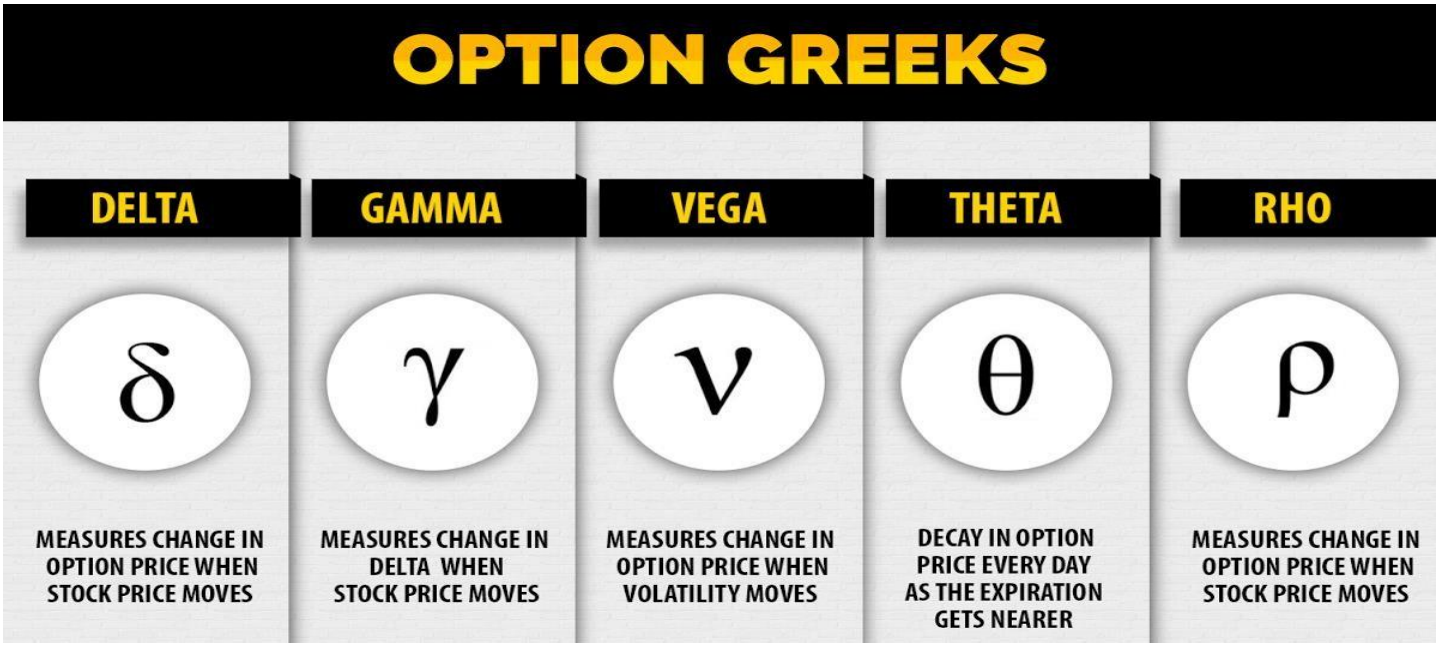
F&O SIMPLIFIED

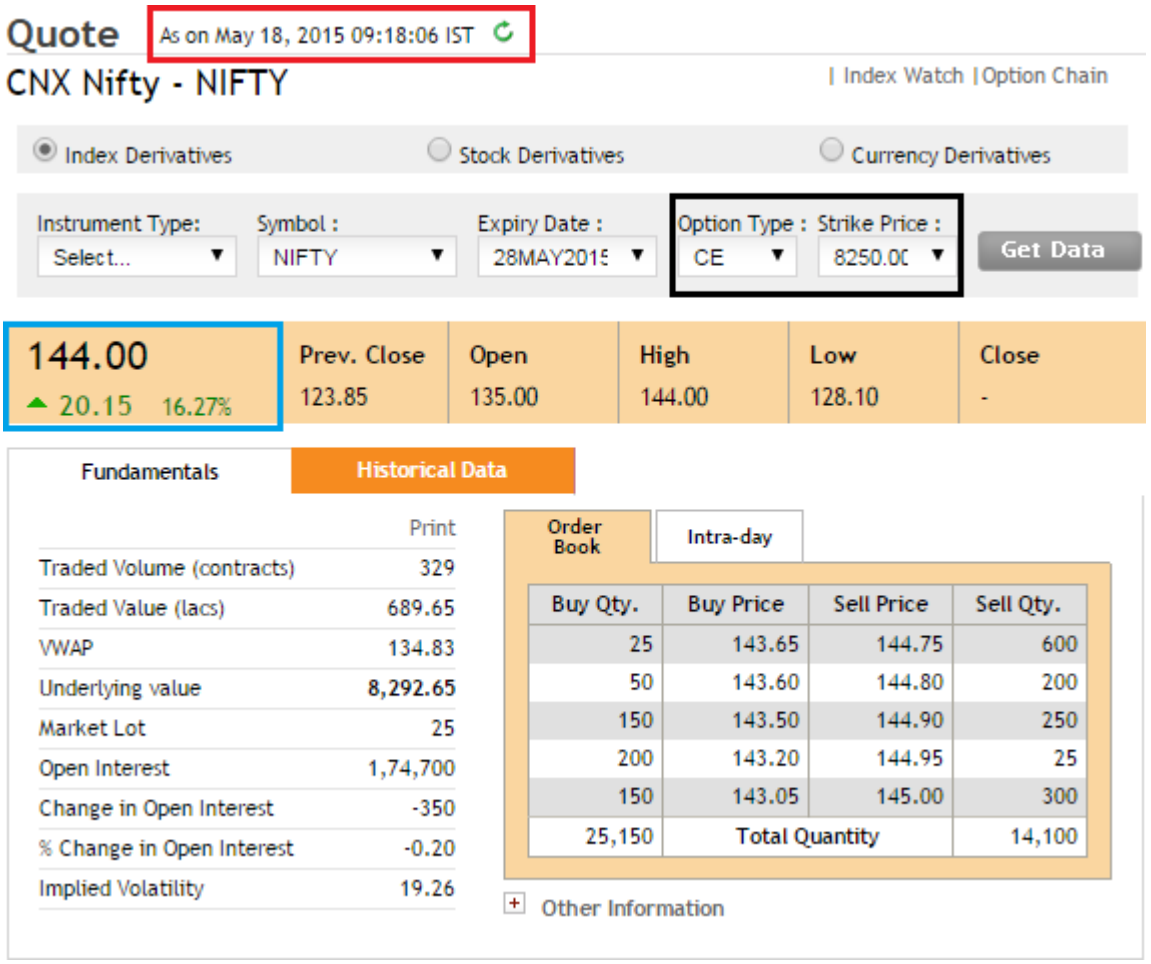


1. **Delta** – Measures the rate of change of options premium based on the directional movement of the underlying
2. **Gamma** – Rate of change of delta itself
3. **Vega** – Rate of change of premium based on change in volatility
4. **Theta** – Measures the impact on premium based on time left for expiry

