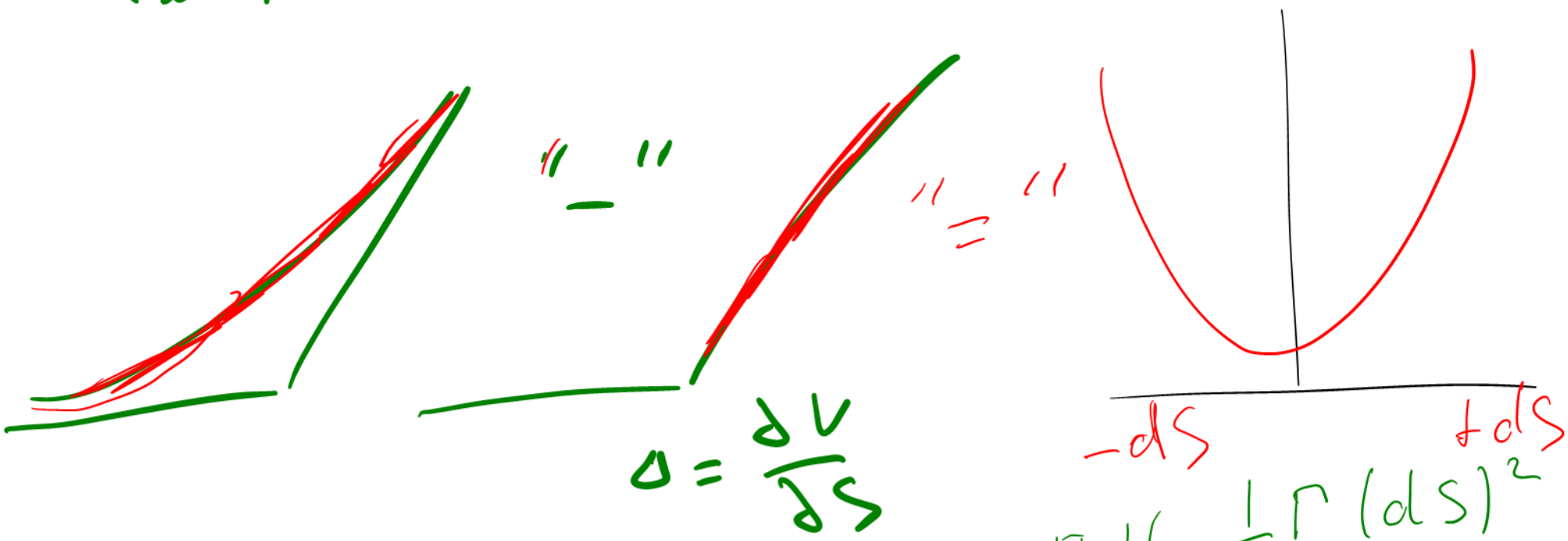
r diamond @ fidelity.com
075 45 924 503

Call, V



$$\frac{1}{2}\Gamma S^2\sigma^2 dt + \Theta(dt) = r\Pi dt \qquad \frac{1}{2}\Gamma(dS)^2$$

$$V - \Delta S \qquad \frac{1}{2}\Gamma S^2\sigma^2 dt$$

$r = 0$

$$\frac{1}{2}\Gamma S^2\sigma^2 dt + \Theta(dt) = 0$$

Asset Moves — Time Decay.

Hedging / Replication	Cash
Buy Δ of stock	$-\Delta S$
Sell Δ of stock	$+\Delta S$

"pile of money"

