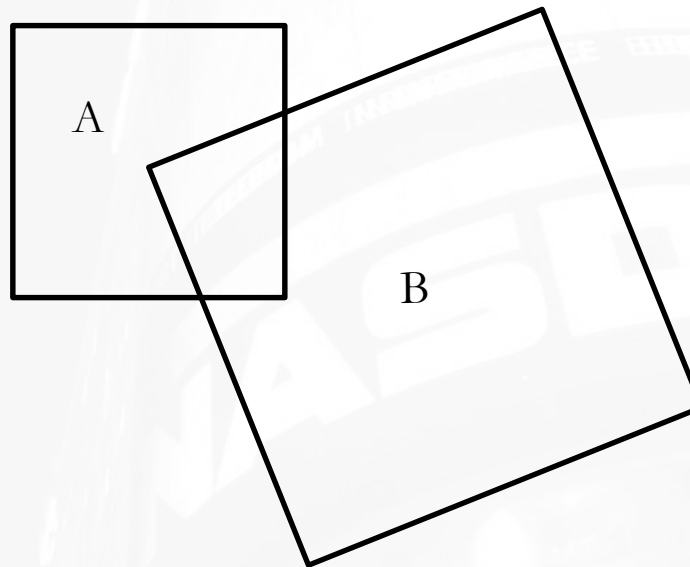


**QUANTITATIVE
FINANCE
SOCIETY**

OPTIONS 101

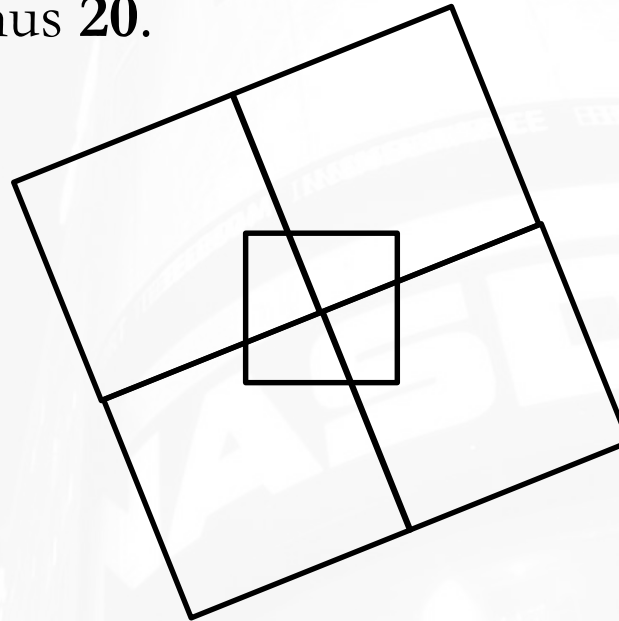
BRAINTEASER!

Two squares overlap. Square A has a side length of 12. The area of overlap is 9% of the area of square B, and the overlapping square B corner coincides with square A's center. What is the side length of square B?



ANSWER

Imagine 4 square B's in a grid, all with one corner in A as below. The overlapping area of each must be 25% of A. So the area of square B is $\frac{25}{9}(144) = 25(16) = 400$. The side length is thus **20**.



Portfolio Team Application

❖ **Timeline:**

- Opens on Friday, 2/9 at 9:00 AM
- Closes on Friday, 2/16 at 12:00 PM (Noon)

❖ **Eligibility:** open to all NYU students, no experience required

❖ **Application Process:**

- Fill in Google form (admin details & portfolio preference)
- Submit your application responses as a PDF/Word

❖ All instructions will be on the front page of our website, and emailed to everyone on our mailing list (<http://eepurl.com/hfg6ef>)

Portfolio Team Application Tips

- ❖ If you are an underclassmen, please answer all questions for your grade, regardless of portfolio interest
- ❖ Helpful if you cite sources (links are fine)
- ❖ 2 pages max for the three responses
 - ❖ Can easily be done in one page
- ❖ Try to submit as a PDF or Word, if you choose to submit as a google docs, please give quantfsnyu@gmail.com access
- ❖ Primarily looking for effort, not accuracy

WHAT IS A DERIVATIVE?

