	−0.42
62	+0.42
43	−1.57
59	0.1
72	+1.47

$\mu = 58$ $\quad$ $\mu = 0$

$\sigma = 9.5$ $\quad$ $\sigma = 1$

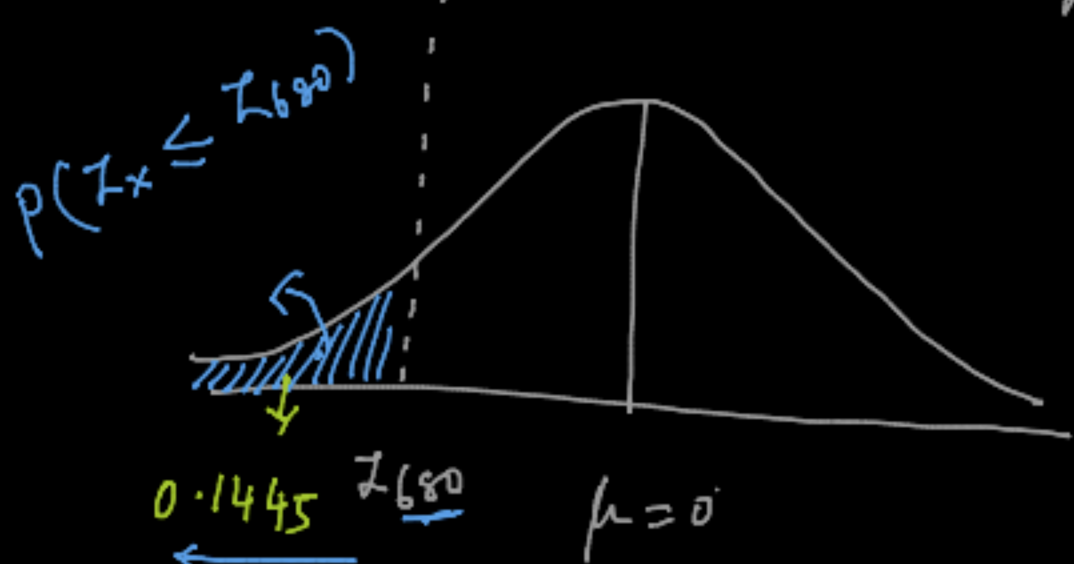




$\sigma = 29$.

z-table

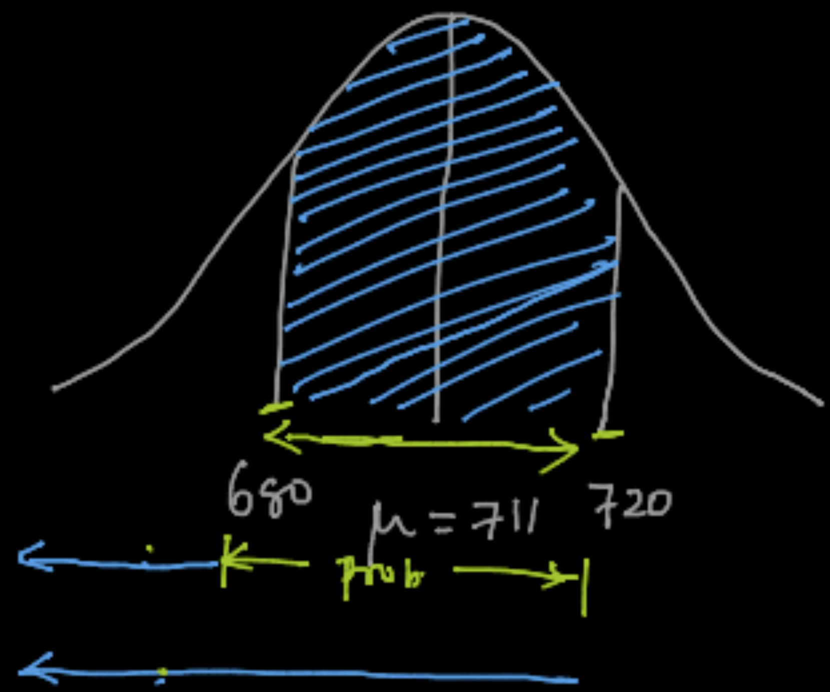
$P(X \leq 680)$:



$$Z_{680} = \frac{680 - 711}{29} = -1.06$$

14.45 %

$P(680 \leq X \leq 720)$

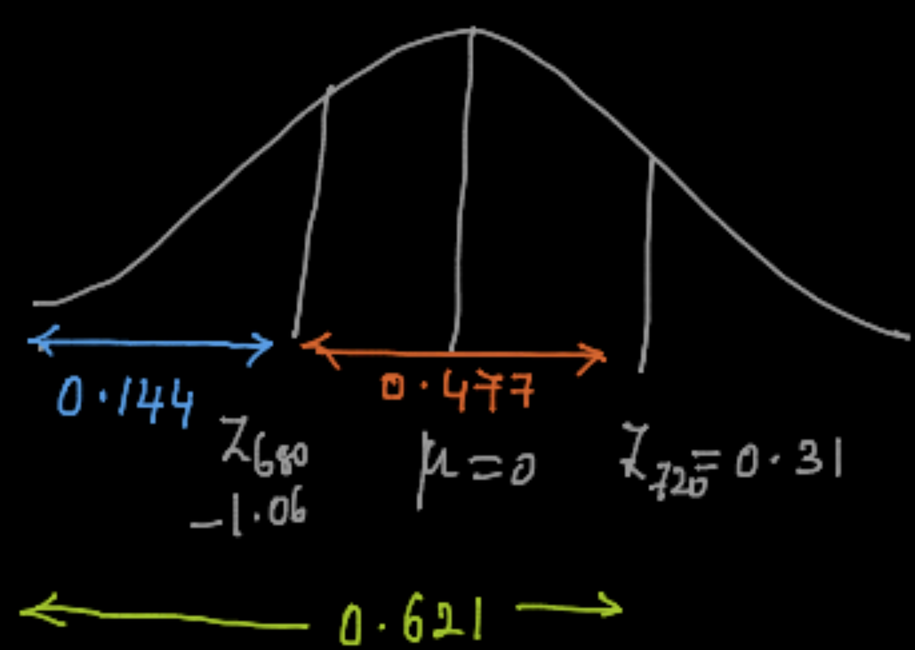


$\sigma = 29.$

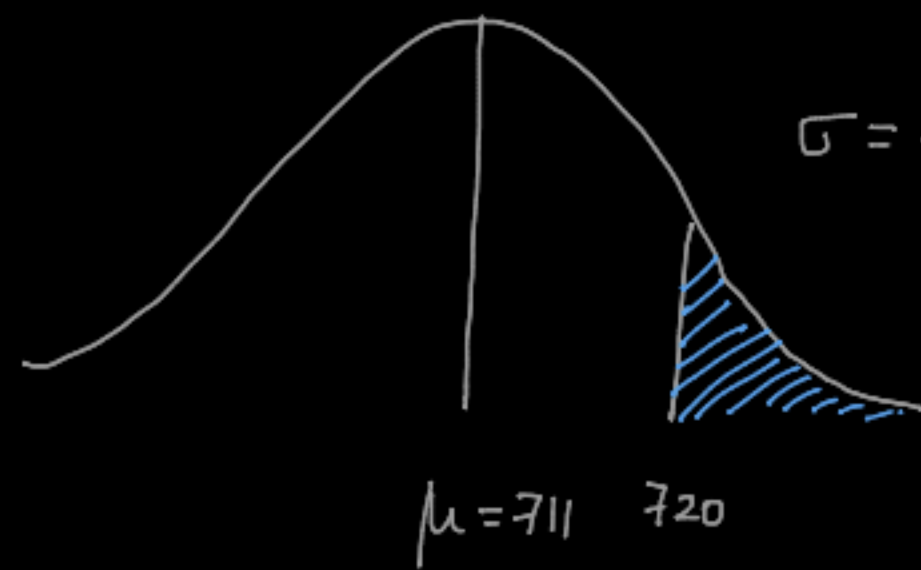
$$Z_{680} = \frac{680 - 711}{29} = -1.06$$