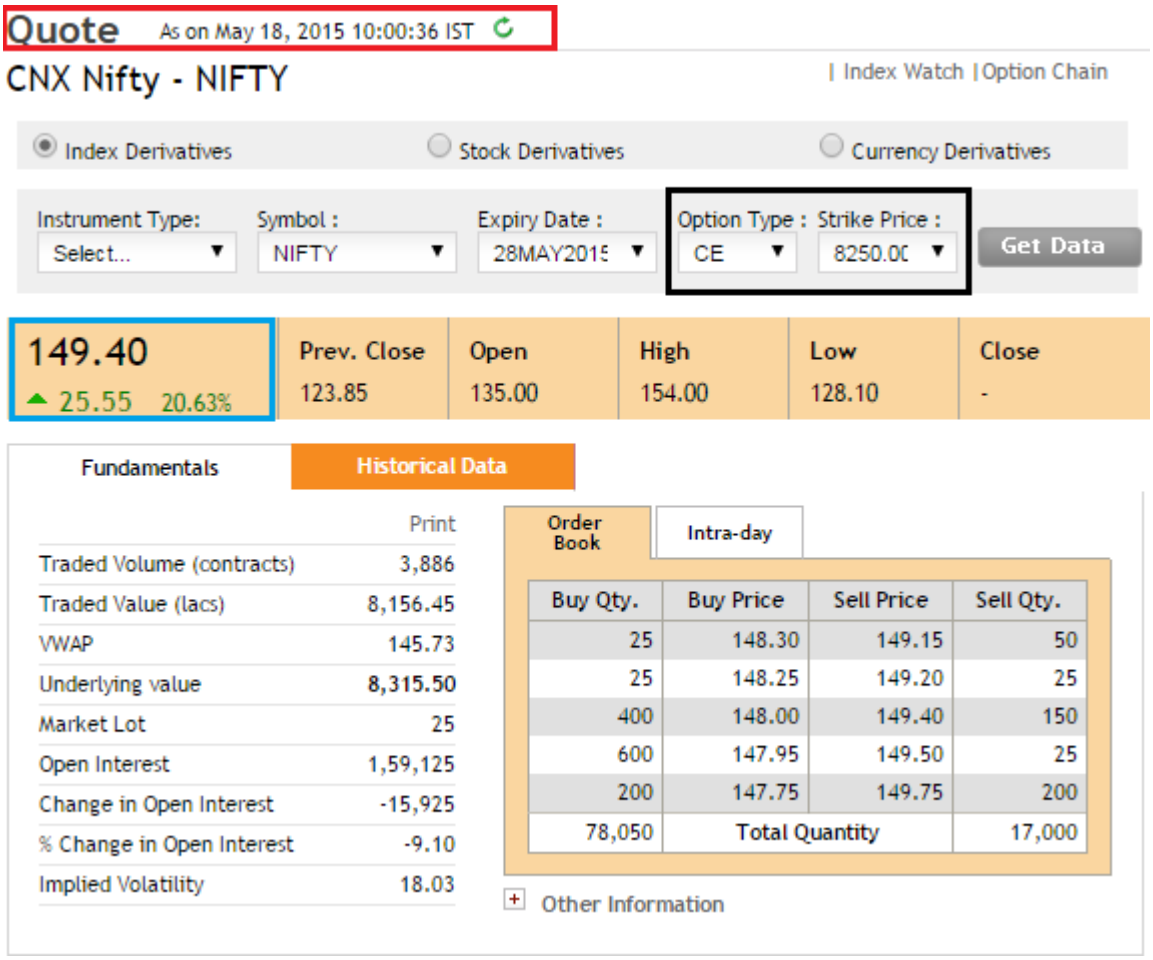
DELTA

Delta of an Option

Notice the following two snapshots here – they belong to Nifty's 8250 CE option. The first snapshot was taken at 09:18 AM when Nifty spot was at 8292.