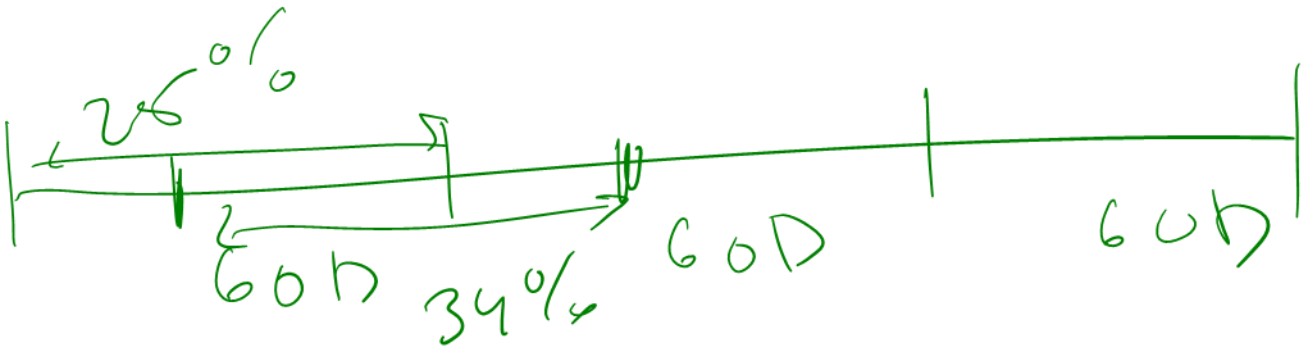
$$-V_i + V_a$$

Profit $V_a(BS) - V_i(BS)$

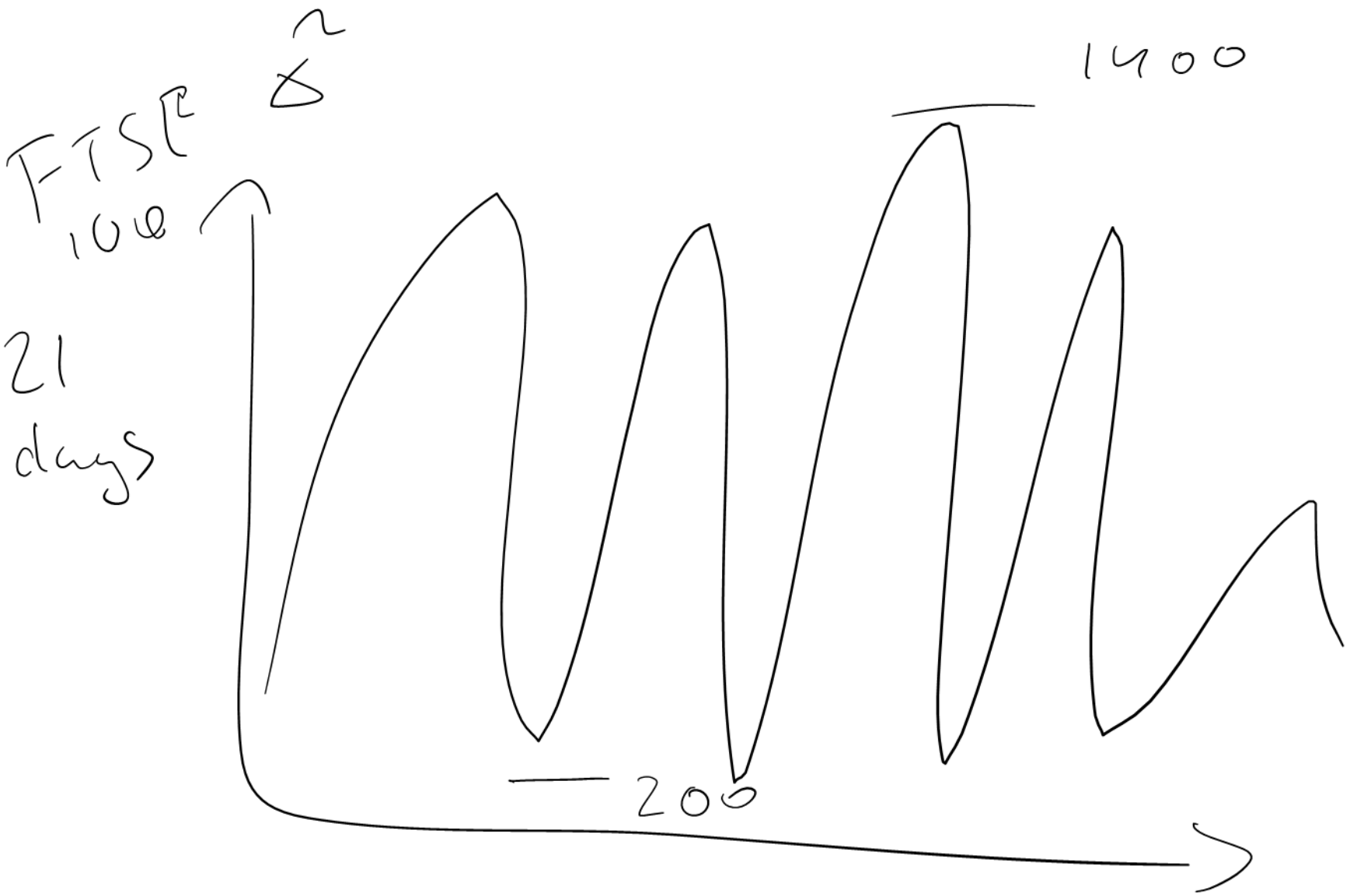
$\sigma = 20\%$ (annualised)

