The rice and the chessboard

An interactive explainer about exponential growth, based on the story of the rice and the chessboard. A text version of the explainer, for anyone who cannot use it.

About this document

The explainer is an interactive page with no sound. You move along a chessboard one square at a time and watch the rice double on each square, with a chart, everyday examples and two sliders to experiment with.

This version gives all the explainer's text word for word, describes what it shows, and gives its figures in tables, so you can follow it without the controls. Where the explainer asks you to predict or try something, this version asks you to predict first, then gives the answer. In each section, "On screen" gives the exact words shown, and "What you see" describes the pictures.

The page has a pale green background and headings in an elegant serif typeface. The chessboard has dark and light green squares inside a darker green frame, with rice drawn as small white grains. From square 33 the squares are shaded gold, and red marks the current square.

If you find any problems with this document or the explainer, please contact Steven Williams at s.williams10@lse.ac.uk.

Contents

- The idea: exponential growth, page 1
- Before you start: a prediction, page 2
- The board, page 2
- Grains on each square, page 4
- Why it matters, page 5
- Change the assumptions, page 6
- About this explainer, page 7
- Key frames, page 7

The idea: exponential growth

On screen

The page heading reads "The rice and the chessboard". Beneath it:

> A demo of what educators can make with Claude. The rice and chessboard story is an example topic, and the content is quick and unchecked.

A box headed "The idea: exponential growth" reads:

> One grain on the first square, two on the second, four on the third: each square doubles the one before. That rule is an example of exponential growth.

> Most things we count grow by adding: one more, then one more again. Exponential growth multiplies instead. Something grows by the same proportion at every step, so the bigger it gets, the faster it grows.
>
> At first the numbers look tiny, which is exactly why exponential growth is so easy to underestimate. Because each step doubles what is already there, every square holds one more grain than all the squares before it combined.
>
> For comparison, if each square simply added one more grain than the last (1, 2, 3, 4 and so on), the whole board would hold just 2,080 grains, about 52 grams of rice.
>
> Move through the board at your own pace and watch what the rule does.

In the first paragraph, “exponential growth” is in bold gold type.

Before you start: a prediction

On screen

> Before you start: on which square do you think the total rice will pass a full year of the world’s rice harvest?

Below the question are a box for a number from 1 to 64, a button labelled “Lock in guess”, and a note: “Your guess stays on this page only.” If the number isn’t between 1 and 64, the note reads “Enter a square between 1 and 64.” Once a guess is locked in, it reads, for example, “Guess locked in: square 40. Now move through the board.”

When you reach the square where the total passes a year’s harvest, a box beside the board tells you how close you were. For example: “You guessed square 40. The total passes a full year of the world's harvest at square 55, so you were 15 squares too early.” Or, for a correct guess: “You guessed square 55. The total passes a full year of the world's harvest at square 55 – exactly right.”

Without the controls

Before reading on, decide on which square you think the total rice will pass a full year of the world’s rice harvest, and make a note of it. The answer comes in the next section, at the same point as it does in the explainer.

The board

What you see

A chessboard of 64 squares in dark and light green, numbered from the bottom left, row by row, so square 64 is at the top right. As you move on, rice appears on each square up to the current one: small white grains, one on the first square, then more and more until the grains cover the square. Each filled square has a small dark label giving its number of grains, shortened from square 15 onwards (for example “16k” or “1.1bn”). The current square has a white outline and a red label.

On screen, under the board: “From square 33 there is too much rice to draw, so the squares are shaded gold, and each count is shown as a power of 2. The current square has a white outline and a red label.”

Controls

Beside the board are a button marked with a minus sign (“Previous square”), a slider for the square number, a button marked with a plus sign (“Next square”), and a “Play” button, which changes to “Pause” while it plays. Play moves on one square every 0.8 seconds, and stops at each milestone with a message such as “Paused at square 32. When you’re ready, press Play to carry on.”

A group headed “Jump to” has five buttons, one for each milestone:

- “Square 1: the first grain”
- “Square 20: a million grains”
- “Square 32: halfway”
- “Square 55: a year’s harvest”
- “Square 64: the last square”

What changes at each square

The square number appears in large type, for example “Square 20”, with a sentence in italics below it. Four figures follow, headed “Grains on this square”, “Grains in total so far”, “Weight of the total” and “Roughly the same as”.

