Schema Y

by Charlie & Fable

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So teach us to number our days, that we may apply our hearts unto wisdom.

—Psalm 90:12

The object is a single leaf of squared paper, folded twice, carrying eighty-four figures in twelve rows and seven columns and not one word of any language. It was found pressed into an odd volume of Milne's *Treatise on Annuities*, at the pages that carry the Carlisle table, in a lot bought by weight from a dealer in Gothenburg; the lot also held a broken aneroid barometer and the second volume of a Danish concordance, and the dealer, asked about provenance,

said what dealers say, that the books came from a house. The ink is iron-gall gone brown; the hand is small, upright, and quick; and the sheet shows no erasure and no correction of any kind. And since—the reader may verify it at leisure—the computed figures on it contain not a single fault, the clean face implies a foul copy: somewhere there was a pencil sheet on which six columns of subtraction were first fought out, and this leaf is the fair transcription, written once, in ink, by a hand that already knew it had won.

On the recto, the numbers. On the verso, nothing. The name is not on the object either: Schema Y is what the sheet was already called when it reached us—by the dealer, or by the dealer's predecessor, or by the private habit of whoever pressed it into the *Treatise*—and we keep it, because whoever coined it, on whatever evening, was drawing on three lineages at once, and the commentary will have use for all three.

The first claim belongs to Samos. Pythagoras, the grammarians insist, was the first to bend the letter Y into a picture of human life: a single stem and two branches, the common road of childhood climbing to the fork where the ways part. For a thousand years the schoolmasters called it the Pythagorean letter and hung on its shape the whole allegory of youth at the cross-

roads; on that ancestry, Schema Y is not a mysterious title but a redundant one, since the Y is already the oldest schema of a life in the alphabet, and to write Schema Y is to say diagram of a life twice, in two ages of the world. The second claim belongs to the counting rooms. In the notation every table of differences inherited, the tabulated column is y, and its successive differences are reckoned against that letter, eastward as far as patience runs; the engine of differences itself was read, column for column, in the same terms. A difference table is, by its own custom, a commentary on y; Schema Y is what such a sheet would be called by anyone who had read the headings of the trade and nothing else. And the third claim is an absence. The doctrine of Paris, which we will have occasion to consult more than once, lettered its diagrams like theorems—an L, an R, an I—and stopped; the later letters of that alphabet were left undrawn; there is no Schema Y in the canon, only the shelf where one would stand, and somebody has filed this sheet, with a quiet and possibly unconscious humor, in the gap. Three lineages that never met—the mystery school, the counting room, the seminar—and one letter in which they consent to meet. When three strangers agree on a name, the name is evidence.

We transcribe the object entire.

0	1.5	1.5	1.5	1.5	1.5	1.5
1.5	4.5	3	1.5	0	−1.5	−3
6	6	1.5	−1.5	−3	−3	−1.5
12	3	−3	−4.5	−3	0	3
15	3	0	3	7.5	10.5	10.5
18	9	6	6	3	−4.5	−15
27	9	0	−6	−12	−15	−10.5
36	9	0	0	6	18	33
45	15	6	6	6	0	−18
60	21	6	0	−6	−12	−12
81	18	−3	−9	−9	−3	9
99	21	3	6	15	24	27

Some inventory before any hypothesis. The first column climbs from nought to ninety-nine in eleven unequal steps and never falls. The remaining six columns wander, above the line and below it. Every column begins with the same figure, one and a half. And every one of the eighty-four entries, wherever it stands and whatever it is doing, is a multiple of one and a half: the sheet is written in a currency, and the coin is three halves. A document in a single denomination is a document with a unit, and a unit is a promise of law.

Lastly, the sheet is generous in a way that found texts almost never are. The usual found text is a codex unicus, a sole witness against which nothing can be checked, so that the critic's hands are tied and every reading is a

wager. This witness is the rare opposite: six of its seven columns will presently claim to be computed from their neighbors, so that nearly every figure on the sheet can be tried against the sheet itself. It is not a codex without a second copy; it is a codex that carries its second copy inside itself, interleaved with the first. What such a document invites is not belief but audit; the audit takes a pencil and an evening; and the sheet, as we have said, passes it whole.