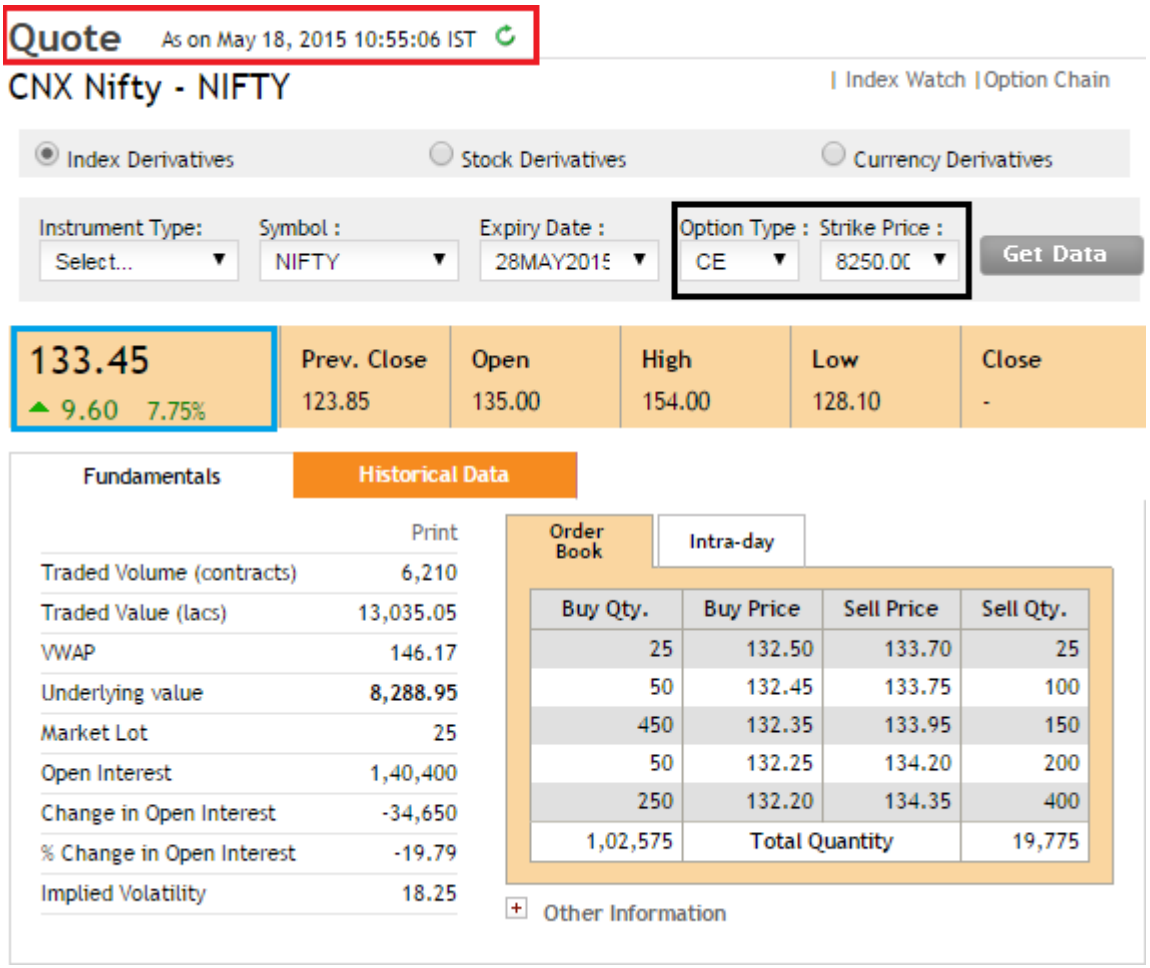


A little while later…



Now notice the change in premium – at 09:18 AM **when Nifty was at 8292** the call option was trading at 144, however at 10:00 AM **Nifty moved to 8315** and the same call option was trading at 150.

In fact here is another snapshot at 10:55 AM – **Nifty declined to 8288** and so did the option premium (declined to 133).



From the above observations one thing stands out very clear – as and when the value of the spot changes, so does the option premium. More precisely as we already know – the call option premium increases with the increase in the spot value and vice versa.

Keeping this in perspective, imagine this – you have predicted that Nifty will reach 8355 by 3:00 PM today. From the snapshots above we know that the premium will certainly change – but by how much? What is the likely value of the 8250 CE premium if Nifty reaches 8355?

Well, this is exactly where the 'Delta of an Option' comes handy. The Delta measures how an options value changes with respect to the change in the underlying. In simpler terms, the Delta of an option helps us answer questions of this sort – "By how many points will the option premium change for every 1 point change in the underlying?"

Therefore the Option Greek's 'Delta' captures the effect of the directional movement of the market on the Option's premium.

The delta is a number which varies –

1. Between 0 and 1 for a call option, some traders prefer to use the 0 to 100 scale. So the delta value of 0.55 on 0 to 1 scale is equivalent to 55 on the 0 to 100 scale.
2. Between -1 and 0 (-100 to 0) for a put option. So the delta value of -0.4 on the -1 to 0 scale is equivalent to -40 on the -100 to 0 scale
3. We will soon understand why the put option's delta has a negative value associated with it

At this stage I want to give you an orientation of how this chapter will shape up, please do keep this at the back of your mind as I believe it will help you join the dots better –

1. We will understand how we can use the Delta value for Call Options
2. A quick note on how the Delta values are arrived at
3. Understand how we can use the Delta value for Put Options
4. Delta Characteristics – Delta vs. Spot, Delta Acceleration (continued in next chapter)
5. Option positions in terms of Delta (continued in next chapter)

So let's hit the road!

Delta for a Call Option

We know the delta is a number that ranges between 0 and 1. Assume a call option has a delta of 0.3 or 30 – what does this mean?