Derivative

- A derivative is a financial instrument whose value is based on the value of another underlying asset
- When the price of the underlying changes, the value of the derivative also changes

Types of Derivatives

- Forwards/Futures
- Options
- Swaps
- Warrants/Convertibles

KEY DEFINITIONS

Call Option

- An agreement that gives the buyer the right, but not the obligation, to buy an underlying asset at a specified price within a specific time period

Put Option

- An agreement that gives the buyer the right, but not the obligation, to sell an underlying asset at a specified price within a specific time period

OTHER KEY TERMS TO KNOW

- S** - Price of Underlying Asset
- F** - Forward (Futures) Price of Underlying Asset
- K** - Strike (Exercise) Price
- t** - Time to Expiration
- r** - Rate of Interest
- σ** - Volatility
- C** - Call Price
- P** - Put Price
- q** - Dividend Yield

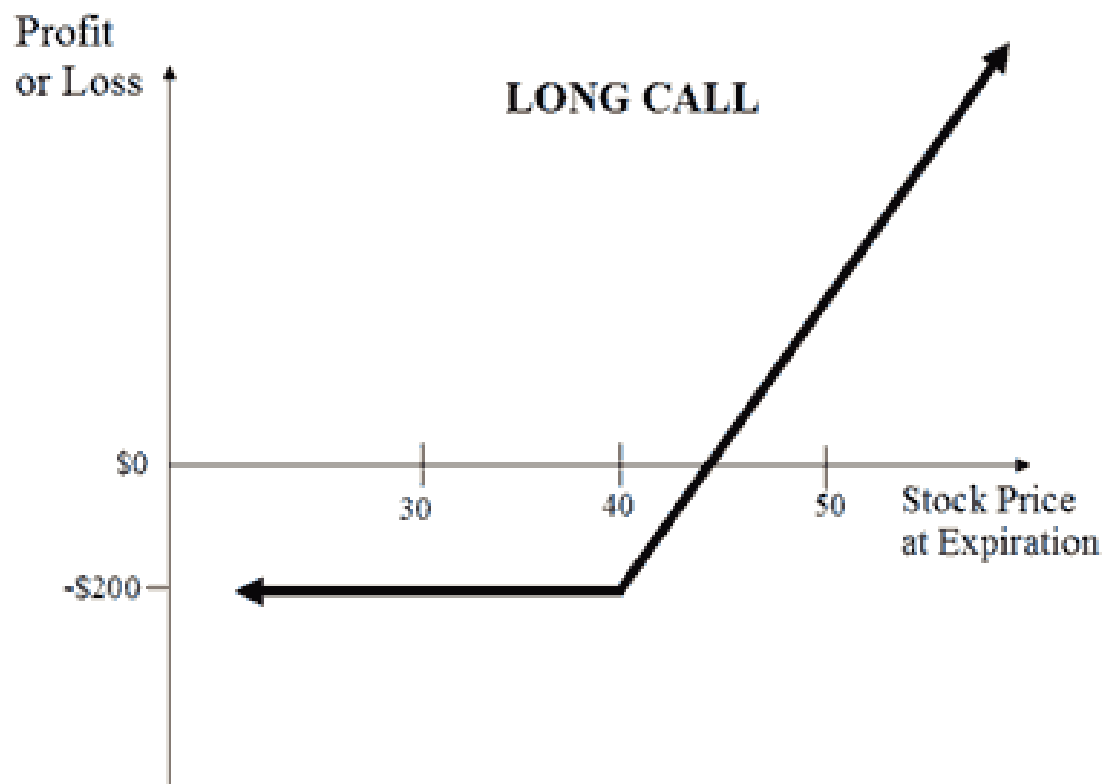
How do you think time to expiration affects the price of an option? What about volatility?

