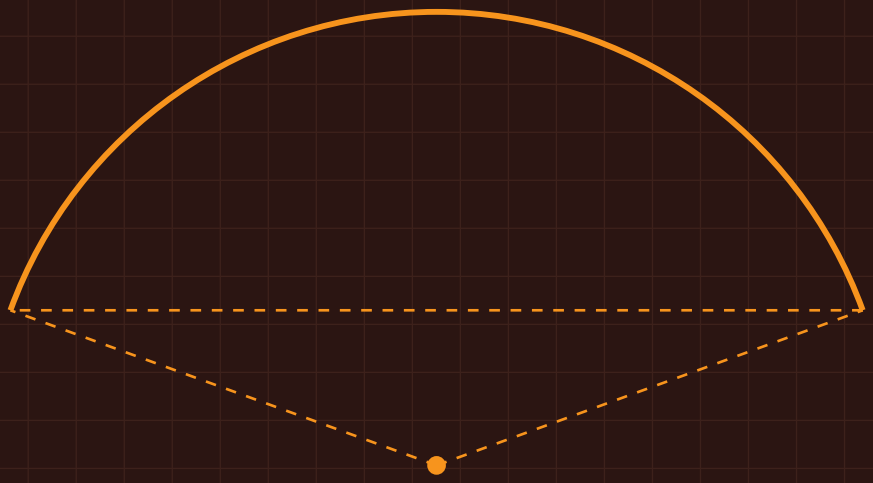
USER GUIDE · VERSION 1.0



Revit Formula Solver

How to solve family geometry and get copy-ready Revit formulas

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1. What this tool does

The **Revit Formula Solver** is a free web page that helps you build parametric Revit families. Most family geometry comes down to a few shapes — an arc, a right triangle, an array, a stair, a polygon or a length that has to fit a module. For each of these you usually know some values and need formulas for the rest.

You tell the page which values you know by **locking** them. The page then:

- calculates every other value so you can check the numbers,
- draws the shape to scale so you can see that it makes sense, and
- writes the matching **Revit formula** for every value you didn't lock, using your own parameter names, ready to paste into the Family Types dialog.

Nothing is installed and nothing is sent anywhere. The page runs entirely in your browser and remembers your last settings on your own computer.

Who it's for

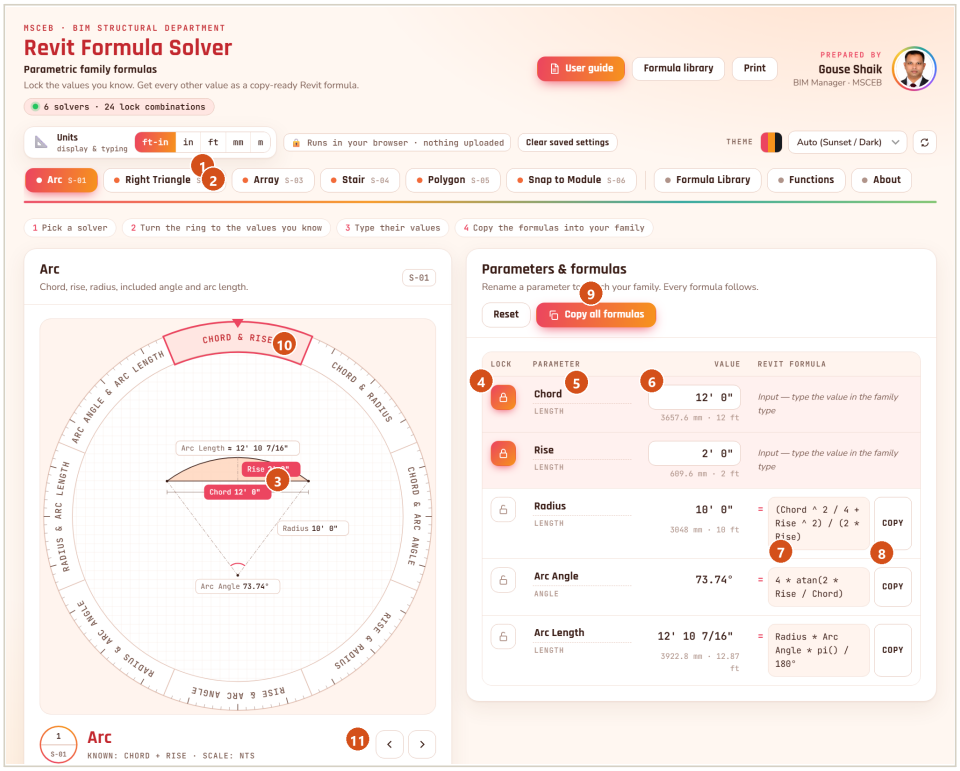
- Revit family creators and BIM modellers building flexible, formula-driven families.
- Architects and designers who want to check geometry quickly (arch heights, stair risers, module fits).
- Anyone learning the Revit formula syntax — the formula library and function reference are a handy cheat sheet.

Opening the page

- **Online:** open the published address.
- **Offline:** double-click **index.html** in the site folder. It opens in any modern browser (Chrome, Edge, Firefox, Safari).
- **On a phone or tablet:** the page rearranges itself into a single column, so every feature still works.

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2. A tour of the screen



The Arc solver with Chord and Rise locked. Numbers match the table below.

