The Greek Letters (revisited)....

Delta $(\Delta) = \frac{\partial c}{\partial s}$ (derivative of call price w.r.t stock price)

$$c = S\,N(d_1) - Ke^{-rT}N(d_2)$$

$$\frac{\partial c}{\partial s} = N(d_1) \quad \text{(partial derivative)}$$

$\therefore$ $N(d_1)$ = cumulative normal distbn. (std) is the Δ of a call option

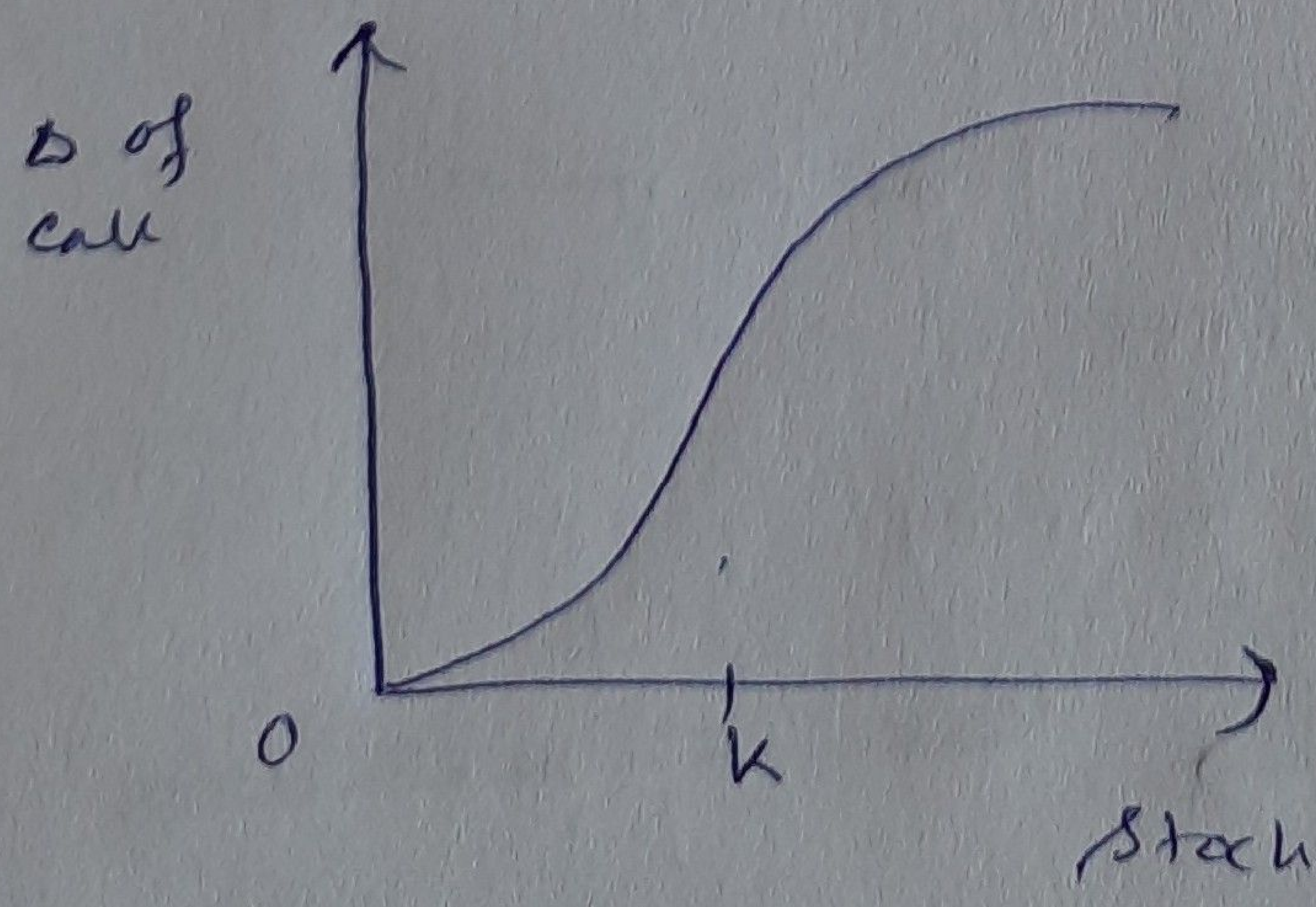