2 TYPES OF OPTIONS

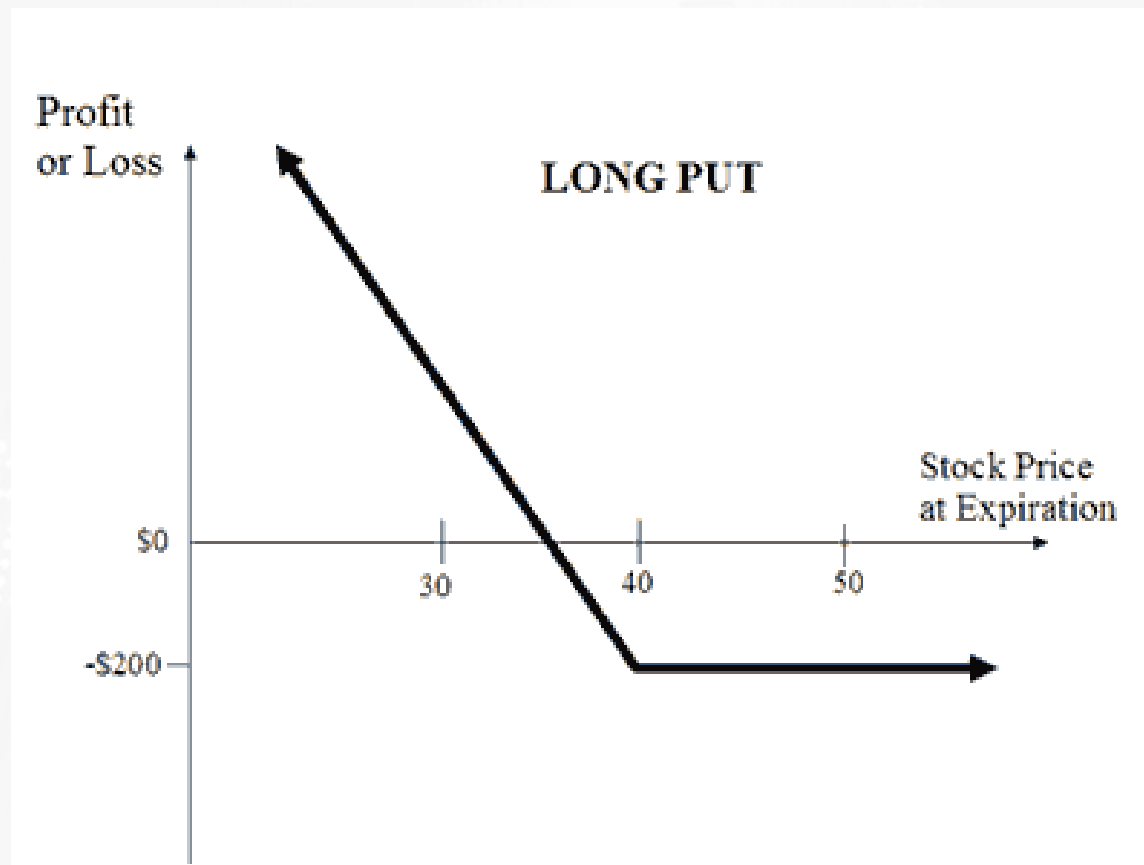
American Options – buyer can exercise the option early, at any point up until expiration

European Options – buyer cannot exercise option early and has to wait until expiration

PAYOFF DIAGRAM FOR BUYING A CALL



PAYOFF DIAGRAM FOR BUYING A PUT



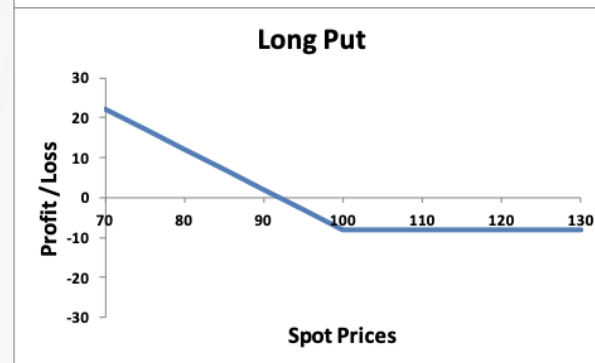
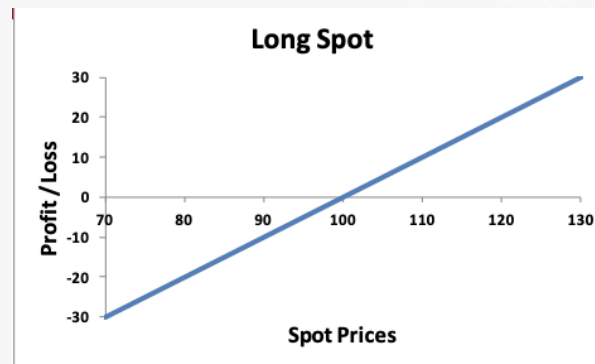
CONCEPT OF MONEYNES

- Options are heavily dependent on the concept of moneyness – relative position of the price of the underlying asset with respect to the strike price of the option
 - In the Money
 - Option is profitable if executed today: $\text{Spot} > \text{Strike}$
 - At the Money
 - Strike price = Spot price
 - Out of the Money
 - Executing option incurs a loss: $\text{Strike} > \text{Spot}$

