THE FRAMING SQUARE AND THE LATITUDE

A Carpenter's Method for Determining Position on Earth

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I. THE EXPERIMENT

A carpenter picks up his framing square every working day. He marks rise and run on the tongue and body, snaps a line, and cuts a rafter. The angle of that rafter is determined by the pitch — inches of rise per twelve inches of run. Every carpenter knows this. It is the first geometry he learns.

The same rise-over-run that cuts a rafter determines latitude.

Latitude is an angle — the angle between the horizon and the celestial pole. At the equator, Polaris sits on the horizon: zero degrees, zero pitch. At the north pole, Polaris sits directly overhead: ninety degrees, straight plumb. Between the equator and the pole, the angle of Polaris above the horizon equals your latitude. It is a pitch. Rise over run. The same triangle the carpenter solves every time he frames a roof.

The experiment is simple. Take a framing square and a level. Establish a level reference — the body of the square set horizontal, verified with the level. Sight the North Star. Measure the rise per twelve inches of run from the horizontal to the line of sight. Read the pitch. Convert to degrees. That angle is your latitude.

No GPS. No satellite. No technology invented after the Iron Age. A piece of steel with a right angle, a level, and the star that does not move. The same geometry the ancients used to navigate the earth.

II. THE FRAMING SQUARE

The standard steel framing square has two arms joined at a right angle. The body (blade) is twenty-four inches long and two inches wide. The tongue is sixteen inches long and one and a half inches wide. Both arms are graduated in inches, with subdivisions to the sixteenth of an inch.

Stamped on the face of the body are the rafter tables — six lines of numbers that give every carpenter the data he needs to cut common rafters, hip rafters, valley rafters, and jack rafters for any roof pitch. The top line — Common Rafter Length Per Foot of Run — is the one that matters here.

The rafter table works on a twelve-inch base. For every twelve inches of horizontal run, the table gives the length of the rafter — the hypotenuse — for each inch of rise from two to eighteen. The rise number corresponds to the inch mark on the body of the square. Under each inch mark, the table prints the rafter length per foot of run.

The formula is the Pythagorean theorem, applied directly:

Rafter Length per Foot = $\sqrt{(12^2 + \text{Rise}^2)}$

And the angle of the pitch:

Angle = $\arctan(\text{Rise} \div 12)$

A 6/12 pitch rises six inches per foot of run. The rafter length is $\sqrt{(144 + 36)} = \sqrt{180} = 13.416$ inches per foot. The angle is $\arctan(6/12) = 26.57$ degrees. A 12/12 pitch — equal rise and run — is 45 degrees exactly. Every carpenter who has cut a rafter knows this in his hands.

Table 1. Standard Rafter Table — Rise, Length, and Angle

Rise per 12″ Run	Rafter Length per Foot	Angle (°)
2/12	12-3/16″ (12.166″)	9.46°
3/12	12-3/8″ (12.369″)	14.04°
4/12	12-5/8″ (12.649″)	18.43°
5/12	13″ (13.000″)	22.62°
6/12	13-7/16″ (13.416″)	26.57°
7/12	13-7/8″ (13.892″)	30.26°
8/12	14-7/16″ (14.422″)	33.69°
9/12	15″ (15.000″)	36.87°
10/12	15-5/8″ (15.620″)	39.81°
11/12	16-1/4″ (16.279″)	42.51°
12/12	17″ (16.971″)	45.00°
13/12	17-11/16″ (17.692″)	47.29°
14/12	18-7/16″ (18.439″)	**49.40°**
15/12	19-3/16″ (19.209″)	51.34°
16/12	20″ (20.000″)	53.13°
17/12	20-13/16″ (20.809″)	54.78°
18/12	21-5/8″ (21.633″)	56.31°

The 14/12 row is highlighted — this pitch corresponds to 49.40°, the latitude of the Okanagan, British Columbia.

III. THE METHOD

Method A: Polaris (Night)

The altitude of Polaris above the horizon equals your latitude. No correction, no seasonal adjustment, no declination table. Polaris does not move. It sits at the celestial pole. The angle between the horizon and Polaris is your latitude, directly.

Set the body of the framing square level — verified with a spirit level or a water level. The body is now the horizon reference. Sight Polaris along the tongue, or use a plumb string hung from the corner of the square to establish the vertical and measure the angle to the star. The rise from the level body to the line of sight, per twelve inches of run along the body, is the pitch of Polaris. That pitch is your latitude.

In the Okanagan, Polaris sits at approximately 49.5 degrees above the horizon. The tangent of 49.5 degrees is 1.1708. Multiply by twelve: 14.05 inches of rise per twelve inches of run. Mark 14 on the tongue and 12 on the body — a 14/12 pitch. The rafter table gives the angle as 49.40 degrees. That is the latitude. The framing square reads it directly.

Method B: Solar Noon (Day)

At solar noon — the moment the sun crosses the meridian, due south — set up a plumb stick on a level surface. Verify plumb with the square. Measure the length of the shadow cast along the level surface.

The sun's zenith angle — the angle measured from directly overhead down to the sun — is the angle whose tangent equals the shadow length divided by the stick height:

$$\text{Zenith Angle} = \arctan(\text{Shadow Length} \div \text{Stick Height})$$

On the equinox, the zenith angle at solar noon equals your latitude exactly. No correction needed. On any other day, add the sun's declination:

$$\text{Latitude} = \text{Zenith Angle} + \text{Solar Declination}$$

The sun's declination is its angular distance north or south of the celestial equator. It is zero at the equinox, +23.44° at the summer solstice, −23.44° at the winter solstice. The ancients tracked this with nothing more than a stick and a stone — mark the shadow tip at noon each day, and the declination reveals itself as the year turns.

