Roof, egress opening and stair formula sheet

Built from our roof pitch guide and calculators. Every number in the checks is invented for practice.

Our one-page summary of the roof, egress and stair arithmetic a B1 candidate does by hand. Work each check, then confirm it with the calculator.

- Pitch is x in 12. Run and overhang are level distances.
- Code limits are not printed here. Find them in your own IRC, R310 and R311 (R319 and R318 in 2024).

Pitch and rise

Rise, angle and pitch factor

rise = run x pitch / 12

angle = arctan(pitch / 12)

pitch factor = sqrt(1 + (pitch / 12)^2), which is sqrt(pitch^2 + 12^2) / 12

Check: Run 144 in (12 ft), pitch 6 in 12: rise 144 x 6 / 12 = 72 in; angle arctan(0.5) = 26.57 degrees; factor sqrt(180) / 12 = 1.1180

Open in calculator: raftertie.com/tools/rafter-length-calculator

Rafter length

Cut length with overhang and ridge allowance

along the slope = (run + level overhang) x pitch factor

ridge allowance = half the ridge board thickness x factor

cut length = (run + overhang) x factor - ridge allowance

Check: Run 144 in, overhang 12 in, 1.5 in ridge board, pitch 6 in 12: 161.00 + 13.42 - 0.84 = 173.57 in, or 14 ft 5 9/16 in

Open in calculator: raftertie.com/tools/rafter-length-calculator

Egress opening

Net clear area, and clear height needed at a width

net clear area (sq ft) = clear width (in) x clear height (in) / 144

height needed (in) = required area (sq ft) x 144 / width (in), but never less than the minimum height; both from your own IRC copy

Check: Clear opening 24 in wide by 36 in high: 24 x 36 / 144 = 864 / 144 = 6.0 sq ft. Invented required area 6.0 sq ft: at 24 in wide, 6.0 x 144 / 24 = 36 in. At 60 in wide, 6.0 x 144 / 60 = 14.4 in, below the minimum height, so the minimum governs

Open in calculator: raftertie.com/tools/egress-opening-check

Stairs

Riser count, actual riser and total run

riser count = total rise / target riser, rounded up to a whole number

actual riser = total rise / riser count

treads = risers - 1 (straight flight onto the upper floor); total run = treads x tread depth

Check: Total rise 105 in, invented target riser 7.5 in: 105 / 7.5 = 14 risers; actual riser 105 / 14 = 7.5 in; 13 treads at 10.5 in give a run of 136.5 in

Open in calculator: raftertie.com/tools/irc-stair-check

Sources

The method is ours, worked in our roof pitch guide and calculators. IRC sections R310 and R311 (R319 and R318 in 2024) are named by number only.

Read next

How to read IRC span tables: raftertie.com/guides/how-to-read-irc-span-tables

Find your weakest topic with the free 10-question check, explained as you answer it, no signup:
raftertie.com/icc-inspector

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