PSEDYS | TECHNICAL REFERENCE MANUAL V3.0

RSI — Relative Strength Index

Technical Reference Manual v1.0

PSEDYS | Complete Edition

Gain/Loss · Wilder RMA · RS · Overbought/Oversold · Centerline 50 · Divergence · Failure Swings · Trend Zones · RSI vs Stochastic · MTF · Bot vs TradingView

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1. What is RSI? Concept and Philosophy

RSI (Relative Strength Index) was created by J. Welles Wilder Jr. and published in 1978 in New Concepts in Technical Trading Systems — the same book that introduced ADX, ATR, and PSAR. RSI measures the **speed and magnitude of price changes** — specifically, the ratio between average gains and average losses over the last N bars.

Wilder's Philosophy: The market cannot rise or fall indefinitely without a pullback. RSI quantifies how "tired" a trend is — an RSI > 70 suggests the market has moved too quickly upwards (overbought), an RSI < 30 suggests the opposite (oversold).

RSI vs other series indicators:

Feature	RSI	ADX	MACD	Stochastic
Type	Momentum oscillator	Trend strength	Trend + momentum	Position oscillator
Basis	Close-to-close changes	High, Low, Close	EMA Close	Close vs High/Low range
Scale	0–100	0–100	± relative to zero	0–100
Direction	Yes (relative to 50)	Indirect (±DI)	Yes (relative to zero)	Yes
Smoothing	**Wilder RMA** (K=1/N)	Wilder RMA	Standard EMA	SMA or EMA
Divergence	**Most used**	Not specific	Yes	Yes
Failure Swings	**Unique to RSI**	No	No	No

2. Calculation Formula — Complete

2.1 Step 1 — Daily Variations (Gain and Loss)

```
Change[i] = Close[i] − Close[i−1]

Gain[i] = max(Change[i], 0)     ← positive if price rose, otherwise 0
Loss[i] = abs(min(Change[i], 0))← positive if price fell, otherwise 0
```

Properties:
- Gain and Loss are **mutually exclusive** on any bar: if Change > 0 → Loss = 0; if Change < 0 → Gain = 0; if Change = 0 → both = 0
- There are no bars with both Gain > 0 and Loss > 0 simultaneously

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2.2 Step 2 — Seed (SMA of the First N Values)

At bar `N+1` (the first bar with calculated RSI), seeds are the simple average:

```
Avg_Gain[N] = (Gain[2] + Gain[3] + ... + Gain[N+1]) / N    ← SMA of N gains
Avg_Loss[N] = (Loss[2] + Loss[3] + ... + Loss[N+1]) / N
```

Critical note: RSI uses **N values of Gain/Loss** for the seed, starting from bar 2 (the first change). Bar 1 has no change from the previous (no bar 0 exists). Thus, the first RSI value is at bar **N+1**.

2.3 Step 3 — Wilder's RMA for Avg_Gain and Avg_Loss

From bar N+2 onwards, **Wilder's RMA** (K = 1/N):

```
Avg_Gain[i] = (Avg_Gain[i−1] × (N−1) + Gain[i]) / N
            = Avg_Gain[i−1] + (Gain[i] − Avg_Gain[i−1]) / N

Avg_Loss[i] = (Avg_Loss[i−1] × (N−1) + Loss[i]) / N
            = Avg_Loss[i−1] + (Loss[i] − Avg_Loss[i−1]) / N
```

These formulas are IDENTICAL to Wilder's RMA — the same multiplier K = 1/N used in ATR and ADX. If the bot calculates RSI with K = 2/(N+1) (standard EMA), RSI values will be significantly different from TradingView.

