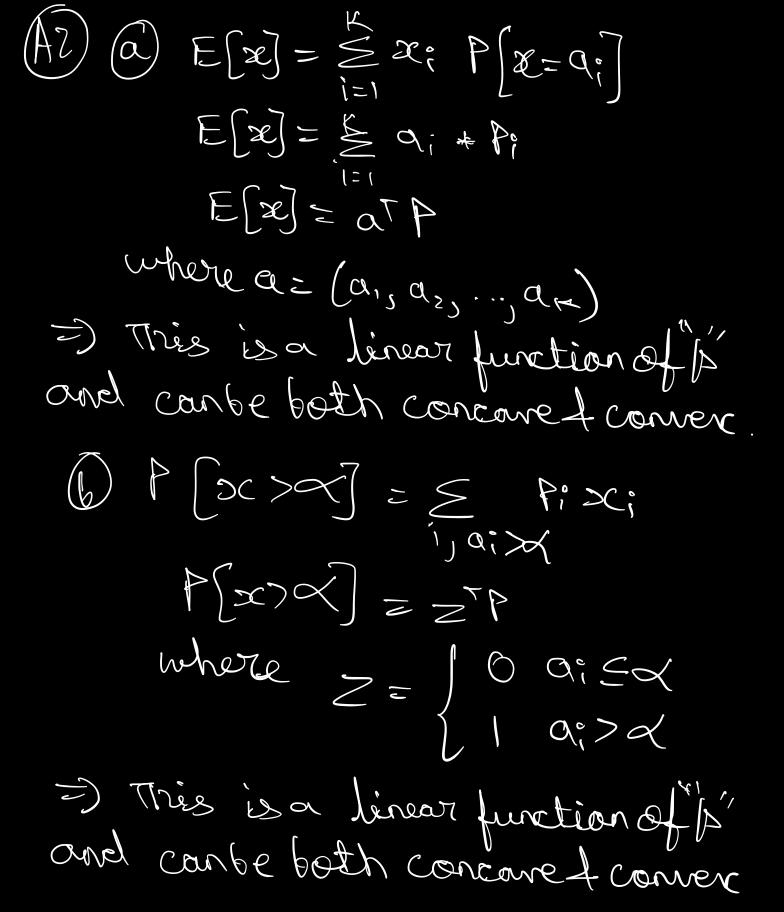
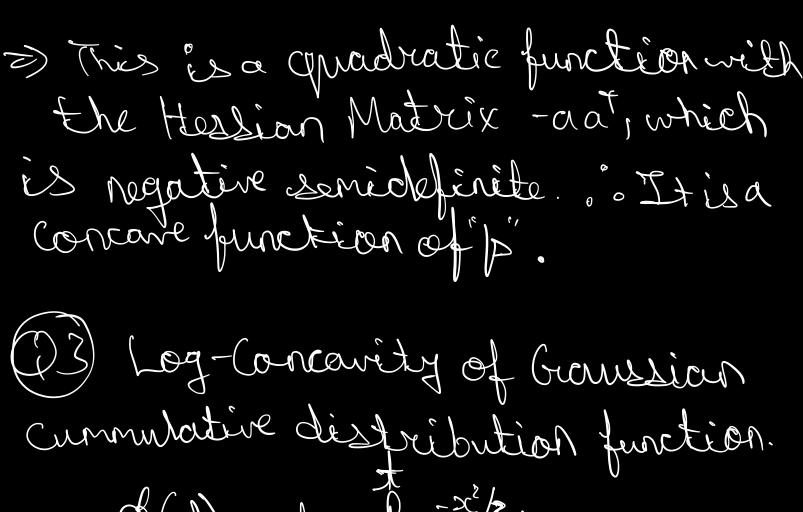
ML HW-Z (10 points) Oriver that a = 6. Let x, 2 x 2 be 2 points on planes 0, 20° = p⁵ min distance $||x,-x_2||^2$ of $||x,-x_2||^2$ of $||x,-x_2||^2$ of $||x,-x_2||^2$ $= \int \alpha \left(\alpha' - \alpha' \right) = \beta' - \beta'$ By using Cauchy-Schwarz Inequality $\left| \alpha^{\mathsf{T}} \left(x_1 - x_2 \right) \right| \leq \left| |\alpha| \right| \left| |\alpha| \left| |\alpha| \right|$ $\Rightarrow (|x,-x_2|) \leq \frac{|b_1-b_2|}{|x|}$