For put option →

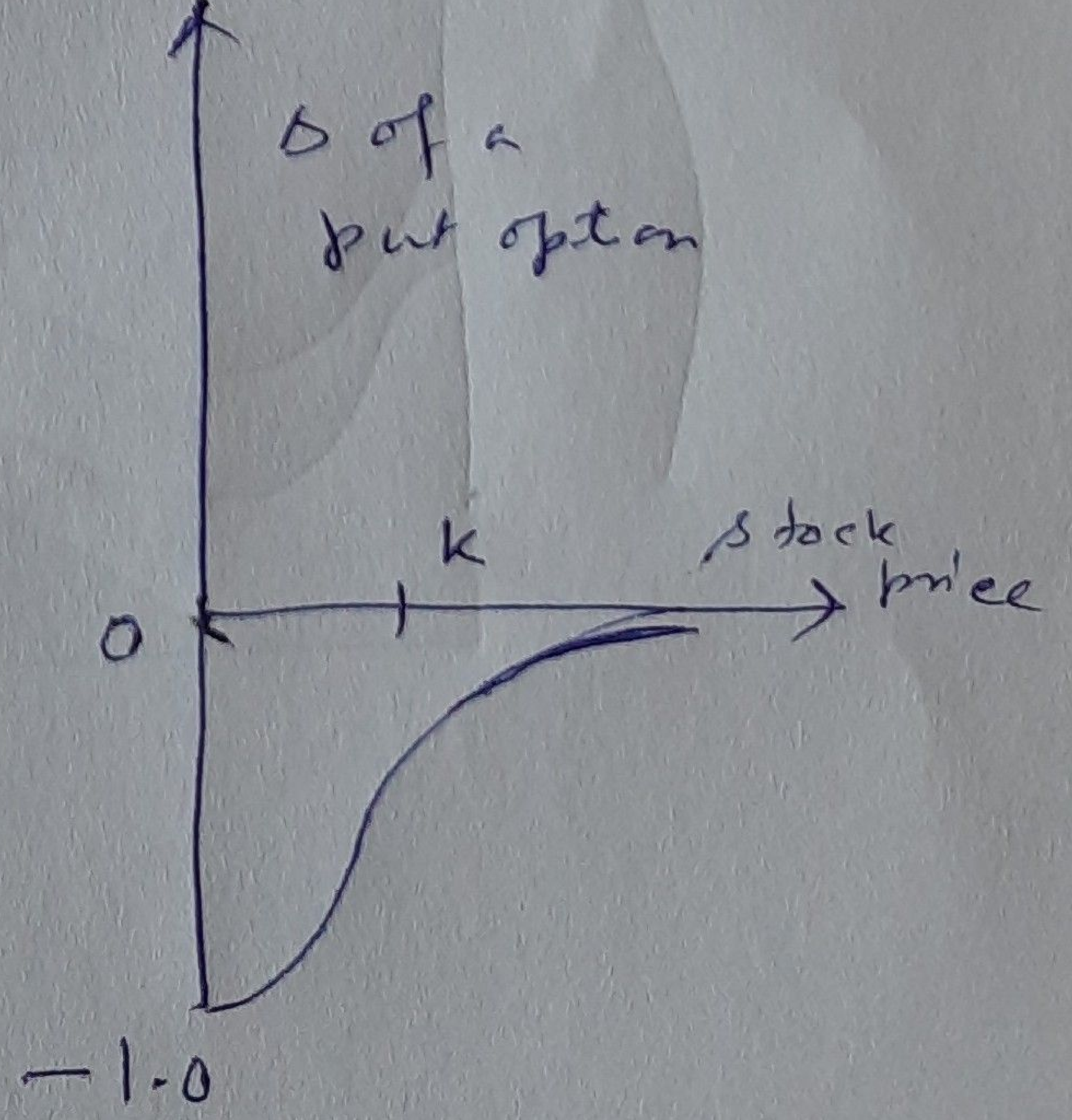
$$p = Ke^{-rT}N(-d_2) - S\{N(-d_1)\}$$

$$\frac{\partial p}{\partial s} = -N(-d_1)$$

$$= -[1 - N(d_1)]$$

Δ of a put option $= N(d_1) - 1$ (Always negative)





Theta (Θ) is rate of change of the value of a portfolio w.r.t passage of time.
This is called time decay of a portfolio