Verify K for N=14:

```
K_Wilder    = 1/14 = 0.071429 (7.14%)
K_EMA_std   = 2/15 = 0.133333 (13.33%)  ← INCORRECT for RSI
```

2.4 Step 4 — RS and RSI

```
RS  = Avg_Gain / Avg_Loss
RSI = 100 − (100 / (1 + RS))
```

Alternative form (equivalent):

```
RSI = 100 × Avg_Gain / (Avg_Gain + Avg_Loss)
```

RS Interpretation:

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```
RS = 1:   Avg_Gain = Avg_Loss → perfect balance → RSI = 50
RS > 1:   Greater Gain → bullish market → RSI > 50
RS < 1:   Greater Loss → bearish market → RSI < 50
RS → ∞:   Loss → 0, Large Gain → RSI → 100
RS → 0:   Gain → 0, Large Loss → RSI → 0
```

2.5 Edge Cases (RSI = 0 and RSI = 100)

RSI = 100: Occurs when `Avg_Loss = 0` — all bars in the seed were winners (no bar with Close < Close_prev). Practically possible at the first value (seed), theoretically impossible after multiple Wilder iterations (Avg_Loss decreases but does not reach exactly 0 due to exponential smoothing).

RSI = 0: Occurs when `Avg_Gain = 0` — all bars in the seed were losers.

Implementation rule:

```
if avg_loss == 0:
    rsi = 100.0   # avoid division by zero
elif avg_gain == 0:
    rsi = 0.0
else:
    rsi = 100 - 100 / (1 + avg_gain / avg_loss)
```

2.6 Complete Numeric Example — period=14, 50 bars

Data: uptrend 15 bars → retracement 13 bars → recovery 22 bars
Start: 100.00, Max: ~115.85, Final: 115.85

Manual verification bar 15 (first RSI value):

```
Gain[bars 2..15] = [1.00, 0.53, 0.44, 1.02, 0.32, 0.68, 0.76, 0.81, 0.35, 0.83, 0.70, 1.05, 0.23,
Loss[bars 2..15] = [0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0]  ← pure bullish trend, no loss

Avg_Gain seed = 9.88 / 14 = 0.7057
Avg_Loss seed = 0.00 / 14 = 0.0000

Avg_Loss = 0 → RSI = 100.00  ✓ (all bars 2-15 were winners)
```

Table bars 15–50 (selection):

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Bar	Close	Gain	Loss	Avg_Gain	Avg_Loss	RSI	Zone
15	109.88	1.16	0.00	0.7057	0.0000	**100.00**	OB
18	109.83	0.00	0.44	0.5891	0.0314	94.94	OB
22	107.16	0.00	1.07	0.4409	0.2048	68.28	BULL
26	104.93	0.00	0.91	0.3278	0.3027	51.99	BULL
27	**104.51**	0.00	0.42	0.2872	0.3239	**47.02**	**BEAR** ← RSI <50
30	103.13	0.54	0.00	0.2823	0.3661	43.53	BEAR
33	**104.66**	0.55	0.00	0.3235	0.2933	**52.44**	**BULL** ← RSI >50
36	107.81	0.84	0.00	0.4659	0.2347	66.50	BULL
38	108.95	0.19	0.00	0.4783	0.2024	**70.27**	OB
44	111.96	0.54	0.00	0.4861	0.1297	78.93	OB
50	115.85	0.94	0.00	0.5439	0.0832	86.74	OB

Key signals identified:
- Bars 15–21: **RSI overbought** (>70) — strong bullish trend in progress
- Bar 27: **RSI cross 50 bearish** → correction confirmation
- Bar 33: **RSI cross 50 bullish** → trend resumption confirmation
- Bars 38–50: **RSI overbought** again — strong recovery trend

2.7 Alternative Parameters

Variant	Period	K	Warm-up	Half-life	Feature
Standard	**14**	**0.0714**	**15**	**9.4 bars**	**PSEDYS default**
Fast	9	0.1111	10	5.9 bars	More reactive, more false signals
Slow	21	0.0476	22	14.2 bars	Rare, more reliable signals
Ultra-slow	25	0.0400	26	17.0 bars	Macro filter

---

3. Lag and Warm-up

3.1 RSI Lag

RSI uses Wilder's RMA with K=1/N, identical to ATR in ADX:

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```
Lag center of mass RMA14 = (14−1)/2 = 6.5 bars
Half-life: 9.4 bars (compared to 4.84 for EMA14)
```

RSI has **similar lag to ATR** — Wilder used the same smoothing for both, deliberate internal consistency.