$$Z_{720} = \frac{720 - 711}{29} = 0.31$$

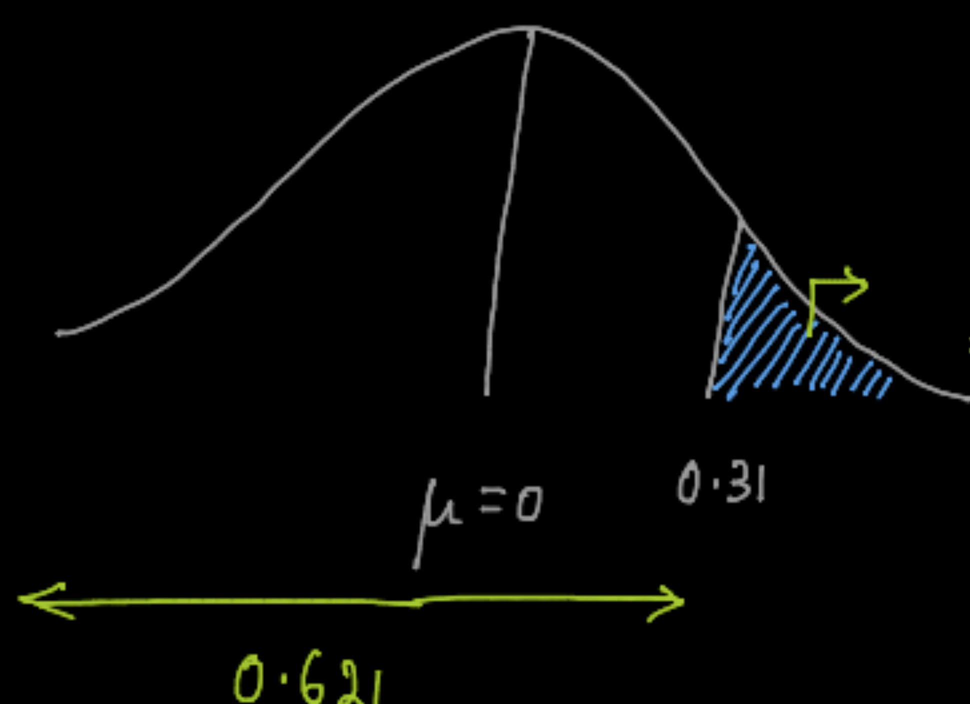
47%



$P(X \geq 720)$



$\sigma = 29.$



$1 - 0.621$

$= 0.37$

$P(X \geq 720) = 0.37$

37%

Central limit Theorem

$n < 30$ $\quad S_{1000}$ $\quad \bar{X}_{1000} = \$2502$

$n = 30$

$\frac{1}{30}(x_1 + x_2 + \dots + x_{30}) = \bar{x}_1$ $\quad$ 100

S_1

$\$2463$ ✓

S_2 $n=30$ $\bar{x}_2 = \$2395$

$S_3 = 30$

$2512 = \bar{x}_3$

μ_{pop} = Avg Income of Indian

$\$2500$ ✓

Estimate

sufficiently large.

