On the study of various Isoperimetric and Variational Problems. Possible mathematical connections with several parameters of Number Theory and sectors of String Theory.

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Abstract

In this paper, we analyze various Isoperimetric and variational problems. We describe the possible mathematical connections obtained with several parameters of Number Theory and sectors of String Theory.

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Renato Caccioppoli

Mathematician (1904 – 1959)

Vesuvius landscape with gorse – Naples

https://www.pinterest.it/pin/95068242114589901/

From:

Droplet Minimizers of an Isoperimetric Problem with Long-Range Interactions - *MARCO CICALESE, EMANUELE SPADARO* – 2013

We have:

than the nonlocal one. In order to identify the correct regime, we show here the different contributions to the energy of a single ball. As shown in (2.15), given a ball $B_{r_m}(p) \subset \Omega$ of radius r_m centered at p and with average mass m, i.e., $m|\Omega| = \omega_n r_m^n$ (here $|\Omega|$ stands for the n-dimensional volume of Ω), it holds that

$$F_{\gamma,m}(\chi_{B_{r_m}(p)}) = \begin{cases} 2\pi r_m + \gamma\left(\frac{\pi}{2} r_m^4 \log r_m + \left(\pi^2 g_{r_m}(p) - \frac{3\pi}{8}\right) r_m^4\right) & \text{if } n = 2, \\ n\omega_n r_m^{n-1} + \gamma\left(\frac{2\omega_n}{4-n^2} r_m^{n+2} + \omega_n^2 g_{r_m}(p) r_m^{2n}\right) & \text{if } n \geq 3, \end{cases}$$

where $g_{r_m}(p)$ is uniformly bounded for p in a compact subset of Ω; see Sec-

We consider n = 11 ; $r_m = 2.81794 \times 10^{-15}$

$|\Omega|$ = n-dimensional volume. We consider the following formula:

$$V_n(R) = \frac{\pi^{n/2}}{\Gamma\left(\frac{n}{2}+1\right)} R^n,$$

Thence:

(Pi^5.5*2.81794*10^-15)/(gamma(11/2+1))

where R = 2.81794×10^{-15} is the Electron radius

Input interpretation

$$\frac{\pi^{5.5} \times 2.81794 \times 10^{-15}}{\Gamma\left(\frac{11}{2}+1\right)}$$

$\Gamma(x)$ is the gamma function

Result

$5.30929\ldots \times 10^{-15}$

$5.30929\ldots \times 10^{-15}$

Now, from:

$\omega_n r_m^n$ = m |Ω| ; where m = 9.1093837015×10^{-31} (Electron mass), we obtain:

9.1093837015×10^-31 * (Pi^5.5*2.81794*10^-15)/(gamma(11/2+1))

Input interpretation

$$9.1093837015 \times 10^{-31} \times \frac{\pi^{5.5} \times 2.81794 \times 10^{-15}}{\Gamma\left(\frac{11}{2}+1\right)}$$

$\Gamma(x)$ is the gamma function

Result

$4.83644\ldots \times 10^{-45}$

$\omega_n r_m^n$ = 4.83644…*10^{-45}

We have:

$$\delta_0, r_0 > 0 \qquad \gamma r_m^3 < \delta_0 \ \ if\, n \geq 3.$$

r_m = 2.81794*10^{-15}

δ_0 = 16 ;

From:

γ (2.81794*10^-15)^3 = 8 ; γ = 3.5751540638 × 10^{44}

Indeed:

