# Calculation Example: European Option Valuation Without Dividends

Question: Find the price of a 6 month European call option with a strike price of $50, written on a non-dividend paying stock currently trading at $60. The risk-free interest rate is 10% pa continuously compounded and the standard deviation of the stock's returns is 20% pa.

Long Call

f_t

before maturity (t=0)

at maturity (t=T)

c_0

K S_0

50 60

S_t
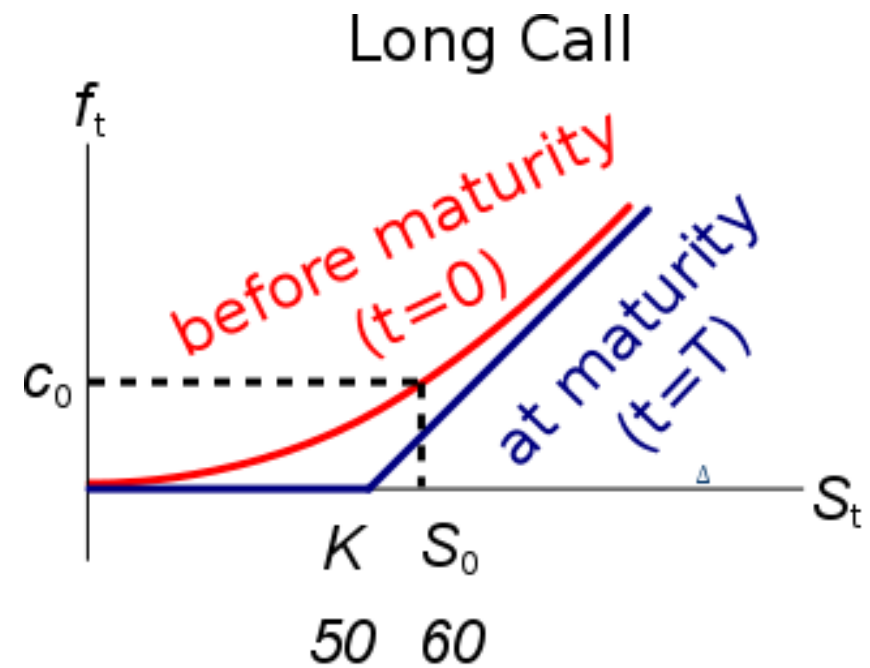
Answer:

$$d_1 = \frac{\ln[S_0/K_T] + \left(r + \frac{\sigma^2}{2}\right).T}{\sigma.\sqrt{T}}$$

$$d_1 = \frac{\ln[60/50] + \left(0.1 + \frac{0.2^2}{2}\right) \times 0.5}{0.2 \times \sqrt{0.5}}$$

$$= 1.71347$$

$$d_2 = d_1 - \sigma.\sqrt{T}$$

$$d_2 = 1.71347 - 0.2 \times \sqrt{0.5}$$

$$= 1.57205$$

$$c_0 = S_0.N[d_1] - K_T.e^{-rT}.N[d_2]$$

$$= 60 \times N[1.71347] - 50 \times e^{-0.1 \times 0.5} \times N[1.57205]$$

$$= 60 \times 0.9567 - 50 \times e^{-0.1 \times 0.5} \times 0.9420$$

$$= 57.4012 - 44.8044$$

$$= \$12.60$$

Long Call