The 364-Day Year with Leap Weeks

A worked paper built from the calculations in this conversation

This revision fixes the earlier sparse draft. It uses the math developed in the thread itself and shows the actual calculations, tables, and drift curves. The central question is this: if a calendar year is defined as 364 days, or exactly 52 weeks, how can leap weeks be used to preserve the weekly cycle while keeping long-term solar accuracy equal to the Gregorian calendar?

1. Starting assumptions

The proposed calendar has 13 months of 28 days. Each month begins on Sunday and ends on Saturday. A normal year therefore contains exactly 52 weeks, with no leftover day. Leap corrections are allowed only as whole weeks placed after week 52 and outside the monthly structure. A leap year may therefore contain one leap week, and a rare correction year may contain two leap weeks.

Item	Value	Comment
Normal calendar year	364 days	Exactly 52 weeks
Month structure	13 x 28 days	All months identical
Tropical year used for comparison	365.24219 days	Modern mean tropical year
Allowed correction	7 days at a time	Leap weeks only
Location of leap weeks	After week 52	Not part of any month

Because 364 is divisible by 7, the weekly cycle never breaks. Year after year, the same date lands on the same weekday. In theological terms, this preserves an unbroken sequence of seven-day weeks. If one begins from the creation pattern of six days of labor followed by one day of rest, the calendar never interrupts that cadence with a stray day outside the week. It only adds complete weeks, so the sequence continues without fracture.

2. Why a base 6-year rhythm is attractive

A 364-day year is shorter than the solar year by about 1.24219 days. That means the calendar falls behind the sun each year. If enough of that shortfall is allowed to build up, it approaches one week, and a 7-day leap week can pull the calendar back toward the seasons. A natural first guess is to add one leap week every 6th year.

Solar shortfall per year = 365.24219 - 364 = 1.24219 days

Shortfall over 6 years = 6 x 1.24219 = 7.45314 days

One leap week = 7.00000 days

Residual error after one 6-year correction = 7.45314 - 7 = 0.45314 days

This is close enough to feel elegant. In ordinary experience, people would simply live under a steady rhythm: five normal years, then one year with an added leap week. Most lifetimes would be dominated by that 6-year beat.

Block	Days in block	Average year length	Difference from tropical year
6 normal 364-day years + 1 leap week	6 x 364 + 7 = 2191	2191 / 6 = 365.16667	-0.07552 days/year

The minus sign matters. The base 6-year rule by itself is still too short. It does not keep up with the sun. So the 6-year cycle works as a base rhythm, but it needs extra reinforcement if the goal is Gregorian-level precision.

3. What the base rule does over 400 years

The Gregorian calendar is best understood in 400-year blocks, because its leap-day pattern fully repeats every 400 years. To make a leap-week calendar 'equal to Gregorian' in average length, the 364-day system should land on the same total day count over the same 400-year interval.

Days in 400 normal 364-day years = 400 x 364 = 145,600

Days in 400 Gregorian years = 400 x 365 + 97 = 146,097

Needed correction for the 364-day calendar = 146,097 - 145,600 = 497 days

497 days / 7 = 71 leap weeks

That is the key equivalence. A 364-day leap-week system matches the Gregorian calendar exactly over 400 years if it inserts 71 leap weeks in each 400-year cycle. The day totals are then identical.

System	Base days in 400 years	Intercalation	Total days in 400 years
Gregorian	400 x 365 = 146,000	97 leap days	146,097
364-day leap-week calendar	400 x 364 = 145,600	71 leap weeks = 497 days	146,097

So the right target is not vague at all. It is exact: 71 leap weeks every 400 years. If that target is met, the average year length is the same as the Gregorian average year length.

Average year length = 146,097 / 400 = 365.2425 days

4. Why five extra leap weeks are needed

Now return to the base rule. If a leap week is inserted every 6th year, then in a 400-year span the ordinary leap years are year 6, 12, 18, ..., 396. That is 66 leap years, because floor(400 / 6) = 66.

Base leap weeks from the every-6th-year rhythm = 66

Target leap weeks for Gregorian equivalence = 71

Extra leap weeks still needed = 71 - 66 = 5

That means five of the ordinary leap years in each 400-year cycle must receive a second leap week. Those are the double-leap years. This is not an arbitrary embellishment. It is the exact amount required to lift the base 6-year scheme up to the Gregorian average.