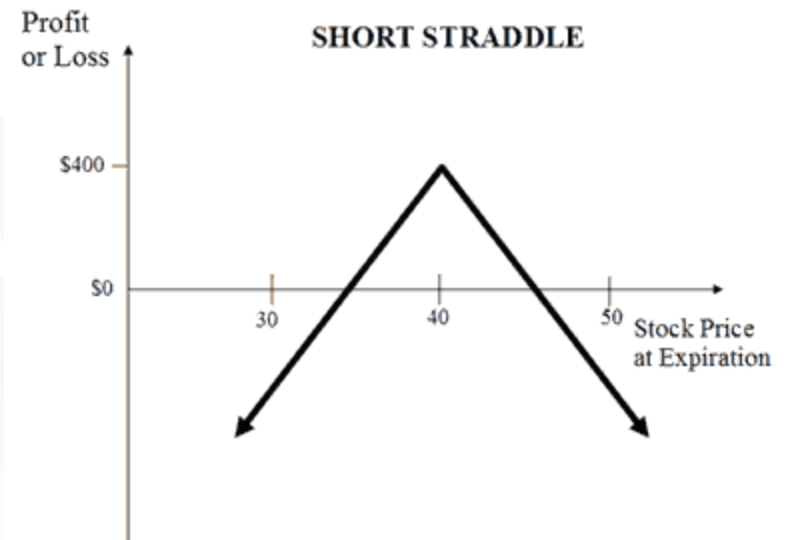
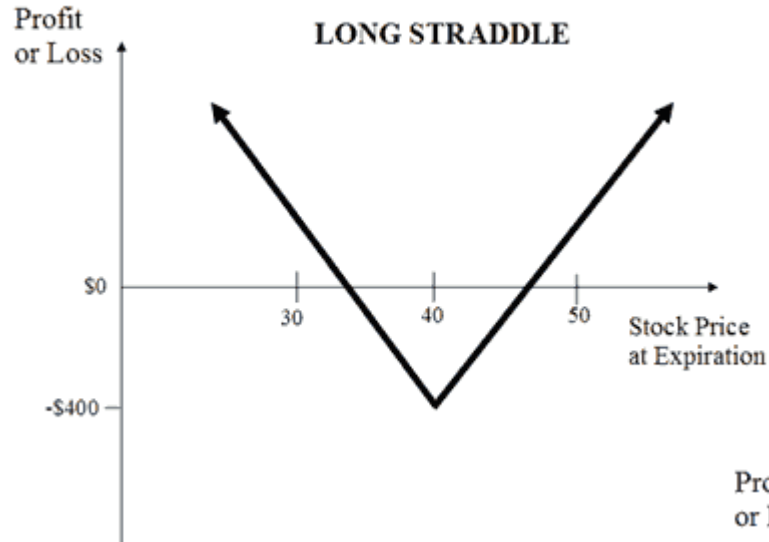
WHY PEOPLE TRADE OPTIONS

- Leverage
- Hedging – Protected downside risk
- Speculation
- Have a unique view that you can't play with just the underlying asset
 - Vega: betting on the volatility of the underlying
 - Theta: collecting the time premium
 - Etc.

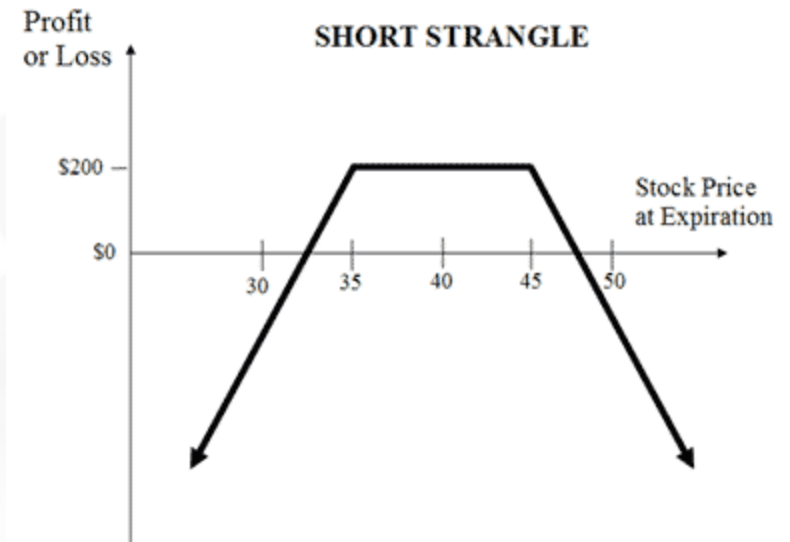
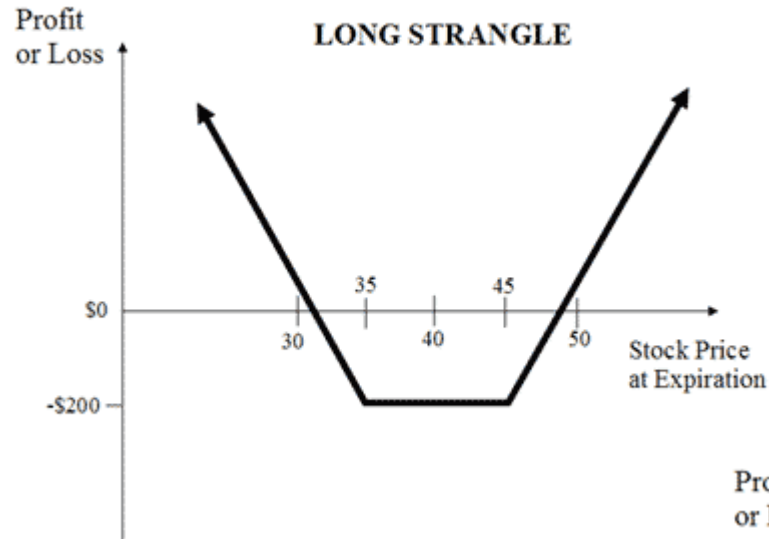
SUMMARY OF PAYOFF DIAGRAMS



