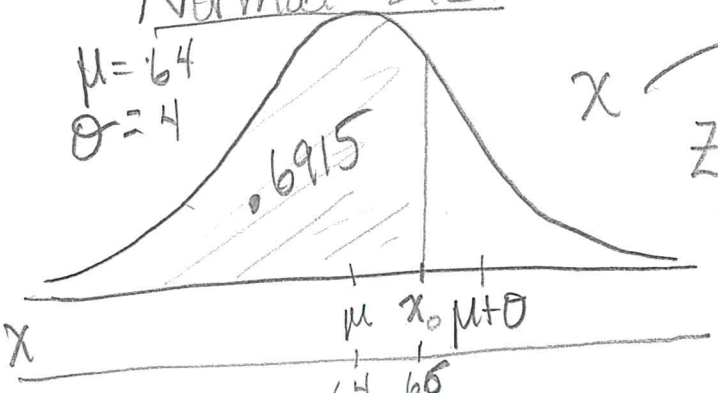
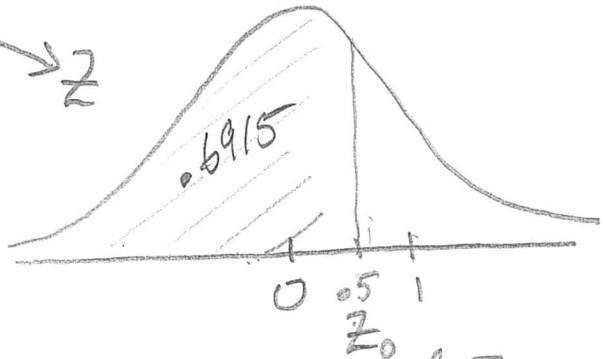
§6.2 General Normal Distributions

$$z = \frac{x - \bar{x}}{s}$$

Normal Dist



$$x \rightarrow z \qquad z = \frac{x - \mu}{\sigma}$$



Area to left of x_0 = Area to left of z_0

$$P(X < x_0) = P(z < z_0)$$

normalcdf(-9999, x_0, μ, σ) = normalcdf(-9999, z_0, 0, 1)

normalcdf(-9999, 66, 64, 4) = .6915 = ncdf(-9999, .5, 0, 1)

Given

$\mu = 64$ = inches

$\sigma = 4$ inches

$x_0 = 66$ inch

$$z_0 = \frac{x_0 - \mu}{\sigma} = \frac{66 - 64}{4} = \frac{2}{4} = .5$$

the probability that a women has height less than 66 inches

$$P(X < 66) = .6915$$

Ex 1 The Amount of Water used per shower is normally distributed with a mean of $\mu = 60$ gallons $\sigma = 9$ gallons.

HW(Time your Showers ⊙ 3 gal/min = # of gal)
Bring on Tuesday

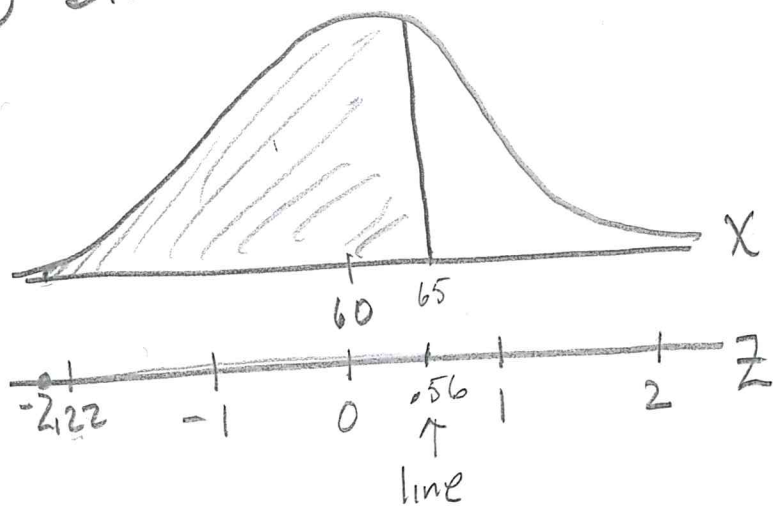
a) What proportion of Showers use between 40 and 65 gallons?