One clean distribution is to place the second leap week in years 78, 156, 234, 312, and 390 of the 400-year cycle. Each of those years is already divisible by 6, so each is already a leap year under the base rule. The second week simply turns those five years into double-leap years.

Rule inside each 400-year cycle	Effect
If year number is divisible by 6	Add 1 leap week after week 52
If year number is also 78, 156, 234, 312, or 390	Add a second leap week
All other years	No leap week

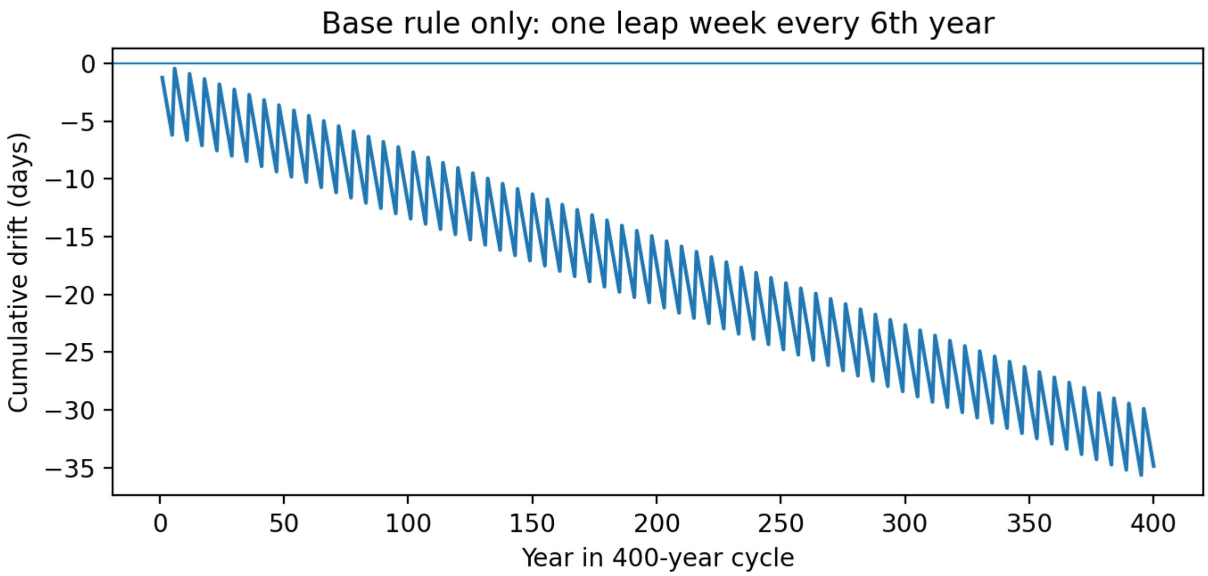
This yields the full 400-year count:

Component	Count	Days added
Ordinary leap years	66	66 x 7 = 462
Extra weeks in five double-leap years	5	5 x 7 = 35
Total leap weeks	71	497

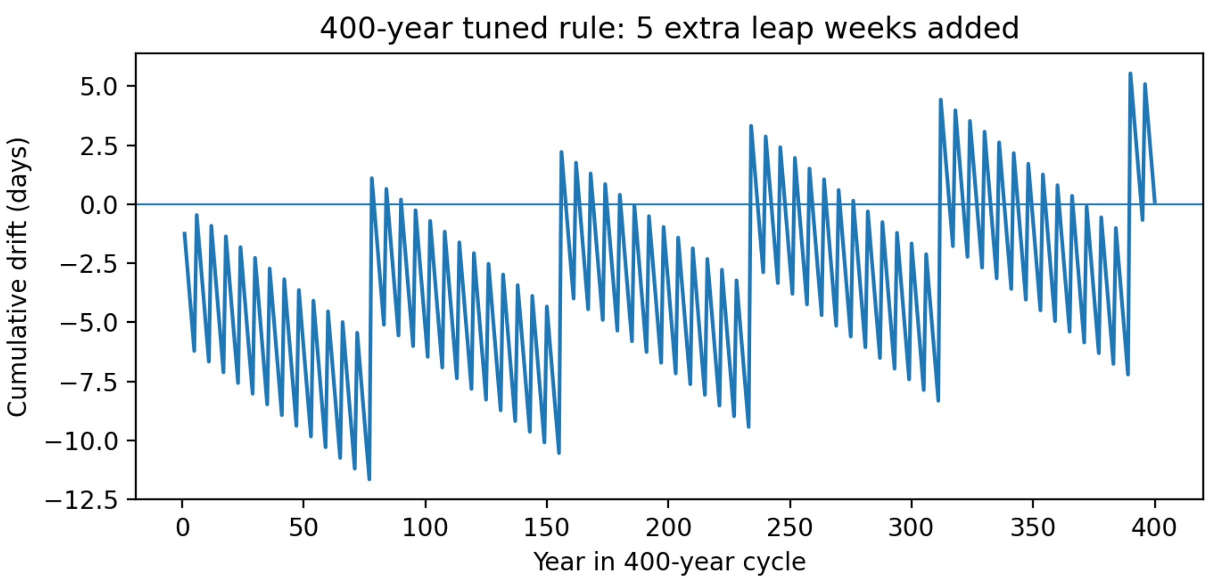
And because 462 + 35 = 497 days, the leap-week calendar and the Gregorian calendar finish the 400-year cycle with the same total number of days.

