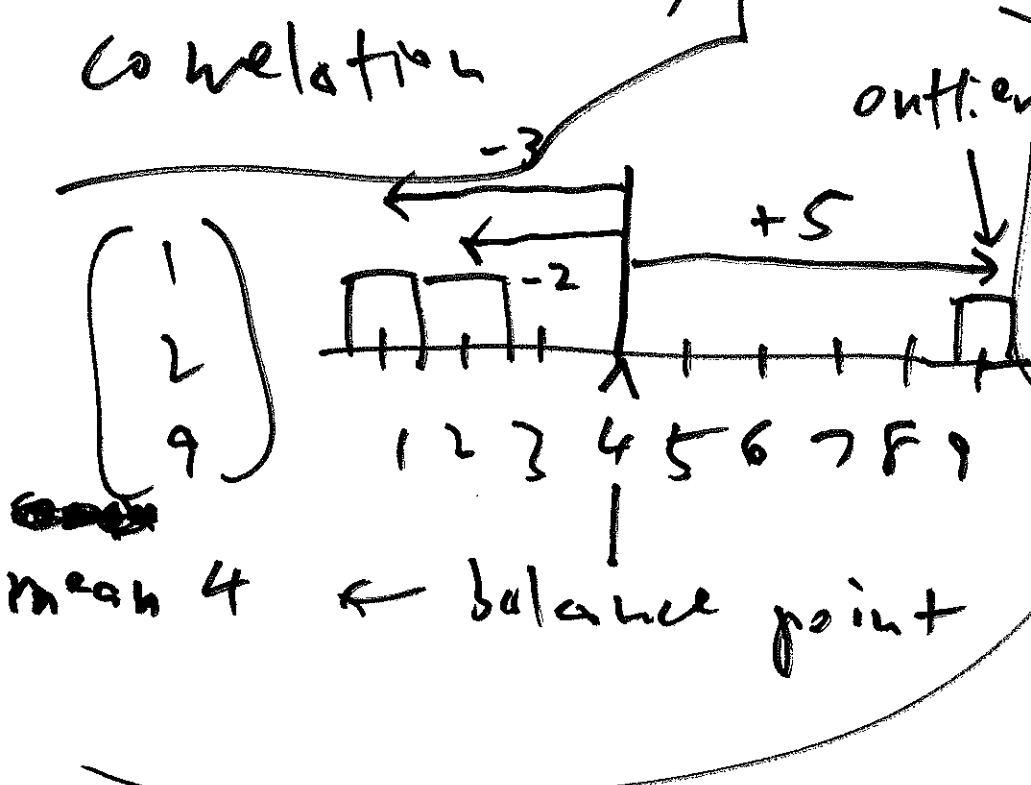
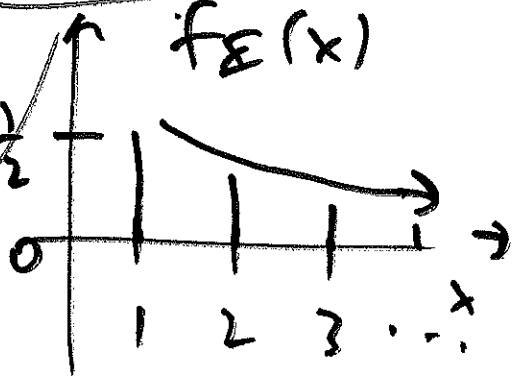
This expected time: value, variance, next standard deviation, time: covariance, correlation

quiz 5 due tonight

AMS 131, 16 Aug 19

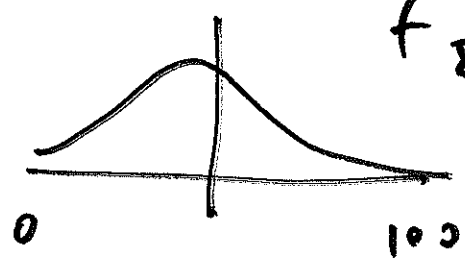
quiz 6 due ① next Tue





$E[h(X)] = h[E(X)]$ would be nice, but not generally true.