On most squares, the sentence follows the same pattern, for example “Square 10 holds one more grain than all 9 squares before it combined.” Six squares have their own sentence:

- **Square 1:** “One grain. The rule never changes: every square doubles the one before.”
- **Square 2:** “Square 2 holds one more grain than square 1.”
- **Square 20:** “The total passes a million grains, and you are not yet a third of the way across the board.”
- **Square 32:** “Halfway. Large, but still imaginable. Now keep going.”
- **Square 55:** “The total passes a full year of the world’s rice harvest.”
- **Square 64:** “The last square holds more rice than the other 63 put together.”

Key squares

This table gives the four figures for a selection of squares, with a grain weighing 25 mg, as the explainer assumes to begin with.

Square	Grains on this square	Grains in total so far	Weight of the total	Roughly the same as
1	1	1	25 mg	A single grain
2	2	3	75 mg	A pinch of rice
3	4	7	175 mg	A pinch of rice
8	128	255	6.4 g	Less than a tablespoon
10	512	1,023	26 g	About 0.3 servings (75 g each)
16	32,768	65,535	1.6 kg	About 1.6 bags of rice (1 kg each)
20	524,288	1,048,575	26 kg	About 26 bags of

Square	Grains on this square	Grains in total so far	Weight of the total	Roughly the same as
				rice (1 kg each)
24	8,388,608	16,777,215	419 kg	About 419 bags of rice (1 kg each)
32	2,147,483,648	4,294,967,295	107 tonnes	About 4 lorry loads (27 tonnes each)
40	549,755,813,888	1,099,511,627,775	27,488 tonnes	About 1,018 lorry loads (27 tonnes each)
48	140,737,488,355,328	281,474,976,710,655	7.0 million tonnes	1% of a year's world rice harvest
54	9,007,199,254,740,992	18,014,398,509,481,983	450.4 million tonnes	81% of a year's world rice harvest
55	18,014,398,509,481,984	36,028,797,018,963,967	900.7 million tonnes	About 1.6 years of the world's rice harvest
56	36,028,797,018,963,968	72,057,594,037,927,935	1.8 billion tonnes	About 3.3 years of the world's rice harvest
60	576,460,752,303,423,488	1,152,921,504,606,846,975	28.8 billion tonnes	About 52 years of the world's rice harvest
64	9,223,372,036,854,775,808	18,446,744,073,709,551,615	461.2 billion tonnes	About 830 years of the world's rice harvest

Grains on each square

On screen

The heading “Grains on each square”, with two buttons, “Linear scale” and “Logarithmic scale”. Below the chart, a note changes with the scale:

- **Linear scale:** “On a linear scale the tallest bar always fills the chart, so every earlier square shrinks towards nothing as you move on. Gold bars are the second half of the board, and the red bar is the current square.”
- **Logarithmic scale:** “On a logarithmic scale each doubling is the same step up, so steady doubling becomes a straight line. Gold bars are the second half of the board, and the red bar is the current square.”

On the linear scale, a label above the chart gives the tallest bar, for example “Tallest bar: 2,147,483,648 grains” The axis is labelled “Square 1” at the left and “Square 64” at the right. On the logarithmic scale, faint lines across the chart are labelled “1”, “thousand”, “million”, “billion”, “trillion”, “quadrillion” and “quintillion”.

What you see

A bar chart with one bar for each square up to the current one: dark green for squares 1 to 32, gold for squares 33 to 64, and red for the current square. On the linear scale, the current square's bar always reaches the top, and the bars before it fall away so quickly that, by square 64, everything before about square 56 is a flat line along the bottom. On the logarithmic scale, the bars rise in equal steps, forming a straight slope from the first square to the last.

Why it matters

On screen

> The rice doubles on every square, but anything that grows by a fixed percentage doubles at a fixed interval too. Savings, debt and the spread of an infection all follow the same pattern.

Three small charts follow, each with a label and a caption:

Label	Caption
Over 40 years	Savings at 7% a year double in about 10 years.
Over 16 years	A debt at 20% a year doubles in under 4 years.
Over 30 days	Infections doubling every 3 days grow about a thousandfold in a month.

Below them: "Each dot marks a doubling. The dots are evenly spaced because the doubling time never changes."

What you see

Each chart shows a gold curve that starts almost flat and rises more and more steeply, with red dots along it, one at each doubling. The dots are evenly spaced from left to right: three on the savings curve, four on the debt curve and ten on the infections curve.

