17-5 day 2 The Standard Normal Distribution

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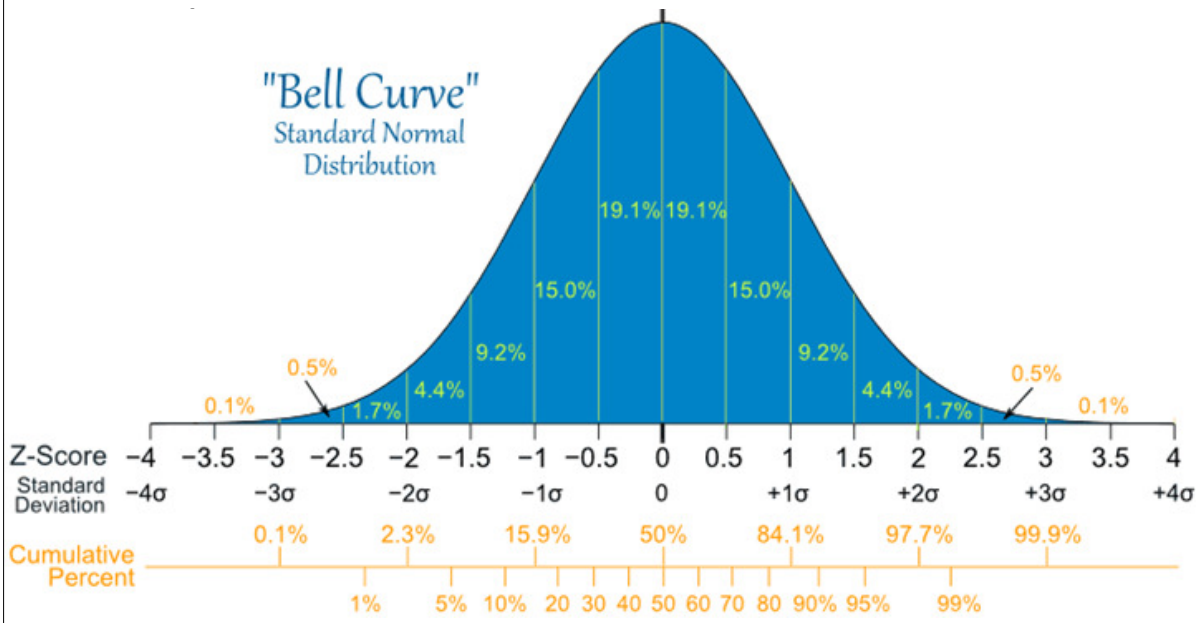
A standard Normal Distribution

A normal distribution that has a mean of 0 and a standard deviation of 1 is called a Standard Normal



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Standardizing a non-standard distribution

If x is a value of a normal randon variable with mean μ and standard deviation σ , the standardized value of x is: $z = \frac{x - \mu}{\sigma}$

A standard value is also called a z-score.

The z-score basically tells you how many standard deviations away from the mean a particular value is.

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

This formula basically shifts the normal distribution into the "standard position" so that it has a mean of zero and standard deviation of 1. This new distribution we created by this transformation is called the Standard Normal Distribution.

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Probability Density Function of the Standard Normal Distribution

The probability density function for a normally distributed random variable x is:

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}z^2}$$

$$-\infty < x < \infty$$

for

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Ex1. People found to have high blood pressure are started on a course of medication and their blood pressure is checked at the end of 4 weeks. The drop in blood pressure over the period is normally distributed with a mean of 5.9 units and a standard deviation of 1.9 units.

a.) Patient A shows a 10 point drop in their blood pressure while patient B shows a 3 point drop in their blood pressure. Find the z score for each patient.

$\frac{x-\mu}{\sigma}$ $\mu = 5.9$ $\sigma = 1.9$

$z_A = \frac{10-5.9}{1.9} = 2.158$

$z_B = \frac{3-5.9}{1.9} = -1.53$

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b.) Find the proportion of patients who show between 3 and 10 point drop in their blood pressure.

N.D. $\mu = 5.9 \quad \sigma = 1.9$

$$\int_3^{10} \frac{1}{1.9\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x-5.9}{1.9}\right)^2} dx$$

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$\int_3^{10}(1/(1.9\sqrt{(2\pi)})e^{-1/2((X-5.9)/1.9)^2}dX$

.9210663725

2.158

S.N.D. $\int_{-1.53}^{2.158} \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}z^2} dz$

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$\int_{-1.53}^{2.158}(1/\sqrt{2\pi}e^{-1/2Z^2})dZ$

.9215277196

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normalcdf(3,10,5.9,1.9)
.9210664081

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normalcdf(-1.53,2.158,0,1)
.9215277564

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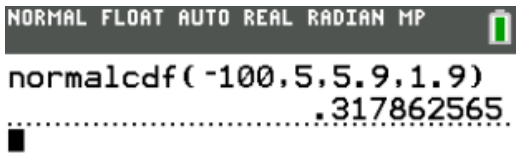
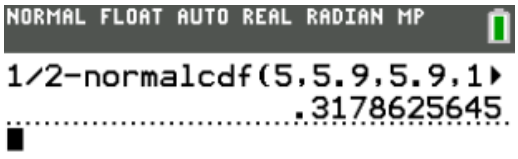
c.) Find the portion of patients having up to a 5 point drop in their blood pressure.





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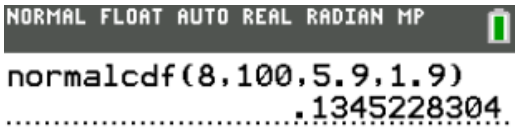
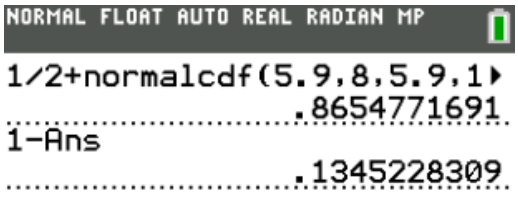
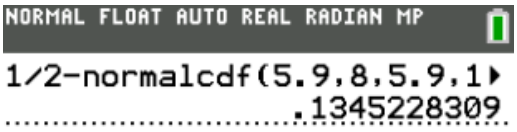
d.) Find the portion of patients showing at least an 8 point drop in their blood pressure.







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