5. Drift behavior: base rule vs tuned 400-year rule

The charts below plot cumulative drift against the mean tropical year. Negative drift means the calendar is running behind the sun. The first chart uses the base 6-year rule only. The second chart adds the five extra leap weeks needed for Gregorian equivalence.



Under the base rule alone, the calendar repeatedly drops below solar time and never fully recovers. It is orderly, but too short.



Once five extra leap weeks are added inside the 400-year cycle, the long-run average becomes the Gregorian average. The drift still oscillates, because corrections come in week-sized chunks, but the 400-year total now lands in the right place.

6. Worked comparison with Julian and Gregorian calendars

The Julian calendar uses a leap day every fourth year, giving an average year of 365.25 days. The Gregorian calendar refines that by omitting three century leap days every 400 years except the 400th year, giving 365.2425 days. The 364-day leap-week calendar can be tuned to the same 365.2425-day average, but by weeks rather than days.

Calendar	How correction works	Average year length	Approximate drift vs tropical year
Julian	1 leap day every 4 years	365.25000	+0.00781 days/year
Gregorian	97 leap days every 400 years	365.24250	+0.00031 days/year
364-day with leap weeks	71 leap weeks every 400 years	365.24250	+0.00031 days/year

So in average length, the tuned 364-day scheme is not merely 'close' to Gregorian. It is equal to Gregorian. Both average 365.2425 days. The difference lies in structure. Gregorian keeps uneven months and interrupts date-to-weekday alignment. The leap-week calendar preserves a perfect 52-week grid and makes its corrections in larger, rarer blocks.

400-year total	Julian	Gregorian	364-day leap-week calendar
Base common-year framework	400 x 365 = 146,000	400 x 365 = 146,000	400 x 364 = 145,600
Intercalation added	100 leap days	97 leap days	71 leap weeks = 497 days
400-year total	146,100	146,097	146,097

7. The seven-day cycle and the creation pattern

The strongest theological argument for this calendar is not that it abolishes all correction. It does not. The strongest argument is that all correction takes place by complete weeks. If the seven-day cycle is understood as a divine pattern established at creation, then a leap-day system is awkward because it inserts a single extra day into the annual count and therefore shifts the relation between dates and weekdays. A leap-week system does not do that. It only extends the sequence by another complete unit of seven days.

That means the sequence 'first day, second day, third day ... seventh day' is never broken by a non-week day. The Sabbath rhythm is perpetuated through history without a detached day floating outside the weekly order. In this design, God’s creation week is not merely remembered symbolically. It becomes the structural backbone of the calendar.

8. Example of how history would record the extra weeks

Because the leap weeks stand outside the thirteen months, they can be recorded plainly in historical chronology. A normal year ends at the close of week 52. If the year is a leap year, the record would continue with 'Leap Week: Year XXXX'. If it is a double-leap year, it would continue with a second such week before the next year begins. The monthly calendar remains pure, and the intercalation remains visible rather than hidden in a single altered month.