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What ascends from nought to ninety-nine in eleven unequal strides, all of them multiples of three halves? We tried the guesses one tries. A temperament of the musical scale, the sheet being close in spirit to a monochord; but no tuning known to us wants these numbers. A schedule of payments; but no debt amortizes in strides of nine, nine, nine. A liturgical ladder, a table of weights, a surveyor's chain. Every guess died of the same wound: it explained four figures and was murdered by the fifth. There is exactly one reading under which all twelve figures stand up at once, and it is the one the sheet's borrowed letter had been advertising all along. The first column is a life. The figures are ages, in years; the sheet is a biography with the events removed;

and the eleven strides are the intervals at which, in the compiler's judgment, a human being changes state.

The proof is that the lawbooks testify. Set the column beside the thresholds at which the codes of Europe have actually cut a life, and the two dockets interleave. Twelve is the canonists' age, the oldest marriageable age of the church courts and the age of the first confirmations. Fifteen is where the statutes of the north draw more than one of their lines. Eighteen is the modern majority, the most legislated number alive. And just off the column stands twenty-one, at which the common law made adults of its wards for six centuries until, within living memory, parliament after parliament moved the age of majority down to eighteen—a correction of exactly one step of three, the law repairing itself along the grid without once naming the grid it moved on. The legislatures are numerologists of long standing; they have merely delegated the doctrine to precedent.

Now observe what the column refuses. Ten, twenty, thirty, forty, fifty: nowhere. Of the round numbers of the shopkeeper—the ages at which the birthday trade sells its black balloons—the sheet seats exactly one, and the manner of the exception proves the rule. The old woodcuts of the stair of life, the Lebenstreppe that hung in kitchens from Lübeck to Bergen, march a man up by

decades to fifty and down by decades to a hundred; of that staircase of ten steps the sheet keeps a single stair, the sixtieth; and sixty is the decimal stair's least decimal tenant. It is Babylon's number before it is anyone's, the base of the sexagesimal reckoning, the smallest number that all of one, two, three, four, five, and six divide. The sheet declines the round numbers of base ten and accepts the one number that base ten was always forced to share.

There is a second rival grid, older than the decimal one, and the sheet's treatment of it is harsher. Solon counted the life in ten hebdomads, seven years to the step; the melancholy speech in the forest counts seven ages; and the physicians of the climacteric doctrine taught that every seventh and every ninth year was a year of danger, the two series crossing at sixty-three, the grand climacteric, the year the doctrine dressed in black. The sheet will have none of the sevens. No age upon it divides by seven. Forty-nine is absent; sixty-three is absent; threescore and ten, the psalmist's own allotment, is absent. Of the doctrine's two crowning years, sixty-three and eighty-one, the sheet seats only the second, which is nine times nine: it has kept the climacteric that owes everything to nine and nothing to seven. The sheet is a partisan. In the old quarrel of the sevens and the

nines it has chosen the nines, and not idly, for nine is three squared, and three, as we will keep discovering, is the dynasty here.

About that dynasty, one oddity of protocol. The powers of three are the natural aristocracy of a grid ruled by three, and the sheet's policy toward them is strange: three itself is refused a seat, nine is refused a seat, and twenty-seven and eighty-one—the cube and the fourth power—are seated with honors. The dynasty admits its founder only from the third generation. Where three itself ought to sit, the sheet has instead its smallest and strangest figure: one and a half, three cut in two, the unit of the whole currency. Eighteen months. The reader may know that the doctrine of Paris dates to precisely the eighteenth month the scene before the mirror in which an infant first recognizes itself, and adds, in the same breath, that the recognition is a misrecognition. We set the coincidence down here and will collect it later, with interest, in the one place on the sheet where it pays.

The remaining seats can be toured briskly. Six is the schoolhouse door, the age at which the institutions first take delivery of a person. Twenty-seven is the year the singers die. Thirty-six is six squared. Forty-five is the meridian of a ninety-year day. Ninety-nine is

nine elevens, and stops one short of the odometer, as if to say that the third digit is somebody else's business. And one figure more, which is refused and admitted at once: the twelve ages average to thirty-three years, four months, and a half. Thirty-three, an age with a famous tenant, is denied a seat among the ages—and appears on the sheet twice regardless: once concealed in the mean, and once in the open, in the last column, where the sixth difference at the row of six squared comes out at exactly thirty-three. A court that will not admit a witness may still hear him through the wall.