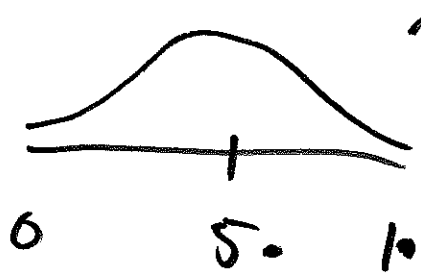
$Y = X + 50$



$E(Y) = E(X) + 50$

~~$E(X)$~~ $E(X)$

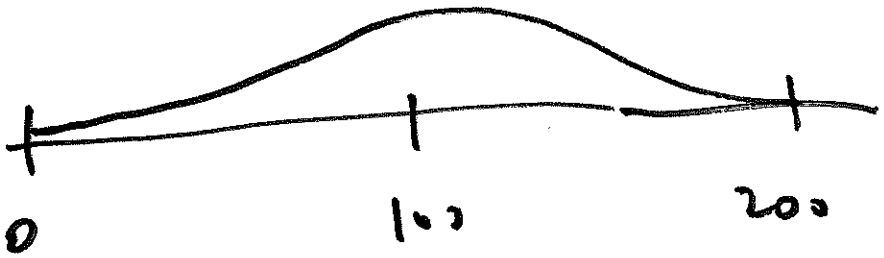
$E(X + c) = + c$



$Y = 2X$

$E(Y) = E(2X)$

$= 2 \cdot E(X)$

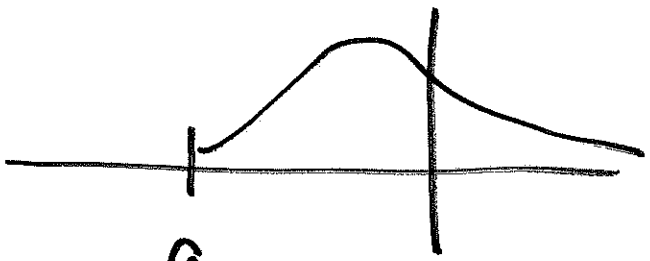


$E(cX) = c \cdot E(X)$

$E(aX + b) = aE(X) + b$

if $Y = aX + b = h(X)$ →

$E[h(X)] = h[E(X)]$

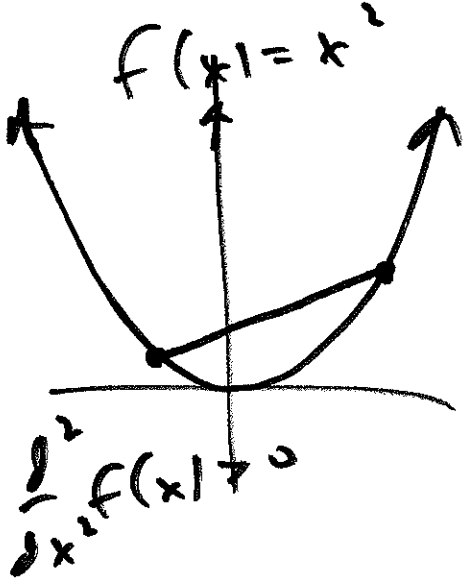


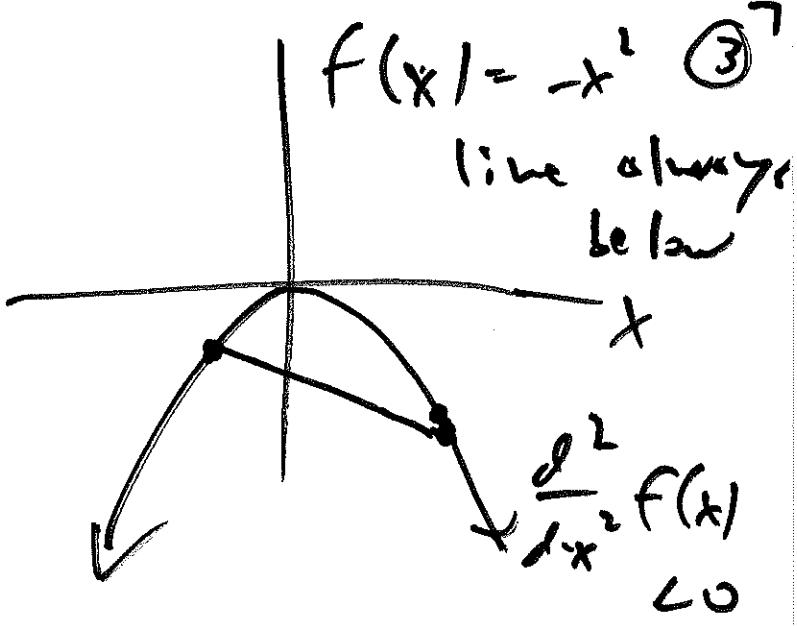
$E(X) = 3$

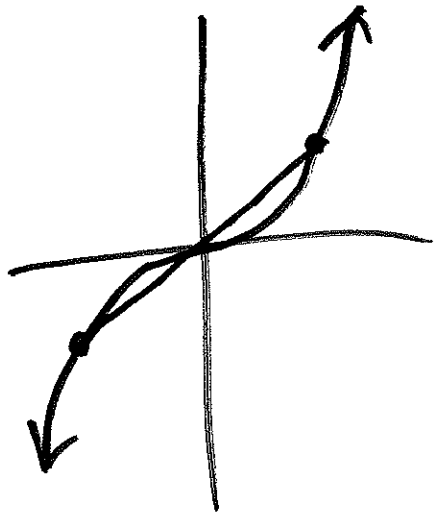
$E(X_1 + X_2)$

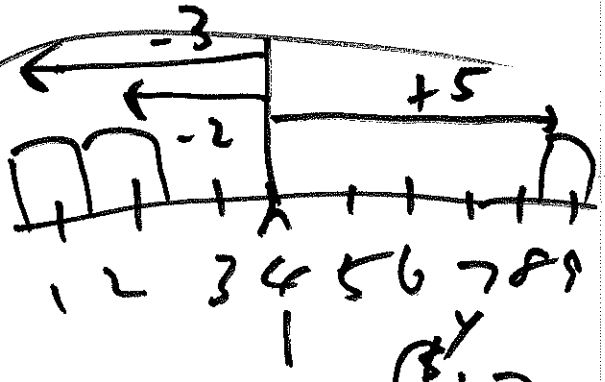
$= E(X_1) + E(X_2)$

$E(X_1 + \dots + X_n) = E(X_1) + \dots + E(X_n)$









$$\begin{bmatrix} y \\ \$1 \\ \$2 \\ \$9 \end{bmatrix}$$

$\$4 = \bar{y}$

$$\begin{bmatrix} 1 \\ 2 \\ 9 \end{bmatrix} \xrightarrow[4]{\text{subtract}} \begin{bmatrix} -3 \\ -2 \\ +5 \end{bmatrix} \xrightarrow{\text{abs value}} \begin{bmatrix} +3 \\ +2 \\ +5 \end{bmatrix}$$

mean 0

mean $\frac{10}{3} \doteq 3.3$