#	ITEM	WHAT IT DOES
1	Units	Switches how lengths are shown and how bare numbers you type are read: ft-in, in, ft, mm or m. Formulas don't change — Revit handles units itself.
2	Solver tabs	Pick the shape you're working on: Arc, Right Triangle, Array, Stair, Polygon or Snap to Module.
3	Diagram tags	Each value is also a tag on the drawing. Click a tag to lock or unlock it. Locked tags are filled in the theme colour.
4	Lock button	Locks a value you know. Most solvers take two locks; locking a third releases the oldest one.
5	Parameter name	Click and type to rename a parameter to match your family (for example Rise → Arch Height). Every formula updates.
6	Value box	Type a value. Locked values are your inputs; unlocked values are results. Typing into a result locks it for you. The grey line below shows the value in other units.
7	Revit formula	The formula to paste into the Formula column of the Family Types dialog for that parameter.
8	COPY	Copies that one formula to the clipboard.
9	Copy all formulas	Copies a summary of the solver: the inputs with their values and parameter types, then every formula.

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#	ITEM	WHAT IT DOES
10	Selector ring	Lists every pair of values the solver can work from. Turn it to lock a pair: drag the ring, click a segment, or use the arrow keys when it has focus. The pair under the pointer at the top is the one in use.
11	Turn arrows	Step the ring to the previous or next pair. On a phone the ring is hidden to give the drawing more room; use these arrows instead.

Other controls

- **Reset** puts the current solver back to its starting values, names and locks. **Clear saved settings** in the toolbar forgets everything the page remembered on this device.
- **Print** gives a one-page A4 printout of the current solver on a white background: header with your name and photo, the drawing, notes, and every value and formula. The ring and buttons are left off the printout.
- **Theme** in the title block changes the colours. Pick from the dropdown in the toolbar (Sunset, Classic, Blueprint Light, Ocean, Colorful, Sage, Dark, Blueprint Night, Graphite) or click the round-arrow button to step through them. **Auto** follows your system: Sunset by day, Dark after dark. Your choice is remembered.
- **Presets** (Stair and Snap to Module) fill in common values such as a CMU block or a code riser height.
- **Rounding** (Snap to Module) is on the ring, and also as buttons under the table: round down, nearest or round up.
- **Notes** under each diagram explain the geometry and the less obvious parts of the formulas.

3. Step by step: from known values to a working family

This is the full workflow, using the Arc solver as the example: an arched window head where you know the opening width and the arch height.

In the web page

1. Open the **Arc** tab.
2. Lock the two values you know — here **Chord** (the opening width) and **Rise** (the arch height). Turn the ring until **CHORD & RISE** sits under the pointer, or click their lock buttons or tags in the drawing.
3. Type the values, for example **4' 0"** and **1' 0"**. Press Enter or click away to apply.
4. Check the drawing and the results. If something looks wrong — for example, an arc that bulges the wrong way — the values are wrong, not the formula.
5. Rename the parameters to the names used in your family. If your family already has **Width**, rename Chord to Width.
6. Click **Copy all formulas**, or copy formulas one at a time with **COPY**.

In Revit (Family Editor)

1. Open your family and go to **Create › Properties › Family Types**.

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2. Create each parameter with the **type** shown under its name on the page: Length, Angle, Integer or Number. The names must match the page exactly — spelling, spaces and capitals.
3. Type values for the **locked** parameters (your inputs).
4. Paste each formula into the **Formula** column of the matching result parameter.
5. Click **Apply**. Revit should show the same values the page showed.
6. Associate your sketch dimensions, arc radius or array count with the parameters, then **flex** the family: change the inputs and check that the geometry follows.

TIP
Locked values are the parameters people will change. Results are driven by formulas and greyed out in the Family Types dialog, so nobody can type over them by accident.

WATCH OUT
Revit refuses a formula that refers to a parameter that doesn't exist yet, or whose type doesn't match (for example a Length formula in a Number parameter). Create all the parameters first, then paste the formulas.

Example result

With Chord and Rise locked, the Arc solver gives:

PARAMETER	TYPE	VALUE / FORMULA
Width	Length	`4' 0" (input)`
Rise	Length	`1' 0" (input)`
Radius	Length	`(Width ^ 2 / 4 + Rise ^ 2) / (2 * Rise)`
Arc Angle	Angle	`4 * atan(2 * Rise / Width)`
Arc Length	Length	`Radius * Arc Angle * pi() / 180°`

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4. Typing values and units

You can type a value in almost any common format. A value with its own unit is always read correctly, whatever the Units switch is set to. A bare number (no unit mark) is read in the current units, except in ft-in where — just like Revit — a bare number means feet.

YOU TYPE	READ AS	NOTES
`9' 4"`	9 ft 4 in	Feet and inches.
`9'-4 1/2"`	9 ft 4.5 in	Dash and fractions are fine.
`112"`	9 ft 4 in	Inches only.
`4 1/2" or 4.5 in`	4.5 in	Mixed numbers and words work.
`2.5 ft`	2 ft 6 in	
`600 mm`	600 mm	Also cm and m.
`0.6 m`	600 mm	
`12`	depends on Units	12 ft in ft-in or ft · 12 in · 12 mm · 12 m.
`30 or 30°`	30°	Angles are always degrees.
`8`	8	Integers (counts, sides) are rounded to whole numbers.

- Results in ft-in are shown to the nearest 1/32". A ≈ sign means the true value isn't an exact 1/32" — check the grey decimal line for full precision.
- If the page can't read what you typed, the box turns red and nothing changes. Fix the value and press Enter again.
- Your units, solver, names, values and locks are saved in your browser. Use **Reset** to start a solver over.