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So much for the first column. The other six are what make the sheet an instrument rather than a list, and to read them the reader needs one tool, which we supply here with apologies to those who carry it already. Write any sequence in a column. In a second column, write the step from each entry to the next: the differences. In a third, the differences of the differences; and so on eastward. If the first column is a position, the second is a velocity, the third an acceleration, the fourth what the engineers frankly call jerk, and past that the English names give out, though the numbers do not. This is the calculus of finite differences. It is

what Newton did to tables, what Briggs did to build the logarithms, and what the great computing rooms did to everything, because differencing is also how a table is policed: the rooms checked their arithmetic by differencing it, a single false digit being unable to hide in a difference table—it blooms downstream into a fan of binomial coefficients, unmistakable as a fingerprint on glass. This sheet, tried by its own method, comes up clean, save a single figure at the very bottom that is neither correct nor incorrect, and that we will come to.

The physician, it happens, owns a phrase for truth reached by subtraction: *differential diagnosis*—the disease arrived at by striking out the diseases it is not, candidate after candidate, until the remainder, however improbable, is the patient's. So far as we know the phrase has never been lent to the arithmetic that shares its method; we lend it here, because the fit is exact and because the loan carries the register with it. What this sheet performs upon a life—six rounds of elimination, each column the residue of the last—the clinic would recognize at a glance; diagnosis itself, taken apart, is dia-gnosis, a knowing reached by going through. And a diagnosis wants a patient. The sheet, which contains no word, is about somebody who is sick.

The method had one great machine. The engine of differences that Babbage began in brass in the eighteen-twenties was designed to do exactly and only this—to hold a few columns of differences and grind a table out of them—and among the first tables it was intended to grind were tables of lives, for the annuity offices, whose whole trade was the pricing of mortality. The inaugural machine of the mechanical age was commissioned, in part, to run differences on human lifespans. The sheet before us is therefore not without ancestry. It is the worksheet of a difference engine whose operator owned no brass: a difference engine run on a population of one.

Now the hope of the method, which the reader must feel in order to feel the sheet disappoint it. If a sequence is secretly a polynomial, the differencing kills it by degrees: a straight line dies in the second column, where its differences go constant; a quadratic dies in the third; a quintic would go constant in the sixth column and flat in the seventh, and the table would close, and the closing would be the proof that the sequence had a formula. The whole art is a hunt for the column in which the numbers finally hold still. De Moivre, pricing annuities a century before the engine, proposed for the multitude exactly this mercy: that the survivors of a cohort decrease by equal steps, so that the difference

table of a nation closes in its second column. Whatever a population is, it is simple. The sheet is the counterproof. It is six columns deep and nothing has gone still; the sixth difference is the loudest column on the page; the life refuses to be a polynomial of any degree the paper can hold. Either the compiler ran out of sheet, or the sequence is of infinite degree, and we do not regard those as different explanations.

The sheet's own protocol, recoverable from the figures, is this. The second column is the forward stride: against each age stands the interval from it to the next, the velocity out of that year. Every later column looks the other way: each cell is its western neighbor less the cell above that neighbor, the change measured backward, out of what has already happened. Speed, on this sheet, is reckoned prospectively, and change of speed retrospectively; the future belongs to position alone, and everything deeper is bookkeeping about the past. We do not know whether the asymmetry was doctrine or accident, but it has two consequences, one at the top of the sheet and one at the bottom, and both will matter. At the top: every column opens with one and a half. In the second column that figure is honest arithmetic, the first stride, nought to eighteen months. In every column east of it, the same figure can only be a seed—an

axiom set down so that the subtraction has something to subtract from. And since the first interval of the life happens to equal the unit of the currency, the topmost cell of the second column is undecidable between the two readings: it is the one cell on the sheet that is a theorem and an axiom at once, and no examination of the ink will ever say which. At the bottom: a forward-looking column needs a future to look at, and the last age has none. We defer that cell, because it is not a cell. It is a door.