x* (2.81794*10^-15)^3 = 8

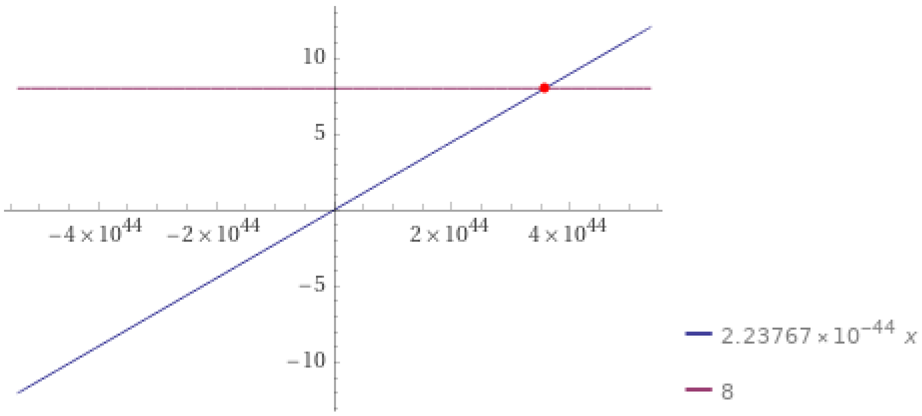
Input interpretation

$x\left(2.81794 \times 10^{-15}\right)^3 = 8$

Result

$2.23767 \times 10^{-44} x = 8$

Plot



Alternate form

$2.23767 \times 10^{-44} x - 8 = 0$

Alternate form assuming x is real

$2.23767 \times 10^{-44} x + 0 = 8$

Solution

$x = 357515406389472979487245268499604469507424256$

$3.5751540638 \times 10^{44}$ that is equal to γ

For:

$\omega_n r_m^{n-1}$ =

((9.1093837015×10^-31 * (Pi^5*2.81794*10^-15)/(gamma(10/2+1))))

Input interpretation

$$9.1093837015 \times 10^{-31} \times \frac{\pi^5 \times 2.81794 \times 10^{-15}}{\Gamma\left(\frac{10}{2} + 1\right)}$$

$\Gamma(x)$ is the gamma function

Result

$6.54619\ldots \times 10^{-45}$

$\omega_n r_m^{n-1}$ = 6.54619*10^{-45}

And for:

$\omega_n r_m^{n+2}$ =

((9.1093837015×10^-31 * (Pi^6.5*2.81794*10^-15)/(gamma(13/2+1))))

Input interpretation

$$9.1093837015 \times 10^{-31} \times \frac{\pi^{6.5} \times 2.81794 \times 10^{-15}}{\Gamma\left(\frac{13}{2}+1\right)}$$

$\Gamma(x)$ is the gamma function

Result

$2.33756\ldots \times 10^{-45}$

$\omega_n r_m^{n+2}$ = 2.33756*10^{-45}

From:

$$n\omega_n r_m^{n-1} + \gamma\left(\frac{2\omega_n}{4-n^2} r_m^{n+2} + \omega_n^2 g_{r_m}(p) r_m^{2n}\right) \qquad \text{if } n \geq 3,$$

we obtain:

11* 6.54619*10^-45 + 3.5751540638 × 10^44((((1/(4-11^2)*2(2.33756*10^-45))+(4.83644*10^-45)^2*a*b)))

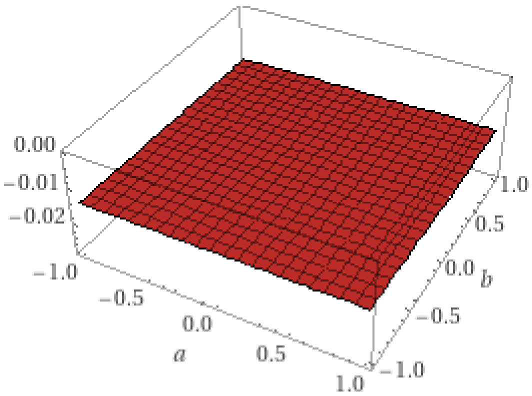
Input interpretation

$$11 \times 6.54619 \times 10^{-45} + 3.5751540638 \times 10^{44} \left(\frac{1}{4-11^2} \times 2 \times 2.33756 \times 10^{-45} + \left(4.83644 \times 10^{-45}\right)^2 a\, b\right)$$

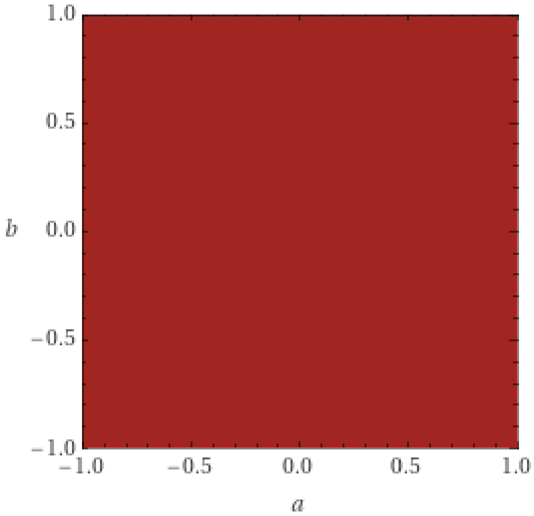
Result

$$3.5751540638 \times 10^{44} \left(2.33912 \times 10^{-89}\, a\, b - 3.99583 \times 10^{-47}\right) + 7.20081 \times 10^{-44}$$

