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A PRACTICAL FIELD GUIDE

The Options Greeks

Δ Γ Θ ν ρ

Delta, Gamma, Theta, Vega, and Rho: what each one measures, how it behaves, and how to actually use it. Built to be read once and kept forever.

5 GREEKS · 10 SECTIONS · iwpintel.com

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A field guide to the five options Greeks: what each measures, how it moves, and how to trade around it. Tap any section to jump to it.

START HERE

01 The Greeks at a Glance

What each Greek measures, how to read the signs, and the two ideas that make the rest click.

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An option's price moves for five reasons: the **underlying moves**, that move **speeds up or slows**, **time passes**, **implied volatility shifts**, and **interest rates change**. The Greeks are simply the five dials that tell you how much your option reacts to each one. Master them and you stop guessing why a position made or lost money.

GREEK	REACTS TO A CHANGE IN	LONG CALL	LONG PUT	BIGGEST WHEN
Δ Delta	Underlying price (per $1)	+	−	Deep in-the-money
Γ Gamma	Delta itself (per $1)	+	+	At-the-money, near expiry
Θ Theta	Time (per day)	−	−	At-the-money, near expiry
ν Vega	Implied volatility (per 1 pt)	+	+	At-the-money, long-dated
ρ Rho	Interest rate (per 1 pt)	+	−	In-the-money, long-dated

The two ideas that unlock everything

1. Order. Delta, Theta, Vega and Rho each measure a *direct* sensitivity. Gamma is different: it measures how *Delta* changes. It is the acceleration behind your directional exposure, which is why it dominates near expiry.

2. The trade-off. You cannot escape it: buying options gives you positive Gamma but negative Theta (you pay time for convexity). Selling options flips both (you collect time but owe convexity). Every strategy lives on this see-saw.

READING THE SIGN CONVENTION

A **positive** Greek means the option gains when that input rises; a **negative** Greek means it loses. Short positions flip every sign. Per-contract Greeks are quoted per share, so multiply by 100 (the contract multiplier) and by your number of contracts to get real dollars.

THE INPUTS BEHIND THE FORMULAS

$$d_1 = \frac{\ln(S/K) + (r + \sigma^2/2)T}{\sigma\sqrt{T}}, \quad d_2 = d_1 - \sigma\sqrt{T}$$

where: S = spot price, K = strike, r = risk-free rate, σ = implied volatility, T = time to expiry (in years). N(·) is the normal CDF; N′(·) is the normal bell curve. Every Greek below is built from these.

02 THE GREEK
Delta
How much the option's price moves for a $1 move in the underlying.

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Δ Delta $\partial V / \partial S$

How much the option's price moves for a **$1 move** in the underlying.

Delta is your directional exposure. A call with a delta of 0.60 gains about $0.60 (×100 = $60 per contract) if the stock rises $1, and loses the same if it falls $1. It doubles as the **hedge ratio** (0.60 delta ≈ 60 shares of exposure per contract) and, loosely, as the market's implied **probability of finishing in-the-money**.

UNITS	CALL RANGE	PUT RANGE	ATM ≈
$ per $1 move (per share)	0 → +1	−1 → 0	±0.50

SIGN BY POSITION

Long call	Long put	Short call	Short put
+	−	−	+
0 to +1	−1 to 0	0 to −1	0 to +1

WHAT MOVES IT

Moneyness

The main driver. Deep in-the-money → delta approaches ±1 (moves like the stock). Deep out-of-the-money → delta approaches 0. At-the-money sits near ±0.50.

Time

As expiry nears, deltas polarize: in-the-money options push toward ±1, out-of-the-money toward 0. At-the-money stays near ±0.50.

Volatility

Higher implied vol pulls deltas toward 0.50 (more uncertainty about where it lands); lower vol pushes them to the extremes.

HOW TO USE IT

Read delta as **share-equivalents**: a +250 position delta behaves like being long 250 shares right now. To hedge, trade the opposite delta in stock (short 60 shares against one 0.60-delta call to be delta-neutral). Sum deltas across a book to see your true net direction.

BLACK-SCHOLES

$$\Delta_{\text{call}} = N(d_1)\,, \quad \Delta_{\text{put}} = N(d_1) - 1$$

$N(d_1)$ is the probability-like term from the normal curve. A put's delta is simply the call's delta minus one (put-call parity).

WATCH OUT

Delta is **not constant**. Gamma is quietly changing it under you, fastest at-the-money and near expiry. And "delta ≈ probability of expiring in-the-money" is a useful rule of thumb, not a precise figure.

03 THE GREEK

Gamma

How much Delta changes for a $1 move in the underlying, the accelerator.

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Γ

Gamma $\partial\text{Delta}/\partial S$

How much **Delta** changes for a $1 move in the underlying, the accelerator.