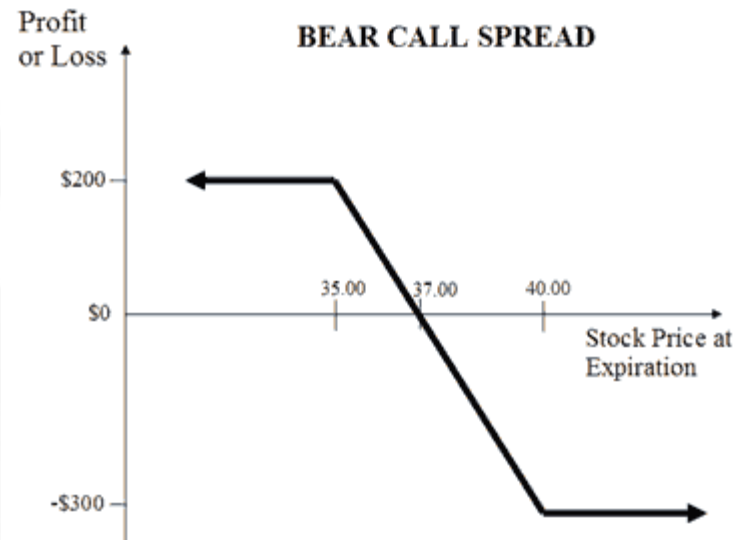
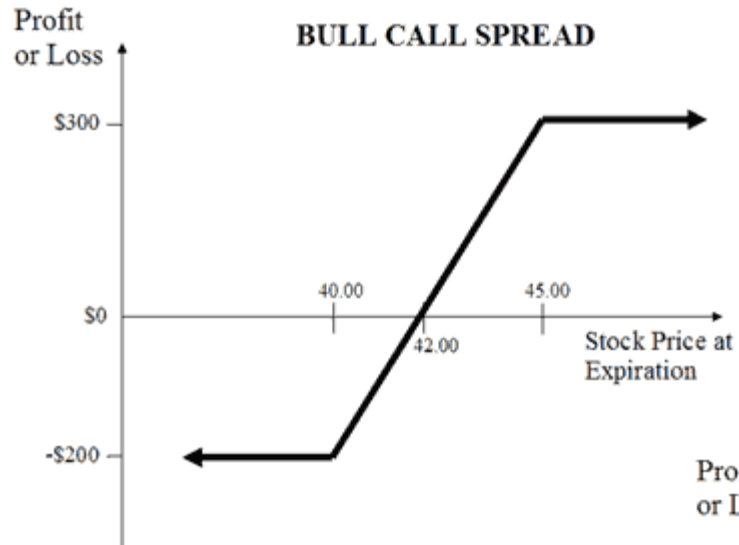
DIFFERENT STRATEGIES: VOLATILITY STRATEGIES