① Find z-Scores ② Draw Curve with both x, z Axis

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

$$z_{40} = \frac{40 - 60}{9} = -2.22$$

$$z_{65} = \frac{65 - 60}{9} = 0.56$$



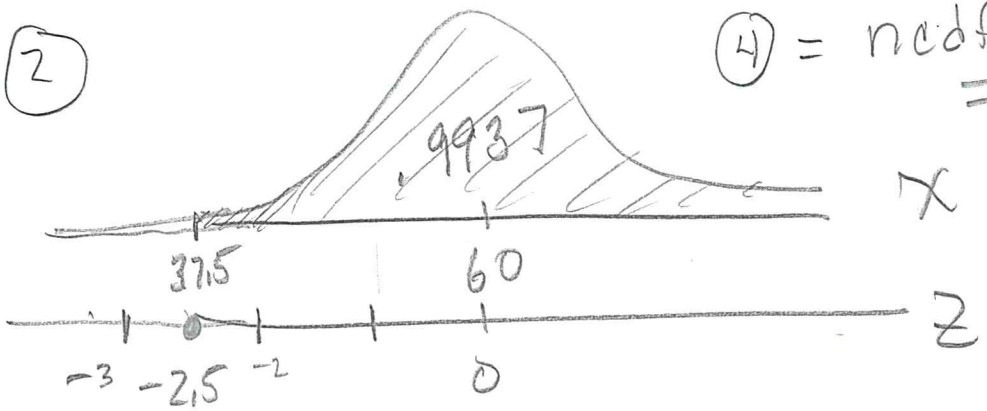
③ $P(40 < X < 65)$ ④ = normalcdf(LB, UB, μ, σ)
= normalcdf(40, 65, 60, 9)

= 0.6976

Ex2 What (%) of population uses more than $x = 37.5$ gallons of water.

$\mu = 60 \quad \sigma = 9$

① $z = \frac{37.5 - 60}{9} = -2.5$

② 

③ $P(37.5 < x < 9999)$

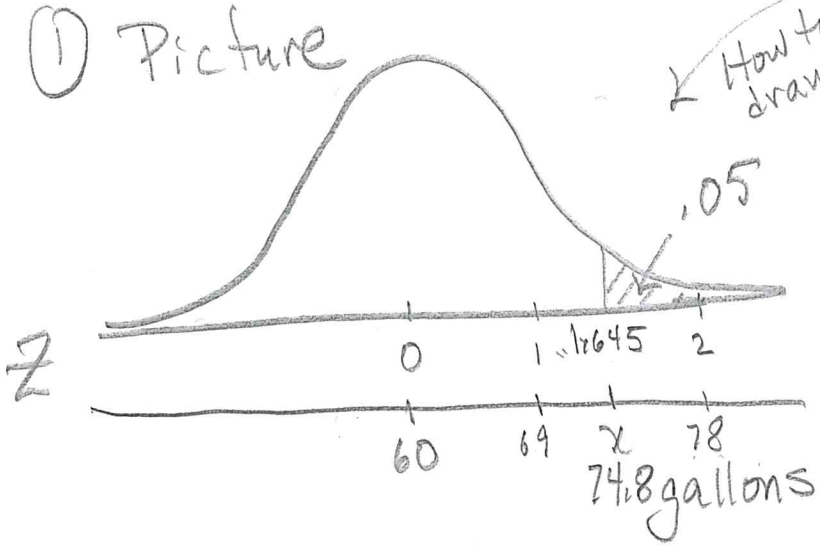
$= P(x > 37.5)$

④ $= \text{ncdf}(37.5, 9999, 60, 9)$

$= \boxed{.9937}$ ↑ Area

Ex3 How many gallons separate the longest 5% of showers? ~> Statistically long!

① Picture



② $z = \text{invnorm}(.95, 0, 1)$ ↑ Area left

$\boxed{z = 1.645}$

How to draw

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

$z\sigma = x - \mu$

$\boxed{z\sigma + \mu = x}$

$x = 1.645 \cdot 9 + 60$

$\boxed{x = 74.8 \text{ gallons}}$

$x = \text{invnorm}(.95, 60, 9) = 74.8$

Ex 1 The Amount of water used per shower is Normally distributed with a mean $\bar{X} = 20\text{gal}$ and $s = 2.5\text{gal}$ (2.5 gal. per Min)