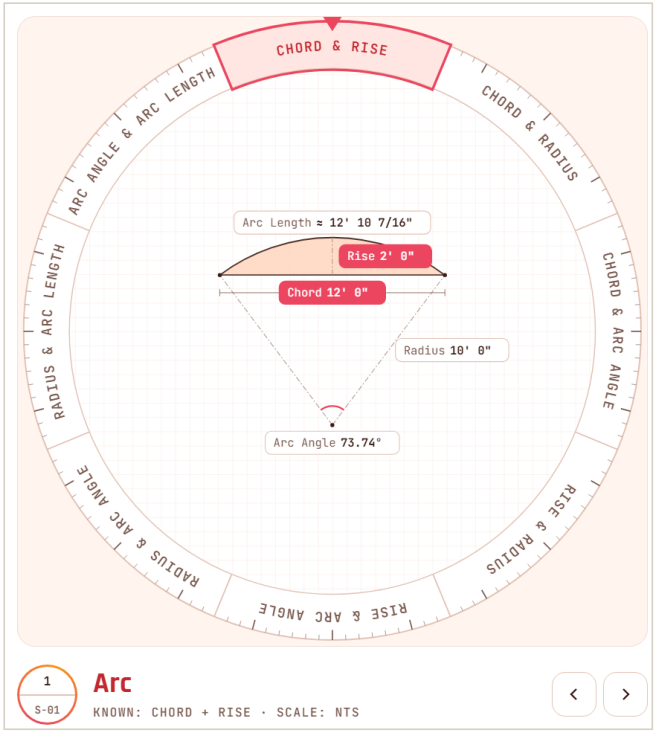
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5. The solvers

Each solver below lists what it's for, which combinations of locked values it accepts, and tips for using it in a family. The combinations are the same ones printed around the selector ring, so turning the ring always gives a pair that works. If you lock a pair by hand that has no direct formula, the page tells you which pairs do work.

5.1 Arc

For arched heads, curved walls, vaults, segmental arches, and anything defined by a chord and a curve.



PARAMETER	TYPE
Chord	Length
Rise	Length
Radius	Length
Arc Angle	Angle
Arc Length	Length

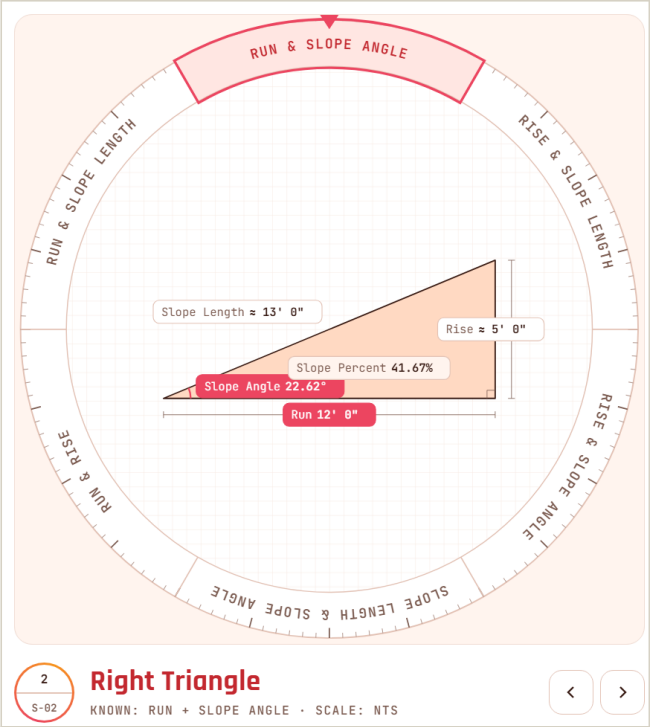
Lock combinations that work: Chord + Rise · Chord + Radius · Chord + Angle · Rise + Radius · Rise + Angle · Radius + Angle · Radius + Arc Length · Angle + Arc Length.

- **Chord + Rise** is the safest pair for families. It works for every arc, including arcs longer than a half circle.
- Chord + Radius always gives the shorter arc (180° or less).
- Chord + Arc Length can't be solved with a formula, so it isn't offered.
- In the Family Editor, drive the arc's radius with the Radius parameter and lock the arc's ends to reference planes spaced by Chord.

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5.2 Right Triangle

For slopes, roof pitches, ramps, braces, sloped sills and any diagonal member.



PARAMETER	TYPE
Run	Length
Rise	Length
Slope Length	Length
Slope Angle	Angle
Slope Percent	Number (result)

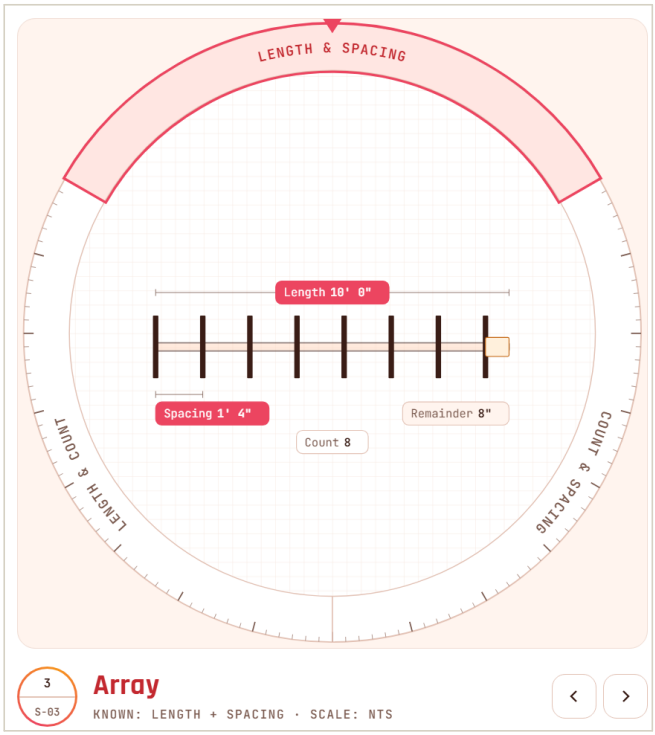
Lock combinations that work: any two of Run, Rise, Slope Length and Slope Angle (all six pairs).

