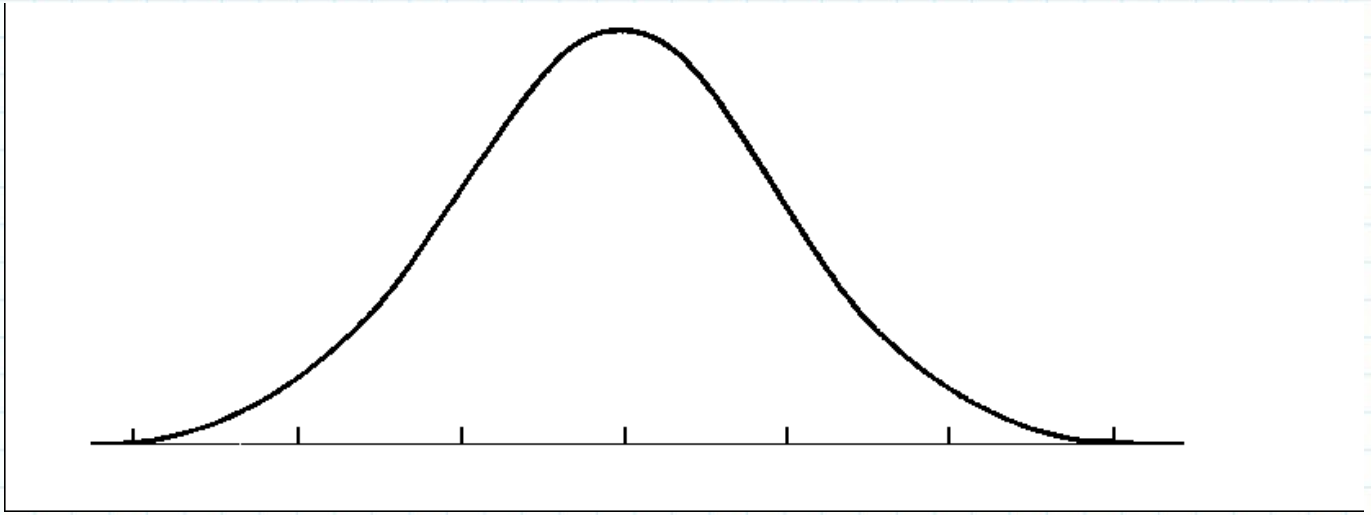
Nonstandard Normal Distributions

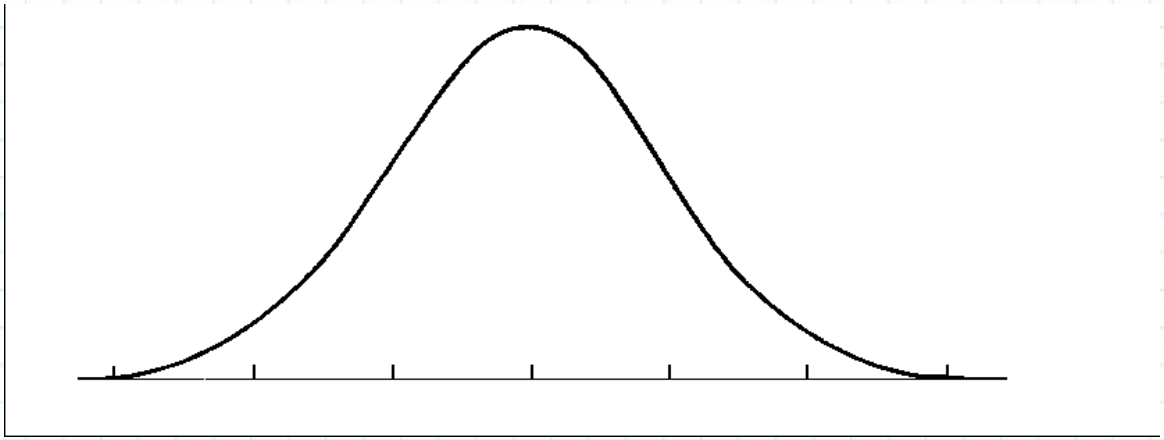
Math 122

Normal Distributions



The most important distribution for statistics.