3D plot **(figure that can be related to a D-brane/Instanton)**



Contour plot



Geometric figure

line

Alternate form

$2.06121\times10^{-139}\,(4.05718\times10^{94}\,a\,b-6.93074\times10^{136})$

Expanded form

$8.3627\times10^{-45}\,a\,b-0.0142857$

Root

$$a \neq 0, \quad b \approx \frac{1.70827 \times 10^{42}}{a}$$

Property as a function

Parity

even

Root for the variable b

$$b = \frac{1\,708\,265\,194\,215\,972\,392\,228\,875\,639\,649\,382\,466\,322\,432}{a}$$

Derivative

$$\frac{\partial}{\partial a}(357\,515\,406\,379\,999\,999\,999\,999\,999\,952\,327\,684\,080\,533\,504 \left(2.33912 \times 10^{-89}\, a\, b - 3.99583 \times 10^{-47}\right) + 7.20081 \times 10^{-44}) = 8.3627 \times 10^{-45}\, b$$

Indefinite integral

$$\int (7.20081 \times 10^{-44} + 3.5751540638 \times 10^{44} \left(-3.99583 \times 10^{-47} + 2.33912 \times 10^{-89}\, a\, b\right))\, da = 4.18135 \times 10^{-45}\, a^2\, b - 0.0142857\, a + \text{constant}$$

Limit

$$\lim_{a \to \pm\infty} \left(7.20081 \times 10^{-44} + 3.5751540638 \times 10^{44} \left(-3.99583 \times 10^{-47} + 2.33912 \times 10^{-89}\, a\, b\right)\right) = -0.0142857$$

$$\lim_{b\to\pm\infty} \left(7.20081\times 10^{-44} + 3.5751540638\times 10^{44} \left(-3.99583\times 10^{-47} + 2.33912\times 10^{-89}\, a\, b\right)\right) = -0.0142857$$

Definite integral over a disk of radius R

$$\iint_{a^2+b^2<R^2} \left(3.5751540638\times 10^{44}\left(2.33912\times 10^{-89}\, a\, b - 3.99583\times 10^{-47}\right) + 7.20081\times 10^{-44}\right) da\, db = 0 - 0.0448799\, R^2$$

Definite integral over a square of edge length 2 L

$$\int_{-L}^{L}\int_{-L}^{L} \left(7.20081\times 10^{-44} + 3.5751540638\times 10^{44}\left(-3.99583\times 10^{-47} + 2.33912\times 10^{-89}\, a\, b\right)\right) db\, da = 0 - 0.0571428\, L^2$$

From:

$$11\times 6.54619\times 10^{-45} + 3.5751540638\times 10^{44}\left(\frac{1}{4-11^2}\times 2\times 2.33756\times 10^{-45} + \left(4.83644\times 10^{-45}\right)^2 a\, b\right)$$

for a = b = 0.5 (a, b = p, g) , we obtain:

11* 6.54619*10^-45 + 3.5751540638 × 10^44((((1/(4-11^2)*2(2.33756*10^-45))+(4.83644*10^-45)^2*0.5*0.5)))

Input interpretation

$$11\times 6.54619\times 10^{-45} + 3.5751540638\times 10^{44}\left(\frac{1}{4-11^2}\times 2\times 2.33756\times 10^{-45} + \left(4.83644\times 10^{-45}\right)^2\times 0.5\times 0.5\right)$$

Result

−0.01428570450149799658119658119658119658119650709781690463459598 2…

-0.0142857045….

Inverting and changing the sign, we obtain:

-1/((11* 6.54619*10^-45 + 3.5751540638 × 10^44((((1/(4-11^2)*2(2.33756*10^-45))+(4.83644*10^-45)^2*0.5*0.5)))))

Input interpretation

$$-\left(1\Big/\left(11\times 6.54619\times 10^{-45}+3.5751540638\times 10^{44}\left(\frac{1}{4-11^2}\times 2\times 2.33756\times 10^{-45}+\left(4.83644\times 10^{-45}\right)^2\times 0.5\times 0.5\right)\right)\right)$$

Result

70.000047942692652469344415564649626382933444888948358354085253889 …

70.000047942692….

