Math 110

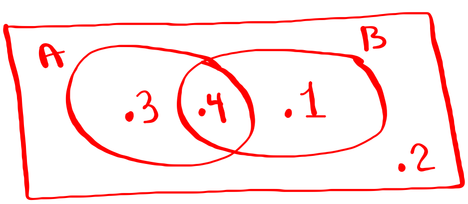
Winter 2021

Lecture 13

Class QZ 7

Given $P(A) = .7$ $\quad P(B) = .5$ $\quad P(A \text{ and } B) = .4$

1) Venn Diagram



2) $P(A \text{ or } B)$

$= .3 + .4 + .1 = \boxed{.8}$

3) $P(A \mid B)$

$= \dfrac{P(A \text{ and } B)}{P(B)} = \dfrac{.4}{.5} = \boxed{.8}$

Ch. 6 SG 19 – 24?

Prob. dist with Continuous random Variable

- Uniform Prob. dist (watch the video on that)
- Standard normal prob. dist.
- Normal Prob. dist
- Central limit Theorem
- Applications

Standard Normal Prob. Dist.:

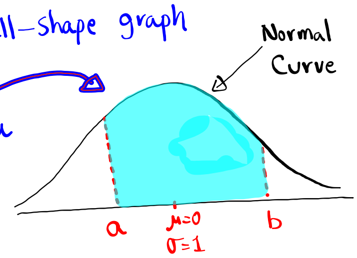
1) we use Z-variable, and $P(Z=c)=0$

2) Distribution is symmetric, bell-shaped with total area 1.

3) Mean = Mode = Median

4) $\mu=0$ & $\sigma=1$

5) $\boxed{P(a<Z<b)}$ is the corresponding area within the bell-shape graph



6) To find this area

[2nd] [VARS]

[normalcdf(]

with Menu

Lower:

upper:

μ:

σ:

[Paste] [Enter]

No Menu

Lower, Upper, μ, σ

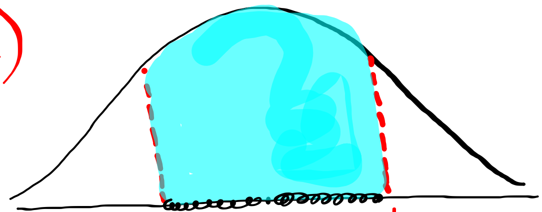
[Enter]

Find $P(-1 < Z < 1)$

$= \text{normalcdf}(-1, 1, 0, 1)$

(−)

$= \boxed{.683} \approx 68\%$



-1 $\mu=0$ 1

$\sigma=1$

$P(-2 < Z < 2)$

μ σ

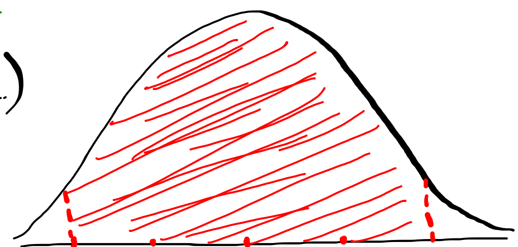
$= \text{normalcdf}(-2, 2, 0, 1)$

upper

Lower

$= \boxed{.954}$

$\approx 95\%$



-2 $\mu=0$ 2

$\sigma=1$

Find $P(Z > -1.645)$

$= \text{normalcdf}(-1.645, E99, 0, 1)$

L U μ σ

(−)

$= \boxed{.950}$

-1.645 $\mu=0$ ∞

$\sigma=1$

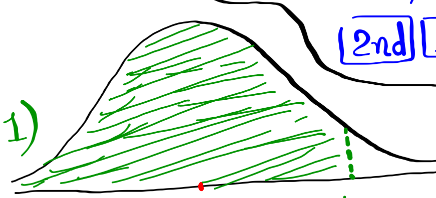
$10^{99} = E99$

$\boxed{2nd}\boxed{,}$

Find $P(Z < 1.96)$

$= \text{normalcdf}(-E99, 1.96, 0, 1)$

(−) $\boxed{2nd}\boxed{,}$



$-\infty$ $-E99$ $\mu=0$ 1.96

$\sigma=1$

$= \boxed{.975}$

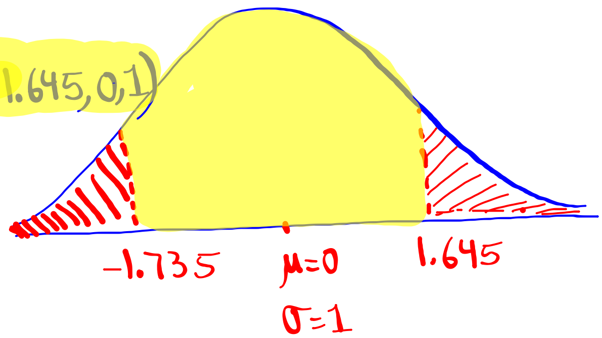
Find $P(Z < -1.735 \text{ OR } Z > 1.645)$