$$\begin{bmatrix} y_1 \\ \vdots \\ y_n \end{bmatrix} \xrightarrow[\bar{y}]{\text{subtract}} \begin{bmatrix} y_1 - \bar{y} \\ \vdots \\ y_n - \bar{y} \end{bmatrix}$$

deviations from the mean

MAD = mean absolute deviation

$$\frac{1}{n} \sum_{i=1}^{n} |y_i - \bar{y}|$$

(Laplace) 1785

square → deviations

$$\begin{bmatrix} (-8)^2 \\ (-2)^2 \\ (+5)^2 \end{bmatrix} = \begin{bmatrix} 64 \\ 4 \\ 25 \end{bmatrix}$$

Gauss

$\sqrt{12.7} \doteq 3.6$

mean $\frac{38}{3} \doteq 12.7$

$$\sqrt{\frac{1}{n}\sum_{i=1}^{n}(y_i - \bar{y})^2} = \underline{\text{standard deviation}}$$

(10.5)

$$\frac{1}{n}\sum_{i=1}^{n}(y_i - \bar{y})^2 = \underline{\text{variance}}$$

5050

$$\begin{bmatrix} 1 & 100 \\ 2 & 99 \\ 1 & \vdots \\ 50 & 51 \\ \hline 51 & \end{bmatrix} \quad \begin{matrix} \uparrow \\ \uparrow \\ 101 \\ \downarrow \\ \downarrow \end{matrix} \quad \Big\} 50$$

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$-\infty \leq E(X) \leq +\infty$ ✓