Gamma is the second derivative: it tells you how fast your directional exposure shifts as the stock moves. High gamma means a small move can swing you from mildly long to aggressively long. Long options always carry **positive** gamma (convexity works for you); short options carry **negative** gamma (moves work against you).

UNITS	LONG OPTIONS	SHORT OPTIONS	PEAKS
delta per $1 move	always +	always −	ATM, near expiry

SIGN BY POSITION

Long call	Long put	Short call	Short put
+	+	−	−
convex	convex	concave	concave

WHAT MOVES IT

Moneyness

Gamma is highest exactly at-the-money and falls away on both sides. Deep in- or out-of-the-money options have very little gamma: their delta is already pinned near ±1 or 0.

Time

As expiry approaches, at-the-money gamma **explodes**. On expiration day a tiny move can flip an ATM option's delta from 0.2 to 0.8 in minutes.

Volatility

Lower implied vol concentrates gamma tightly around the strike; higher vol spreads it across a wider range of prices.

HOW TO USE IT

Long gamma is a **"buy low, sell high" engine**: when you re-hedge a long-gamma book, moves force you to trade against the trend and bank the swings. That's what your Theta is paying for. Short gamma is the opposite and dangerous into expiry, where exposure can run away from you.

BLACK-SCHOLES

$$\Gamma = \frac{N'(d_1)}{S\,\sigma\,\sqrt{T}}$$

Identical for calls and puts. $N'(d_1)$ is the height of the bell curve at d_1, which is why gamma peaks at-the-money.

WATCH OUT

Gamma is largest right where positions feel calmest: at-the-money, close to expiry. Sold "safe" out-of-the-money options gain gamma fast if the stock travels to the strike, turning a quiet position violent. This is the classic **short-gamma blow-up**.

04 THE GREEK

Theta

How much value the option loses per day as time passes.

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Θ Theta ∂V/∂t

How much value the option **loses per day** as time passes.

Every option is a melting ice cube. Theta is the rate of the melt, quoted in dollars per day. Buyers pay it (negative Theta) as the price of holding optionality; sellers collect it (positive Theta) as income. It is the mirror image of Gamma: the convexity you buy is rented, and Theta is the rent.

UNITS	LONG OPTIONS	SHORT OPTIONS	PEAKS
$ lost per day	− (you pay)	+ (you collect)	ATM, near expiry

SIGN BY POSITION

Long call	Long put	Short call	Short put
−	−	+	+
pays decay	pays decay	earns decay	earns decay

WHAT MOVES IT

Moneyness

At-the-money options have the most time value to lose, so they decay fastest. Deep in- or out-of-the-money options carry little time value and bleed slowly.

Time

Decay is **non-linear**. An ATM option loses time value roughly with the square root of time left, so the last few weeks decay far faster than the first, the famous accelerating curve.

Volatility

Higher implied vol means more time value at risk, so Theta (the daily bleed) is larger in absolute dollars.

HOW TO USE IT

Theta is the number premium-sellers live on: covered calls, cash-secured puts, and credit spreads all harvest it. As a buyer, treat Theta as a countdown: you need the underlying to move (Gamma) faster than time decays your option (Theta).

BLACK-SCHOLES

$$\Theta_{\text{call}} = -\frac{S\,N'(d_1)\,\sigma}{2\sqrt{T}} - rKe^{-rT}N(d_2)$$

Shown per year; divide by 365 for the per-day figure most platforms quote. The first term is the decay of time value, the second the carry on the strike.

WATCH OUT

Theta is not a smooth daily drip: it accelerates into expiry and markets often price in **weekend decay** early. And you can never collect Theta without being short Gamma: the income comes with the risk that a big move overwhelms it.

05 THE GREEK

Vega

How much the option's price changes per 1 percentage-point change in implied volatility.

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ν Vega $\partial V/\partial\sigma$

How much the option's price changes per **1 percentage-point** change in implied volatility.

Vega is your exposure to fear and expectation, not to the stock itself. If implied volatility rises from 20% to 21%, an option with a vega of 0.12 gains about $0.12 (×100 = $12 per contract). Both calls and puts gain value when volatility rises: more expected movement makes optionality worth more. It is the Greek that lets you be right on direction and still lose.

UNITS	LONG OPTIONS	SHORT OPTIONS	PEAKS
$ per 1 vol point	+ (want vol up)	− (want vol down)	ATM, long-dated

SIGN BY POSITION

Long call	Long put	Short call	Short put
+	+	−	−
long vol	long vol	short vol	short vol

WHAT MOVES IT

Moneyness

Vega is largest at-the-money, where a shift in volatility has the most leverage over the price, and tapers off for deep in- or out-of-the-money strikes.