Year type	Weeks in year	Historical notation
Normal year	52	Ends after week 52
Leap year	53	Leap Week: 2034

Year type	Weeks in year	Historical notation
Double-leap year	54	Leap Week: 2340 and Second Leap Week: 2340

9. Six thousand years under the repeating 400-year cycle

A 6000-year interval contains exactly 15 complete 400-year cycles. So if one cycle contains 71 leap weeks, then 6000 years contain:

Leap weeks in 6000 years = 15 x 71 = 1065

Days added by leap weeks = 1065 x 7 = 7455

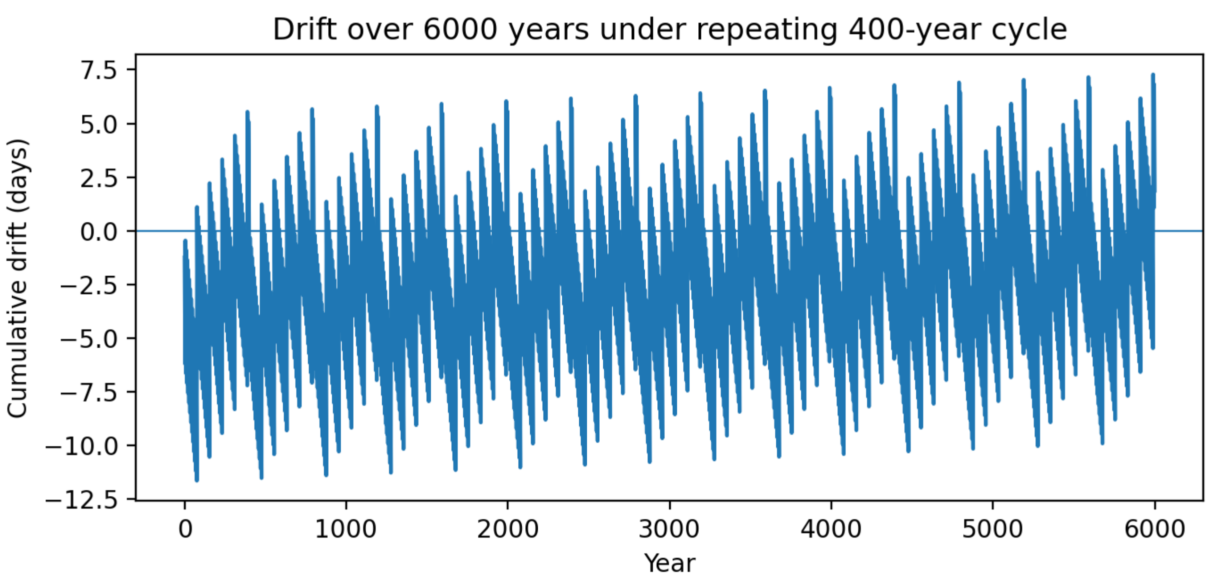
Total calendar days in 6000 years = 6000 x 364 + 7455 = 2,191,455

Average year length = 2,191,455 / 6000 = 365.2425 days

Against a mean tropical year of 365.24219 days, the repeating 400-year cycle runs slightly fast, exactly as the Gregorian calendar does, because both share the same 365.2425-day average.

Annual excess over tropical year = 365.2425 - 365.24219 = 0.00031 days

Excess over 6000 years = 6000 x 0.00031 = 1.86 days



After six millennia, the repeated 400-year cycle is ahead of the tropical year by only about 1.86 days. That is tiny. It means the long-term precision of the leap-week system is the same as the long-term precision of the Gregorian calendar, because the two systems share the same 400-year average.

10. A compact summary of the rule

Question	Answer
What is the base rhythm?	Add 1 leap week every 6th year.
Why is that not enough?	Because 66 leap weeks appear in 400 years, but 71 are needed.
How is it fixed?	Add a second leap week in five leap years per 400-year cycle.
What total does that produce?	71 leap weeks in 400 years.
Why 71?	Because 71 x 7 = 497 extra days, exactly the amount needed to reach 146,097 days in 400 y
How does that compare with Gregorian?	It is equal in average year length: 365.2425 days.

Question	Answer
What theological advantage does it claim?	It preserves an uninterrupted seven-day sequence by correcting only with whole weeks.

11. Conclusion

The every-6th-year leap week works well as a human-scale rhythm, but on its own it undershoots the sun. The remedy is exact and simple: five extra leap weeks per 400 years. Once those are added, the 364-day calendar accumulates the same number of days as the Gregorian calendar over the same 400-year span. So the proposal does not trade precision for symmetry. Properly tuned, it achieves both.

Its practical appeal is the frozen weekly grid. Its theological appeal is the unbroken seven-day cycle. Its mathematical appeal is that the correction can be stated clearly: 71 leap weeks every 400 years, built on an ordinary 6-year rhythm with five double-leap years added inside the cycle.

That is why the extra leap weeks matter. They are the exact bridge between a perfectly weekly 364-day year and Gregorian-level solar accuracy.