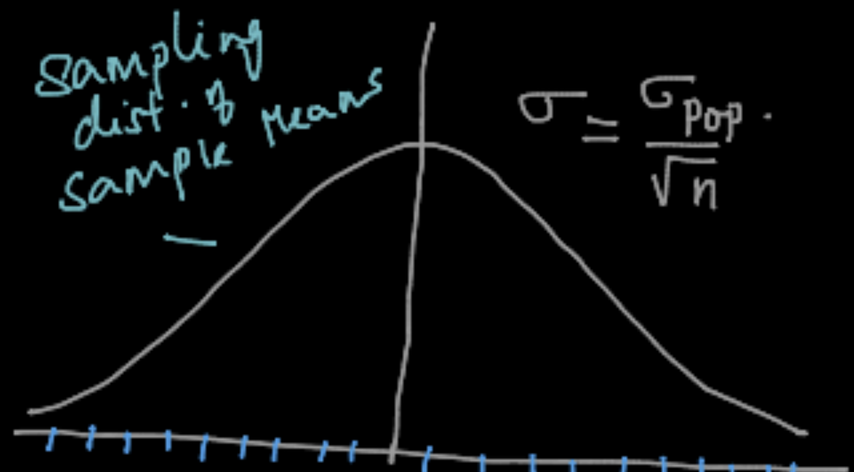
$\boxed{n = 30}$

	Sample Avg. $(\bar{x})$
S_1	2463
S_2	2395
S_3	2512
⋮	⋮
S_{1000}	2502

① Normal dist ← Distribution

sampling dist. of sample means

$\sigma = \frac{\sigma_{pop}}{\sqrt{n}}$



Sample Means $(\bar{x})$

Atleast 30 sample

30,000

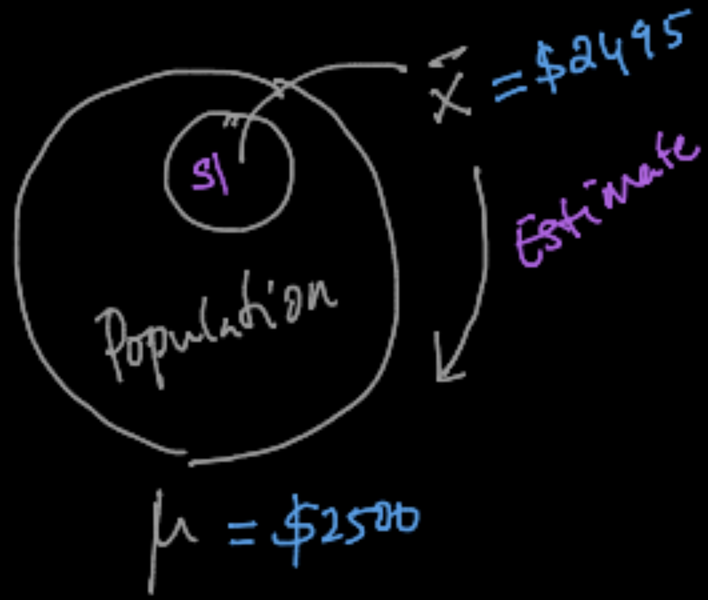
100,000

Central Limit Theorem μ_{pop}

1. The dist. of Sample Means will always be Norm. dist.
2. The mean value will be μ_{pop}.
3. Std. dev. will be $\sigma_{pop}/\sqrt{n}$ $\quad n \rightarrow$ sample size.