$= 1 - \text{normalcdf}(-1.735, 1.645, 0, 1)$

↑

Total Area

$= \boxed{.091}$



Find $Z = Q_3$

75% below it

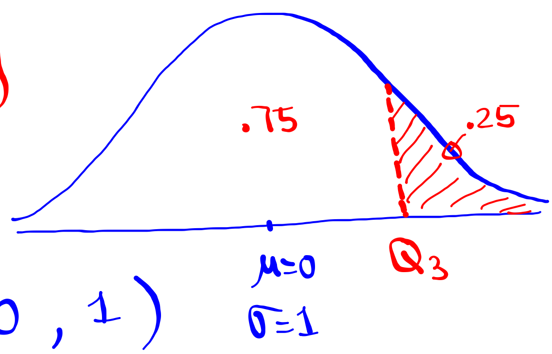
25% above it

$\boxed{\text{2nd}}$ $\boxed{\text{VARS}}$

$Z = Q_3 = \boxed{\text{invNorm}}(.75, 0, 1)$

Area ↑ μ ↑ σ ↑

$= \boxed{.674}$



Find $Z = P_{90}$

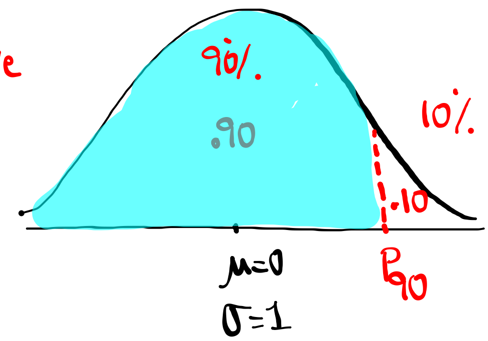
90% below

10% above

$Z = P_{90} = \text{invNorm}(.9, 0, 1)$

Left Area, μ, σ

$= \boxed{1.282}$



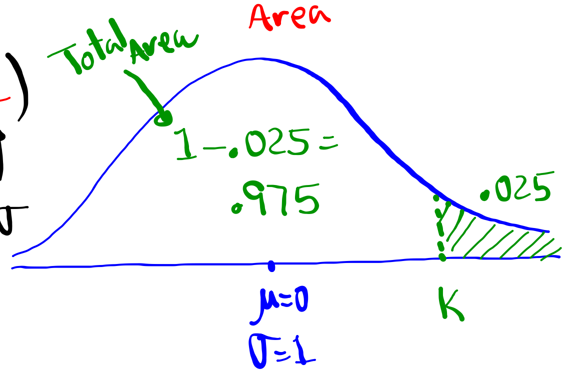
Find K such that $P(Z > K) = .025$

Right Area

$K = \text{invNorm}(.975, 0, 1)$

Left Area, μ, σ

$\boxed{K = 1.960}$



Find two Z-values that separate the middle 80% from the rest.

$1 - .8 = .2$

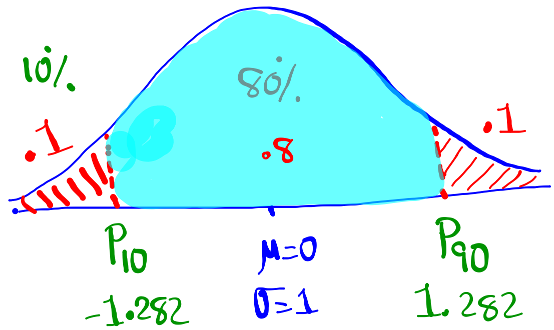
$.2 \div 2 = .1$

$P_{10} = \text{invNorm}(.1, 0, 1)$

$= \boxed{-1.282}$

$P_{90} = \text{invNorm}(.9, 0, 1)$

$= \boxed{1.282}$



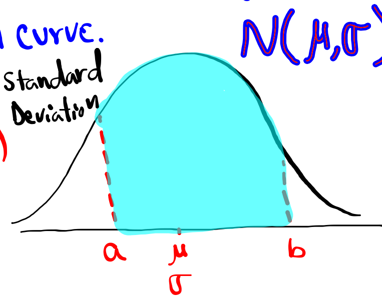
Normal Prob. dist.:

1) We use x-variable, and $P(x=c)=0$
2) Distribution is symmetric, bell-shaped with total area $=1$.
3) Mean = Mode = Median
4) μ & σ are given in the problem.
5) $P(a < x < b)$ is the corresponding area within the normal curve.

normalcdf(a, b, μ, σ)

Lower — a; Upper — b; Mean — μ; Standard Deviation — σ

$N(\mu, \sigma)$



Given: $N(75, 10)$ $\mu = 75$, $\sigma = 10$

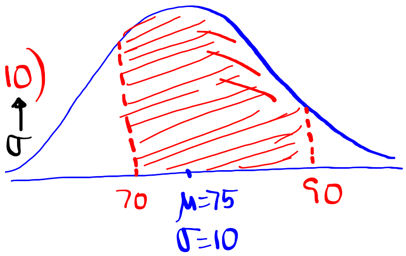
Normal dist.