Time

More time = more vega. Long-dated options (LEAPS) are dominated by vega; an expiring option has almost none, because there is no future left for volatility to act on.

Event risk

Implied vol ramps into known events (earnings, FDA, Fed) and collapses right after (the **IV crush**), which can sink a long option even when the stock moves your way.

HOW TO USE IT

Vega is the earnings and event Greek. Buy it when you expect volatility (or the move) to exceed what's priced; sell it to harvest inflated pre-event premium. Calendars and diagonals are structured vega trades: long the far month's vega, short the near month's.

BLACK-SCHOLES

$$\nu = S\,N'(d_1)\,\sqrt{T}$$

Same for calls and puts. This is per 1.00 change in σ; divide by 100 for the per-1%-point figure platforms display. Note the $\sqrt{T}$: vega grows with time to expiry.

WATCH OUT

Standard vega assumes **every** strike and expiry's implied vol moves together by the same amount. Reality has skew and term structure, so a real vol move is lumpy. After events, expect the **IV crush** to hand vega straight back.

06

THE GREEK

Rho

Sensitivity to a 1 percentage-point change in the risk-free interest rate.

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ρ

Rho $\partial V/\partial r$

Sensitivity to a **1 percentage-point** change in the risk-free interest rate.

Rho is the quiet Greek. Higher rates raise call values and lower put values, because rates change the cost of carrying the underlying versus holding the option. For short-dated trades it is usually a rounding error. But for long-dated options, and whenever rates move fast, it stops being ignorable.

UNITS	LONG CALL	LONG PUT	PEAKS
$ per 1 rate point	+ (likes high rates)	− (likes low rates)	ITM, long-dated

SIGN BY POSITION

Long call	Long put	Short call	Short put
+	−	−	+
gains if rates rise	loses if rates rise		

WHAT MOVES IT

Time

Rho scales with time to expiry: the longer the option, the more a rate change compounds on the discounted strike. LEAPS have meaningful rho; weeklies have almost none.

Moneyness

In-the-money options, whose value tracks the discounted strike most closely, carry the largest rho. Far out-of-the-money options carry very little.

Rate regime

In a zero-rate world rho barely matters. When rates jump (as in 2022–2023), it re-enters the conversation, especially for long-dated books and box spreads.

HOW TO USE IT

For most retail, day-to-day trading, rho is the Greek you check last. Where it earns its keep: LEAPS, deep-in-the-money long-dated positions, interest-rate-sensitive structures, and deciding whether early exercise makes sense on carry grounds.

BLACK-SCHOLES

$$\rho_{\text{call}} = KTe^{-rT}N(d_2)\,, \quad \rho_{\text{put}} = -KTe^{-rT}N(-d_2)$$

Per 1.00 change in r; divide by 100 for a 1%-point move. The e^(−rT) term is the discounting of the strike that rho acts on.

WATCH OUT

Ignoring rho on **LEAPS** is a real mistake: a full rate cycle can move a long-dated call's value by more than traders expect. Match your rate assumption to the option's life, not to today's overnight rate.

PUTTING IT TOGETHER

07 How the Greeks Interact

No Greek acts alone. The trade-offs between them are where real P&L is won and lost.

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You never hold one Greek. Every position is a bundle, and the Greeks push against each other. Three relationships explain most of what you'll feel:

Gamma ↔ Theta

The core trade-off. **Long options** = +Gamma / −Theta: you profit from movement but pay for time. **Short options** = −Gamma / +Theta: you earn time but are exposed to movement. If a position collects Theta, it is short Gamma somewhere. No exceptions for vanilla options.

Vega ↔ Theta

Long-vega positions are usually long-gamma too, so they also bleed Theta. Selling vega (short premium) collects Theta but leaves you short volatility: a vol spike hits you twice, through both Vega and Gamma.

THE MENTAL MODEL

Think of it as one dial with two ends. Turn toward **buying options** and you get convexity (Gamma) and vol exposure (Vega), paid for with decay (Theta). Turn toward **selling options** and you harvest decay, financed by taking on move-risk and vol-risk. There is no free Theta.

SECOND-ORDER GREEKS (THE ONES BEHIND THE GREEKS)

GREEK	MEASURES HOW...	WHY YOU CARE
Gamma	Delta changes as the underlying moves	Already essential, the acceleration of direction
Vanna	Delta changes as volatility moves	Skew trades; your hedge shifts when IV moves
Charm	Delta changes as time passes	Weekend/overnight hedge drift; expiry pinning
Vomma	Vega changes as volatility moves	Vol-of-vol; matters for large vega books

DELTA-NEUTRAL IS NOT RISK-NEUTRAL

Hedging Delta to zero removes only your *first-order* directional risk. You are still fully exposed to Gamma (the move), Theta (time), and Vega (vol). Most option blow-ups happen in "hedged" books that were neutral on Delta and badly short everything else.