3.2 Warm-up

```
First Gain/Loss value: bar 2 (requires previous Close)
Seed Avg_Gain/Loss:    bar N+1 = bar 15 (14 Gain/Loss values)
First RSI value:       bar 15
Recommended warm-up:   2×N = 28 bars
Production:            100+ bars
```

Cold start: RSI has a single simple seed (SMA of N values). Unlike MACD or ADX, there is no cascade of seeds. Convergence to TradingView is rapid — within ~20–30 bars after start.

---

4. RSI Levels — Complete Interpretation

4.1 Standard Levels

RSI Level	Zone	Meaning
> 80	Extreme Overbought	Exceptionally strong bullish trend or potential peak
> 70	**Overbought**	Average gains significantly > average losses — attention zone
60–70	Strong Bull	Solid bullish bias
50–60	**Bull**	**RSI above midline — bullish bias**
50	**Midline**	**Balance: Avg_Gain = Avg_Loss**
40–50	Bear	RSI below midline — bearish bias
30–40	Strong Bear	Solid bearish bias
< 30	**Oversold**	Average losses significantly > average gains — attention zone
< 20	Extreme Oversold	Exceptionally bearish trend or potential bottom

4.2 Level 50 — Mathematical Significance

RSI = 50 is the exact balance point: `Avg_Gain = Avg_Loss`.

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```
RSI > 50: Avg_Gain > Avg_Loss → market gains more than it loses → BULLISH
RSI < 50: Avg_Gain < Avg_Loss → market loses more than it gains → BEARISH
RSI = 50: complete balance → transition or sideways market
```

---

5. RSI 50 — Centerline

5.1 Using RSI 50 as a Trend Filter

RSI 50 is a **more robust** trend filter than the 30/70 levels for entry signals:

```
RSI > 50 (and rising): LONG bias — the market gains more than it loses
RSI < 50 (and falling): SHORT bias

Usage in bot:
→ Entry Long ONLY when RSI > 50
→ Entry Short ONLY when RSI < 50
→ Avoid entries against the centerline
```

5.2 RSI 50 Crossover as a Trend Signal

Bullish cross 50: RSI moves from < 50 to > 50
→ Avg_Gain exceeds Avg_Loss → bullish regime change
→ Quality signal similar to EMA crossover but based on price momentum

Bearish cross 50: RSI moves from > 50 to < 50
→ Avg_Loss exceeds Avg_Gain → bearish regime change

Strength of the 50 crossover:

```
RSI crosses 50 with "impulse" (previous values rapidly decreasing/increasing) → strong signal
RSI oscillates around 50 → sideways → false signals
```

5.3 Cross 50 Filter for Entry

```
LONG entry filter:
  RSI[-1] < 50 AND RSI[0] > 50 → freshly bullish → optimal entry timing
  RSI > 50 for several bars and rising → trend confirmation → valid entry

SHORT entry filter:
  RSI[-1] > 50 AND RSI[0] < 50 → freshly bearish
```

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6. Overbought (>70) and Oversold (<30) — Correct Usage

6.1 Most Common Mistake

WRONG: RSI > 70 → Short immediately; RSI < 30 → Long immediately.

CORRECT: RSI > 70 indicates that **the market is strong**, not that an immediate reversal is imminent. RSI can remain overbought for dozens or hundreds of bars in strong trends.

```
In the BTC 2021 bull run:
RSI on 1D stayed > 70 for 3+ months
→ Anyone who entered Short at RSI 70 lost significantly
```

6.2 Correct Use of 30/70 Levels

Valid Scenario for OB/OS:

```
RSI > 70 + BEAR context (price below EMA 200 4H or general bearish trend)
→ Overbought in a bearish trend = corrective rally that may exhaust
→ Short entry when RSI falls below 70 (exit from OB zone)

RSI < 30 + BULL context (price above EMA 200 4H)
→ Oversold in a bullish trend = pullback that may exhaust
→ Long entry when RSI rises above 30 (exit from OS zone)
```

Exit Signal from OB/OS (more reliable than entry):

```
Exit OB Signal: RSI falls below 70 from overbought zone
  → Avg_Loss has increased compared to Avg_Gain → bullish momentum weakens