Well, as we know the delta measures the rate of change of premium for every unit change in the underlying. So a delta of 0.3 indicates that for every 1 point change in the underlying, the premium is likely change by 0.3 units, or for every 100 point change in the underlying the premium is likely to change by 30 points.

The following example should help you understand this better –

Nifty @ 10:55 AM is at 8288

Option Strike = 8250 Call Option

Premium = 133

Delta of the option = + 0.55

Nifty @ 3:15 PM is expected to reach 8310

What is the likely option premium value at 3:15 PM?

Well, this is fairly easy to calculate. We know the Delta of the option is 0.55, which means for every 1 point change in the underlying the premium is expected to change by 0.55 points.

We are expecting the underlying to change by 22 points (8310 – 8288), hence the premium is supposed to increase by

= 22*0.55

= 12.1

Therefore the new option premium is expected to trade around **145.1** (133+12.1)

Which is the sum of old premium + expected change in premium

Let us pick another case – what if one anticipates a drop in Nifty? What will happen to the premium? Let us figure that out –

Nifty @ 10:55 AM is at 8288

Option Strike = 8250 Call Option

Premium = 133

Delta of the option = 0.55

Nifty @ 3:15 PM is expected to reach 8200

What is the likely premium value at 3:15 PM?

We are expecting Nifty to decline by **– 88** points (8200 – 8288), hence the change in premium will be –

= – 88 * 0.55

= **– 48.4**

Therefore the premium is expected to trade around

= 133 – 48.4

= 84.6 (new premium value)

As you can see from the above two examples, the delta helps us evaluate the premium value based on the directional move in the underlying. This is extremely useful information to have while trading options. For example assume you expect a massive 100 point up move on Nifty, and based on this expectation you decide to buy an option. There are two Call options and you need to decide which one to buy.

Call Option 1 has a delta of 0.05

Call Option 2 has a delta of 0.2

Now the question is, which option will you buy?

Let us do some math to answer this –

Change in underlying = 100 points

Call option 1 Delta = 0.05

Change in premium for call option 1 = 100 * 0.05

= 5

Call option 2 Delta = 0.2

Change in premium for call option 2 = 100 * 0.2

= 20

As you can see the same 100 point move in the underlying has different effects on different options. In this case clearly the trader would be better off buying Call Option 2. This should give you a hint – the delta helps you select the right option strike to trade. But of course there are more dimensions to this, which we will explore soon.

At this stage let me post a very important question – Why is the delta value for a call option bound by 0 and 1? Why can't the call option's delta go beyond 0 and 1?

To help understand this, let us look at 2 scenarios wherein I will purposely keep the delta value above 1 and below 0.

Scenario 1: Delta greater than 1 for a call option

Nifty @ 10:55 AM at 8268

Option Strike = 8250 Call Option

Premium = 133

Delta of the option = 1.5 (purposely keeping it above 1)

Nifty @ 3:15 PM is expected to reach 8310

What is the likely premium value at 3:15 PM?

Change in Nifty = 42 points

Therefore the change in premium (considering the delta is 1.5)

= 1.5*42

= 63

Do you notice that? The answer suggests that for a 42 point change in the underlying, the value of premium is increasing by 63 points! In other words, the option is gaining more value than the underlying itself. Remember the option is a derivative contract, it derives its value from its respective underlying, hence it can never move faster than the underlying.

If the delta is 1 (which is the maximum delta value) it signifies that the option is moving in line with the underlying which is acceptable, but a value higher than 1 does not make sense. For this reason the delta of an option is fixed to a maximum value of 1 or 100.

Let us extend the same logic to figure out why the delta of a call option is lower bound to 0.

Scenario 2: Delta lesser than 0 for a call option

Nifty @ 10:55 AM at 8288

Option Strike = 8300 Call Option

Premium = 9

Delta of the option = – 0.2 (have purposely changed the value to below 0, hence negative delta)

Nifty @ 3:15 PM is expected to reach 8200

What is the likely premium value at 3:15 PM?