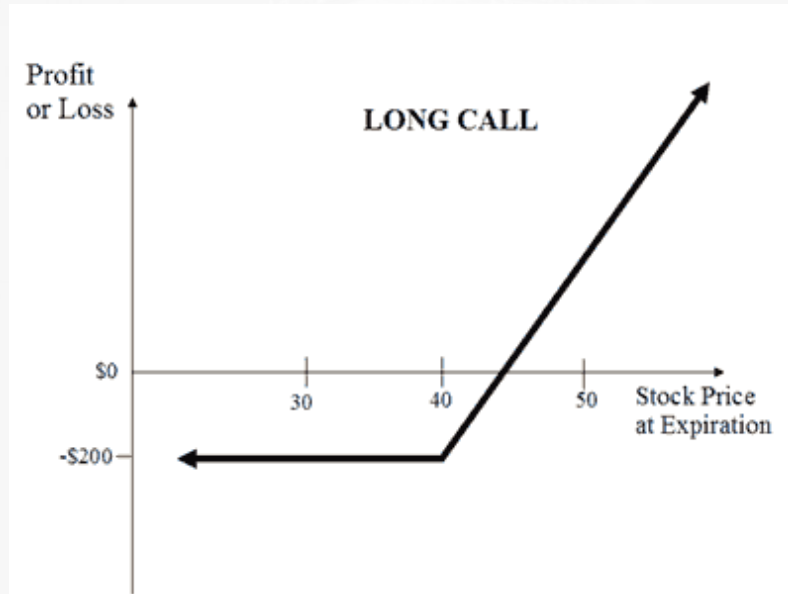
DIFFERENT STRATEGIES: VOLATILITY STRATEGIES



DIFFERENT STRATEGIES:



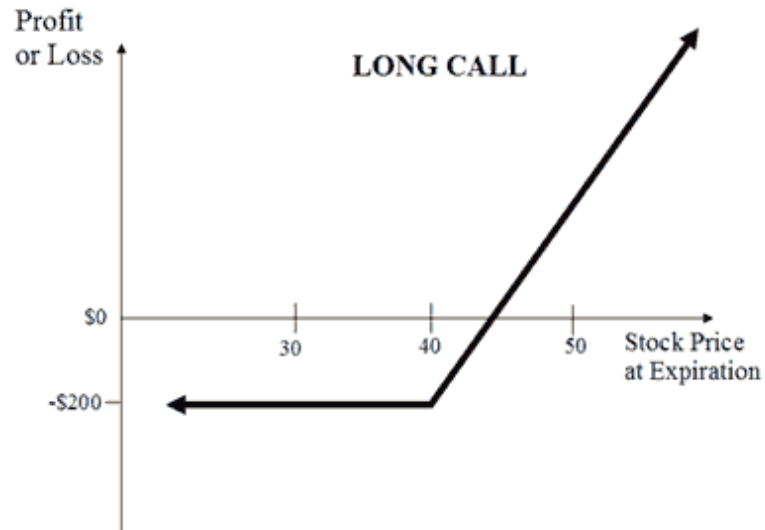
PRICING EXERCISE



How much do you think a call option should be priced if...

- Strike price is 40
- Price of underlying is 50
- Expiration date is in a year

PRICING EXERCISE



Black-Scholes Value:

10.932

Stock Price:
(in USD)

50

(ex. 31.55)

Exercise Price:
(in USD)

40

(ex. 22.75)

Time to maturity:
(in years)

1

(ex. 3.5)

Annual risk-free interest rate

1%

(ex. 5%)

Annualized volatility

20%

(ex. 50%)

Black-Scholes Value:

14.963

Stock Price:
(in USD)

50

(ex. 31.55)

Exercise Price:
(in USD)

40

(ex. 22.75)

Time to maturity:
(in years)

1

(ex. 3.5)

Annual risk-free interest rate

1%

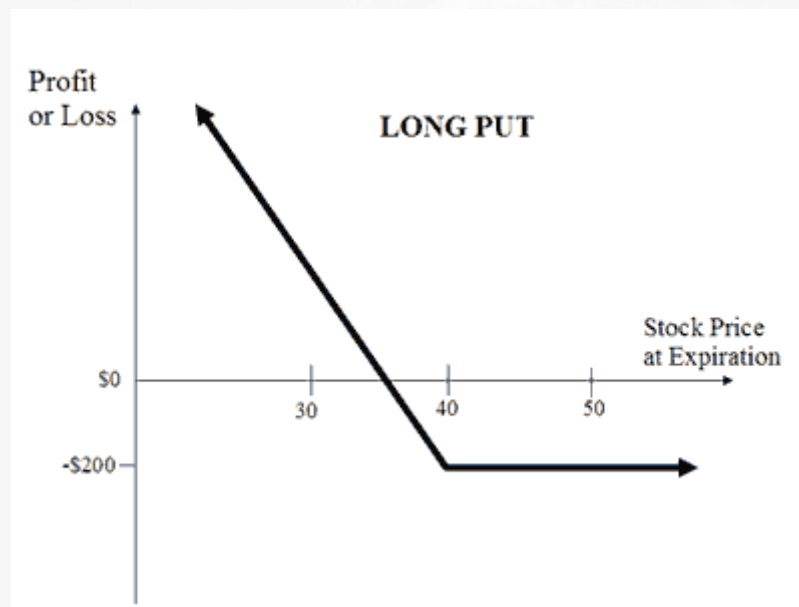
(ex. 5%)