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The second column, read aloud, goes: one and a half; four and a half; six; three; three; nine; nine; nine; fifteen; twenty-one; eighteen; and then, at the bottom, twenty-one again. This is the tempo of a life as the compiler heard it, and it rewards the ear.

First, the gear changes. Divide each stride by the stride before it and almost every ratio is untidy—four thirds, five thirds, seven fifths—the drift of a thing that is not a machine. Exactly three ratios are clean. Out of the mirror, the stride triples: one and a half becomes four and a half. Out of majority, the stride triples again: three becomes nine. And out of twelve, once only, the stride is cut exactly in half. Time, on this sheet, changes

gear cleanly three times in a life—at eighteen months, at twelve, and at eighteen—and drifts everywhere else. The logarithm, which is the honest judge of ratios, adds a remark: a tripling is a tripling whatever it multiplies, so that in the logarithm's ledger the acceleration out of the mirror and the acceleration out of majority are entries of identical size. The self's first recognition and the law's first recognition are, to that judge, the same event, heard twice, sixteen and a half years apart.

Second, the plateau. From twenty-seven to forty-five the stride is nine, nine, nine: three intervals at one unchanging pace, the only figure on the sheet to hold office three terms running. Eighteen years in one gear. The column does not say whether the plateau is a cruise or a captivity; a difference table records no mood; but it is a fact of the sheet that between twenty-seven and forty-five the life learns nothing new about speed, and it will shortly be a fact of the trace that the sheet's deepest self-accounting closes its books in the middle of this very flat, as though nothing after it were going to need writing down.

Third, the totals. Run a thumb down the second column keeping a running sum: one and a half; six; twelve; fifteen; eighteen—the ages themselves, returning one by one. The reader will protest that this is no discov-

ery but the definition of a difference, and the reader is right; we note it anyway, because a table whose margins recite its own first column is a table that testifies against itself at every line, and that property is about to be used in earnest. But follow the thumb to the bottom. The running sum arrives at ninety-nine, the terminus, with one cell still to go; and the cell holds twenty-one; and the sum closes at one hundred and twenty. Here is the door we deferred. The last velocity on the sheet is a stride out of ninety-nine toward an age the column does not contain. Read coldly, it is a blunder: a forward difference computed where no forward exists. Read as the sheet reads, it is the twelfth stride of a twelve-row life, the one stride the compiler wrote knowing it could never be checked: a prophecy, in the technical sense of a figure that no future column can convict. And its assertion is exact. After the last age there is one stride more, of twenty-one years, and it ends at a hundred and twenty.

> *And the* Lord *said, My spirit shall not always strive with man, for that he also is flesh: yet his days shall be an hundred and twenty years.*

The number is not the compiler's. It is the oldest ceiling in the book: pronounced in the sixth chapter of Genesis,

honored in Moses, who died at exactly that age with his eye undimmed and his force unabated, and current to this day in the blessing that wishes a guest a hundred and twenty years, more not being polite to ask. The bottom line of the ledger is a toast. And we owe the reader one honesty about it: the column's total reaching one hundred and twenty, and the phantom stride pointing at one hundred and twenty, are not two witnesses but one—the sum lands there because the phantom is inside it. The prophecy has a single signature. The compiler merely wrote it in two places, the way one signs both the letter and the envelope.

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The totals of the other columns repay the same thumb. Summed top to bottom, the seven columns of the sheet come to: four hundred and a half; one hundred and twenty; twenty-one; three; six; fifteen; twenty-four. And the bottom row of the sheet reads: ninety-nine; twenty-one; three; six; fifteen; twenty-four; twenty-seven. Set the two lines side by side and the theorem declares itself: the total of every column is the last cell of the column to its west. The sum of all the accelerations a life will ever undergo is its final velocity; the sum of the jerks is the final acceleration; and so on eastward, each

column a ledger that closes into its neighbor's bottom line. The proof is a telescope: in a column built by subtraction, everything cancels but the ends; and because the seed at the head of each column equals the seed of the column before, the ends settle into the neighbor's last cell exactly. The sheet keeps its accounts in its own bottom margin. Only the second column is exempt, and its exemption is the prophecy: its total overshoots the terminus by precisely the phantom stride, closing the books not at ninety-nine but at the hundred and twenty.