Change in Nifty = 88 points (8288 -8200)

Therefore the change in premium (considering the delta is -0.2)

= -0.2*88

= **-17.6**

For a moment we will assume this is true, therefore new premium will be

= -17.6 + 9

= **– 8.6**

As you can see in this case, when the delta of a call option goes below 0, there is a possibility for the premium to go below 0, which is impossible. At this point do recollect the premium irrespective of a call or put can never be negative. Hence for this reason, the delta of a call option is lower bound to zero.

Who decides the value of the Delta?

The value of the delta is one of the many outputs from the Black & Scholes option pricing formula. As I have mentioned earlier in this module, the B&S formula takes in a bunch of inputs and gives out a few key outputs. The output includes the option's delta value and other Greeks. After discussing all the Greeks, we will also go through the B&S formula to strengthen our understanding on options. However for now, you need to be aware that the delta and other Greeks are market driven values and are computed by the B&S formula.

However here is a table which will help you identify the approximate delta value for a given option –

Option Type	Approx Delta value (CE)	Approx Delta value (PE)
Deep ITM	Between + 0.8 to + 1	Between – 0.8 to – 1
Slightly ITM	Between + 0.6 to + 1	Between – 0.6 to – 1
ATM	Between + 0.45 to + 0.55	Between – 0.45 to – 0.55
Slightly OTM	Between + 0.45 to + 0.3	Between – 0.45 to -0.3
Deep OTM	Between + 0.3 to + 0	Between – 0.3 to – 0

Of course you can always find out the exact delta of an option by using a B&S option pricing calculator.

Delta for a Put Option

Do recollect the Delta of a Put Option ranges from -1 to 0. The negative sign is just to illustrate the fact that when the underlying gains in value, the value of premium goes down. Keeping this in mind, consider the following details –

Parameters	Values
Underlying	Nifty
Strike	8300
Spot value	8268
Premium	128
Delta	-0.55
Expected Nifty Value (Case 1)	8310
Expected Nifty Value (Case 2)	8230

Note – 8268 is a slightly ITM option, hence the delta is around -0.55 (as indicated from the table above).

The objective is to evaluate the new premium value considering the delta value to be **-0.55**. Do pay attention to the calculations made below.

Case 1: Nifty is expected to move to 8310

Expected change = 8310 – 8268

= 42

Delta = – 0.55

= -0.55*42

= -23.1

Current Premium = 128

New Premium = 128 -23.1

= 104.9

Here I'm subtracting the value of delta since I know that the value of a Put option declines when the underlying value increases.

Case 2: Nifty is expected to move to 8230

Expected change = 8268 – 8230

= 38

Delta = – 0.55

= -0.55*38

= -20.9

Current Premium = 128

New Premium = 128 + 20.9

= 148.9

Here I'm adding the value of delta since I know that the value of a Put option gains when the underlying value decreases.

I hope with the above two Illustrations you are now clear on how to use the Put Option's delta value to evaluate the new premium value. Also, I will take the liberty to skip explaining why the Put Option's delta is bound between -1 and 0.

In fact I would encourage the readers to apply the same logic we used while understanding why the call option's delta is bound between 0 and 1, to understand why Put option's delta is bound between -1 and 0.

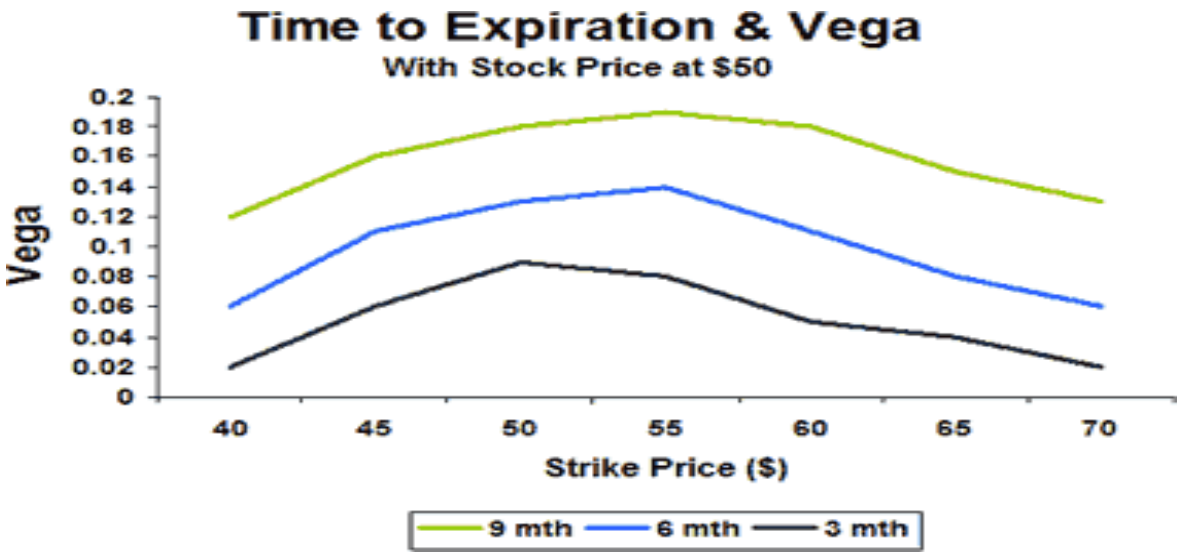
In the next chapter we will dig deeper into Delta and understand some of its characteristics.

