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cf_digit

Let

- T = maturity date $(T > t)$
- K = strike price
- x = spot price
- t = pricing date
- σ = volatility
- r = interest rate
- δ = dividend yields
- $\theta = T - t$
- $b = r - \delta$

Set:

$$d_1 = \frac{\log\left(\frac{x}{K}\right) + \left(b + \frac{\sigma^2}{2}\right)\theta}{\sigma\sqrt{\theta}} \qquad d_2 = d_1 - \sigma\sqrt{\theta}$$

and N as the cumulative normal distribution function:

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

Digit Option

$$\textsc{Payoff}: \quad C_T = \begin{cases} K & \text{if} \quad S_T > K, \\ 0 & \text{otherwise} \end{cases}$$

$$\textsc{Price}: \quad C(t,x) = K e^{-r\theta} N(d_1)$$

$$\textsc{Delta}: \quad \frac{\partial C(t,x)}{\partial x} = K \frac{e^{-d_2^2/2}}{\sqrt{2\pi\theta}\,\sigma x}$$

References