- Slope Angle is measured between Run and Slope Length.
- Slope Percent is always a result (rise ÷ run × 100). A 1:12 ramp is 8.33 %.
- Slope Length must be longer than Run or Rise; the page warns you if it isn't.

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5.3 Array

For balusters, mullions, studs, shelves, louvres — any row of equally spaced items with one at each end.



PARAMETER	TYPE
Length	Length
Count	Integer
Spacing	Length
Remainder	Length (result)

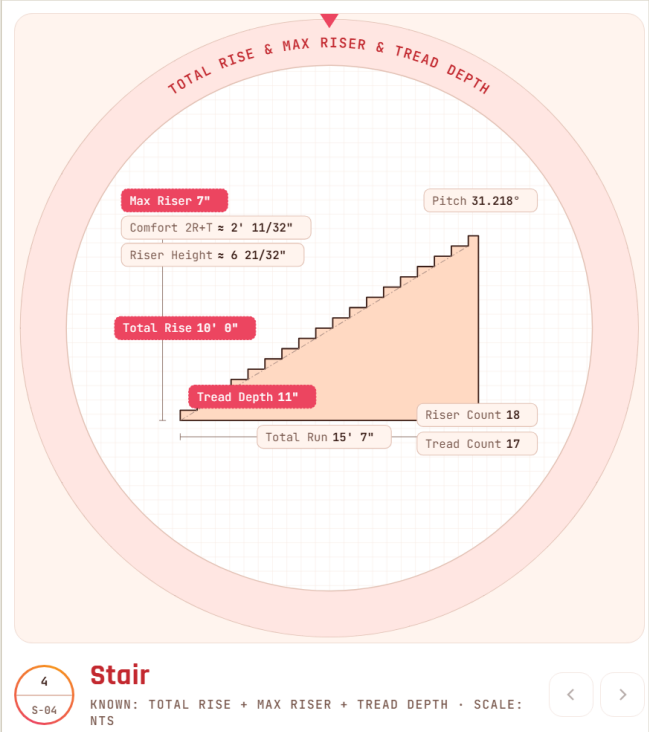
Lock combinations that work: Length + Count · Length + Spacing · Count + Spacing.

- Count includes the items at both ends, so there are Count − 1 gaps.
- With Length + Spacing, the spacing is kept and any leftover shows as **Remainder** (orange in the diagram).
- Revit arrays need at least 2 items. To allow 0 or 1, hide the array with a Yes/No visibility parameter.
- To spread items evenly under a maximum spacing, use the “Even spacing under a maximum” formula in the library.

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5.4 Stair

For stair families, steps, bleachers and stepped planters: works out risers and run from the floor-to-floor height.



PARAMETER	TYPE
Total Rise	Length (input)
Max Riser	Length (input)
Tread Depth	Length (input)
Riser Count	Integer
Riser Height	Length
Tread Count	Integer
Total Run	Length
Pitch	Angle
Comfort 2R+T	Length

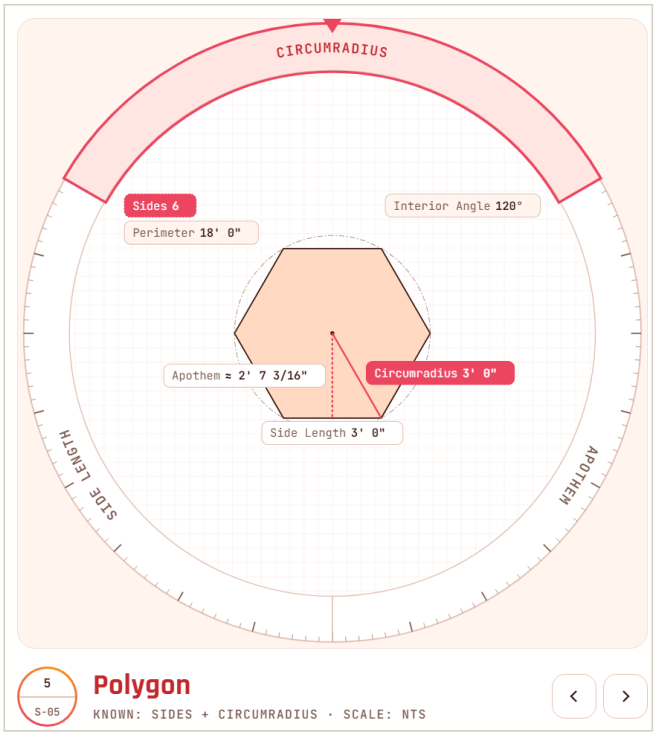
Lock combinations that work: the three inputs are always locked — just type their values.