Try a growth rate

On screen: a slider labelled "Try a growth rate: 7% per period", from 1% to 50%. Below it, a result such as "Doubles about every 10 periods (rule of 70 estimate: 10). Ten doublings, about 102 periods, make it 1,024 times bigger." Then: "A period can be a year, a day or any other step. A handy shortcut, the rule of 70, estimates the doubling time as 70 divided by the percentage."

Without the controls: before reading the table, predict how long something growing at 20% per period takes to double, and whether the rule of 70 gives a good estimate at high rates as well as low ones.

Growth rate per period	Doubles about every	Rule of 70 estimate	Ten doublings take about
1%	70 periods	70 periods	697 periods
2%	35 periods	35 periods	350 periods

Growth rate per period	Doubles about every	Rule of 70 estimate	Ten doublings take about
3%	23 periods	23 periods	234 periods
5%	14 periods	14 periods	142 periods
7%	10 periods	10 periods	102 periods
10%	7.3 periods	7.0 periods	73 periods
15%	5.0 periods	4.7 periods	50 periods
20%	3.8 periods	3.5 periods	38 periods
30%	2.6 periods	2.3 periods	26 periods
50%	1.7 periods	1.4 periods	17 periods

Ten doublings always make something 1,024 times bigger.

On screen, at the end of the section, in large italics: “Exponential growth looks harmless at first. That is what makes it so easy to underestimate.”

Change the assumptions

On screen

A box headed “Change the assumptions” reads: “The grain counts are exact. The weights depend on how heavy a grain of rice is, so try changing it.”

A slider labelled “Weight of one grain: 25 mg” goes from 15 to 35 mg, with the note “Real grains vary, roughly 20 to 30 mg.” Beside it, under the heading “World rice harvest per year”: “About 553 million tonnes of milled rice, the FAO’s forecast for 2026/27 (September 2026).”

Below, a sentence changes with the slider. With a grain of 25 mg, it reads:

> With these assumptions, the total passes a year's world harvest at square 55, and the whole board comes to about 830 years of harvest. Try the extremes: the years change a lot, the square hardly moves.

Without the controls

Before reading the table, predict: if each grain weighed 35 mg instead of 15 mg, more than twice as much, how much would the square change, and how much would the number of years change?

Weight of one grain	The total passes a year’s harvest at	The whole board comes to
15 mg	Square 56	About 500 years
20 mg	Square 55	About 670 years
25 mg	Square 55	About 830 years
30 mg	Square 55	About 1,000 years
35 mg	Square 54	About 1,170 years

The “a year’s harvest” button in the “Jump to” group follows this setting, so it moves between squares 54 and 56.