Normal Distribution with mean μ and standard deviation σ

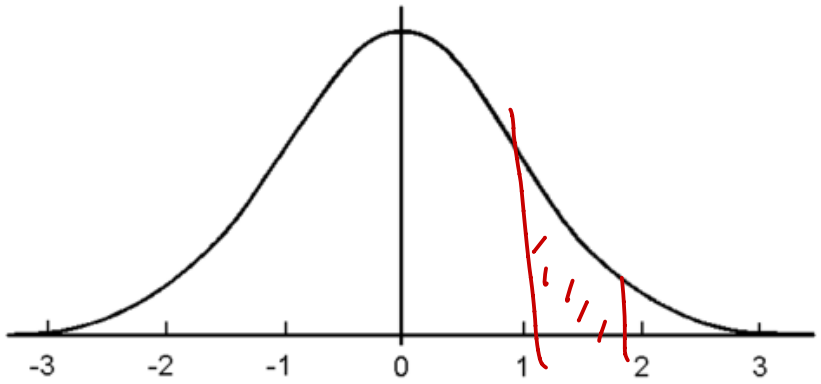


$$y = \frac{e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}}{\sigma\sqrt{2\pi}}$$

Standard Normal Distribution

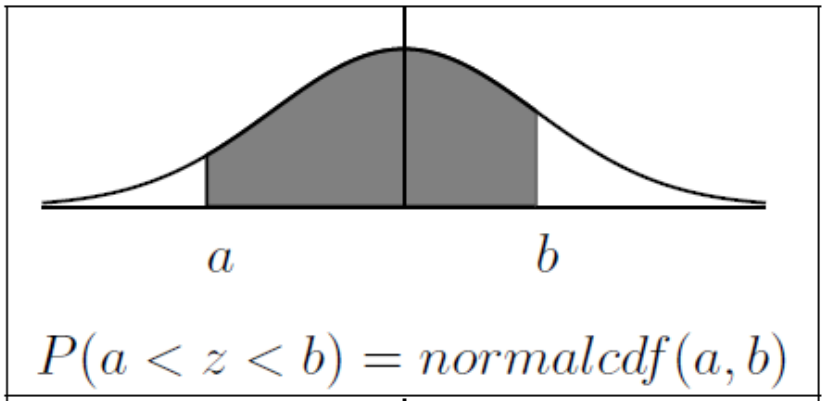
- Has mean μ=0 and standard deviation σ=1