- Riser Count rounds **up**, so the actual riser is never taller than your maximum.
- Tread Count is Riser Count − 1, because the upper floor is the last “tread”.
- The comfort check warns you if two risers plus one tread fall outside about 24"–25½" (610–650 mm).
- Presets give typical residential, commercial and metric values. Always check the building code for your project.

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5.5 Polygon

For regular polygons: hexagonal tiles, octagonal columns, bay windows, gazebo plans, nuts and bolt heads.



PARAMETER	TYPE
Sides	Integer (input)
Circumradius	Length
Apothem	Length
Side Length	Length
Perimeter	Length (result)
Interior Angle	Angle (result)

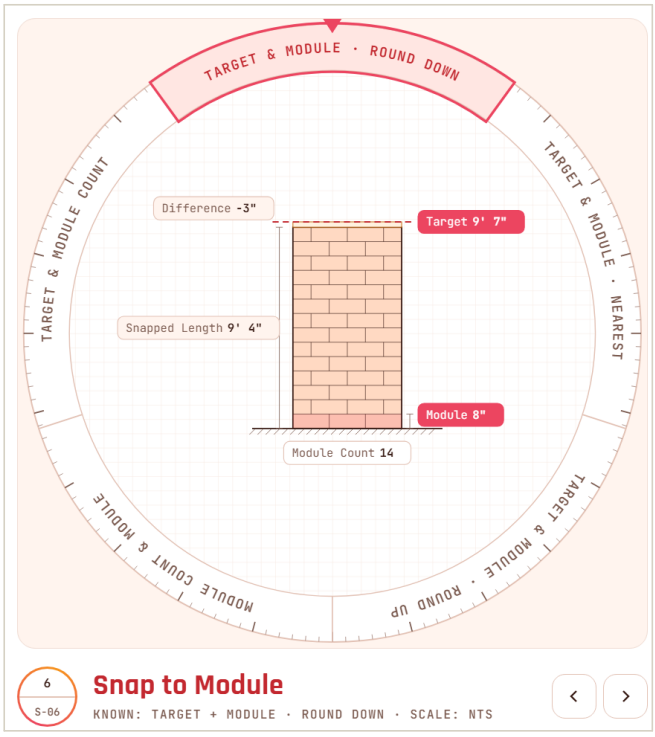
Lock combinations that work: Sides is always an input; lock one of Circumradius, Apothem or Side Length.

- Circumradius goes from the centre to a corner. Apothem goes from the centre to the middle of a side.
- Across-flats = 2 × Apothem. Across-corners = 2 × Circumradius.
- Make Sides an Integer parameter so that 180° / Sides gives a clean angle.

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5.6 Snap to Module

For fitting a length to a module: masonry courses, stud bays, ceiling grids, tiles, cladding panels.



PARAMETER	TYPE
Target	Length
Module	Length
Module Count	Integer
Snapped Length	Length (result)
Difference	Length (result)

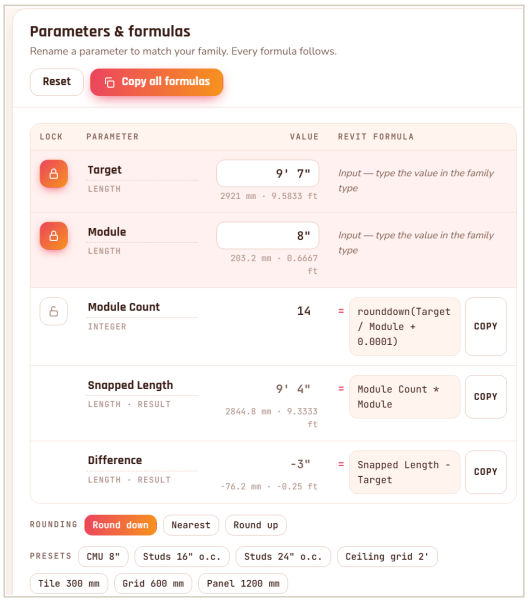
Lock combinations that work: Target + Module (round down, nearest or round up) · Module Count + Module · Target + Module Count. The ring shows all five.

- With Target + Module, turn the ring to the rounding you want: **Round down** never goes past the target, **Round up** never falls short, **Nearest** picks the closer one.
- Difference = Snapped Length − Target. Negative means the snapped length is shorter.
- Module Count + Module builds a length up from a count. Target + Module Count divides the target into equal modules; your own module size is kept for when you turn back.
- Presets fill in common modules: 8" CMU, 16" and 24" stud spacing, 2' ceiling grid, 300 mm tile, 600 mm grid, 1200 mm panel.

TIP

Why **+ 0.0001** and **− 0.0001**? Computers store some decimals inexactly. A length that is exactly 14 modules can calculate as 14.0000000001, and roundup would give 15. The tiny guard value stops that, and is far too small to change a real result.