7 minute Shower → 17.5 gal

4 mintes 10 gal

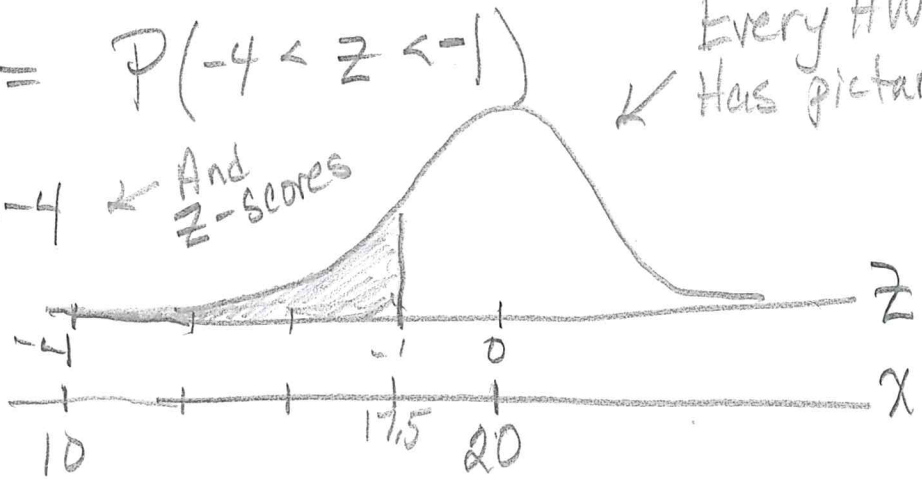
a) Find the prob % getting a randomly Seleded Person who uses between 10gal and 17.5gal

$P(10 < X < 17.5) = P(-4 < z < -1)$

Every HW Has picture

$z_{10} = \frac{X - \bar{X}}{s} = \frac{10 - 20}{2.5} = -4$ ← And z-scores

$z_{17.5} = \frac{(17.5 - 20)}{2.5} = -1$



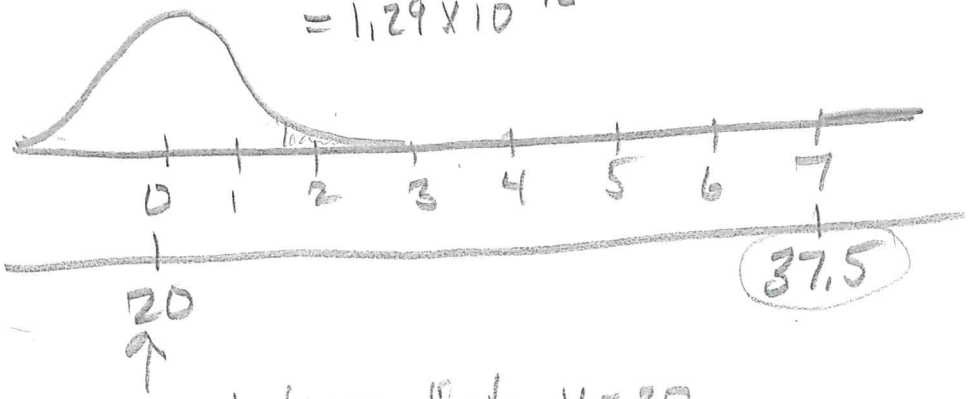
= normalcdf (LB, UB, μ, σ)

= normal cdf (10, 17.5, 20, 2.5) = .1586

b) What proportion of the population uses more than 37.5 gallons of water?

$P(x > 37.5) = P(z > 7) =$ normalcdf(37.5, 9999, 20, 2.5)
$= 1.29 \times 10^{-12}$

$z = \frac{37.5 - 20}{2.5} = 7$

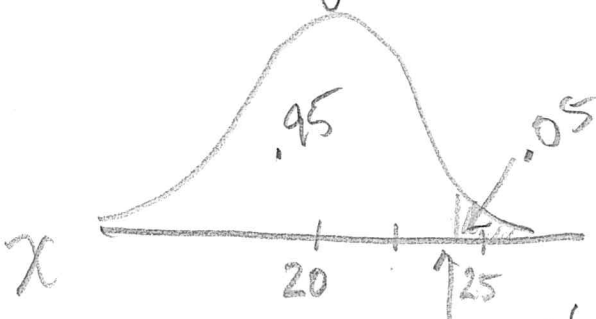


Do you believe that $\mu = 20$

Probably Not True

Hypothesis Test Chapter 8

c) How many gallons separates the longest 5% of showers?