KEY POINT

1. Option Greeks are forces that influence the premium of an option
2. Delta is an Option Greek that captures the effect of the direction of the market
3. Call option delta varies between 0 and 1, some traders prefer to use 0 to 100.
4. Put option delta varies between -1 and 0 (-100 to 0)
5. The negative delta value for a Put Option indicates that the option premium and underlying value moves in the opposite direction
6. ATM options have a delta of 0.5
7. ITM option have a delta of close to 1
8. OTM options have a delta of close to 0.

VEGA

IV FACTOR



Implied Volatility (IV)

- When the markets are highly volatile, market tends to move steeply and during such time the volatility index tends to rise.
- Volatility index declines when the markets become less volatile. Volatility indices such as India VIX are sometimes also referred to as the 'Fear Index', because as the volatility index rises, one should become careful, as the markets can move steeply into any direction. Investors use volatility indices to gauge the market volatility and make their investment decisions
- Volatility Index is different from a market index like NIFTY. NIFTY measures the direction of the market and is computed using the price movement of the underlying stocks whereas India VIX measures the expected volatility and is computed using the order book of the underlying NIFTY options. While Nifty is a number, India VIX is denoted as an annualized percentage.

Per day volatility what market think can be calculated

Divide IV by 16

Vega indicate that if IV change by 1 than how much vega will change .

KEY POINT

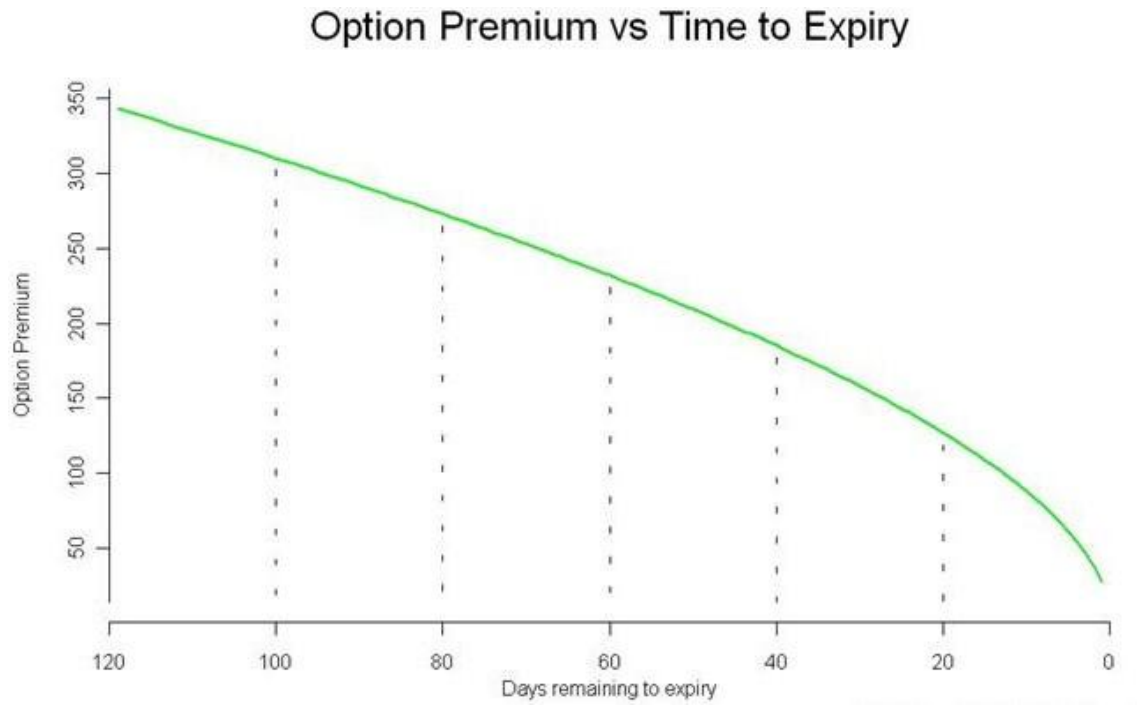
1. Vega of at the money strike will be highest. (Strike wise)
2. Vega of next expiry will be high. (Time wise)