Three marginalia, and we move on. The totals, themselves differenced—for why should the totals be spared?—fall from twenty-one to three and then climb by three, nine, and nine: the little staircase at the bottom of the accounts hums the plateau's motif. Twenty-one, unseated from the ages when the majority moved down to eighteen, turns out to be everywhere in service: it is the longest stride on the sheet, it is the phantom, and it is the entire sum of the accelerations—three sevens; the sheet, which will not seat a seven, has no scruple about employing them. And the very last figure on the sheet, the sixth difference at the terminus, is twenty-seven: at its greatest depth and its final cell, the sheet closes on one of its own ages, pronouncing, as its last word, the year the singers die.

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A life cut at eleven places is a book of eleven chapters, and the lengths of the chapters are a shape one can weigh. The longest chapter, sixty to eighty-one, runs twenty-one years; the shortest, the first, eighteen months; the ratio is fourteen to one, which an acoustician would call twenty-three decibels—the loudest chapter of the life stands to the quietest as unraised conversation to a whisper. Under four bits of range. A life, by this instrument, is a quiet recording; nothing in it is more than fourteen times anything else.

Weigh the chapters as probabilities—each chapter's share of the ninety-nine years—and the standard measures agree on one report: the compiler wasted nothing. The entropy of the partition is three bits and an eighth, of a possible three and a half if all eleven chapters were equal: a shade over ninety per cent of the theoretical maximum, the divergence from perfect equality a third of a bit. Eleven cuts could scarcely be placed more informatively than these eleven are. And a homelier measure, older than the bit: draw two instants at random from the ninety-nine years, and ask whether they fall in the same chapter. Thirteen times in fifteen, they do not. The chapter likeliest to hold both is the long

crossing from sixty to eighty-one, which swallows one pair in twenty-two: the most self-resembling years of the life, two decades in which two random moments are most apt to be the same kind of moment. The chapter least able to resemble itself is the first: of all the pairs of instants a life contains, one in four thousand three hundred and fifty-six falls entirely inside the opening eighteen months. As information, that opening is the rarest event on the sheet—six bits of surprise and a little more—and as experience it is the one chapter of which the reader retains nothing. The densest signal on the sheet is addressed to no memory at all.

There is a doctrine for that, and the sheet has clearly heard of it. Janet proposed, and the psychology of time has never quite put down, that the felt length of a year is inverse to one's age—that the years shorten as the account grows, and in that proportion. Under such a law, ages of equal felt spacing stand in equal ratios: the memorable years of a life should climb a geometric ladder. Build the ladder honestly, on the sheet's own two endposts—eighteen months at the bottom, ninety-nine at the top, ten equal ratios between, each rung half again its predecessor—and set the sheet's ages against it. The sheet rides above the ladder at every interior rung. It crests at twelve, where the counted age runs almost

three and a half times ahead of the felt one, and from twelve it descends without a single reversal, rung after rung, until at ninety-nine—and only there, and there because we nailed both ends—count and feeling agree. The shape between the ends is the content: the childhood of this sheet is overloaded even by the standard of childhood's famous overload; the calendar of significance sprints ahead of the calendar of sensation for a dozen years and spends the remaining eighty-seven being caught. Gompertz found that the force of mortality compounds geometrically; Janet, that the feeling of time thins geometrically; between those two exponentials the sheet walks the whole way above its own logarithm and never once below it. No age on this sheet arrives later than it is felt. And at the end the two calendars close. On the last rung, for the first time, a year is a year.

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We come to the heavy machinery, and we ask the indulgence of the reader who mistrusts it: nothing below requires more than the sheet, though some of it requires more than an evening. Read the twelve rows and seven columns as a single rectangular operator—an array that

eats seven numbers and returns twelve—and submit it to the standard interrogations.

