17-5 day 3 The Inverse Normal Distribution

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17. Solve the differential equation

$$(x+2)^2\frac{dy}{dx}=4xy \quad (x>-2)$$

given that $y=1$ when $x=-1$.

$\frac{dy}{dx}=\frac{4xy}{(x+2)^2}$

$dy=\frac{4xy}{(x+2)^2}dx$

$\int\frac{dy}{y}=\int\frac{4x}{(x+2)^2}dx$

$\ln|y|=\int 4x(x+2)^{-2}dx$

$\int u\,dv=uv-\int v\,du$

$u=4x \quad dv=(x+2)^{-2}$

$du=4 \quad v=-(x+2)^{-1}$

$\ln|y|=-4x(x+2)^{-1}+\int(x+2)^{-1}\cdot 4\,dx$

$\ln|y|=-4x(x+2)^{-1}+4\int\frac{1}{x+2}dx$

$\ln|y|=\frac{-4x}{x+2}+4\ln|x+2|+C$

$e^{\ln|y|}=e^{\frac{-4x}{x+2}+4\ln|x+2|+C}$

$|y|=e^{\frac{-4x}{x+2}+4\ln|x+2|+C}$ (-1,1)

$y=\pm e^{\frac{-4x}{x+2}+4\ln|x+2|+C}$

$1=\pm e^{4+4\ln|1|+C}$

$1=\pm e^{4+C} \quad e=\cdot 4$

$y=e^{\frac{-4x}{x+2}+4\ln|x+2|-4}$

$y=e^{\frac{-4x}{x+2}-4}\cdot e^{4\ln|x+2|}$

$y=e^{\frac{-4x}{x+2}-4}\cdot(x+2)^4$

$\boxed{y=(x+2)^4e^{\frac{-4x}{x+2}-4}}$

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This is basically working backwards. Instead of finding the probability of a certain value. You have the probability and you are finding the value.

Find a value of x such that the

$P(X < x)$ = specified valued

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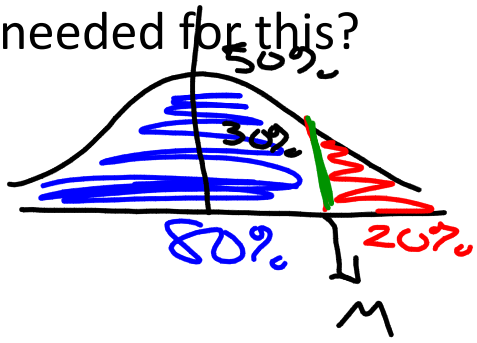
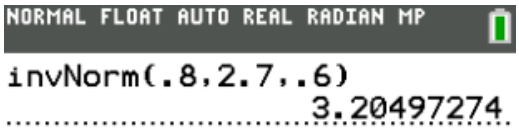
Ex1a. Your high school has an average GPA of 2.7 with a standard deviation of .6. You want to take classes PSEO next year but you have to be in the top 20% of your class to be eligible. What is the minimum GPA needed for this?



$$\int_{-\infty}^{M} \frac{1}{.6\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x-2.7}{.6}\right)^2} dx = .8$$



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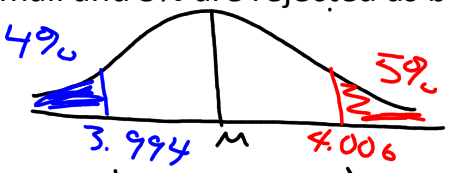
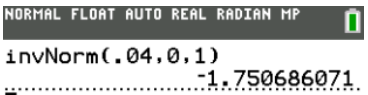
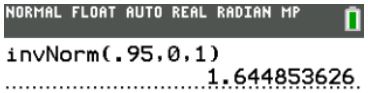
Ex2. The diameter of pistons manufactured by a company are normally distributed. Only those pistons whose diameters lie between 3.994cm and 4.006 cm are acceptable. Find the mean and standard deviation of the distribution if 4% of the pistons are rejected as being too small and 5% are rejected as being too large.

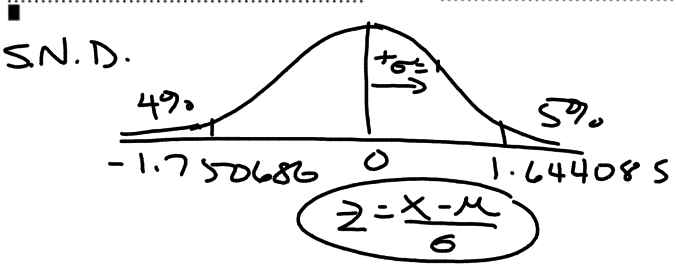


z-score
-1.750686

z-score
1.644854







$-1.750686 = \frac{3.994-\mu}{\sigma}$

$\sigma = \frac{3.994-\mu}{-1.750686}$

$1.644085 = \frac{4.006-\mu}{\sigma}$

$\sigma = \frac{4.006-\mu}{1.644085}$

$\frac{3.994-\mu}{-1.750686} = \frac{4.006-\mu}{1.644085}$

$-1.75(4.006) + 1.75\mu = 1.64(3.994) - 1.64\mu$

$-7.013248 + 1.75\mu = 6.569547 - 1.64\mu$

$13.582795 = 3.39554\mu$

$\mu = 4.0002$

$\sigma = \frac{4.006-\mu}{1.64485}$

$\sigma = .003536$

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