From which:

24*((-1/((11* 6.54619*10^-45 + 3.5751540638 × 10^44((((1/(4-11^2)*2(2.33756*10^-45))+(4.83644*10^-45)^2*0.5*0.5))))))+2)+1

Input interpretation

$$24\left(-\left(1\Big/\left(11\times 6.54619\times 10^{-45}+3.5751540638\times 10^{44}\left(\frac{1}{4-11^2}\times 2\times 2.33756\times 10^{-45}+\left(4.83644\times 10^{-45}\right)^2\times 0.5\times 0.5\right)\right)\right)+2\right)+1$$

Result

1729.0011506246236592642659735515910331904026773347606004980460933 …

1729.0011506246….

This result is very near to the mass of candidate glueball **f_0(1710) scalar meson.** Furthermore, 1728 occurs in the algebraic formula for the j-invariant of an elliptic curve. ($1728 = 8^2 * 3^3$) The number 1728 is one less than the Hardy–Ramanujan number 1729 (taxicab number)

(24*((-1/((11* 6.54619*10^-45 + 3.5751540638 × 10^44((((1/(4-11^2)*2(2.33756*10^-45))+(4.83644*10^-45)^2*0.5*0.5))))))+2)+1)^1/15

Input interpretation

$$\left(24\left(-\left(1\left/\left(11\times 6.54619\times 10^{-45}+3.5751540638\times 10^{44}\left(\frac{1}{4-11^2}\times 2\times 2.33756\times 10^{-45}+\left(4.83644\times 10^{-45}\right)^2\times 0.5\times 0.5\right)\right)\right)\right)+2\right)+1\right)\text{^}(1/15)$$

Result

1.6438153016777310820779163280106621402276621737888968068869402952...

1.64381530167…. ≈ ζ(2) = $\frac{\pi^2}{6}$ = 1.644934 ... (trace of the instanton shape)

(1/27(24*((-1/((11* 6.54619*10^-45 + 3.5751540638 × 10^44((((1/(4-11^2)*2(2.33756*10^-45))+(4.83644*10^-45)^2*0.5*0.5))))))+2)))^2

Input interpretation

$$\left(\frac{1}{27}\left(24\left(-\left(1\left/\left(11\times 6.54619\times 10^{-45}+3.5751540638\times 10^{44}\left(\frac{1}{4-11^2}\times 2\times 2.33756\times 10^{-45}+\left(4.83644\times 10^{-45}\right)^2\times 0.5\times 0.5\right)\right)\right)\right)+2\right)\right)\right)^2$$

Result

4096.0054548148467811273994898747868575215754847986560284549030122

...

4096.005454814… ≈ 4096 = 64^2

We have the following Theorem:

THEOREM 4.1. *There exists $\delta_0 > 0$ such that the following holds: Assume $r_m < 1$ and*

$$\gamma r_m^3 |\log r_m| < \delta_0 \text{ if } n = 2 \quad \text{or} \quad \gamma r_m^3 < \delta_0 \text{ if } n \geq 3.$$

Then, every minimizer $E_m \subset \mathbb{T}^n$ of $F_{\gamma,m}$ is, up to a translation, a convex set such that

$$\partial E_m = \{(1 + \psi_m(x)) r_m x : x \in \mathbb{S}^{n-1}\}$$

for some $\psi_m : \mathbb{S}^{n-1} \to \mathbb{R}$ with

$$\|\psi_m\|_{C^1} \lesssim \gamma r_m^{n+3}, \tag{4.2}$$

and its energy has the following asymptotic expansion:

$$F_{\gamma,m}(\chi_{E_m}) = \begin{cases} 2\pi r_m + \frac{\pi\gamma}{2} r_m^4 \log r_m + \gamma\left(-\frac{1}{8} + \pi^2 h(0)\right) r_m^4 + O(\gamma r_m^6) \\ \quad \text{if } n = 2, \\ n\omega_n r_m^{n-1} + \frac{2\gamma\omega_n}{4-n^2} r_m^{n+2} + \gamma\omega_n^2 r_m^{2n} h(0) + O(\gamma r_m^{2n+2}) \\ \quad \text{if } n \geq 3, \end{cases} \tag{4.3}$$

where h is the Robin function associated to G.