$$\sigma_{3M} = \sqrt{0.2^2 \times \frac{1}{4}} = 10\%$$

$$\sigma_{1D} = \sqrt{0.2^2 \times \frac{1}{252}} \simeq 1.26\%$$



Daily $\frac{\Sigma (r_t - \mu)^2}{N-1} \Rightarrow$ Annualise.



heteroskedasticity.

Binary Call

1) Constant Vol

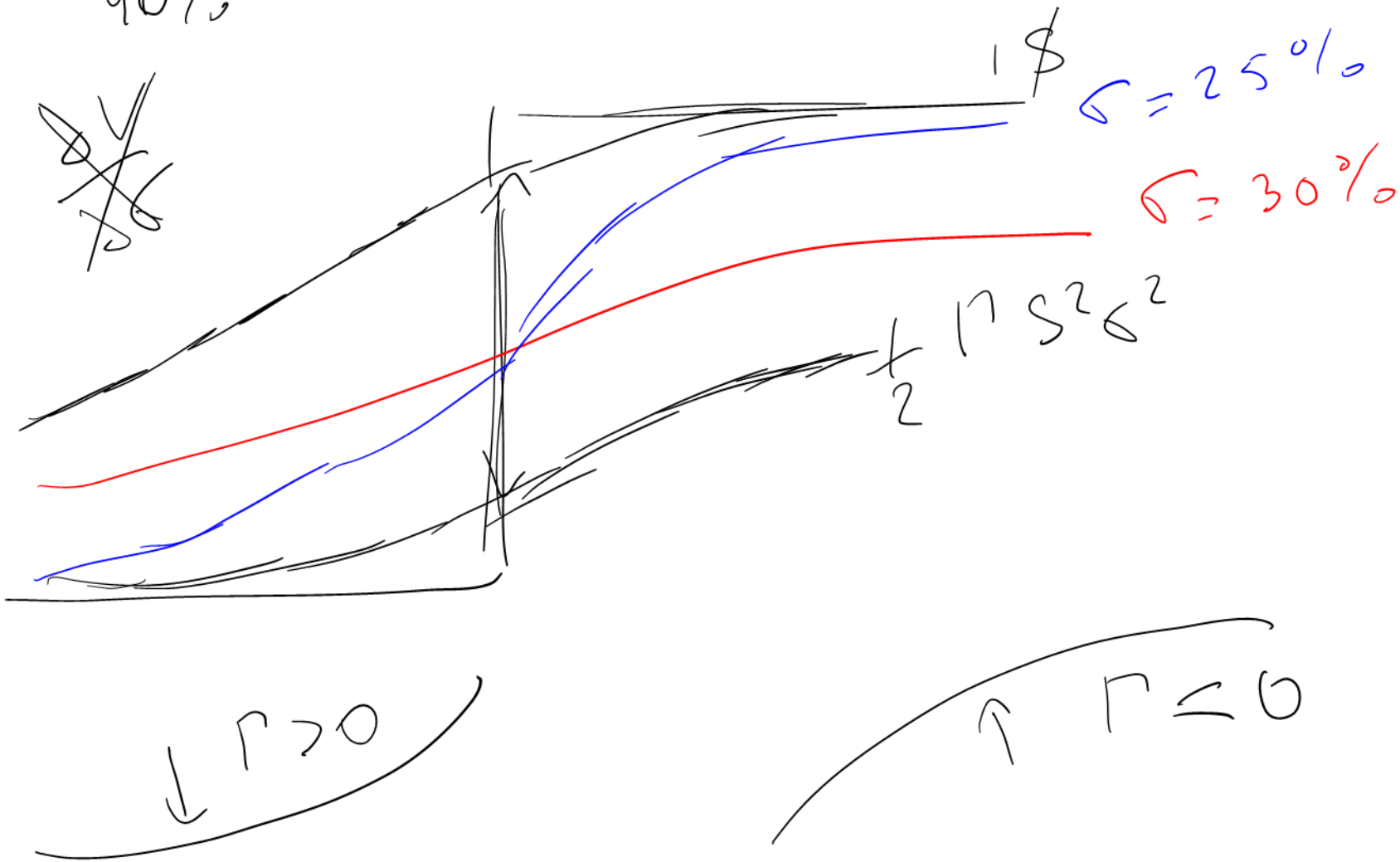
2) Uncertain V.C.