Exit OS Signal: RSI rises above 30 from oversold zone
  → Avg_Gain has increased compared to Avg_Loss → bearish momentum weakens
```

---

7. RSI in Trending Markets — Trend Zones

Wilder himself documented that RSI behaves differently in trends vs sideways markets.

7.1 Bull Market RSI Zone

In a strong **bull market**:

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```
Bullish RSI Zone: 40–90
  → RSI rarely falls below 40 (support at 40)
  → RSI can remain > 70 for extended periods
  → RSI 40–50: buying zone on pullback (not oversold at 30)
```

7.2 Bear Market RSI Zone

In a strong **bear market**:

```
Bearish RSI Zone: 10–60
  → RSI rarely rises above 60 (resistance at 60)
  → RSI can remain < 30 for extended periods
  → RSI 50–60: selling zone on rally (not overbought at 70)
```

7.3 Identifying Trend Zone with RSI

```
# Last 50 RSI bars:
rsi_window = rsi_vals[-50:]
rsi_max = max(rsi_window)
rsi_min = min(rsi_window)

if rsi_max > 70 and rsi_min > 40:
    trend_zone = "BULL MARKET ZONE"     # no short at 70
elif rsi_max < 60 and rsi_min < 30:
    trend_zone = "BEAR MARKET ZONE"     # no long at 30
else:
    trend_zone = "NEUTRAL/SIDEWAYS"     # classic OB/OS valid
```

---

8. RSI Divergences with Price

RSI divergences are among the **most reliable reversal signals** in technical analysis — RSI captures the loss of momentum before the price does.

8.1 Classic Bearish Divergence

```
Price:  Higher High (new higher peak)
RSI:   Lower High  (RSI makes a lower peak)
→ Price rises but bullish momentum decreases → reversal risk
→ Most reliable in overbought zone (RSI > 60–70 at both peaks)
```

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Validation Condition:
- Both RSI peaks > 50 (in bullish zone)
- Second RSI peak < first by at least 3–5 points (significant difference)
- Confirmation: RSI falls below the midpoint level between the two peaks

8.2 Classic Bullish Divergence

```
Price:  Lower Low   (new lower trough)
RSI:    Higher Low  (RSI makes a higher trough)
→ Price falls but bearish momentum decreases → bullish reversal risk
→ Most reliable in oversold zone (RSI < 40–30 at both troughs)
```

8.3 Hidden Divergence (Continuation Signal)

Hidden Bullish (uptrend continuation):

```
Price: Higher Low (smaller pullback = bullish sign)
RSI:  Lower Low  (RSI makes a lower trough)
→ Bullish trend continues after pullback
```

Hidden Bearish (downtrend continuation):

```
Price: Lower High (weaker rally = bearish sign)
RSI:  Higher High (RSI makes a higher peak)
→ Bearish trend continues after rally
```

8.4 Validating RSI Divergence

```
Mandatory Conditions:
1. Peaks/troughs are SIGNIFICANT (swing highs/lows, not any bar)
2. RSI difference between the two points > 3 points
3. Minimum timeframe: 15M (on 5M → frequent false signals)
4. Confirmation with closed candle in reversal direction

Additional Filters:
5. ADX > 15 (there is an underlying trend)
6. Increased volume on the confirmation bar

Note: RSI 14 on 15M or 1H produces more reliable divergences than RSI on 5M
```

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9. Failure Swings — Wilder's Original Signal

Failure Swings are the reversal signals Wilder considered superior to simple divergence — they do not require comparison with price, relying solely on RSI behavior.

9.1 Bullish Failure Swing

```
RSI Sequence:
1. RSI falls below 30 (oversold)
2. RSI bounces back above 30
3. RSI makes a pull-back BUT does not fall below 30 again  ← bearish "failure"
4. RSI exceeds the RSI level from step 2 (prior high)

→ Signal: LONG confirmed

RSI Visual:    ... < 30 ... [A=bounce above 30] ... [B=pull-back BUT > 30] ... > A
Entry: at the bar when RSI exceeds level A
```

9.2 Bearish Failure Swing

```
RSI Sequence:
1. RSI rises above 70 (overbought)
2. RSI falls back below 70
3. RSI makes a rally BUT does not exceed 70 again  ← bullish "failure"
4. RSI falls below the RSI level from step 2 (prior low)

→ Signal: SHORT confirmed

RSI Visual:    ... > 70 ... [A=fall below 70] ... [B=rally BUT < 70] ... < A
Entry: at the bar when RSI falls below level A
```

9.3 Why Failure Swings are Powerful

Failure Swings confirm that **the market can no longer reach the previous momentum level**. No need to compare with price (avoids situations where divergence might be uncertain). It is a pure internal RSI signal.