From (4.3) , we consider

$$n\omega_n r_m^{n-1} + \frac{2\gamma\omega_n}{4-n^2} r_m^{n+2} + \gamma\omega_n^2 r_m^{2n} h(0) + O(\gamma r_m^{2n+2})$$

and obtain, for h(0) = $1/r^{n-2}$:

11*6.54619*10^-45 + (1/(4-11^2)*(2.33756*10^-45)*2*3.5751540638 × 10^44)+3.5751540638 × 10^44*((4.83644*10^-45)^2)*(1/(2.81794*10^-15)^9)+(3.5751540638 × 10^44*(2.81794*10^-15)^24)

Input interpretation

$$11\times 6.54619\times 10^{-45}+\frac{1}{4-11^2}\times 2.33756\times 10^{-45}\times 2\times 3.5751540638\times 10^{44}+3.5751540638\times 10^{44}\left(4.83644\times 10^{-45}\right)^2\times\frac{1}{\left(2.81794\times 10^{-15}\right)^9}+3.5751540638\times 10^{44}\left(2.81794\times 10^{-15}\right)^{24}$$

Result

$7.4638120382315540823675301675857913027223228713266032566 4314\ldots\times 10^{86}$

$7.46381203823\ldots .*10^{86}$

Dividing the above result, by the previous expression

$$9.1093837015\times 10^{-31}\times\frac{\pi^{5.5}\times 2.81794\times 10^{-15}}{\Gamma\left(\frac{11}{2}+1\right)}$$

we obtain, after some calculations:

((89+2))/((1/((7.4638120382315 × 10^86 *((9.1093837015×10^-31 * (Pi^5.5*2.81794*10^-15)/(gamma(11/2+1))))^2))-2))

Input interpretation

$$\frac{89+2}{\frac{1}{7.4638120382315\times 10^{86}\left(9.1093837015\times 10^{-31}\times\frac{\pi^{5.5}\times 2.81794\times 10^{-15}}{\Gamma\left(\frac{11}{2}+1\right)}\right)^2}-2}$$

$\Gamma(x)$ is the gamma function

Result

1.6462233656208656404424677578458473725264955980396497720469853442 ...

$1.64622336562\ldots . \approx \zeta(2)=\frac{\pi^2}{6}=1.644934\ldots$ (trace of the instanton shape)

(From: **Stability and minimality for a nonlocal variational problem** - *Nicola Fusco* - 1st Joint Meeting Brazil - Italy in Mathematics - Plenary Talk 7)

We have that:

Theorem 1 (Choksi-Sternberg 2007)

If E is a critical point and X is as above, then

$$J''(E)[X] = \int_{\partial E}\left(|D_\tau(X\cdot\nu)|^2 - |B_{\partial E}|^2(X\cdot\nu)^2\right)d\sigma + 8\gamma\int_{\partial E}\int_{\partial E} G(x,y)(X\cdot\nu)(x)(X\cdot\nu)(y)\,d\sigma_x\,d\sigma_y + 4\gamma\int_{\partial E}\partial_\nu v_E(X\cdot\nu)^2\,d\sigma$$

From:

J. reine angew. Math. 611 (2007), 75—108 - DOI 10.1515/CRELLE.2007.074
On the first and second variations of a nonlocal isoperimetric problem
by *Rustum Choksi* at Burnaby and *Peter Sternberg* at Bloomington

We have:

Theorem 2.6. *Let u be a stable critical point of $\mathscr{E}_\gamma$ given by* (2.7) *such that ∂A is C^2. Let ζ be any smooth function on ∂A satisfying the condition*

$$\int_{\partial A} \zeta(x)\, d\mathscr{H}^{n-1}(x) = 0.$$

Then for v solving (2.2) *one has the condition*

$$J(\zeta) := \int_{\partial A} \left(|\nabla_{\partial A}\zeta|^2 - \|B_{\partial A}\|^2\zeta^2\right) d\mathscr{H}^{n-1}(x) + 8\gamma \int_{\partial A}\int_{\partial A} G(x,y)\zeta(x)\zeta(y)\, d\mathscr{H}^{n-1}(x)\, d\mathscr{H}^{n-1}(y) + 4\gamma \int_{\partial A} \nabla v \cdot \nu \zeta^2\, d\mathscr{H}^{n-1}(x) \geqq 0. \tag{2.20}$$