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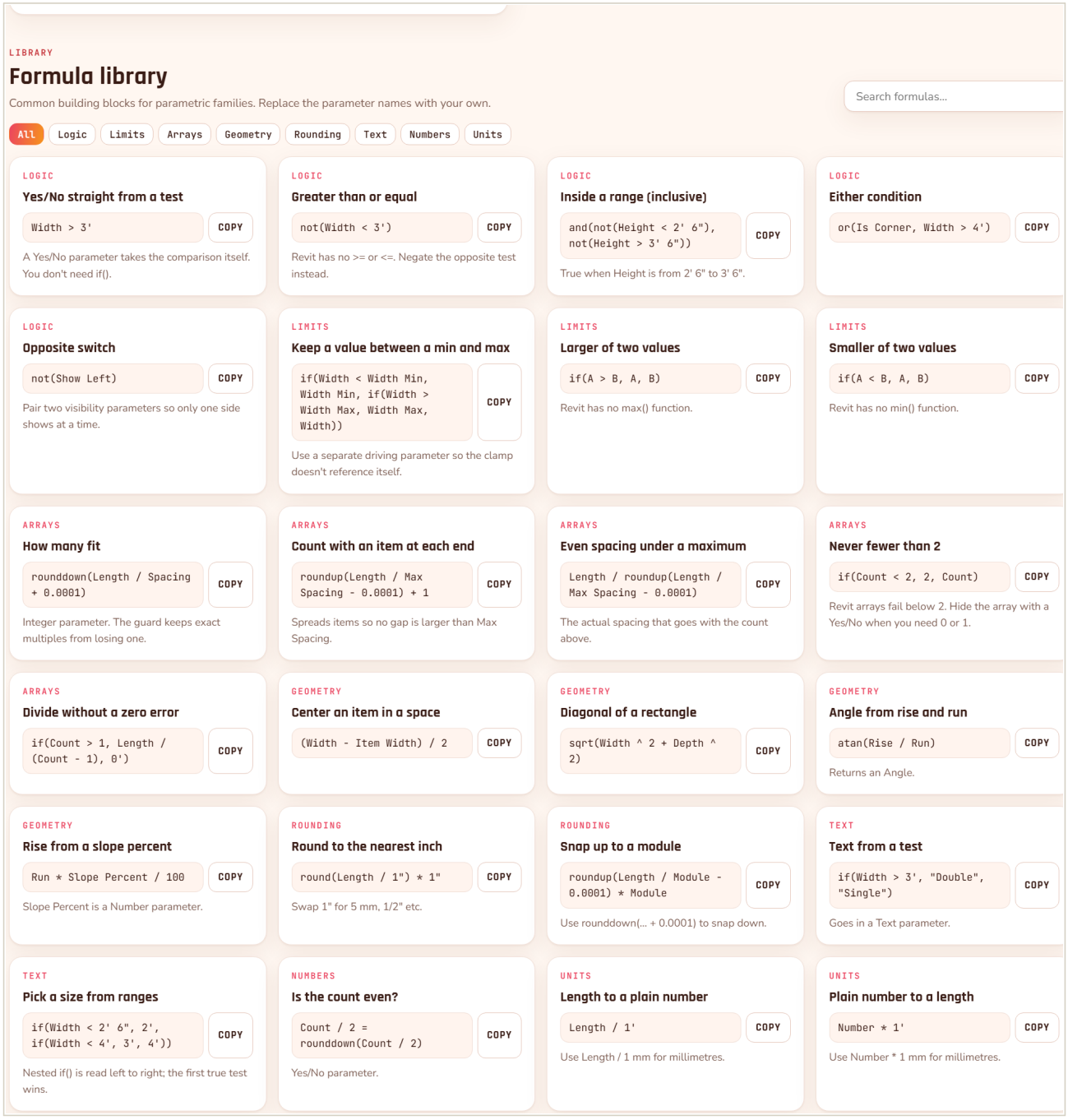


Snap to Module: the Rounding and Presets rows sit under the table.

6. Formula library and function reference

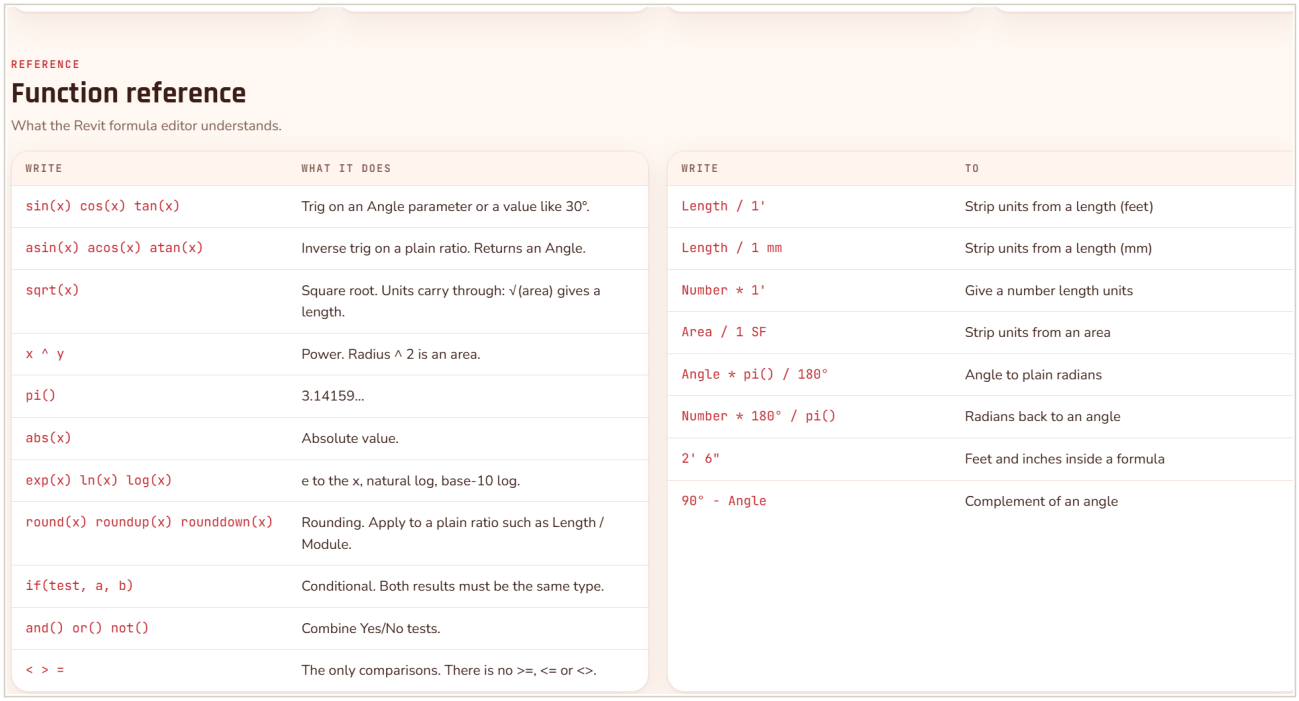
Below the solver, the **Formula library** collects small formulas that come up in almost every parametric family: Yes/No visibility tests, clamping a value between limits, array counts, centring, rounding, text labels and unit conversions.