$V(X) = E[(X-\mu)^2] \geq 0$

$b < \infty$
$a < \infty$

$V(X) < \infty$ with equality iff

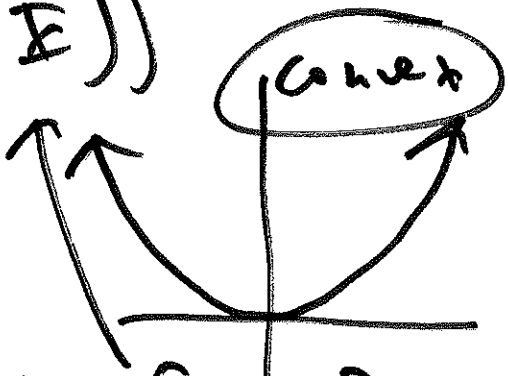
$-a \quad +b$

$X = \mu$ w.p. 1

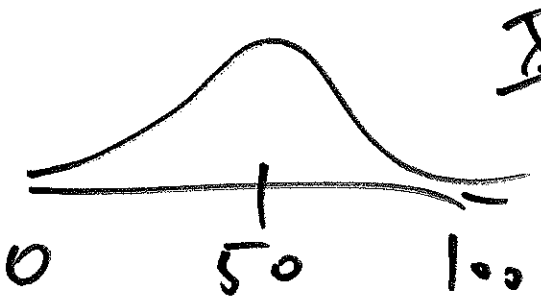
$$V(X) = E(X^2) - \left(E(X)\right)^2 \geq 0$$ (5)

So $E(X^2) \geq \left(E(X)\right)^2$

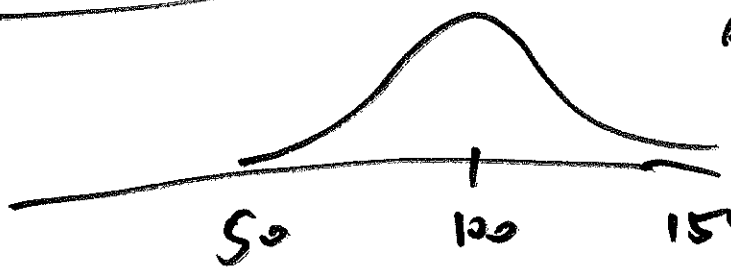
$g(x) = x^2$ ↑



$E[g(X)] \geq g[E(X)]$



SD σ_X



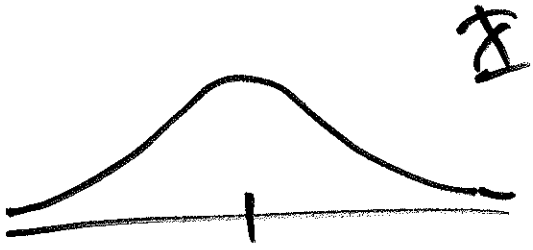
$X + 50 = Y$

$SD(Y) = \sigma_Y$

$= \sigma_X$

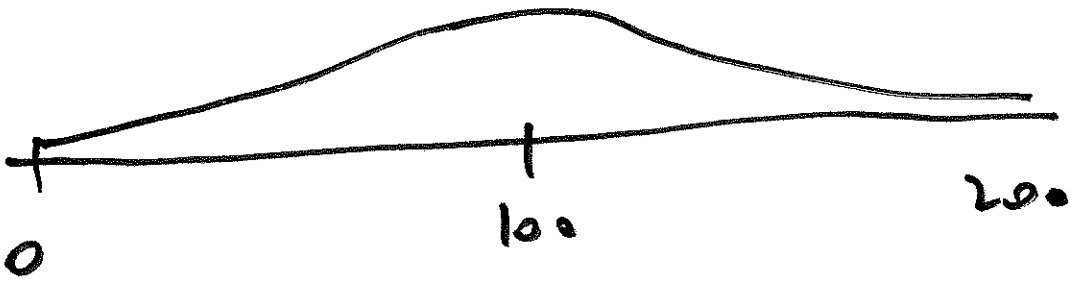
$V(X + c) = V(X)$

$SD(X + c) = SD(X)$



$SD(Y) = 2 \cdot SD(X)$

$Y = 2X$



$$V(cX) = c^2 V(X)$$

$$SD(cX) = |c| SD(X)$$

$$V(aX+b) = V(aX) = a^2 V(X)$$

$$SD(aX+b) = |a| SD(X)$$

X_1, X_2 indep. $\Rightarrow$ $V(X_1 + X_2) = V(X_1) + V(X_2)$

$SD(X_1 + X_2) \neq SD(X_1) + SD(X_2)$

X_1, X_2 indep $\Rightarrow$ $V(X_1 + X_2) =$ (7)

$$V(X_1) + V(X_2)$$

$$SD(X_1 + X_2) = \sqrt{V(X_1 + X_2)}$$

$$\overset{(I)}{=} \sqrt{V(X_1) + V(X_2)}$$

$$= \sqrt{[SD(X_1)]^2 + [SD(X_2)]^2}$$