Here $\nabla_{\partial A}\zeta$ denotes the gradient of ζ relative to the manifold ∂A, $B_{\partial A}$ denotes the second fundamental form of ∂A so that $\|B_{\partial A}\|^2 = \sum_{i=1}^{n-1} \kappa_i^2$ where $\kappa_1, \dots, \kappa_{n-1}$ are the principal curvatures and ν denotes the unit normal to ∂A pointing out of A.

From:

$$\tilde{E}''(0) = \int_{\partial A} \left(|\nabla_{\partial A}\zeta|^2 - \|B_{\partial A}\|^2\zeta^2\right) d\mathscr{H}^{n-1}(x) + (n-1)^2 \int_{\partial A} (H - \overline{H}) H \zeta^2\, d\mathscr{H}^{n-1}(x). \tag{2.54}$$

$$
\begin{aligned}
(2.72)\qquad \tilde{F}''(0) &= 8\int_{\partial A}\int_{\partial A} G(x,y)\zeta(x)\zeta(y)\,d\mathscr{H}^{n-1}(x)\,d\mathscr{H}^{n-1}(y)\\
&\quad + 4\int_{\partial A}\nabla v(x)\cdot \nu(x)\zeta^2(x)\,d\mathscr{H}^{n-1}(x)\\
&\quad + 4(n-1)\int_{\partial A} v(x)H(x)\zeta^2(x)\,d\mathscr{H}^{n-1}(x)\\
&\quad - 4(n-1)\Big(\int_{\partial A} v(y)\,d\mathscr{H}^{n-1}(y)\Big)\Big(\fint_{\partial A} H(x)\zeta^2(x)\,d\mathscr{H}^{n-1}(x)\Big)\\
&= 8\int_{\partial A}\int_{\partial A} G(x,y)\zeta(x)\zeta(y)\,d\mathscr{H}^{n-1}(x)\,d\mathscr{H}^{n-1}(y)\\
&\quad + 4\int_{\partial A}\nabla v(x)\cdot \nu(x)\zeta^2(x)\,d\mathscr{H}^{n-1}(x)\\
&\quad + 4(n-1)\gamma\int_{\partial A}\Big[v(x)-\fint_{\partial A} v(y)\,d\mathscr{H}^{n-1}(y)\Big]H(x)\zeta^2(x)\,d\mathscr{H}^{n-1}(x).
\end{aligned}
$$

Thence:

$$
\begin{aligned}
\tilde{E}''(0) &= \int_{\partial A}(|\nabla_{\partial A}\zeta|^2 - \|B_{\partial A}\|^2\zeta^2)\,d\mathscr{H}^{n-1}(x)\\
&\quad + (n-1)^2\int_{\partial A}(H-\overline{H})H\zeta^2\,d\mathscr{H}^{n-1}(x).
\end{aligned}
$$

$$
\begin{aligned}
&\tilde{F}''(0)\\
&= 8\int_{\partial A}\int_{\partial A} G(x,y)\zeta(x)\zeta(y)\,d\mathscr{H}^{n-1}(x)\,d\mathscr{H}^{n-1}(y)\\
&\quad + 4\int_{\partial A}\nabla v(x)\cdot \nu(x)\zeta^2(x)\,d\mathscr{H}^{n-1}(x)\\
&\quad + 4(n-1)\gamma\int_{\partial A}\Big[v(x)-\fint_{\partial A} v(y)\,d\mathscr{H}^{n-1}(y)\Big]H(x)\zeta^2(x)\,d\mathscr{H}^{n-1}(x).
\end{aligned}
$$

we see that (2.54) and (2.72) combine to yield

$$(2.73) \qquad \left.\frac{d^2\mathscr{E}_\gamma(\tilde{U}(\cdot,t))}{dt^2}\right|_{t=0} = \tilde{E}''(0) + \gamma\tilde{F}''(0)$$

$$= \int_{\partial A} (|\nabla_{\partial A}\zeta|^2 - \|B_{\partial A}\|^2\zeta^2)\, d\mathscr{H}^{n-1}(x)$$

$$+ 8\gamma \int_{\partial A}\int_{\partial A} G(x,y)\zeta(x)\zeta(y)\, d\mathscr{H}^{n-1}(x)\, d\mathscr{H}^{n-1}(y)$$

$$+ 4\gamma \int_{\partial A} \nabla v \cdot \nu\zeta^2\, d\mathscr{H}^{n-1}(x).$$