find X that corresponds to an area of .05 to the right

$X = \text{invnorm}(1 - .05, 20, 2.5) = 24.11$ gallons

$Z = \text{invnorm}(1 - .05, 0, 1) = 1.645$

$\mu = 10\,gal$ = Average Amt of water used per sho
$\theta = 1.5$

Ex 1 IQ Scores are Normally distributed with a mean of $\mu = 100$ and a Standard deviation $\theta = 15$

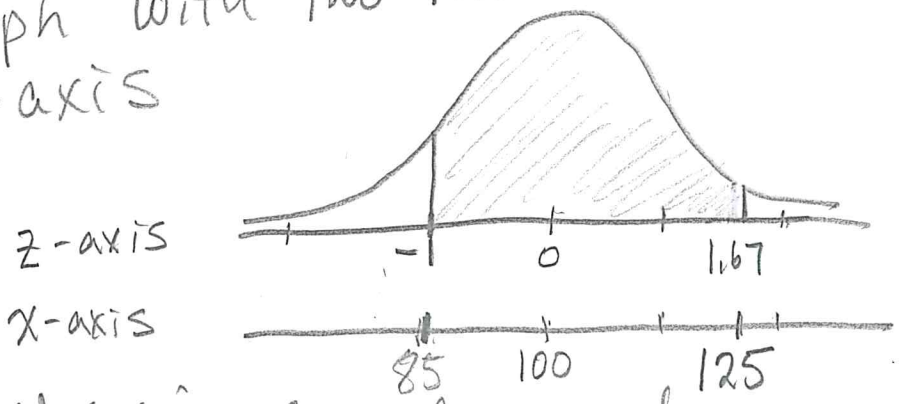
a) Find the proportion of adults with IQ-Scores between 85 and 125.

① Find z-Scores that correspond to IQ scores

$$z_{85} = \frac{x - \mu}{\theta} = \frac{85 - 100}{15} = \frac{-15}{15} = -1$$

$$z_{125} = \frac{125 - 100}{15} = \frac{25}{15} = \boxed{1.67}$$ ← Round z to 2 decimals

② Draw Graph with two Axes x-axis and a z-axis



③ Probability Notation & Calc. input

$P(85 \le x \le 125) = \text{Normal cdf}(\overset{\text{Lower}}{a}, \overset{\text{upper}}{b}, \mu, \theta)$

$= \text{Normalcdf}(85, 125, 100, 15)$

$= \boxed{.7936}$ ← Round proportions to 4 decimals

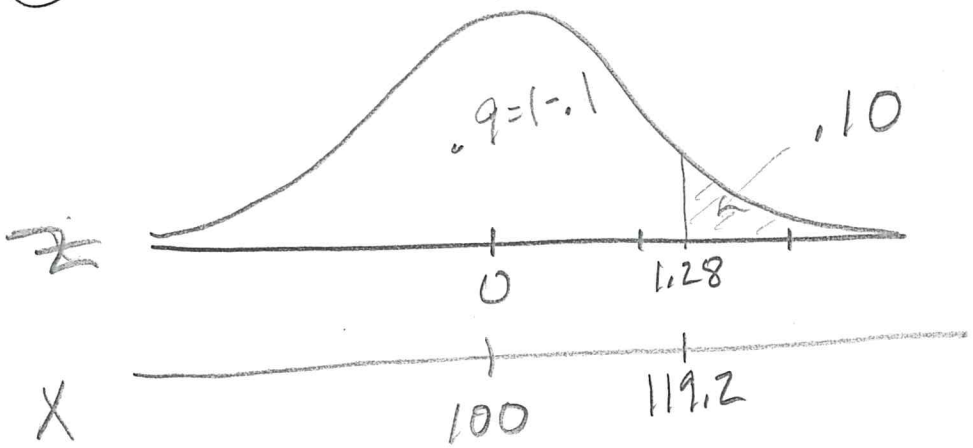
$\rightarrow \mu = 100, \sigma = 15$

b) What IQ Score corresponds to the top 10% of IQ Scores?

↑ Given a %, asks to find the score.

use invnorm(Area left, μ, σ) = X

① Draw Graph



② use Invnorm twice

Z = invnorm(.9, 0, 1) = 1.28

X = invnorm(1-.1, 100, 15) = 119.2

↑ Round X to one more than data

Note: $z = \frac{x - \mu}{\sigma}$

$z\sigma = x - \mu$

$+\mu \quad +\mu$

Formula Page: $X = \mu + z\sigma = 100 + 1.28 \cdot 15 = 119.2$