Confidence Intervals

Point Estimate → $\bar{x}$



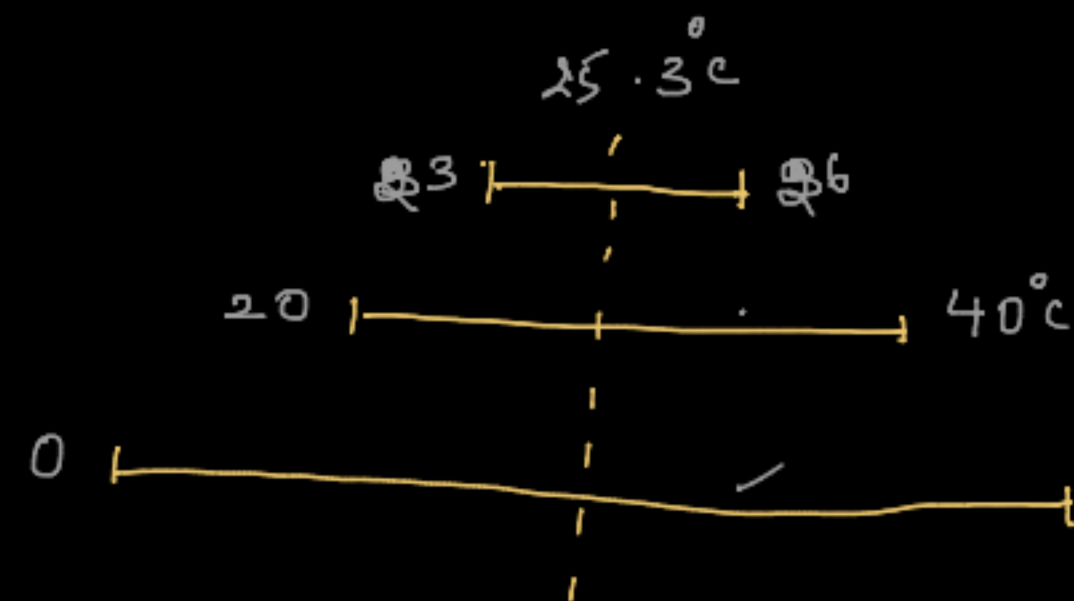
Range Estimate $= \bar{x} \pm \Delta$

↳ Margin of Error

↳ Confidence (C)