$P(70 < x < 90)$

$= \text{normalcdf}(70, 90, 75, 10)$

$\uparrow$ L $\uparrow$ U $\uparrow$ μ $\uparrow$ σ

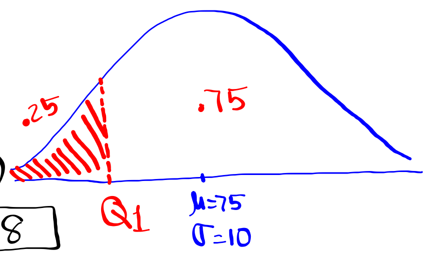
$= \boxed{.625}$



Find $x = Q_1$, Round to a whole #.

25% below

75% above



$x = Q_1 = \text{invNorm}(.25, 75, 10)$

$= 68.255 \approx \boxed{68}$

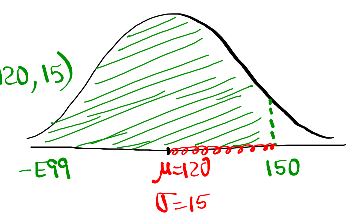
Consider a normal dist with the mean of 120 and standard deviation of 15.

$N(120, 15)$

Find $P(x < 150)$

$= \text{normalcdf}(-E99, 150, 120, 15)$

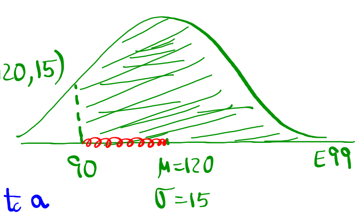
$= \boxed{.977}$



Find $P(x > 90)$

$= \text{normalcdf}(90, E99, 120, 15)$

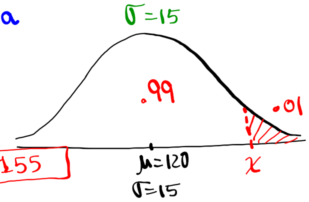
$= \boxed{.977}$



Find $x = P_{99}$, Round to a whole #

99% below .99

1% above .01



$x = \text{invNorm}(.99, 120, 15) \approx \boxed{155}$

Consider $N(240, 20)$

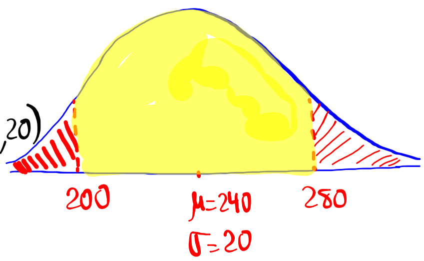
Normal $\nearrow$, μ $\uparrow$, σ $\uparrow$

Find $P(x < 200 \text{ or } x > 280)$

$= 1 - P(200 < x < 280)$

$= 1 - \text{normalcdf}(200, 280, 240, 20)$

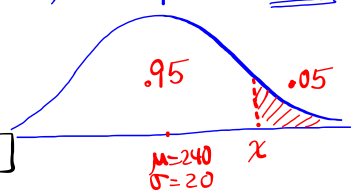
$= \boxed{.046}$



Find x, Rounded to a whole #, that separates the top 5% from the rest.

$x = P_{95} = \text{invNorm}(.95, 240, 20)$

$= 272.897 \approx \boxed{273}$



Exam 1 Scores are normally distributed with the mean of 84 and standard deviation of 8.

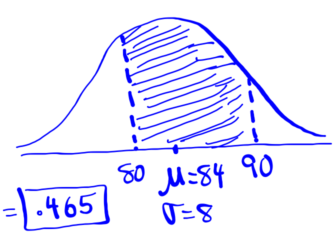
$N(84, 8)$

If I randomly select one exam, find the Prob. that score is

a) between 80 and 90.

$P(80 < x < 90)$

$= \text{normalcdf}(80, 90, 84, 8) = \boxed{.465}$

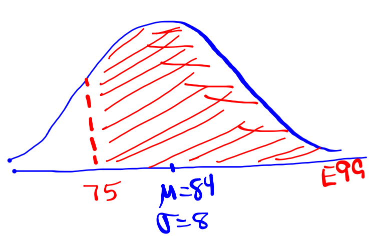


b) above 75.