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10. RSI vs Stochastic — Comparison

Aspect	RSI	Stochastic
What it measures	Rate of change (Close vs previous Close)	Position of Close relative to period High/Low
Basis	Close-to-close changes	(Close − Lowest Low) / (Highest High − Lowest Low)
Smoothing	Wilder RMA (K=1/N)	SMA or EMA (K=2/(N+1))
Sensitivity to spikes	Moderate	High (absolute High/Low)
False signals in trending	Fewer (Wilder smooth)	More (prolonged OB/OS)
Failure swings	Yes (Wilder concept)	No
Divergences	Excellent	Good
Standard period	14	%K=14, %D=3
Ideal for	Divergences, momentum, trend filter	Rapid entry timing, classic OB/OS

Combining RSI + Stochastic:

```
RSI > 50 (bullish trend) + Stochastic < 30 (local pullback) = optimal Long entry
RSI < 50 (bearish trend) + Stochastic > 70 (local rally) = optimal Short entry
```

---

11. RSI in Sideways Market

11.1 RSI Behavior in Sideways

In a sideways market (price oscillates within a range), RSI oscillates in the 40–60 zone:

```
RSI does not reach 70+ (no sufficiently strong bullish move)
RSI does not reach 30- (no sufficiently strong bearish move)
RSI frequently oscillates around 50
```

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11.2 Sideways Detection with RSI

```
# RSI in the central zone = possible sideways:
rsi_range = max(rsi[-20:]) - min(rsi[-20:])
rsi_centered = 40 < rsi[-1] < 60

if rsi_range < 20 and rsi_centered:
    # RSI compact in the 40-60 zone over 20 bars → sideways indicated
    sideways_suspected = True
```

11.3 RSI vs Choppiness in Sideways

Choppiness Index and RSI complement each other:
- RSI in 40–60 = sideways
- Choppiness > 61.8 = sideways confirmed
- ADX < 18 = trend absent

All three simultaneously = sideways confirmed → skip.

---

12. Multi-Timeframe Analysis (MTF)

12.1 MTF PSEDYS Hierarchy — RSI

Level	Timeframe	RSI Usage	Long Condition	Role
1 (Macro)	4H	RSI > 50	RSI > 50 and rising	Macro bullish bias
2 (Meso)	1H	RSI > 50	RSI > 50	Momentum confirmation
3 (Micro)	15M	RSI zone + divergences	RSI > 50, no bearish divergence	Entry filter
4 (Entry)	5M	RSI cross 50 or OB/OS exit	RSI > 40–50	Entry timing

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12.2 MTF RSI Score

RSI 4H	RSI 1H	RSI 15M	RSI 5M	Action
> 50 ✅	> 50 ✅	> 50, no div ✅	Cross 50 or exit OS ✅	Full Long Entry
> 50 ✅	> 50 ✅	40–50 ⚠	> 50 ✅	Entry with 75% sizing
> 50 ✅	> 50 ✅	Bearish divergence ❌	any	Skip — 15M warning
> 50 ✅	< 50 ❌	any	any	Skip — 1H momentum bearish
< 50 ❌	any	any	> 50	Skip — macro bearish

12.3 RSI + EMA + ADX — Complete Setup

```
Optimal Long setup with RSI:
1. EMA 200 4H < price (macro EMA bullish)
2. RSI 4H > 50 and rising (macro bullish momentum)
3. ADX 5M ≥ 18 (trend strength)
4. EMA stack 5M bullish
5. RSI 5M: bullish cross 50 or exit from oversold (RSI rises above 30)
6. No bearish divergence on 15M or 1H

→ Long Entry with SL below the last swing low
```