The first interrogation resolves any operator into independent modes, each with a weight, the weights declining. The sheet's weights come out near one hundred and sixty-four; sixty-two; thirty-one; ten; four; one; and a fifth. The leading mode is no mystery: it is the ages themselves, the plain fact of getting older, and it carries some eighty-four parts in a hundred of everything the operator contains. We record the figure for the sake of its complement. One part in six of this sheet, near enough, is not getting older. One part in six is the lurch, the plateau, the gear changes, the prophecy—structure that mere accumulation cannot explain—and the whole of this commentary has been about the sixth part. The tail of the weights carries its own news: the first weight stands to the last as roughly eight hundred to one, which is the operator's way of saying that its deepest structure is fragile—nudge one age by a single year and the shallow columns barely stir while the sixth column swings by the length of a childhood. The sixth difference of a life is real, and it is a rumor: both facts are now on the record. One curiosity of the same interrogation, entered without comment: square off the first seven rows, birth through twenty-seven, into an opera-

tor of their own, and its spectrum contains a conjugate pair. The first half of the life does not merely stretch and shrink. It rotates.

The second interrogation is older and stranger: the trace, the sum of the main diagonal, the operator's account of itself. The diagonal of this sheet falls southeast from the natal corner through seven cells—nought; four and a half; one and a half; minus four and a half; seven and a half; minus four and a half; minus ten and a half—and it is worth knowing what those cells are. A pencil and patience will verify that the kth cell of the diagonal equals the kth difference of the ages taken at the second row: the diagonal is the whole jet of the life—its velocity, its acceleration, its jerk, and so on to the sixth order—evaluated at eighteen months. The operator's self-account is a report from the mirror. Sum the diagonal, and the trace comes to minus six.

Expand that sum back into the ages themselves and the weights fall out one by one: the ages enter the trace with the coefficients one; nought; minus three; nine; minus thirteen; eleven; minus five; one; and thereafter nothing. Three findings sit in that string, in ascending order of strangeness. The first: the weights sum to one, so the trace is not a mere number but a lawful weighting of ages—dimensionally, an age itself. The operator,

asked when it is, answers: minus six. Six years before birth; the reflection, across the natal zero, of the very age at which the institutions first take delivery of a person. The sheet's deepest self-measurement dwells at the mirror image of the schoolhouse door, on the far side of being born. The second finding: the heaviest weights fall on fifteen, thirteen parts against, and on eighteen, eleven parts for—the trace is substantially a quarrel between fifteen and eighteen—and past thirty-six the weights are nothing at all. Every age beyond thirty-six is invisible to the trace. The operator closes its self-account in the middle of the plateau of nines, as though the flat had persuaded it that nothing further would need entering; old age writes nothing into the trace; the deepest summary this sheet can give of itself is a summary of its first thirty-six years.

The third finding is the one we promised to collect. The coefficient of eighteen months—of the mirror, the seed, the unit of the currency, the figure that funds every column on the sheet—is exactly nought. Not small: nought. And the reason is checkable in one line. Across the six computed columns, the seed enters the diagonal alternately subtracted and added—minus, plus, minus, plus, minus, plus—and six being even, the account cancels to nothing. Had the compiler ruled five columns,

or seven, the mirror would weigh in the trace. At six columns deep it cannot. The sheet is blind to its own origin because of how deep it is, and the depth at which the blindness sets in is six: the sheet's own figure for the age at which one first counts as anybody. The doctrine of Paris, consulted, would decline to be surprised; it holds that the first recognition is a misrecognition, and here is a calculus in which the founding cell underwrites every column and appears in no account. Misrecognition, on this sheet, is not a mood. It is bookkeeping.

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One symmetry more, checkable in a breath. Multiply the ages by three. Five of the twelve, so multiplied, land on the sheet again: nought upon nought; six upon eighteen; twelve upon thirty-six; fifteen upon forty-five; twenty-seven upon eighty-one. The schoolhouse door onto the majority. The canonists' twelve onto six squared. The fifteen of the northern codes onto the meridian. The year the singers die onto the last climacteric. Five ages of the first half of life, tripled, are five ages of the second: the second life is the first life at treble the gauge, and the sheet contains a working scale model of itself, one to three. And the three ages the map orphans are precisely the ones no model could carry—

eighteen months, sixty, ninety-nine: the seed, the finish line, and the terminus. Beginnings and endings do not scale. Only the middle rhymes. The squares tell the same story from their side: the sheet squares its six into thirty-six and its nine into eighty-one, and its twelve it cannot square, for one hundred and forty-four lies beyond not only the terminus but the prophecy.

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