C = 80%

C = 95%



→ 0%

→ 70%

→ 60%

→ 100%

Significance level (α) $= 1 - C$

$C = 80\%$ $\alpha = 20\%$

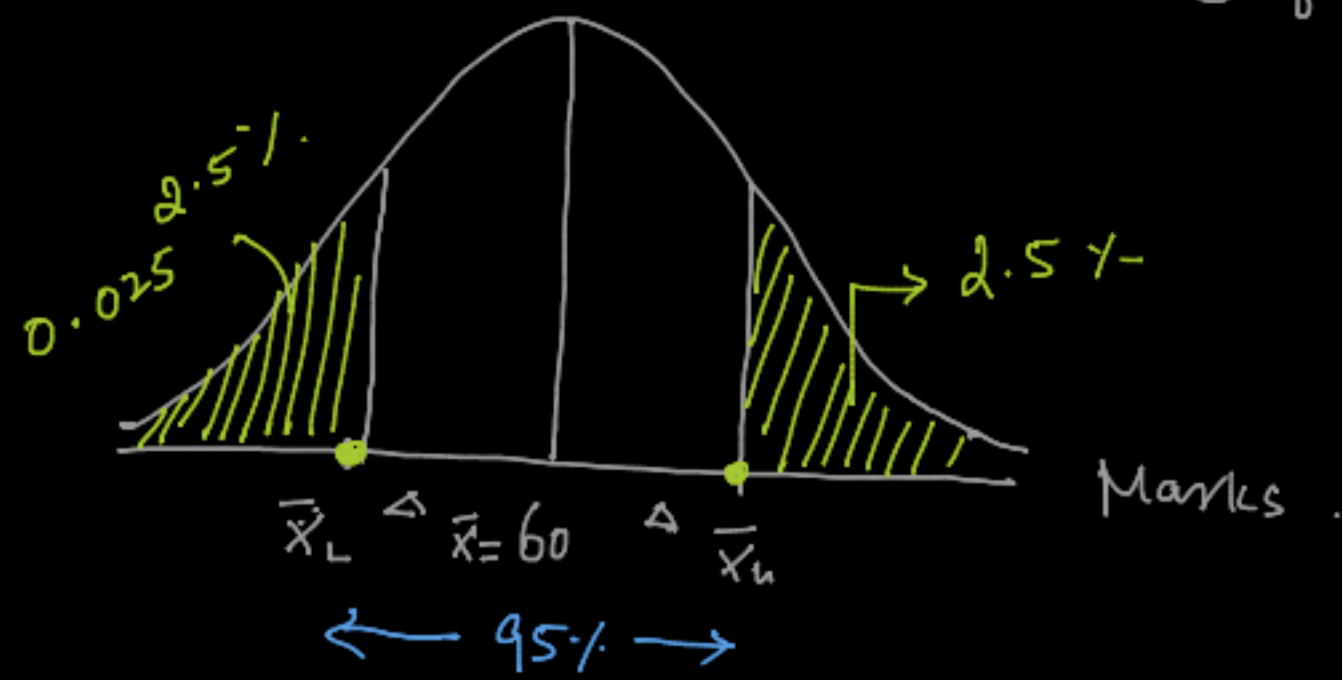
$= 0.80$ $\alpha = 0.20$

$C = 95\%$ $\alpha = 5\%$

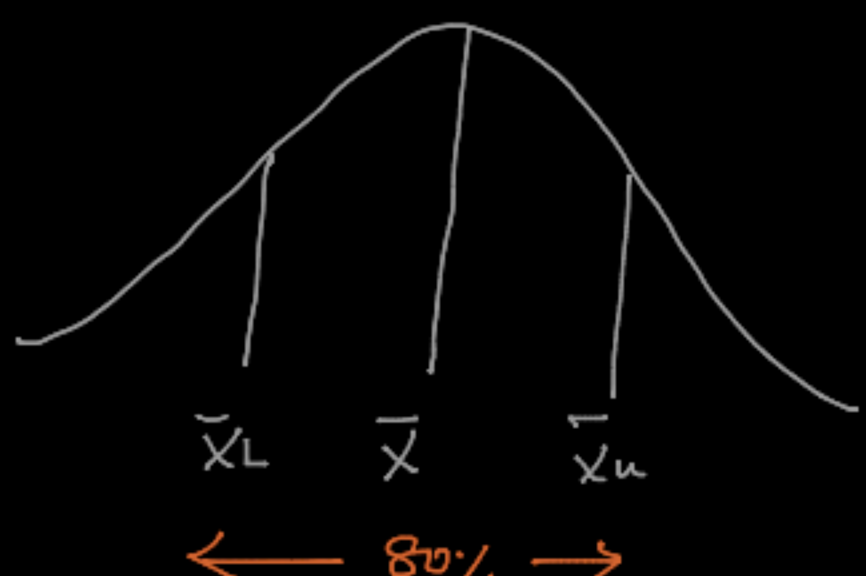
$= 0.95$; $\alpha = 0.05$

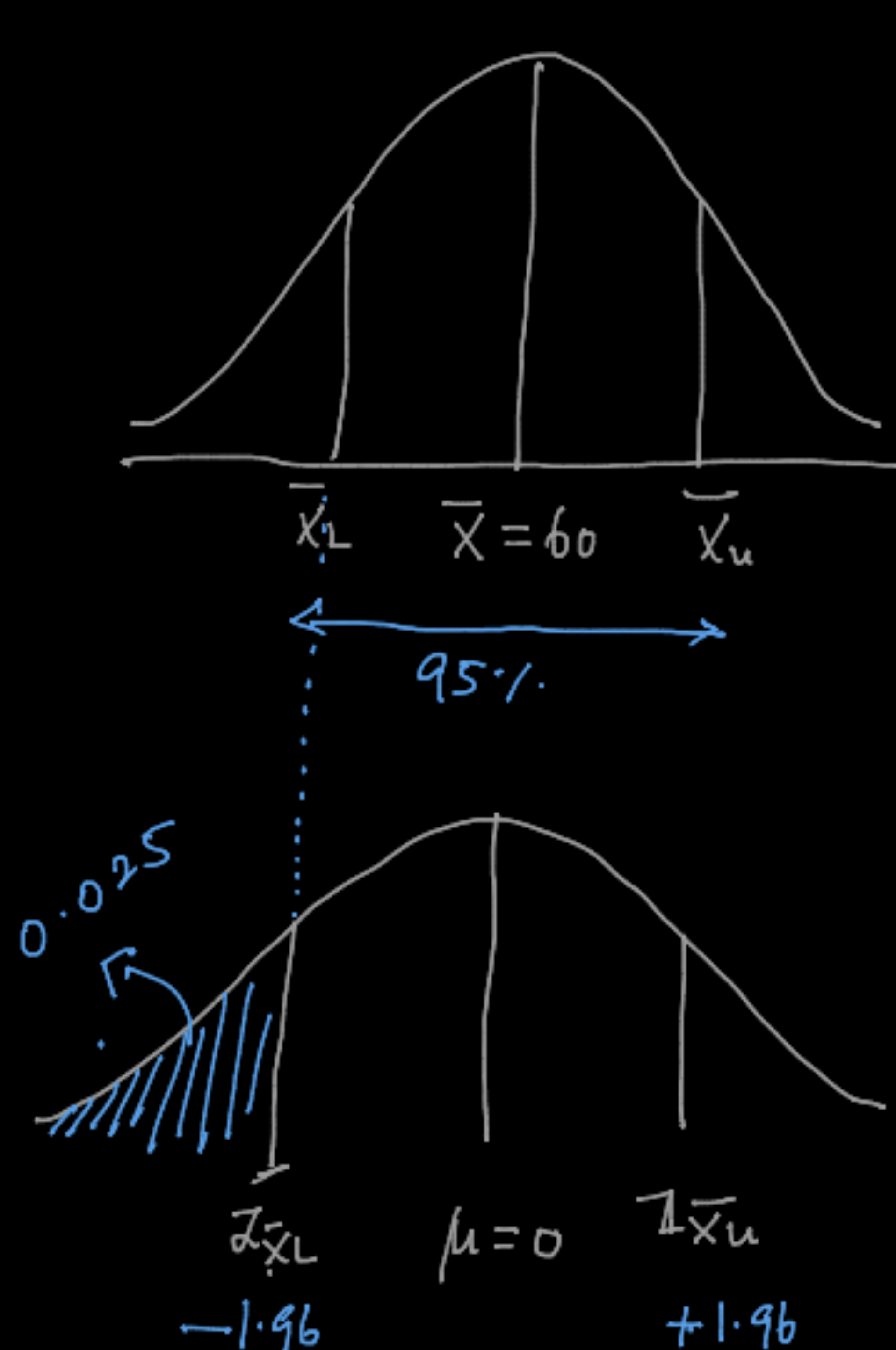
Confidence level

$C = 95\%$



$C = 80\%$





$C = 95\% = 0.95$

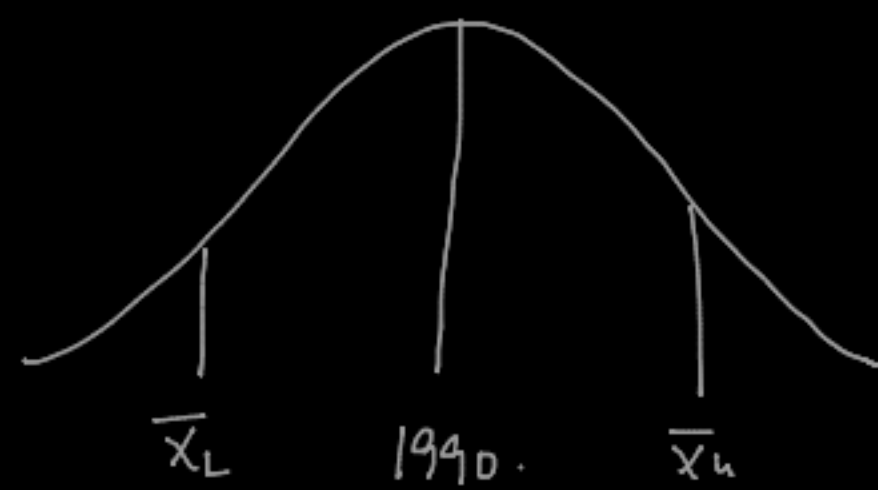