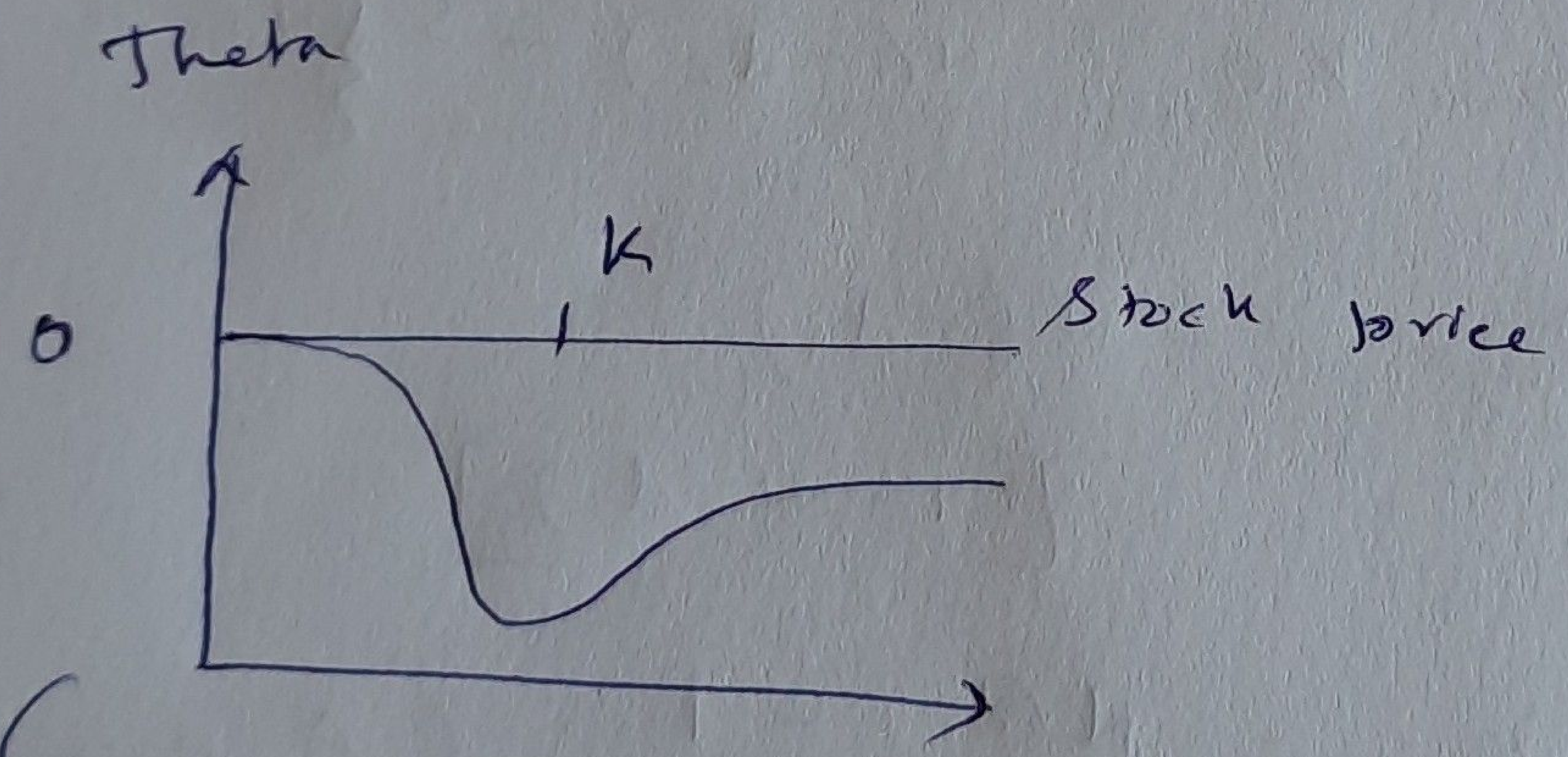
$$c = S N(d_1) - K e^{-rT} N(d_2)$$

$$\frac{\partial c}{\partial t} = \frac{S N'(d_1)\,\sigma}{2\sqrt{T}} - rK e^{-rT} N(d_2)$$

For a put option-

$$\frac{\partial p}{\partial t} = -\frac{S N'(d_1)\,\sigma}{2\sqrt{T}} + rK e^{-rT} N(-d_2)$$

$$N(-d_2) = 1 - N(d_2)$$



European call option