THETA

TIME DECAY FACTOR

All options – both Calls and Puts lose value as the expiration approaches. The Theta or time decay factor is the rate at which an option loses value as time passes. Theta is expressed in points lost per day when all other conditions remain the same.

A long option (option buyer) will always have a negative theta meaning all else equal, the option buyer will lose money on a day by day basis. A short option (option seller) will have a positive theta. Theta is a friendly Greek to the option seller. Remember the objective of the option seller is to retain the premium.



This is the graph of how premium erodes as time to expiry approaches. This is also called the **'Time Decay'**graph. We can observe the following from the graph –

1. **At the start of the series** – when there are many days for expiry the option does not lose much value. For example when there were 120 days to expiry the option was trading at 350, however when there was 100 days to expiry, the option was trading at 300. Hence the effect of theta is **low**
2. **As we approach the expiry of the series** – the effect of theta is **high**. Notice when there was 20 days to expiry the option was trading around 150, but when we approach towards expiry the drop in premium seems to accelerate (option value drops below 50).

   So if you are selling options at the start of the series – you have the advantage of pocketing a large premium value (as the time value is very high) but do remember the fall in premium happens at a low rate. You can sell options closer to the expiry – you will get a lower premium but the drop in premium is high, which is advantageous to the options seller.

GAMMA

DELTA FACTOR

Unlike the delta, the Gamma is always a positive number for both Call and Put Option. Therefore when a trader is long options (both Calls and Puts) the trader is considered 'Long Gamma' and when he is short options (both calls and puts) he is considered 'Short Gamma'.

For example consider this – The Gamma of an ATM Put option is 0.004, if the underlying moves 10 points, what do you think the new delta is?

Before you proceed I would suggest you spend few minutes to think about the solution for the above.

Here is the solution – Since we are talking about an ATM Put option, the Delta must be around – 0.5. Remember Put options have a –ve Delta. Gamma as you notice is a positive number i.e +0.004. The underlying moves by 10 points without specifying the direction, so let us figure out what happens in both cases.

Case 1 – Underlying moves up by 10 points

- Delta = – 0.5
- Gamma = 0.004
- Change in underlying = 10 points
- Change in Delta = Gamma * Change in underlying = 0.004 * 10 = 0.04
- New Delta = We know the Put option loses delta when underlying increases, hence – 0.5 + 0.04 = **– 0.46**

Case 2 – Underlying goes down by 10 points

- Delta = – 0.5
- Gamma = 0.004
- Change in underlying = – 10 points
- Change in Delta = Gamma * Change in underlying = 0.004 * – 10 = – 0.04
- New Delta = We know the Put option gains delta when underlying goes down, hence – 0.5 + (-0.04) = **– 0.54**

Now, here is trick question for you – In the earlier chapters, we had discussed that the Delta of the Futures contract in always 1, so what do you think the gamma of the Futures contract is? Please leave your answers in the comment box below :).

KEY POINT

1. Gamma measures the rate of change of delta
2. Gamma is always a positive number for both Calls and Puts
3. Large Gamma can translate to large gamma risk (directional risk)
4. When you buy options (Calls or Puts) you are long Gamma
5. When you short options (Calls or Puts) you are short Gamma