13. PSEDYS — RSI as Filter and Feature

13.1 RSI in `entry_features` TI

RSI is not directly stored in the `entry_features` of `live_positions` (from CLAUDE.md the list includes adx, choppiness, ema_stack, macd_cross etc.), but it can be calculated retroactively or added as a custom feature:

```
-- Analysis of open positions with calculated RSI context from GM:
SELECT lp.symbol, lp.direction, lp.profile_name,
       lp.entry_price, lp.stop_loss,
       (lp.entry_features->>'adx')::float AS adx,
       (lp.entry_features->>'macd_cross') AS macd_cross
FROM live_positions lp
WHERE lower(lp.state) != 'closed'
ORDER BY lp.confidence DESC;
-- RSI calculated separately from GM API at the entry bar
```

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13.2 RSI as an exit filter

RSI > 80 on existing Long positions = momentum overbought → tighten trailing SL:

```
# Exit logic with RSI:
if position_direction == 'long':
    if rsi > 80:
        tighten_trailing_sl()       # reduce trailing stop distance
    if rsi > 90:
        close_partial_position(50%) # partial exit at extreme RSI
    # On bearish RSI divergence on 15M:
    if bearish_divergence_15m:
        tighten_sl_to_breakeven()
```

14. Bot vs TradingView Validation

14.1 Main Sources of Divergence

Source	Probability	Impact
K = 2/(N+1) instead of K = 1/N	High	Major — significantly different RSI
Seed: SMA vs direct Wilder	Medium	First N+10 bars
Loss calculated as negative (without abs)	Medium	Significant (Avg_Loss becomes negative)
Avg_Loss = 0 untreated	Low	Crash (division by zero)

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14.2 Validation Checklist

```
STEP 1 — Check K:
□ Avg_Gain/Loss Wilder: K = 1/N = 1/14 ← NOT 2/(N+1)
□ Formula: Avg_Gain[i] = (Avg_Gain[i-1]*(N-1) + Gain[i]) / N

STEP 2 — Check Loss:
□ Loss[i] = abs(min(Change[i], 0))  ← always positive
□ NOT Loss[i] = min(Change[i], 0)    ← would be negative → Avg_Loss negative → RSI > 100

STEP 3 — Check seed:
□ Seed at bar N+1 (bar 15 for period=14)
□ Seed = SMA(Gain[1..N]) and SMA(Loss[1..N])
□ NOT: first values calculated with direct Wilder (without SMA seed)

STEP 4 — Check case Avg_Loss = 0:
□ if avg_loss == 0: rsi = 100.0  (do not divide by zero)

STEP 5 — Numeric test:
□ Compare RSI with TradingView on the same symbol/TF
□ Tolerance: < 0.1 RSI points (Wilder smooth has slightly variable cold start)
□ If different > 0.5 points after 50 bars: check K (cause #1)
```

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14.3 Python Validation Script

```
def rsi(closes, period=14):
    """
    IMPORTANT: use K = 1/period (Wilder), NOT K = 2/(period+1)
    """
    n = len(closes)
    gains  = [None] + [max(closes[i]-closes[i-1], 0)       for i in range(1, n)]
    losses = [None] + [abs(min(closes[i]-closes[i-1], 0))   for i in range(1, n)]

    avg_g = [None] * n
    avg_l = [None] * n
    rsi_v = [None] * n

    # Seed — SMA of the first N values (bars 1..N, indices 1..period)
    avg_g[period] = sum(gains[1:period+1]) / period
    avg_l[period] = sum(losses[1:period+1]) / period

    # First RSI
    if avg_l[period] != 0:
        rsi_v[period] = 100 - 100 / (1 + avg_g[period] / avg_l[period])
    else:
        rsi_v[period] = 100.0

    # Recursive — Wilder RMA K=1/N
    for i in range(period + 1, n):
        avg_g[i] = (avg_g[i-1] * (period-1) + gains[i])  / period
        avg_l[i] = (avg_l[i-1] * (period-1) + losses[i]) / period
        if avg_l[i] != 0:
            rsi_v[i] = round(100 - 100 / (1 + avg_g[i] / avg_l[i]), 4)
        else:
            rsi_v[i] = 100.0

    return rsi_v

# Validation: rsi_v[-1] vs TradingView → difference < 0.1 points = OK
```

15. Practical Exercises with Complete Answers

Exercise 1: RSI > 70 in Bullish Trend — Enter Short?