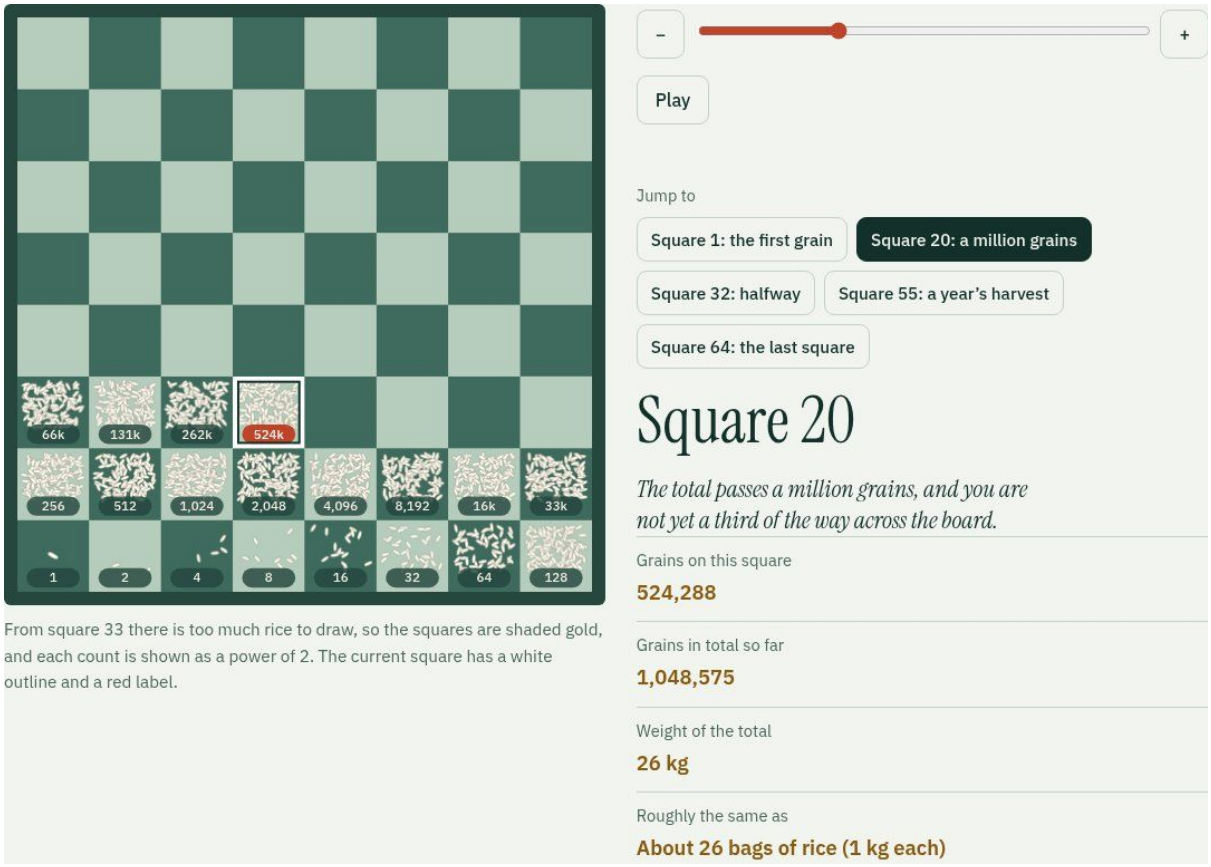
About this explainer

On screen, at the bottom of the page:

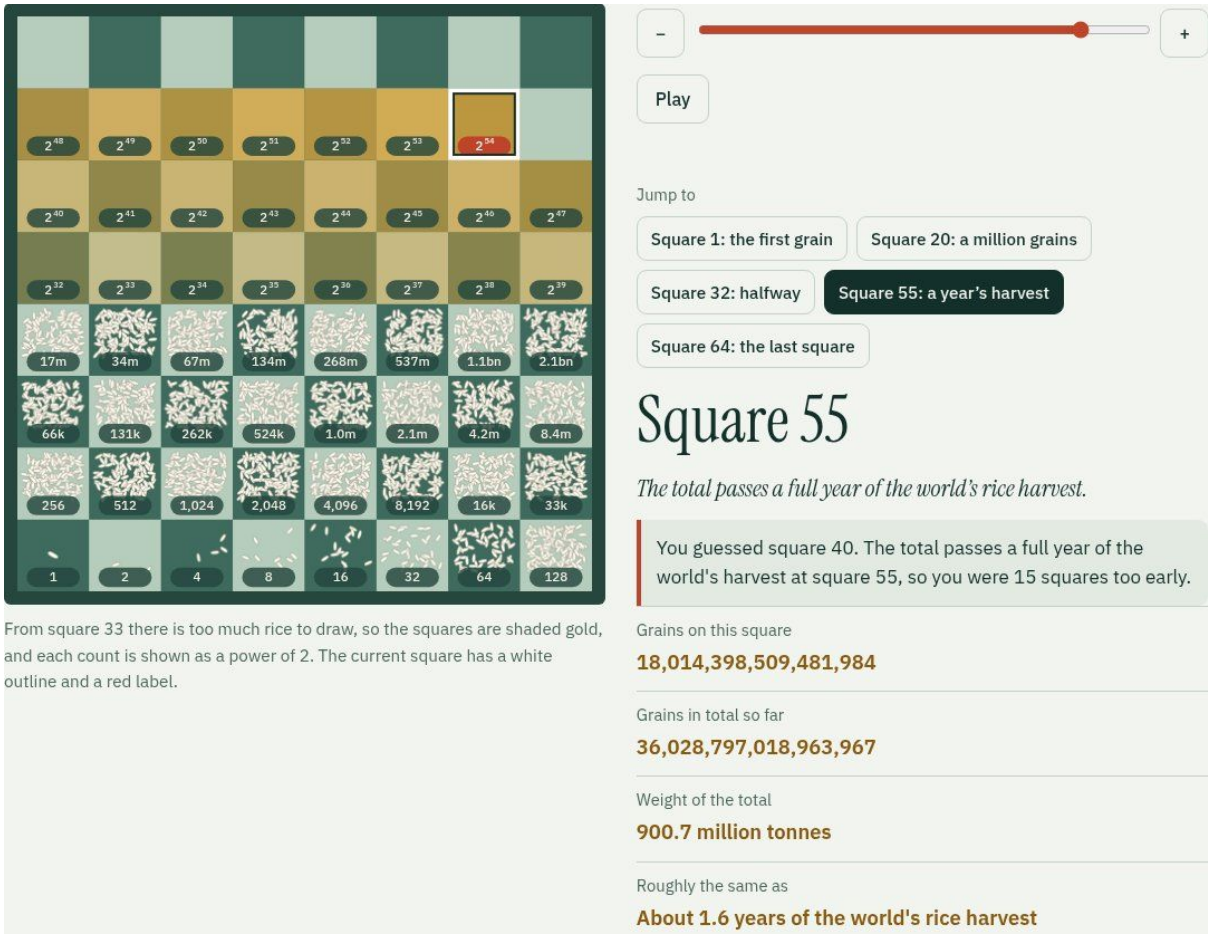
> The story is a legend, told in many versions. Grain counts follow exactly from doubling; weights and harvest figures are estimates. This explorer accompanies a short video and a text version of it, which use the same figures.
>
> Made in a Claude chat by Claude Opus 5.5. Directed by Steven Williams.
>
> The controls should work with a keyboard or screen reader. If you find any problems, please contact Steven Williams at s.williams10@lse.ac.uk.

