2/28/19 - 1

R.V. $0 \le x \le 1$

$$f(x) = \begin{cases} 1 & \text{if } 0 \le x \le 1 \\ 0 & \end{cases}$$

$P[a < X < b] = b - a \quad 0 \le a \le b \le 1$

$P[.6 \le \cancel{x} \le .7] = .1$

SUPPOSE X WAS FEET.

WE WANT CM.

$Y = 30X$ $\quad x = .5$ FT

$g(y)$? $\quad y = 15$ CM.

$P[10 \le y \le 20] = P[\frac{1}{3} \le X \le \frac{2}{3}]$

$= g(y)(20-10) \quad = \frac{1}{3}$

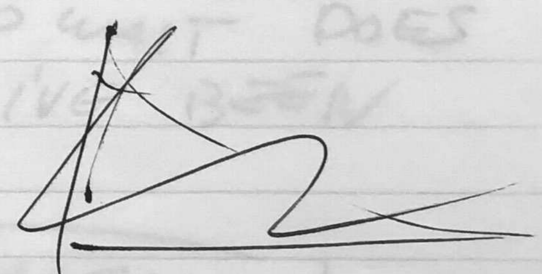
$= 10g(y) \quad g(y) = \frac{1}{30}$

$$\frac{g(y)}{f(x)} = \frac{dx}{dy} = \frac{1}{30}$$

EXPONENTIAL DISTV

$$P[X > a] = e^{-\lambda a} \qquad a \geq 0$$

CDF $P[X \leq a] = 1 - e^{-\lambda a}$



PDF $= \frac{d \, CDF}{dx}$

$$\frac{d(1 - e^{-\lambda a})}{da} = \lambda e^{-\lambda a}$$

MEMORYLESS

$$P[X \ge b+a \mid X \ge a]$$

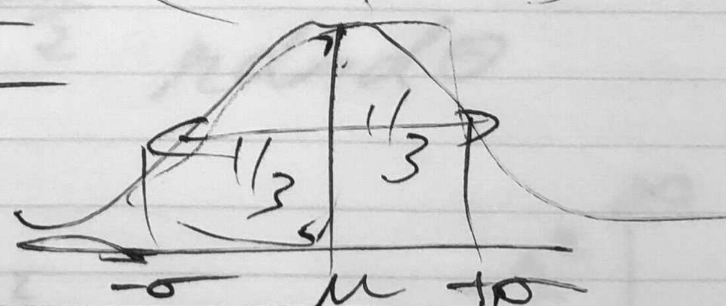
$$= \frac{P[X \ge b+a \;\&\; X \ge a]}{P[X \ge a]}$$

$$= \frac{P[X \ge b+a]}{P[X \ge a]} = \frac{e^{-\lambda(b+a)}}{e^{-\lambda a}} = e^{-\lambda b}$$

HOW LONG I STILL HAVE TO WAIT DOES NOT DEPEND ON HOW LONG I'VE BEEN WAITING.

NORMAL (GAUSSIAN)

2 PARAMS: μ, σ



$\mu = 0$
$\sigma = 1$

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

SHOW $\displaystyle\int_{-\infty}^{\infty} f(x)\,dx = 1$

LET $\displaystyle A = \int_{-\infty}^{\infty} f(x)\,dx = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} e^{-\frac{x^2}{2}}\,dx$

$$A^2 = \frac{1}{2\pi} \int_{-\infty}^{\infty} e^{-\frac{x^2}{2}}\,dx \int_{-\infty}^{\infty} e^{-\frac{y^2}{2}}\,dx$$

$$= \frac{1}{2\pi} \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} e^{-\frac{(x^2+y^2)}{2}}\,dy\,dx$$

CHANGE VARIABLES $\rightarrow (r, \theta)$

$$= \frac{1}{2\pi} \int_0^{\infty}\int_0^{2\pi} e^{-\frac{r^2}{2}}\,r\,dr\,d\theta$$

$$= \int_0^{\infty} r e^{-\frac{r^2}{2}}\,dr = -e^{-\frac{r^2}{2}}\Big|_0^{\infty}$$