Situation: BTC on 4H. EMA 200 at 60,000 (price at 78,000 = +30% above). RSI 4H = 74 and has been > 70 for 12 consecutive bars. On 5M: Signal Cross MACD bullish, ADX = 28.

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Question: RSI 4H overbought for 12 bars. Enter Short?

Answer:

NO — RSI overbought in a strong bullish trend is not a Short signal.

- **Macro context:** Price at +30% above EMA 200 4H = strong bull market. RSI is in the bull market RSI zone (40–90) — staying > 70 is normal and expected.
- **12 consecutive bars > 70** on 4H = ~48 hours of persistent bullish momentum. This is NOT exhaustion — it is confirmation of a strong trend.
- **5M bullish signals:** MACD + ADX > 20 confirm the trend is active even at the micro level.
- **Correct action:** Do NOT Short. If not in Long, look for Long entry on pullback: RSI 4H temporarily drops to 55–60 (pullback to midline) + confirmed bounce = Long opportunity in trend.

Exercise 2: Bearish RSI Divergence on 1H

Situation: On 1H, price makes a new High of 110 (compared to the previous peak of 108). RSI at the new High = 68, compared to RSI at the previous peak = 75. ADX = 24. MACD Histogram slightly decreasing.

Question: Bearish divergence exists. Exit existing Long or enter Short?

Answer:

Tighten SL on existing Long; DO NOT enter Short immediately.

- **Confirmed bearish divergence:** Price HH (110 > 108), RSI LH (68 < 75) → bullish momentum decreased by 7 RSI points at a new price peak. Valid signal (difference > 5 points).
- **ADX = 24** confirms the trend has strength — it hasn't abruptly ended.
- **MACD Histogram decreasing** = additional confirmation that momentum is decelerating.
- **Correct action for existing Long:**
  1. Move SL to breakeven or last swing low
  2. Reduce sizing by 50% (secure profit)
  3. Do not add to Long
- **Short Entry:** Premature on singular divergence. Wait: RSI drops below 60 + MACD bearish cross + EMA bearish crossover on 15M → Confirmed Short.

Exercise 3: RSI Bullish Failure Swing — How to Identify?

Situation: On 15M RSI in the last 20 bars:
- Bar A (15 bars ago): RSI = 28 (below 30)
- Bar B (10 bars ago): RSI = 38 (bounce above 30)
- Bar C (5 bars ago): RSI = 33 (pull-back but remains > 30)
- Bar D (current): RSI = 41 (> RSI at bar B)

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Price has moderately declined over the entire period. ADX = 19.

Question: Identify the signal and action.

Answer:

Bullish Failure Swing confirmed at bar D — Long signal.

- **Complete sequence:**
  1. RSI below 30 (bar A) ✓
  2. Bounce above 30 (bar B, RSI=38) ✓
  3. Pull-back BUT remains > 30 (bar C, RSI=33 > 30) ✓ ← bearish "failure"
  4. RSI exceeds level B (bar D, RSI=41 > 38) ✓ ← confirmation
- **Significance:** Market failed to push RSI below 30 again (bearish failure). Exceeding level B confirms bearish momentum is exhausted.
- **ADX = 19:** Weak trend — Failure Swing signal is sufficient without confirmed ADX (it's a reversal signal, not an existing trend).
- **Correct action:**
- Enter Long at bar D (RSI > 38) with SL below the last price swing low
- TP1 at RSI = 50 (confirmation of entering bull zone)
- If RSI exceeds 50: increase sizing or hold for TP2

Exercise 4: RSI Cold Start — Why Different from TradingView?

Situation: Bot shows RSI 14 = 62.5 on BTC/USDT 5M. TradingView shows 58.3 on the same data. Bot started 2 hours ago (24 bars of 5M).

Question: Why is there a 4.2 RSI points difference?

Answer:

Cold start divergence — bot has too little history for seed convergence.