Key frames

These are stills from the interactive explainer.



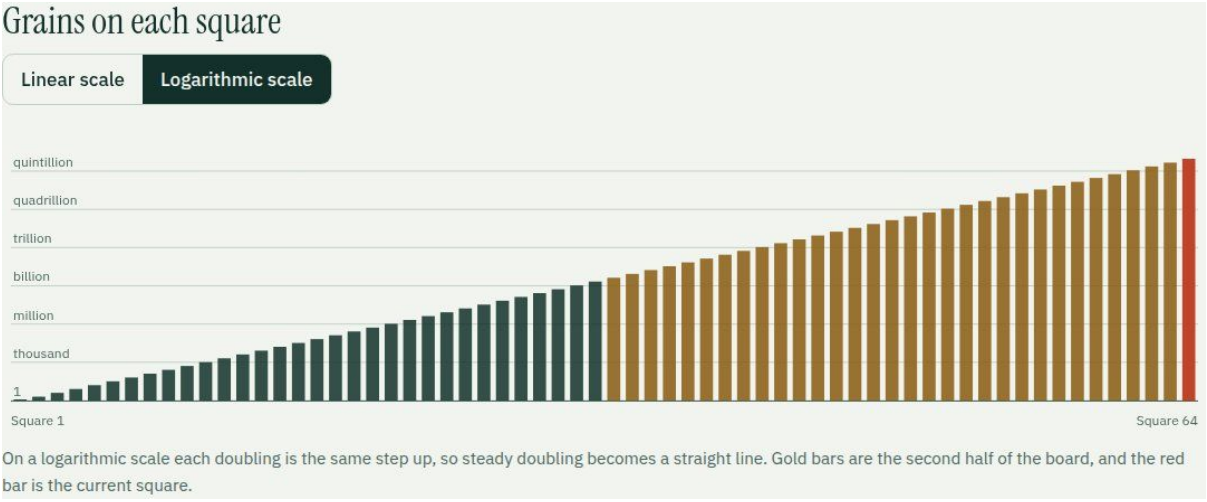
Square 20: the total passes a million grains.



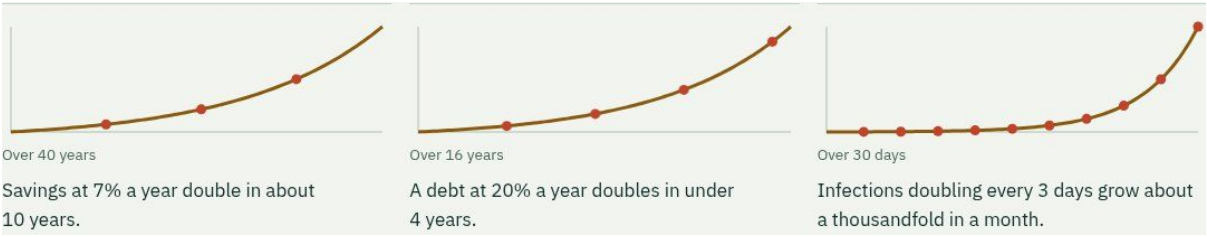
Square 55: the total passes a year of the world's rice harvest.



The chart on a linear scale: the last few squares dwarf everything before them.



The chart on a logarithmic scale: steady doubling becomes a straight line.



Why it matters: the same pattern in savings, debt and infections.