The Gravitational Constant from Integers 31 and 144: Core and Geometric Completion

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March – May 2026

Abstract

The gravitational constant G is examined through a compact integer-based construction involving 31 and 144. A purely arithmetic core,

$$G_{\text{core}} = \frac{31^2}{144 \times 10^{11}} = 6.673611111\ldots \times 10^{-11}\,\text{m}^3\text{kg}^{-1}\text{s}^{-2},$$

is numerically close to the NIST 2026 reference value 6.67387×10^{-11}, with a relative difference of 0.00388%. A refined discrete form is also proposed,

$$G_{\text{Koch}} = \frac{31^2}{\left(144 + \frac{1}{720}\right) \times 10^{11}} = 6.67354674496\ldots \times 10^{-11},$$

which lies between the NIST 2026 and Huazhong 2007 measurements, with gaps smaller than their mutual disagreement. The expressions are presented as a compact arithmetic-geometric reconstruction of G, constructed without direct fitting to laboratory data or CODATA tables.

Integer Core

$$\boxed{G_{\text{core}} = \frac{31^2}{144 \times 10^{11}} = 6.673611111\ldots \times 10^{-11}\,\text{m}^3\text{kg}^{-1}\text{s}^{-2}}$$

This value differs from the NIST 2026 reference by 0.00388%.

Refined Discrete Form

$$\boxed{G_{\text{Koch}} = \frac{31^2}{\left(144 + \frac{1}{720}\right) \times 10^{11}} = 6.67354674496\ldots \times 10^{-11}\,\text{m}^3\text{kg}^{-1}\text{s}^{-2}}$$

Comparison with Reference Values

Source	$\mathbf{G \times 10^{-11}}$	**Relative difference from** G_{Koch}
Huazhong 2007	6.67349	+0.00085%
G_{Koch} (this work)	6.67354674496	—
G_{core} (this work)	6.673611111	−0.00096%
NIST 2026 (Schlamminger et al.)	6.67387	−0.00484%
CODATA 2018	6.67430	−0.0113%

The NIST 2026 measurement (Schlamminger et al., *Metrologia*, April 2026) and the Huazhong 2007 value disagree by 0.0235%. Both gaps from G_{Koch} are smaller than this inter-laboratory disagreement. The two forms fall within the range spanned by the selected reference values, while remaining independent of direct laboratory fitting.

Relation to the Golden Ratio

A compact relation connecting the discrete form to the golden ratio:

$$\frac{\phi^{12}}{\sqrt{5}} = 144 + \frac{1}{720} + \varepsilon, \qquad |\varepsilon| < 10^{-8}$$

This identity is used here as a numerical bridge between the integer structure and the refined discrete form. It implies:

$$G_{\text{Koch}} = \frac{31^2 \cdot \sqrt{5}}{\phi^{12} \times 10^{11}}$$

which is the Kochenov geometric formula.

Conclusion

The gravitational constant can be represented by a compact integer core built from 31 and 144, with a small discrete refinement involving 1/720. The core expression already provides a close numerical approximation to the NIST 2026 reference value, and the refined form preserves the same arithmetic-geometric structure. These results suggest a possible discrete pattern in G, but they should be regarded as a compact reconstruction rather than a replacement for experimental measurement.

Full Precision Reference

$$G_{\text{Koch}} = 6.673546744961618123759199771790423607913 2\ldots \times 10^{-11}\,\text{m}^3\text{kg}^{-1}\text{s}^{-2}$$

Derived from: $G_{\text{Koch}} = 31^2 \cdot \sqrt{5}/(\phi^{12} \times 10^{11})$.

Keywords

gravitational constant, golden ratio, Fibonacci, 144, 31, 1/720, integer core, geometric derivation, NIST 2026, Huazhong 2007, CODATA 2018

Suggested citation

Kochenov, B.V. (2026). The Gravitational Constant from Integers 31 and 144: Core and Geometric Completion. Zenodo. https://doi.org/10.5281/zenodo.20117611

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