$\alpha = 5\% = 0.05$

$\alpha/2 = 2.5 = 0.025$

$$\Delta = z_{\alpha/2} \frac{\sigma_{pop}}{\sqrt{n}}$$

n - Sample size

$\sigma_{pop} \rightarrow$ population std. dev.



$C = 95\%$ $n = 140$

$\alpha = 5\%$.

$\sigma_{pop} = 2500$

$$\Delta = Z_{\alpha/2} \cdot \frac{\sigma_{pop}}{\sqrt{n}}$$

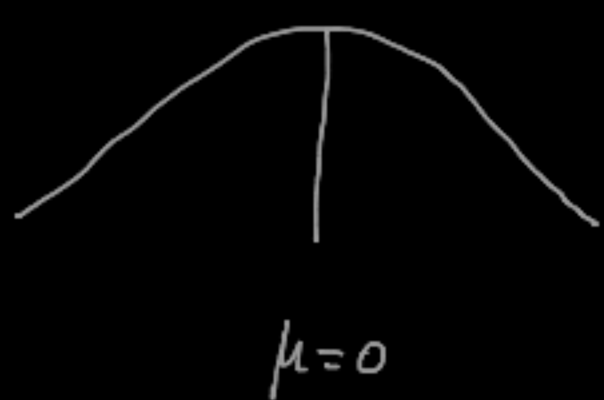
$$\Delta = 1.96 \cdot \frac{2500}{\sqrt{140}}$$