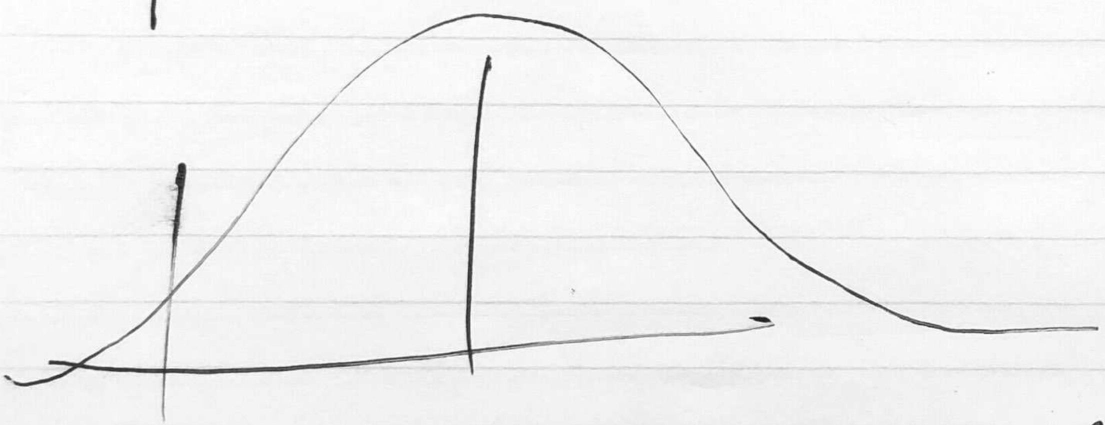
$$= 1$$

~~4~~ 5

N NORMAL $N(\mu, \sigma)$
$\quad\quad\quad\quad\quad\quad\quad 0 \quad 2$

N NORMAL(0, 2)
$\quad\quad\quad\quad\quad \mu \ \sigma$

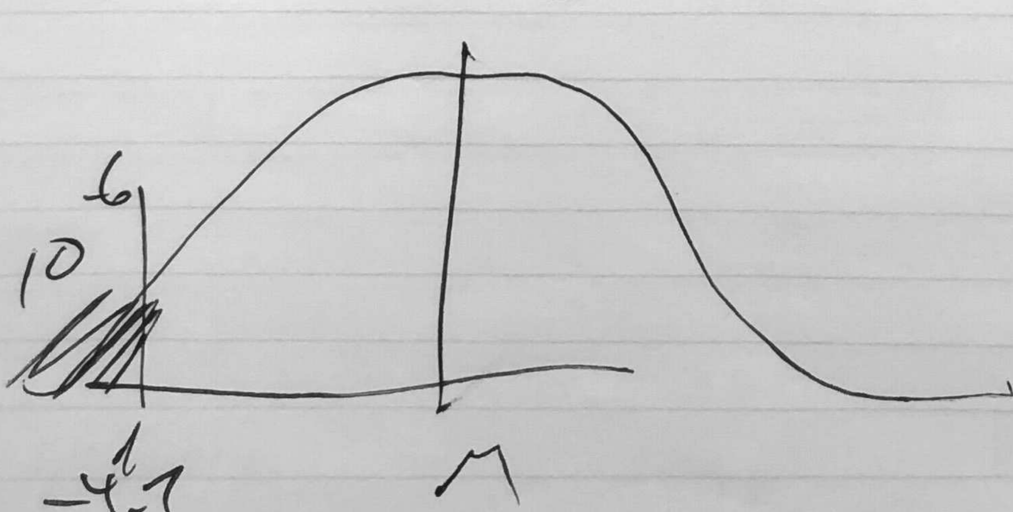
$P[N \leq -\alpha V] = 10^{-6}$



DEFINE A NEW NORMAL R.V.

$M = \frac{N}{2}$ M HAS $\sigma = 1$

$P[M \leq \frac{-\alpha V}{2}] = 10^{-6}$



$\frac{\overset{.01}{x}v}{2} = 4.7$ $\cancel{v}$

$\cancel{.01}\ \frac{v}{200} = 4.7$ $v = 900$