-> This is scatisfied for any 2C, for a x, = b, 2 a x = b, => Also, x, fx, can be represented as: $x_1 = \frac{b_1}{||a||} a + x_2 = \frac{b_2}{||a||} a$ $=) ||x,-xz|| - ||b,-bz|| \rightarrow 2$ => Hore (2) is the sol to () I the distance isgèrer by: Dist(25y) = [6,-62]

(2) Latorenine if given functions are conver, concare, or neither. (10 points)



P[2cock]= CTP wher c= {) L < ai < p>
otherwise 3) Très is a linear function of prond canbe both concoure & conver d - É Pidog(Pi) Since a log(a) is a conver function of a, - \geq P: log(Pi) is a concarre function of "! Var(x) = $E[x^2] - (E[x^2])^2$ $Var(x) = E[x^2] - (a^2 + b^2)^2$ i = 1



$$\varphi(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} e^{-x^2/2} dx$$

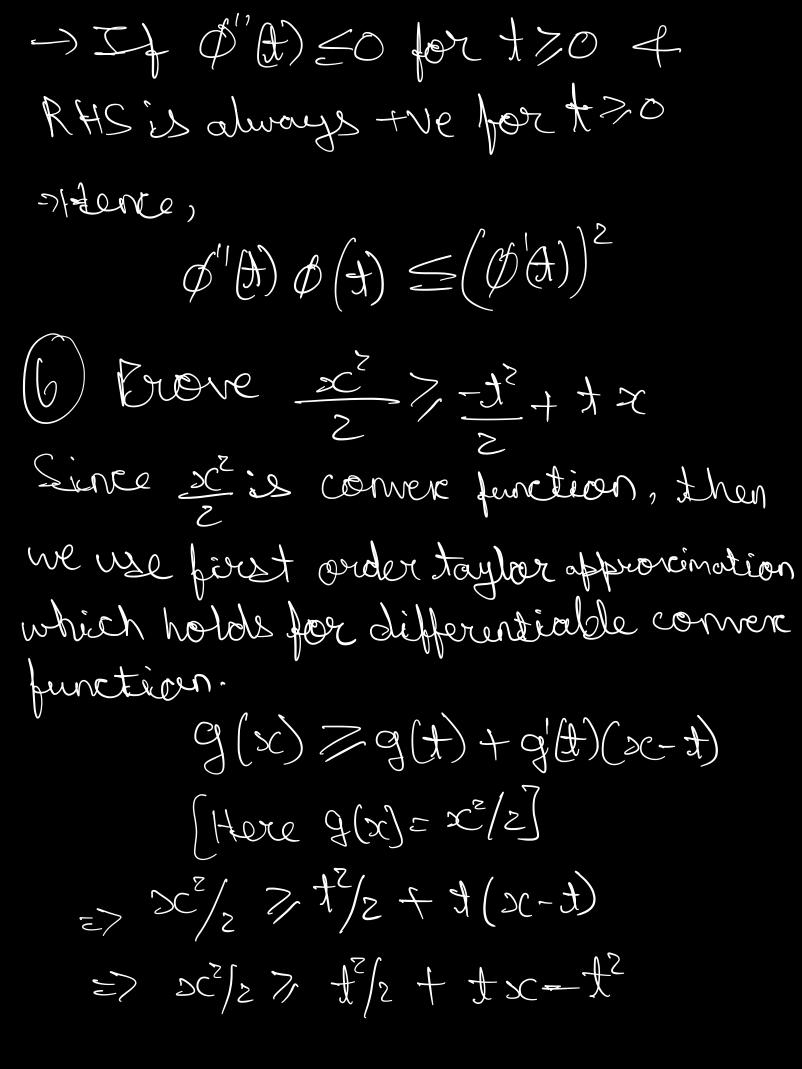
Drove
$$\beta''(t)$$
 $\phi(t) \leq (\phi'(t))^2$
for $t > 0$
 $\Rightarrow \phi'(t) = e^{t/2}$