$P(x > 75)$

$= \text{normalcdf}(75, E99, 84, 8)$

$= \boxed{.870}$

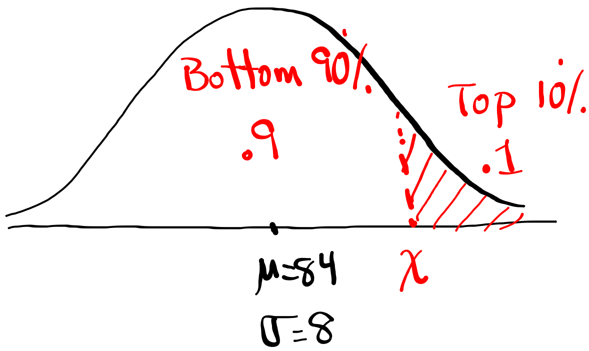


I want to give top 10% A, find exam score that separates the top 10% from the rest.

$x = \text{invNorm}(.9, 84, 8)$

.9 = Left Area, 84 = μ, 8 = σ

$\approx \boxed{94}$



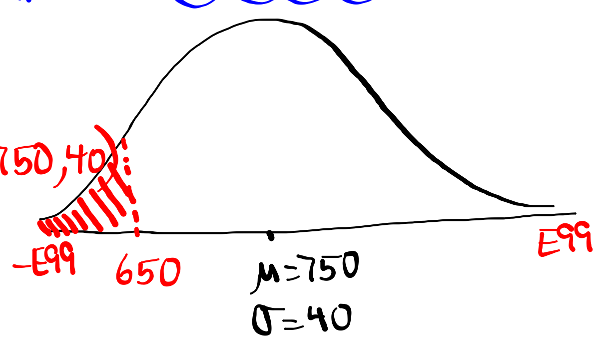
Credit scores are normally distributed with the mean of 750 and standard deviation of 40.

If one credit score is randomly selected, find the prob. that is below 650.

$P(x < 650)$

$= \text{normalcdf}(-E99, 650, 750, 40)$

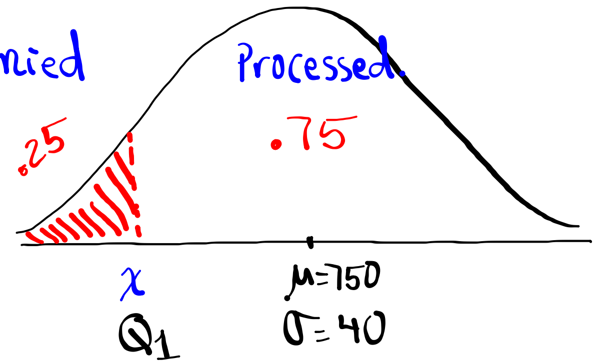
$= \boxed{.006}$



A bank has decided to process loan application for top 75% of credit scores. Find the minimum credit score required to apply for a loan.

$x = \text{invNorm}(.25, 750, 40)$

$\approx \boxed{723}$



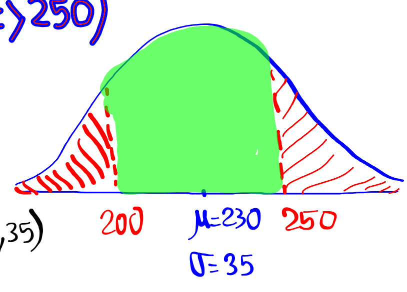
Total points scored in NBA games are normally distributed with the mean 230 and standard dev. of 35.

$N(230, 35)$

If we randomly select one NBA game find the prob. that total points is below 200 or above 250.

$P(x < 200 \text{ OR } x > 250)$

$= 1 - P(200 < x < 250)$



$= 1 - \text{normalcdf}(200, 250, 230, 35)$

$= \boxed{.480}$

Consider a geometric Prob. dist with $p = .1$

$q = 1 - p = \boxed{.9}$

$\mu = \frac{1}{p} = \frac{1}{.1} = \boxed{10}$

$\sigma^2 = \frac{q}{p^2} = \frac{.9}{.1^2} = \boxed{90}$

$\sigma = \sqrt{\sigma^2} = \sqrt{90} = 9.487$

$P(x = 3 \text{ or } x = 5) = P(x = 3) + P(x = 5)$

$= \text{geometpdf}(.1, 3) + \text{geometpdf}(.1, 5)$

$= \boxed{.147}$

$P(\text{after 3rd trial}) = P(x > 3) = P(x \geq 4)$

$= 1 - P(x \leq 3)$

$= 1 - \text{geometcdf}(.1, 3)$

$= \boxed{.729}$