- **TradingView** calculates RSI over weeks or months of data → the seed from the initial 14 bars has long been "diluted" by hundreds of Wilder iterations. Avg_Gain and Avg_Loss reflect the real market state.
- **Bot** started with a seed from the first 14 bars (24 bars available) → the seed is calculated from a small time segment that may be unrepresentative. With only 10 recursive Wilder bars after the seed, values haven't sufficiently converged.
- **Solution:** Download 100+ bars from GM API before using RSI for signals. Ensure the difference from TradingView is < 0.3 points before going live.
- **Possible secondary cause:** Check K = 1/14 (Wilder) and not K = 2/15 (standard EMA).

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16. Cheat Sheet — Quick Summary

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Concept	Value / Rule
Gain Formula	`max(Close[i] − Close[i−1], 0)`
Loss Formula	`abs(min(Close[i] − Close[i−1], 0))`
Seed Avg_Gain/Loss	`SMA(Gain/Loss, N)` ← first N values
Recursive Wilder	`Avg_G[i] = (Avg_G[i-1]×(N-1) + Gain[i]) / N`
K Wilder	`1/N = 1/14 = 0.0714` — NOT `2/(N+1)`
RSI Formula	`100 − 100/(1 + Avg_Gain/Avg_Loss)`
RSI = 100	`Avg_Loss = 0` → set RSI = 100 (no divide/0)
Standard Period	14
Warm-up	N+1 = 15 bars
Lag	6.5 bars (Wilder RMA14)
RSI > 70	Overbought — caution in bear market, normal in bull
RSI < 30	Oversold — caution in bull market, normal in bear
RSI = 50	Equilibrium: Avg_Gain = Avg_Loss
RSI > 50	Avg_Gain > Avg_Loss → BULLISH bias
RSI < 50	Avg_Gain < Avg_Loss → BEARISH bias
Cross 50 bullish	RSI crosses from < 50 to > 50 → bullish trend signal
Cross 50 bearish	RSI crosses from > 50 to < 50 → bearish trend signal
Bull market zone	RSI 40–90 (rarely below 40)
Bear market zone	RSI 10–60 (rarely above 60)
Bearish divergence	Price HH + RSI LH → bullish exhaustion
Bullish divergence	Price LL + RSI HL → bearish exhaustion
Hidden bullish	Price HL + RSI LL → uptrend continuation
Hidden bearish	Price LH + RSI HH → downtrend continuation
Failure Swing bullish	RSI <30 → bounce >30 → pull-back >30 → > prior high
Failure Swing bearish	RSI >70 → fall <70 → rally <70 → < prior low
Exit OB signal	RSI drops below 70 from overbought
Exit OS signal	RSI rises above 30 from oversold
RSI in sideways	Oscillates 40–60, compact, without extremes

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Concept	Value / Rule
RSI vs Stochastic	RSI = velocity (close/close); Stoch = position (vs H/L)
MTF filter	RSI 4H > 50 = global Long bias
Bot vs TV tolerance	< 0.3 RSI points after 50+ bars
Cause #1 divergence	K = 2/(N+1) instead of K = 1/N
Cause #2 divergence	Negative Loss (without abs) → Negative Avg_Loss

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PSEDYS RSI Technical Manual v1.0 — May 2026
Covers: complete formula (Gain/Loss → SMA seed → Wilder RMA K=1/N → RS → RSI), seed two-step (SMA for N+1 bars, recursive Wilder after), edge cases RSI=100/0, numeric example verified bar 15 (Avg_Gain=0.7057, Avg_Loss=0.0000, RSI=100 ✓, RSI 50 cross at bars 27 and 33 ✓), lag 6.5 bars (Wilder RMA), levels 30/50/70 with correct interpretation, RSI 50 centerline as trend filter, OB/OS correct usage vs common mistake, bull/bear trend zones (40-90 vs 10-60), classic + hidden divergences with validation conditions, Failure Swings (original Wilder concept), RSI vs Stochastic comparison, RSI sideways behavior, MTF with score, PSEDYS integration, bot vs TradingView validation (K Wilder + Loss abs), complete Python script, 4 practical exercises.

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