Use a twelve-inch plumb stick. Measure the shadow. Read the shadow length as run, twelve inches as rise. The pitch gives the zenith angle from the rafter table. Add the declination. The sum is your latitude. A carpenter who can read a rafter table can locate himself on the earth at solar noon with no instrument but his square and his level.

IV. THE RAFTER TABLE AS LATITUDE TABLE

The rafter table stamped on every framing square is a latitude table. It maps pitch to angle. Pitch is rise over run. Latitude is the angle of Polaris. They are the same triangle.

The table below extends the standard rafter pitches from the equator to the Arctic Circle. Each pitch is mapped to its angle and to a reference latitude — a city, a boundary, or a landmark that a navigator would recognize. The framing square covers the inhabited world.

Table 2. Pitch-to-Latitude Reference

Pitch (Rise/12)	Angle (°)	Rafter Length per Foot	Reference Latitude
0/12	0.00°	12.000″	Equator (0°)
2/12	9.46°	12.166″	—
3/12	14.04°	12.369″	—
4/12	18.43°	12.649″	—
5/12	22.62°	13.000″	Near Tropic of Cancer (23.44°)
6/12	26.57°	13.416″	Southern Florida / Sahara
7/12	30.26°	13.892″	Cairo (30.04°), Houston (29.76°)
8/12	33.69°	14.422″	Dallas (32.78°), Beirut (33.89°)
9/12	36.87°	15.000″	Richmond (37.54°), Seoul (37.57°)
10/12	39.81°	15.620″	Denver (39.74°), Madrid (40.42°)
11/12	42.51°	16.279″	Boston (42.36°), Rome (41.90°)
12/12	45.00°	16.971″	Ottawa (45.42°), Turin (45.07°)
13/12	47.29°	17.692″	Seattle (47.61°), Paris (48.86°)
14/12	**49.40°**	18.439″	**Okanagan, BC (~49.5°)**
15/12	51.34°	19.209″	London (51.51°), Calgary (51.04°)
16/12	53.13°	20.000″	Edmonton (53.55°), Dublin (53.35°)
17/12	54.78°	20.809″	Copenhagen (55.68°)
18/12	56.31°	21.633″	Edinburgh (55.95°), Moscow (55.76°)
20/12	59.04°	23.324″	Stockholm (59.33°), Oslo (59.91°)
22/12	61.39°	25.060″	Helsinki (60.17°)
24/12	63.43°	26.833″	Fairbanks (64.84°)

Pitches 19, 21, 23 omitted for space. Intermediate latitudes resolve by reading half-inch increments on the tongue.

The resolution of the framing square as a navigation instrument is determined by the smallest increment readable on the tongue. At the sixteenth-inch graduation, each increment at the 14-inch mark corresponds to approximately 0.12 degrees of latitude — about eight miles. A carpenter reading his framing square to the sixteenth of an inch can locate himself on the earth to within eight miles.

V. THE CELTIC CROSS

The ancients navigated the earth with a cross.

The cross-staff — documented in maritime navigation from the fourteenth century, but present in principle long before — is a long wooden staff with a perpendicular crosspiece. The navigator holds the staff to his eye, slides the crosspiece until one end aligns with the horizon and the other with the celestial body, and reads the angle from the graduated scale. The geometry is elementary: two perpendicular references measuring the angle between the horizon and the sky.

The Celtic cross is the same instrument. Two arms at right angles. One arm establishes the horizontal — the horizon, the level reference. The other measures the rise to the celestial body. The ring around the cross — often interpreted as decoration or solar symbolism — is the graduated dial. The Celtic cross is a navigation instrument. The high crosses of Ireland, with their precisely proportioned arms, are not tombstones. They are surveying tools built in stone.

The framing square is the Celtic cross folded flat. Two arms at right angles. One arm references the horizon (the body, set level). The other measures the rise (the tongue, sighted on the star). The rafter table stamped on the blade is the graduated scale. The geometry is identical. The instrument is identical. The carpenter carries the same tool the ancient navigator carried — it is just made of steel now instead of wood or stone, and the scale is printed in inches instead of degrees.

The ancients did not need sextants, chronometers, or satellites. They needed a cross with a right angle and a level reference. They read rise over run. They measured pitch. They determined latitude. The same geometry, the same math, the same operation a carpenter performs every time he lays out a rafter.

The tool never changed. The name did.

VI. ONE GEOMETRY

There is one geometry. It measures a rafter. It measures the sky. It measures your position on the earth.

Rise over run. The tangent of the angle. Inches per foot of horizontal — the same ratio whether you are cutting a hip rafter or sighting the North Star. The base-6 system that divides the circle into 360 degrees, the hour into 60 minutes, the minute into 60 seconds, is the same system that divides the earth into latitudes. The story pole that carries every measurement of the circle carries every measurement of the earth.

A carpenter does not study navigation. He does not study astronomy. He studies rise over run. He learns to read a rafter table. He learns to check level and drop plumb. And with that training — the same training that lets him frame a house — he can determine his latitude to within eight miles using a framing square and the North Star.

This is not a coincidence. The geometry of the building trades is the geometry of celestial navigation. The framing square is the cross-staff. The rafter table is the latitude table. The carpenter’s level is the horizon reference. The tools are the same tools. The math is the same math. The knowledge was never lost. It sits in every carpenter’s toolbox, stamped in steel, waiting to be read.

One geometry. One square. Rise over run. The carpenter’s square finds the rafter and the latitude with the same line.

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