$$y = \frac{e^{-\frac{1}{2}x^2}}{\sqrt{2\pi}}$$

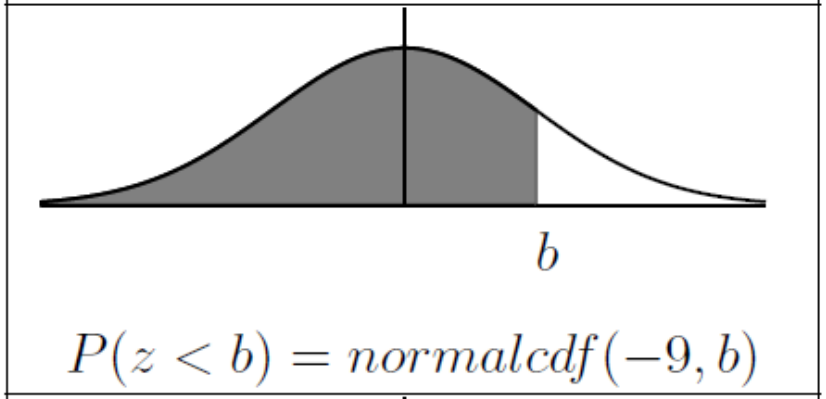


- Usually use z for a standard normal distribution

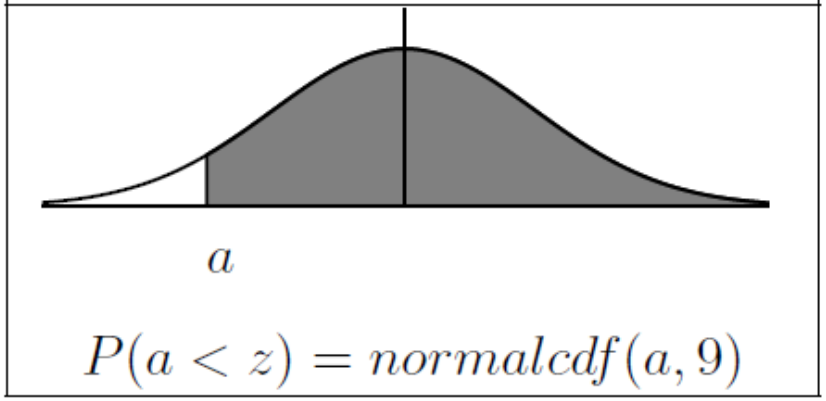
Standard Normal Distribution



$$P(a < z < b) = normalcdf(a, b)$$



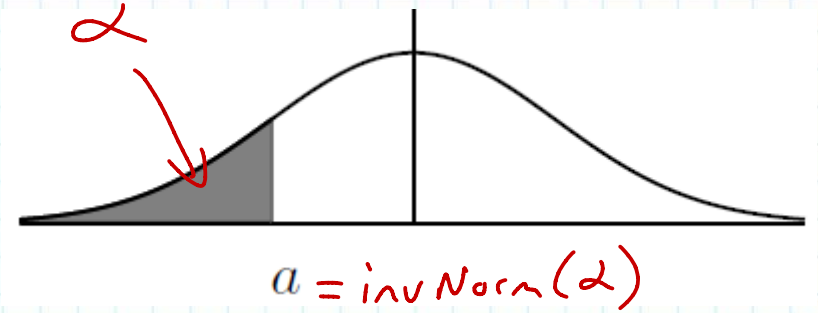
$$P(z < b) = normalcdf(-9, b)$$



$$P(a < z) = normalcdf(a, 9)$$

Inverse Normal Function

- To find a number a so that P(x<a)=α use invnorm(α)



What about normal distributions that are not standard normal?

$\mu \neq 0$ or $\sigma \neq 1$

Z Scores

If x has a normal distribution then

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

Has a standard normal distribution

To work with nonstandard normal distributions, convert to Z scores

Conversions

- To convert to Z scores:

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

- To convert from Z scores:

$$x = \mu + z\sigma$$

Know!

Some normal distributions

	Female		Male	
Measure	Mean	St. Dev.	Mean	St. Dev.
Height	63.8	2.7	69.6	3.2
Weight	154.7	43.0	179.7	47.7
Waist	35.2	6.7	35.2	6.3
Pulse	79.1	13.2	70.5	10.7

	Mean	Standard Deviation
Annual Snowfall in Lincoln	26.7	11.1
IQ	100	15
Infant Birth Weight	7.5lb	1.1lb
SAT Area Test	500	100
ACT	18	6

Heights of college age males are normally distributed with mean 69.6 in and standard deviation 3.2 in.

μ

σ

What is the probability that a randomly chosen college age male is between 5'10 and 6'2?

X = height of random male in inches

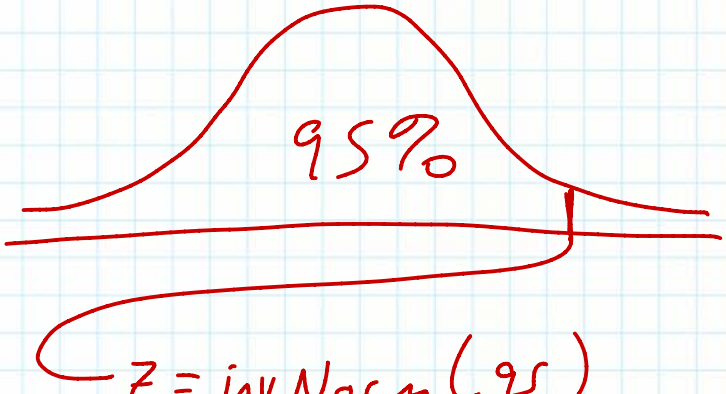
$$P(70 < x < 74) = P\left(\frac{70-69.6}{3.2} < z < \frac{74-69.6}{3.2}\right)$$

$$= P(0.125 < z < 1.375)$$

$$= \text{normalcdf}(0.125, 1.375)$$

$$= 0.3657$$

Find a height taller than 95% of college age males.



$$z = \text{invNorm}(.95)$$

$$= 1.6449$$

$$x = \mu + z\sigma$$

$$= 69.6 + 1.6449 \times 3.2$$

$$= 74.86$$

Heights of college age males are normally distributed with mean 69.6 in and standard deviation 3.2 in.

μ

σ

What is the probability that a randomly chosen college age male is between 5'10 and 6'2?

Use normalcdf

Lower = 70

Upper = 74

$\mu = 69.6$

$\sigma = 3.2$

Prob = 0.3657

Find a height taller than 95% of college age males.

invNorm Dialog

Area = .95

$\mu = 69.6$

$\sigma = 3.2$

$x =$ 74.86 in