Annualized volatility

50%

(ex. 50%)

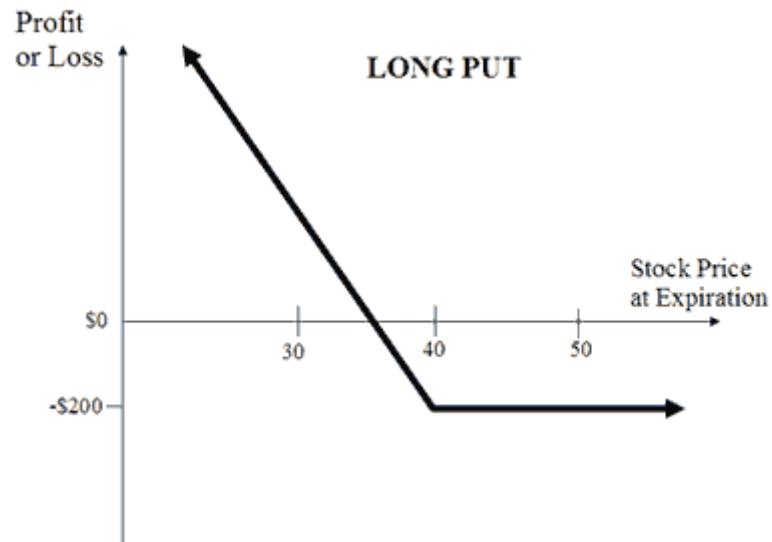
PRICING EXERCISE



How much do you think a put option should be priced if...

- Strike price is 40
- Price of underlying is 40
- Expiration date is in a year

PRICING EXERCISE



Spot Price (SP)	<input type="text" value="40"/>
Strike Price (ST)	<input type="text" value="40"/>
Time to Expiration (t)	<input type="text" value="1"/> Years <input type="button" value="v"/>
Volatility (v)	<input type="text" value="20"/> %
Risk-Free Interest Rate (r)	<input type="text" value="1"/> %
Dividend Yield (d)	<input type="text" value="0"/> %

Put Price: **\$2.98**

Spot Price (SP)	<input type="text" value="40"/>
Strike Price (ST)	<input type="text" value="40"/>
Time to Expiration (t)	<input type="text" value="1"/> Years <input type="button" value="v"/>
Volatility (v)	<input type="text" value="50"/> %
Risk-Free Interest Rate (r)	<input type="text" value="1"/> %
Dividend Yield (d)	<input type="text" value="0"/> %

Put Price: **\$7.66**

PRICING RELATIONSHIPS

- $\text{Max}[0, S-K] \leq C$
- $C(K_L) > C(K_H)$
- $C(t_2) > C(t_1)$

- $\text{Max}[0, K-S] \leq P \leq K$
- $P(K_L) < P(K_H)$
- $P(t_2) > P(t_1)$

- $S, K =$ spot price, strike price
- $K_L, K_H =$ lower strike, higher strike
- $T_1, T_2 =$ shorter maturity, longer maturity

Intrinsic vs. Extrinsic Value?

IMPACT OF EACH VARIABLE

- What happens to the cost of a call option when the following variables change?
 - Price of underlying increases...
 - Strike price increases...
 - Volatility increases...
 - Time increases...
 - Interest rates increase...
 - Dividends increase...

IMPACT OF EACH VARIABLE

- What happens to the cost of a put option when the following variables change?
 - Price of underlying increases...
 - Strike price increases...
 - Volatility increases...
 - Time increases...
 - Interest rates increase...
 - Dividends increase...

