CIRE Derivatives Payoffs

Every option strategy, futures pricing, and Greeks sign you need for CIRE Element 8.

Single-leg options (max gain / max loss)

Long call

`max(S - K, 0) - prem`

Max loss = premium; max gain unlimited

Short call

`prem - max(S - K, 0)`

Max gain = premium; max loss unlimited (uncovered)

Long put

`max(K - S, 0) - prem`

Max loss = premium; max gain = K - prem

Short put

`prem - max(K - S, 0)`

Max gain = premium; max loss = K - prem

Combined strategies

Covered call

`Long stock + short call`

Income; caps upside at strike

Protective put

`Long stock + long put`

Insurance; max loss = (S - K) + prem

Bull call spread

`Long call (low K) + short call (high K)`

Defined risk + reward

Bear put spread

`Long put (high K) + short put (low K)`

Defined risk + reward

Long straddle

`Long call + long put (same K)`

Profits from large move either way

Long strangle

`Long call (high K) + long put (low K)`

Cheaper than straddle, needs bigger move

Pricing relationships

Put-call parity

`C - P = S - PV(K)`

European, no dividends

Cost of carry (futures)

`F = S × e^((r - q)t)`

q = dividend yield or storage minus convenience

Greeks signs

- Delta: long call +, long put -, short call -, short put +
- Gamma: long options +, short options -
- Vega: long options +, short options -
- Theta: long options usually -, short options usually +

Greeks rules of thumb

- Delta of an at-the-money call is around 0.5. Deep-ITM call delta approaches 1.0. Deep-OTM call delta approaches 0.
- Gamma is highest for at-the-money options near expiry. This is why short-dated ATM options are the most expensive to gamma-hedge.
- Vega peaks for longer-dated ATM options. Short-dated options have low vega regardless of moneyness.
- Theta decay accelerates as expiry approaches, especially for ATM options. This is the time-decay curve question.

Common payoff-diagram errors

- Forgetting to subtract the premium when drawing long-position payoff at expiry. Max loss on a long call is the premium, not zero.
- Mixing up bull call spread (debit) with bear call spread (credit). The debit/credit tells you the strategy direction.
- Computing protective-put max loss as just the put premium. Actual max loss = (S - K) + premium because the stock can fall to K before the put starts paying.
- Put-call parity holds only for European options on non-dividend stocks. American options and dividend stocks need adjustments.

Worked example: protective put

Client owns 100 shares of XYZ at $50. Buys a put with strike $45 for $2 premium. Total cost basis: $50 + $2 = $52 effective. At expiry:

- If XYZ closes at $60: stock worth $6,000, put expires worthless. Net = $6,000 - $5,200 = $800 gain.
- If XYZ closes at $50: stock unchanged at $5,000, put expires worthless. Net = $5,000 - $5,200 = -$200 loss (the premium).
- If XYZ closes at $45: stock worth $4,500, put pays $0. Net = $4,500 - $5,200 = -$700 loss. Below this is where the put activates.
- If XYZ closes at $30: stock worth $3,000, put pays $15 x 100 = $1,500. Net = $3,000 + $1,500 - $5,200 = -$700 loss (capped).
- Max loss is therefore: starting investment ($5,200) minus floor ($4,500 from strike + put payout) = $700. This matches the formula max loss = (S - K) + premium = ($50-$45) + $2 = $7 per share.

Greeks signs reference (memorize for exam day)

Long call

`Delta +, Gamma +, Vega +, Theta -, Rho +`

Calls benefit from rising stock, rising vol, rising rates. Decay against you.

Long put

`Delta -, Gamma +, Vega +, Theta -, Rho -`

Puts benefit from falling stock, rising vol, falling rates.

Short call

`Delta -, Gamma -, Vega -, Theta +`

Premium decay works for you. Vol against you.

Short put

`Delta +, Gamma -, Vega -, Theta +`

Same time-decay benefit but bullish exposure.

Read the live cheat sheet

Diagrams, worked examples, and rule citations.

https://registrantprep.ca/cheat-sheets/cire-derivatives-payoffs