- Type in **Search formulas...** to filter by any word, for example “array”, “round” or “Yes/No”.
- Click a category chip (Logic, Limits, Arrays, Geometry, Rounding, Text, Numbers, Units) to narrow the list.
- Click **COPY**, paste into Revit, then replace the example parameter names with yours.



Formula library with search and category filters.

The **Function reference** lists everything the Revit formula editor understands, plus the unit tricks you need most often — such as dividing by 1' to turn a length into a plain number.



REFERENCE

Function reference

What the Revit formula editor understands.

WRITE	WHAT IT DOES
`sin(x) cos(x) tan(x)`	Trig on an Angle parameter or a value like 30°.
`asin(x) acos(x) atan(x)`	Inverse trig on a plain ratio. Returns an Angle.
`sqrt(x)`	Square root. Units carry through: √(area) gives a length.
`x ^ y`	Power. Radius ^ 2 is an area.
`pi()`	3.14159...
`abs(x)`	Absolute value.
`exp(x) ln(x) log(x)`	e to the x, natural log, base-10 log.
`round(x) roundup(x) rounddown(x)`	Rounding. Apply to a plain ratio such as Length / Module.
`if(test, a, b)`	Conditional. Both results must be the same type.
`and() or() not()`	Combine Yes/No tests.
`< > =`	The only comparisons. There is no >=, <= or <>.

WRITE	TO
`Length / 1'`	Strip units from a length (feet)
`Length / 1 mm`	Strip units from a length (mm)
`Number * 1'`	Give a number length units
`Area / 1 SF`	Strip units from an area
`Angle * pi() / 180°`	Angle to plain radians
`Number * 180° / pi()`	Radians back to an angle
`2' 6"`	Feet and inches inside a formula
`90° - Angle`	Complement of an angle

Function reference.

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7. Revit formula rules worth remembering

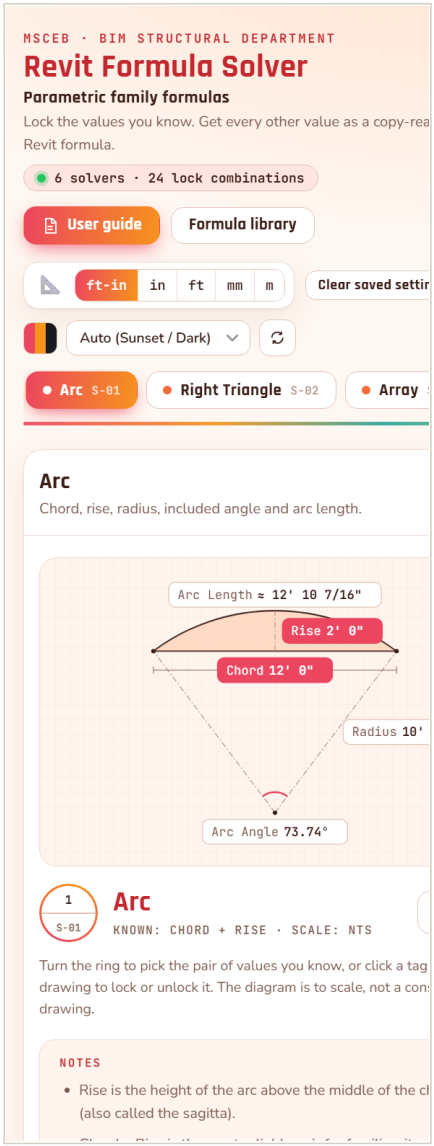
RULE	EXAMPLE
There is no >= or <=. Negate the opposite test.	`not(Width < 3')`
There is no max() or min(). Use if().	`if(A > B, A, B)`
A Yes/No formula is just the test — no if() needed.	`Width > 3'`
Trig functions take angles; inverse trig returns angles.	`atan(Rise / Run)`
Round a plain ratio, not a length.	`round(Length / Module) * Module`
Divide by a unit to strip it; multiply to add it.	`Length / 1' · Number * 1'`
Both branches of if() must have the same type.	`if(Count > 1, Length / (Count - 1), 0')`
Names are case-sensitive and must match exactly.	`Rise is not the same as rise`
A formula can't refer to itself, even through other formulas.	`A = B + 1 and B = A - 1 fails`

8. Troubleshooting

PROBLEM	FIX
Revit says **Inconsistent units**.	The parameter type doesn't match the formula. Use the type shown under the name on the page (Length, Angle, Integer, Number).
Revit says **the parameter doesn't exist**.	Create every parameter first, and check spelling, spaces and capitals. Renaming on the page doesn't rename anything in Revit.
Revit reports a **circular chain of references**.	A locked input was given a formula. Locked values should be typed, not calculated.
The page shows a red message.	The values can't make the shape — for example a chord longer than the diameter. Read the message and change an input.
The page says there's no direct formula.	That pair can't be solved with a formula. Pick one of the pairs listed in the message.
Revit and the page show slightly different values.	Revit rounds the display to your project units. The underlying value is the same — increase the display precision in Manage › Project Units to check.
The array breaks when Count goes below 2.	Use if(Count < 2, 2, Count) and hide the array with a Yes/No parameter instead.
My saved values disappeared.	They're stored in the browser. Private windows, clearing site data or a different browser start fresh.