PUT-CALL PARITY

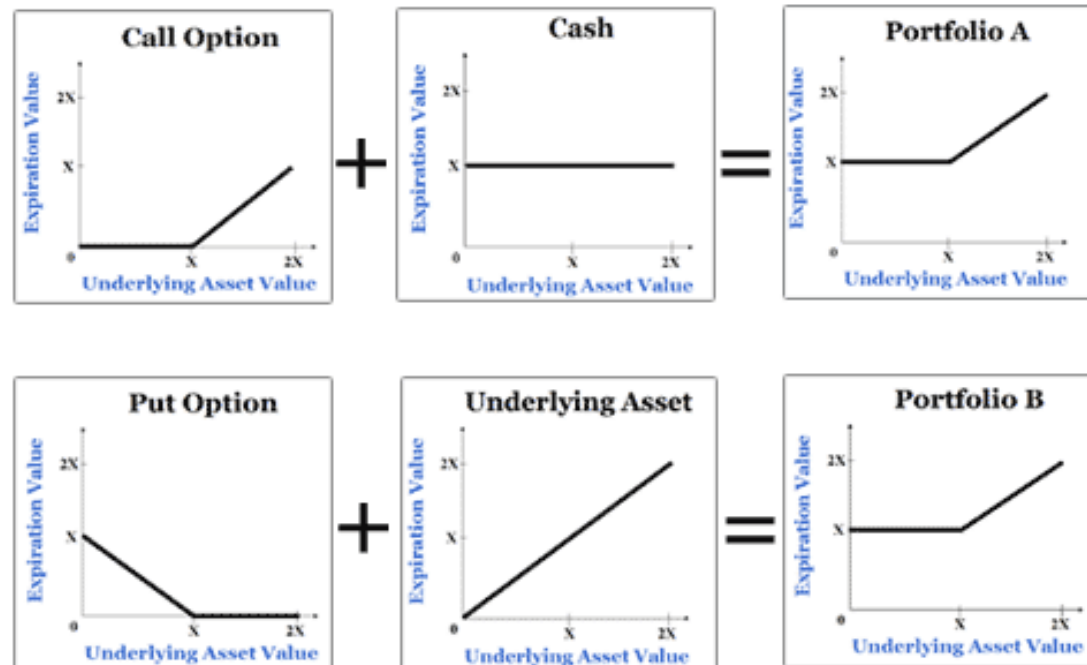
General approach: prices do not provide arbitrage opportunities

Derivation obtained by replicating the payoffs provided by the option using the underlying asset and borrowing/lending. The option payoffs should be priced the same as the replicated payoffs.

The same approach as in pricing futures/forward

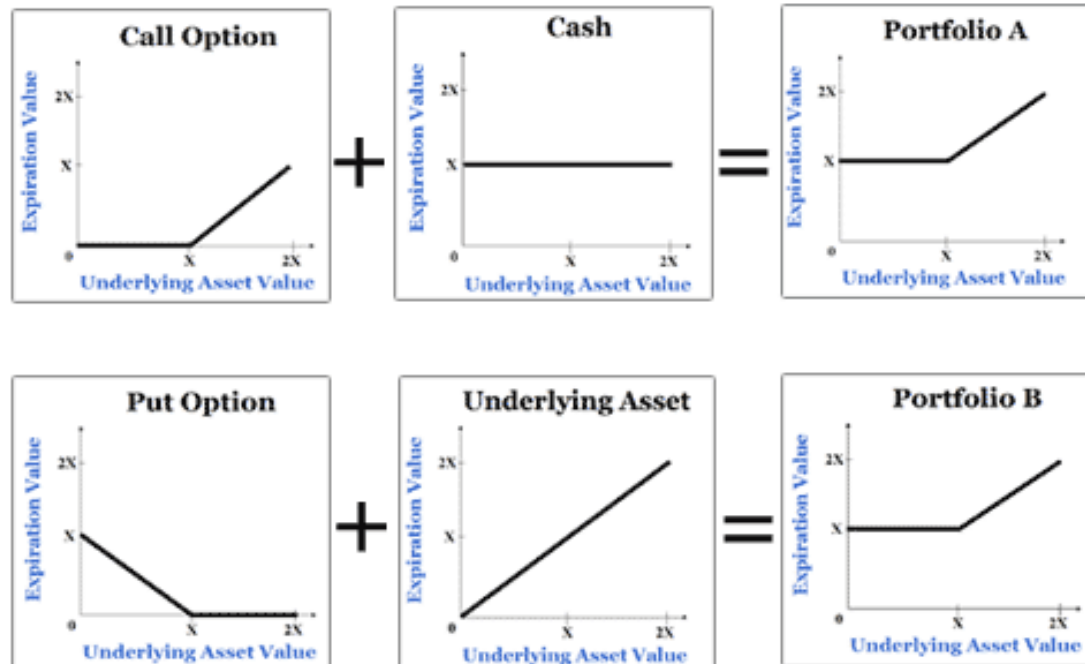
PUT-CALL PARITY

- Defines the relationship between the price of a European put and European call of the same class (same strike/underlying asset/expiration date)



PUT-CALL PARITY

- $P + S = C + PV(K)$
- $C = P + S - PV(K)$





Links

Mailing List Link



Coffee Chat Link





Get in Touch

Feel free to reach out to us over Facebook or email if you have any questions

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