$$\Rightarrow \varphi(A) = e^{-\frac{1}{2}/2}$$

$$\Rightarrow \varphi'(A) = -\frac{1}{2} e^{-\frac{1}{2}/2}$$

$$\Rightarrow \varphi''(A) = -\frac{1}{2} e^{-\frac{1}{2}/2}$$

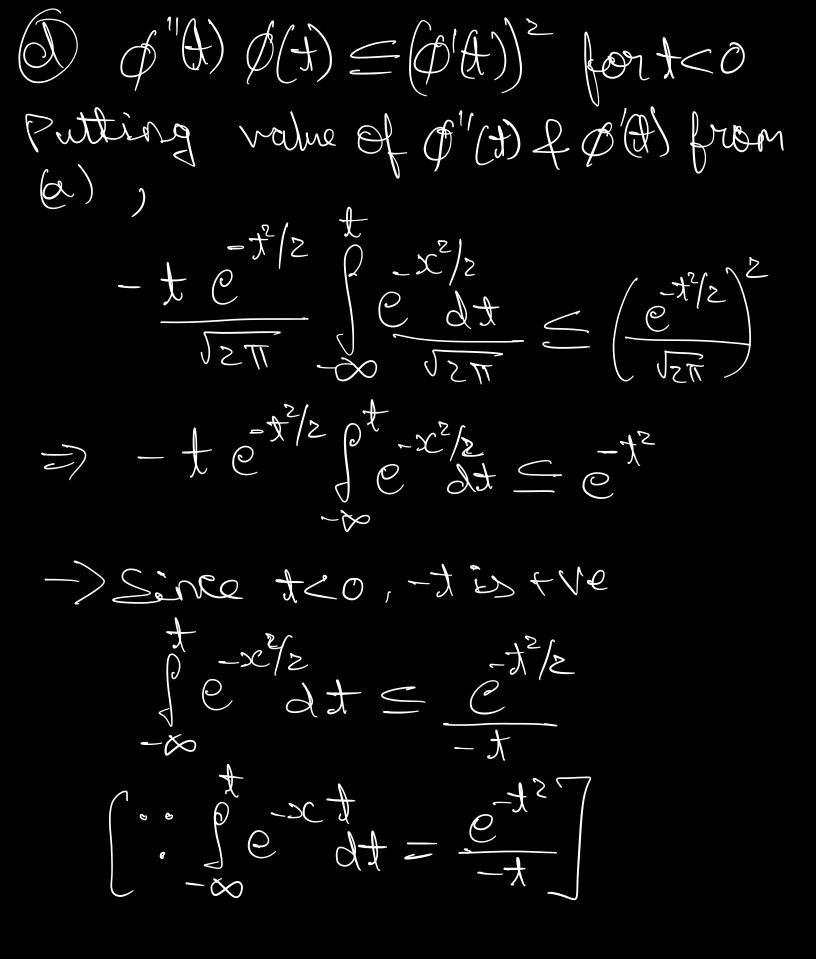
$$\Rightarrow \varphi''(A) = -\frac{1}{2} e^{-\frac{1}{2}/2}$$



Hence proved

Hence proved

C) Since we have
$$\frac{x^2}{2} > \frac{1^2}{1 + 1 \times 2}$$
 $\Rightarrow -\frac{x^2}{2} \leq \frac{1^2}{1 + 1 \times 2} = \frac{x^2}{2} + \frac{1^2}{1 + 1 \times 2}$
 $\Rightarrow -\frac{x^2}{2} \leq \frac{1^2}{2} + \frac{1}{1 \times 2}$
 $\Rightarrow -\frac{x^2}{2} \leq \frac{1}{2} + \frac$



(09) Equivalence et 2 converc Problems. (Ah) => Let 0 be fixed for knoblem (b). We see at optimum of (b) we must have $U: +V: = [\Phi: \Phi - \Psi:],$ because otherwise we can further decreose the Objective function without violating the constraints. munita to -> Eliminating V yields the following problem.

minimise $= \left(u_i^2 - 2Mu_i + 2M|\phi_i^TO-\psi_i| \right)$ Subject to O\le Ui\le min(M, 10; 0-4;)

i = 1, ..., n The problem is safarable over each Ui & we rewrite mênimise (u;-M) - M² U; + 2M/0;0-4:1 Subject to 0=Ui=min(M, \p), 0-Vi) -> Hore if M < | PTO - Will, then we should choose U;=M to minimize the Objective, else choose U; to be as close to M as possible, which ES [D:0-4:1. Thus, forfixed 0 in problem (b), the optimal value is

$\sum_{i=1}^{n} h \left(\overrightarrow{\Phi}_{i} \circ \Theta - \Psi_{i} \right)$
(35) Wine Quality Regression Models: (30 points)
Models. (30 points) The Code is attached to the "ML-HWZ-ipgnb" file.
=> MAE for each types of loss function:
(a) Least Square Loss - 53.296% (b) Huber Loss - 53.112% (c) Hinge Loss - 54.729%

given by the Huber function