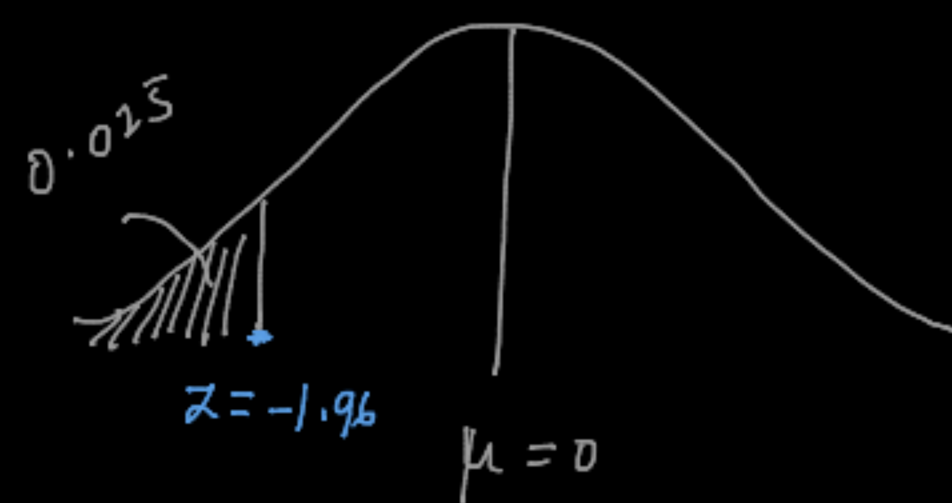
$$= 414.125$$

$R.E = 1990 \pm 414$

Range Estimate [1576 , 2404]

$C = 90\%$





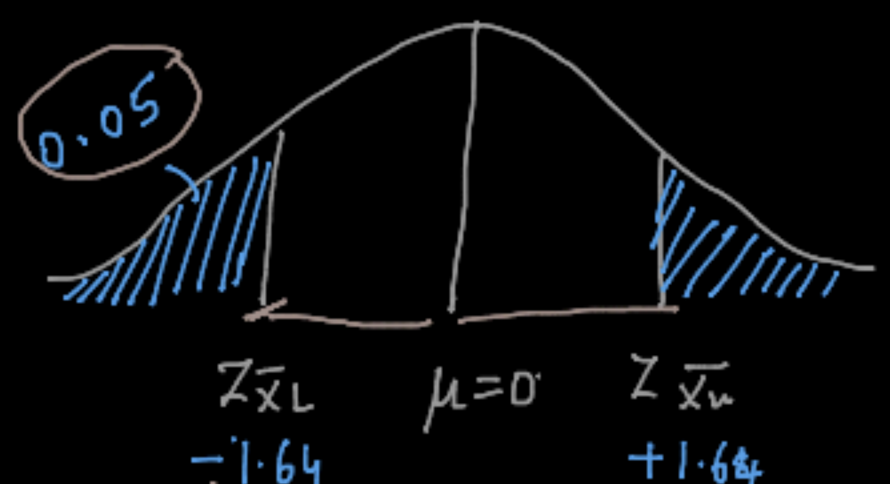
$\bar{x} = 1990$ $\quad n = 140$

$\sigma_{pop} = 2500$ $\quad c = 90\%$

$\alpha = 1 - c$

$= 10\%$ (or) 0.1

10%



$$\Delta = Z_{\alpha/2} \cdot \frac{\sigma_{pop}}{\sqrt{n}}$$

$$= 1.64 \times \frac{2500}{\sqrt{140}}$$

$$= 346$$

Range Estimate $[1990 - 346,\ 1990 + 346]$

$$= [1644,\ 2336]$$