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9. Using it on a phone or tablet



On narrow screens the page stacks into one column: tabs scroll sideways, the diagram sits above the table, and each parameter becomes a small card with its lock, name, value and formula.

Tap tags and locks exactly as you would click them. Copy buttons put the formula on your phone's clipboard, ready to send to yourself or a colleague.

10. Updating your details and publishing the page

All personal details on the page and in this guide come from one place: the **PROFILE** block at the top of the script in **site/index.html**.

1. Open **site/index.html** in a text editor (VS Code, Notepad++ or Notepad).
2. Find the line **const PROFILE = {** near the top of the <script> section.
3. Replace the placeholder text in quotes with your name, title, company, location, short bio, email (and optional second email in **email2**), phone, LinkedIn, GitHub and website. Leave a field as "" to hide it.
4. Your photo is **photo.jpg** in the site folder, named in the **photo** field. To change it, replace that file with a new square picture of the same name. Set **photo** to "" to show your initials instead.
5. To rename the tool itself, change **name**, **subtitle** and **tagline** in the **APP** block just below.
6. Save and refresh the page in your browser.

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Rebuild this guide

After changing your details, run this from the project folder to regenerate the PDF with the new name and fresh screenshots:

```
python tools/build_guide.py
```

Create a free GitHub account

GitHub Pages hosts the page for free. You need an account once; after that, publishing is just uploading files.

1. Go to **github.com** and click **Sign up**.
2. Use your personal email address, so the account stays yours if you change jobs.
3. Choose a short username such as **GS-786**. It becomes part of your page address, so pick one you are happy to share.
4. Set a strong password, complete the puzzle, and enter the code GitHub emails to you. Choose the **Free** plan.
5. Recommended: turn on two-factor authentication under **Settings › Password and authentication**.

Publish the page on GitHub Pages

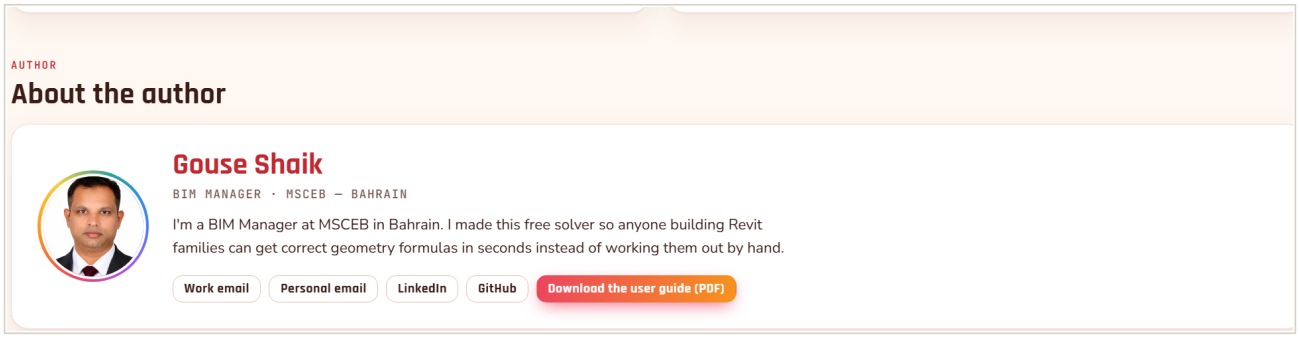
1. Click **+** (top right) › **New repository**. Name it **Revit-Formula-Solver**, set it to **Public**, tick **Add a README file**, then **Create repository**.
2. Click **Add file › Upload files**, drag in **index.html**, **guide.pdf** and **photo.jpg** from the **site** folder, then click **Commit changes**.
3. Go to **Settings › Pages**. Under **Build and deployment** choose **Deploy from a branch**, pick **main** and **/ (root)**, then **Save**.
4. Wait a minute or two and refresh the Pages settings. The address appears at the top: **https://gs-786.github.io/Revit-Formula-Solver/**.
5. Link straight to a solver by adding its name: #arc, #triangle, #array, #stair, #polygon or #snap.

Add your GitHub link and update the site

1. Put your profile address in the **github** field of PROFILE, for example **"https://github.com/GS-786"**.
2. Rebuild this guide with **python tools/build_guide.py** so the new link appears in it too.
3. In the repository, use **Add file › Upload files** again with the changed files. Files with the same name are replaced, and the live page updates within a minute or two.

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11. About the author



The About section at the bottom of the page.

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GitHub	https://github.com/GS-786

I'm a BIM Manager at MSCEB in Bahrain. I made this free solver so anyone building Revit families can get correct geometry formulas in seconds instead of working them out by hand.

Revit is a trademark of Autodesk, Inc. This tool is independent and not affiliated with or endorsed by Autodesk. Always check results in your own family before using them on a project.