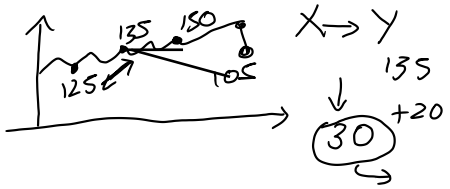
→ **Options & Derivatives:**

- Derivatives → financial contracts whose value, risk & term (time) is dependent on an underlying asset
  ↳ incl bonds, intrest rates, stocks, commodities, etc
- Derivatives ↓ (price, expiration/settlement date)
  - Options ] Exchange
  - Futures ]
  - Forwards ] OTC
  - Swaps ]

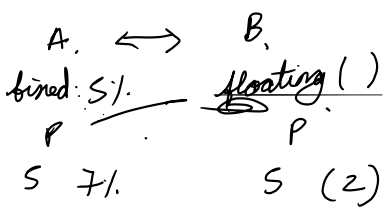
1. Options: contracts which give the right, but not the obligation to buy or sell smtg (corns) at a set price before / on a certain date
   - before → American Market
   - on → European Market

2. Futures: contract which is an agreement to buy or sell smtg (stock) at a fixed price on a future date
   → these are standardized & traded on an exchange. Prices are settled daily.

3. Forwards: private agreement b/w 2 parties to buy or sell smtg at a set price in the future
   → no exchange
   → greater risk
   → over the counter
   → customizable




4. Swaps: contract in where 2 parties agree to exchange cash flows / intrests / etc [things of value] for a defined amt of time, often b/w fixed & floating values
   - Intrest swaps
   - Currency swaps
   - Commodity swaps
   - Credit Swaps etc




→ **Options:**
the right BUT NOT OBLIGATION (before)
to buy or sell smtg at a fixed price on a future date

| Call | Put |
|---|---|
| → BC - Buy | → PS: Sell |
| → Asset price (S)↑ | → Asset price (S)↓ |
| Within time (T): | Within time (T): |
| Call opt ✓ | Put opt ✓ |
| asset bought at K, where K<S | asset sold at k, where K>S |
| Sell asset → Profit | Re-buy asset → Profit = (diff) |

* In India, u can exercise the opt within the time frame.

→ In the Money: the opt would make money if exercised rn (intrinsic)
→ At the Money: strike price = stock price, no immediate profit or loss
→ Out of the Money: if opt exercised rn → loss

Eg: 150 120

| Call | Put |
|---|---|
| P = S | 95 97 100 101 110 |
| S = 100 | 97 |
| K = ~~95~~ 105 | |
| 97 S>k: 110 > 105, -10 | |
| S=K: 105 - 105 = -5 | |
| S<k: ✓ 95 < 105 | |
| | +5 |

→ Black-Scholes formula:

- 
- 

S = stock price
K = exercise price ← strike price (K)
r = risk free interest rate (annually)
T = time to expiration (in yrs)
σ = volatility (std dev of log returns) (annually)

$$C = S\,N\left(\underbrace{\frac{\ln(S/K)+T\left(r+\frac{\sigma^2}{2}\right)}{\sigma\sqrt{T}}}_{d_1}\right) - \underbrace{Ke^{-rT}N\left(\underbrace{\frac{\ln(S/K)+T\left(r+\frac{\sigma^2}{2}\right)}{\sigma\sqrt{T}}-\sigma\sqrt{T}}_{d_2}\right)}_{\text{Payoff}}$$

$$- \underbrace{Ke^{-rT}N\left(\frac{\ln(S/K)+T\left(r-\frac{\sigma^2}{2}\right)}{\sigma\sqrt{T}}\right)}_{\text{Cost}}$$

$$N(d_1) = \frac{1}{\sqrt{2\pi}}\int_{-\infty}^{d_1} e^{-x/2}\,dx$$

$$C = S\,N(d_1) - Ke^{-rt}N(d_2)$$

BS 10S ☺

Impact of:
ln(S/K):
σ:
T:

$$P = Ke^{-rT}N(-d_2) - SN(-d_1)$$

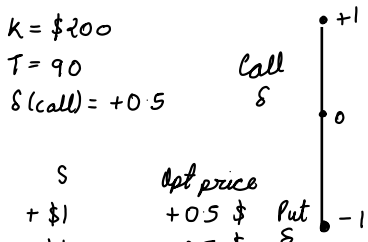
→ Greeks:

1. Delta (δ): predicts how an opt's price changes rel to 1$ stock price movement
   - sentivity of opts price rel to change in stock price
   - call opt → +ve δ
   - put opt → -ve δ

eg: K = $200, T = 90, δ(call) = +0.5

∴

| S | Opt price | |
|---|---|---|
| +$1 | +0.5 $ | Put δ |
| -$1 | -0.5 $ | |




2. Gamma (γ): predicts how an opts δ will change rel to $1 stock price movement ; change in opts prob of expiring in the money as the stock price changes
   eg: δ = 0.5, γ = 0.05

| S | new δ (call) |
|---|---|
| +1$ | 0.5+0.05 = 0.55 |
| -1$ | 0.5-0.05 = 0.45 |

3. Theta (θ): estimates how much an opts price will lose with each passing day
   - its basically how much opt↓ if stock price & volatility remain same

4. Vega (ν): estimates an opts price chages with 1% change in implied volatility ↙
   - how an opt price will change given a change in implied volatility

reflects the anticipated fluctuation in stock price as implied by opt price

Call

$S = 200$
$K = 150$
$P = 20$

Put

$S = 200$
$K = 250$
$P = 20$

190, 210, 195, 225, 220 — 200

225 - best
110 - worst - NO
150

190 - best
225 - worst

(T) ⟶ (J)