08

SCALING UP

Position & Portfolio Greeks

How to turn per-share Greeks into real dollars, and how hedging actually works.

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Screen Greeks are quoted **per share**. To manage real risk you aggregate them across every contract into position-level and portfolio-level numbers.

$$\text{Position Greek} = \text{Greek}_{\text{per share}} \times \text{contracts} \times 100 \times (\pm 1)$$

Multiply by 100 (the contract multiplier) and your contract count; flip the sign (−1) for short positions. Add across all positions for the portfolio Greek.

Dollar Delta

Position delta × price = the dollar move in your book per 1% move in the underlying. Lets you compare option and stock exposure on one scale.

Dollar Gamma

How much your dollar-delta changes per 1% move. The number that tells you how quickly a quiet book becomes a directional one.

DELTA HEDGING, STEP BY STEP

- **Measure** net position delta across the book (e.g. +300 delta = long 300 share-equivalents).
- **Neutralize** by trading the opposite in the underlying: short 300 shares to reach delta-neutral.
- **Re-hedge** as the stock moves: Gamma keeps changing your delta, so a neutral book drifts and must be rebalanced.
- **Long gamma** re-hedging sells into rallies and buys into dips (banking swings); **short gamma** does the opposite, chasing the move.

WHY HEDGING COSTS (OR PAYS)

A long-gamma, delta-hedged position **earns from realized movement** but pays Theta to hold. It's profitable when the stock actually moves more than its implied volatility said it would. Short-gamma is the reverse trade: you keep the Theta unless the move is too big. This is the entire game of volatility trading in one sentence.

IN THE FIELD

09 The Practical Playbook

Which Greeks dominate in the situations you'll actually trade, and what to watch.

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SITUATION	DOMINANT GREEKS	WHAT TO WATCH
Buying a call/put (directional)	Delta, then Gamma	The vol you pay (Vega) and daily decay (Theta): you need the move to beat both
Selling premium (income)	+Theta, −Gamma, −Vega	One big move or a volatility spike can erase weeks of collected decay
Earnings / events	Vega (long into it)	The IV crush and Theta the moment the news is out
0DTE / expiration day	Gamma, Theta	Violent delta swings and pin risk near the strike
LEAPS (long-dated)	Delta, Vega, Rho	Volatility regime and interest rates; Theta is slow and patient
Calendars / diagonals	Vega, Theta	The term structure of IV: you're long one month's vol, short another

ONE QUESTION BEFORE EVERY OPTIONS TRADE

Ask: **"Which Greek am I really betting on?"** If you can't name it, you don't yet have a thesis. A call isn't a bet on the stock alone: it's a joint bet on direction (Delta), speed (Gamma), time (Theta), and volatility (Vega). Know which one you want, and hedge or accept the rest deliberately.

THE THREE MOST COMMON WAYS THE GREEKS BITE

1. Right on direction, wrong on vol: IV crush after earnings (Vega). **2.** A sold "safe" strike that the stock walks up to near expiry (Gamma). **3.** A LEAP that stalls while time and a vol drop quietly erode it (Theta + Vega).

10

REFERENCE

Sign & Behavior Cheat Sheet

Every sign and peak in one place. Tear this page out.

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SIGNS BY POSITION

	LONG CALL	LONG PUT	SHORT CALL	SHORT PUT
Δ Delta	+	−	−	+
Γ Gamma	+	+	−	−
Θ Theta	−	−	+	+
ν Vega	+	+	−	−
ρ Rho	+	−	−	+

WHERE EACH GREEK IS LARGEST

GREEK	PEAKS IN MONEYNESS	PEAKS IN TIME	FORMULA
Δ Delta	Deep ITM (→±1)	–	$N(d_1)$
Γ Gamma	At-the-money	Near expiry	$N'(d_1) / (S\sigma\sqrt{T})$
Θ Theta	At-the-money	Near expiry	$\approx -SN'(d_1)\sigma / (2\sqrt{T}) - \ldots$
ν Vega	At-the-money	Long-dated	$SN'(d_1)\sqrt{T}$
ρ Rho	In-the-money	Long-dated	$KTe^{-rT}N(d_2)$

THE 30-SECOND RECAP

Delta = direction. **Gamma** = how fast direction changes. **Theta** = the cost of time. **Vega** = exposure to volatility. **Rho** = exposure to rates. Buy options and you're long Gamma/Vega, short Theta. Sell them and you flip all three. Name your Greek before you place the trade.

Trade the Greek, not the guess.

Every one of these Greeks is explained in depth, with worked examples, in the IWP knowledge base.

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