σ_{min}, σ_{max}

16%, 40%

$$B = e^{-rT} \underbrace{N(d_2)}_{\mathbb{Q}}$$

$$Pr^{\mathbb{Q}}(S_T > K)$$

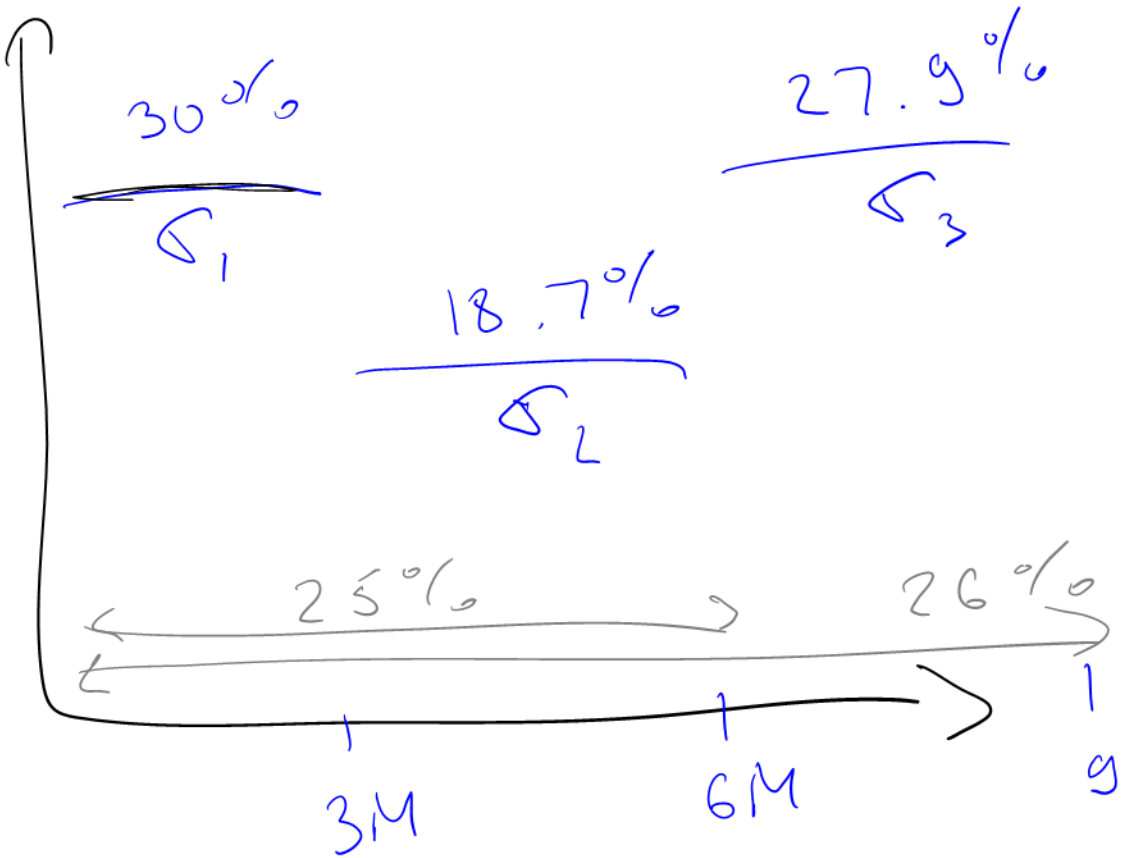


Black-Scholes V_{BS}, d_1, d_2

Assumption	PDE	Formulae
constant σ	✓	✓
Deterministic $\sigma(t)$	✓	$\sqrt{\frac{1}{T-t}\int \sigma^2(\tau)\,d\tau}$
Local $\sigma(S,t)$	✓	Use Local Volatility

Term Structure

Piecewise Constant



$$\sigma_i^2(0, 6M) = \sqrt{\frac{\sigma_i^2(0, 3M) + \sigma_2^2}{2}}$$

25%

$$\sigma_i^2(0, 9M) = \sqrt{\frac{\sigma_i^2(0, 3M) + \sigma_2^2 + \sigma_3^2}{3}}$$

26%

30%