|  |  |  |
| --- | --- | --- |
|  | **Calls** | **Puts** |
| **value** | **Se^{-q \tau}\Phi(d_1) - e^{-r \tau} K\Phi(d_2) \,** | **e^{-r \tau} K\Phi(-d_2) -  Se^{-q \tau}\Phi(-d_1)  \,** |
|  | | |
| **delta** | **e^{-q \tau} \Phi(d_1) \,** | **-e^{-q \tau} \Phi(-d_1)\,** |
| **vega** | **S e^{-q \tau} \phi(d_1) \sqrt{\tau} = K e^{-r \tau} \phi(d_2) \sqrt{\tau} \,** | |
| **theta** | **-e^{-q \tau} \frac{S \phi(d_1) \sigma}{2 \sqrt{\tau}} - rKe^{-r \tau}\Phi(d_2) + qSe^{-q \tau}\Phi(d_1) \,** | **-e^{-q \tau} \frac{S \phi(d_1) \sigma}{2 \sqrt{\tau}} + rKe^{-r \tau}\Phi(-d_2) - qSe^{-q \tau}\Phi(-d_1)\,** |
| **rho** | **K \tau e^{-r \tau}\Phi(d_2)\,** | **-K \tau e^{-r \tau}\Phi(-d_2) \,** |
|  | | |
| **gamma** | **e^{-q \tau} \frac{\phi(d_1)}{S\sigma\sqrt{\tau}} \,** | |
| **vanna** | **-e^{-q \tau} \phi(d_1) \frac{d_2}{\sigma} \, = \frac{\nu}{S}\left[1 - \frac{d_1}{\sigma\sqrt{\tau}} \right]\,** | |
| **charm** | **qe^{-q \tau} \Phi(d_1) - e^{-q \tau} \phi(d_1) \frac{2(r-q) \tau - d_2 \sigma \sqrt{\tau}}{2\tau \sigma \sqrt{\tau}} \,** | **-qe^{-q \tau} \Phi(-d_1) - e^{-q \tau} \phi(d_1) \frac{2(r-q) \tau - d_2 \sigma \sqrt{\tau}}{2\tau \sigma \sqrt{\tau}} \,** |
|  | | |
| **speed** | **-e^{-q \tau} \frac{\phi(d_1)}{S^2 \sigma \sqrt{\tau}} \left(\frac{d_1}{\sigma \sqrt{\tau}} + 1\right) = -\frac{\Gamma}{S}\left(\frac{d_1}{\sigma\sqrt{\tau}}+1\right) \,** | |
| **zomma** | **e^{-q \tau} \frac{\phi(d_1)\left(d_1 d_2 - 1\right)}{S\sigma^2\sqrt{\tau}} = \Gamma\cdot\left(\frac{d_1 d_2 -1}{\sigma}\right) \,** | |
| **color** | **-e^{-q \tau} \frac{\phi(d_1)}{2S\tau \sigma \sqrt{\tau}} \left[2q\tau + 1 + \frac{2(r-q) \tau - d_2 \sigma \sqrt{\tau}}{\sigma \sqrt{\tau}}d_1 \right] \,** | |
|  | | |
| **veta** | **Se^{-q \tau} \phi(d_1) \sqrt{\tau} \left[ q + \frac{ \left( r - q \right) d_1 }{ \sigma \sqrt{\tau} } - \frac{1 + d_1 d_2}{2 \tau} \right] \,** | |
| **vomma** | **Se^{-q \tau} \phi(d_1) \sqrt{\tau} \frac{d_1 d_2}{\sigma} = \nu  \frac{d_1 d_2}{\sigma} \,** | |
| **Ultima** | **\frac{-\nu}{\sigma^2} \left[ d_1 d_2 (1 - d_1 d_2) + d_1^2 + d_2^2 \right]** | |
|  | | |
| **dual delta** | **-e^{-r \tau} \Phi(d_2) \,** | **e^{-r \tau} \Phi(-d_2) \,** |
| **dual gamma** | **e^{-r \tau} \frac{\phi(d_2)}{K\sigma\sqrt{\tau}} \,** | |