Now, from:

$$\int_{\partial A} (|\nabla_{\partial A}\zeta|^2 - \|B_{\partial A}\|^2\zeta^2)\, d\mathscr{H}^{n-1}(x)$$

$$+ 8\gamma \int_{\partial A}\int_{\partial A} G(x,y)\zeta(x)\zeta(y)\, d\mathscr{H}^{n-1}(x)\, d\mathscr{H}^{n-1}(y)$$

$$+ 4\gamma \int_{\partial A} \nabla v \cdot \nu\zeta^2\, d\mathscr{H}^{n-1}(x).$$

Let ζ be any smooth function on ∂A

From:

$$g_{22} = \sqrt{(1+\sqrt{2})}.$$

Hence

$$\begin{aligned} 64g_{22}^{24} &= e^{\pi\sqrt{22}} - 24 + 276e^{-\pi\sqrt{22}} - \cdots, \\ 64g_{22}^{-24} &= 4096e^{-\pi\sqrt{22}} + \cdots, \end{aligned}$$

so that

$$64(g_{22}^{24} + g_{22}^{-24}) = e^{\pi\sqrt{22}} - 24 + 4372e^{-\pi\sqrt{22}} + \cdots = 64\{(1+\sqrt{2})^{12} + (1-\sqrt{2})^{12}\}.$$

Hence

$$e^{\pi\sqrt{22}} = 2508951.9982\ldots.$$

$$e^{\pi\sqrt{22}} = 2508951.9982\ldots.$$

We consider $\zeta = e^{\pi\sqrt{22}}$

$\gamma > 0$

$\gamma = 8$

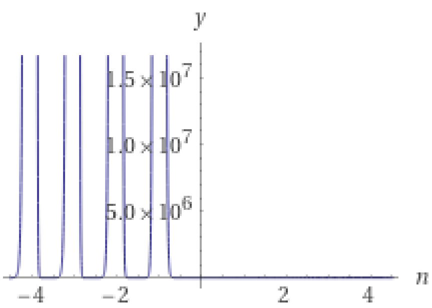
(HarmonicNumber(n))^10

Input

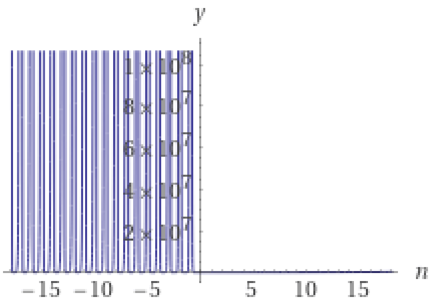
$(H_n)^{10}$

H_n is the n^{th} harmonic number

Plots



(n from −4.5 to 4.5)



(n from −18 to 18)

Values

n	1	2	3	4	5
$(H_n)^{10}$	1	$\frac{59049}{1024}$	25937424601/60466176	95367431640625/6191736422 4	2329194047563391944849/604661760000000000
approximation	1	57.665	428.958	1540.24	3852.06

Alternate form

$$\psi^{(0)}(n+1)^{10} + 10\gamma\,\psi^{(0)}(n+1)^9 + 45\gamma^2\,\psi^{(0)}(n+1)^8 + 120\gamma^3\,\psi^{(0)}(n+1)^7 + 210\gamma^4\,\psi^{(0)}(n+1)^6 + 252\gamma^5\,\psi^{(0)}(n+1)^5 + 210\gamma^6\,\psi^{(0)}(n+1)^4 + 120\gamma^7\,\psi^{(0)}(n+1)^3 + 45\gamma^8\,\psi^{(0)}(n+1)^2 + 10\gamma^9\,\psi^{(0)}(n+1) + \gamma^{10}$$

$\psi^{(n)}(x)$ is the n^{th} derivative of the digamma function

γ is the Euler-Mascheroni constant

Numerical root

$n \approx 0.000070459784309 4207\ldots$

Series expansion at n=0

$$\frac{\pi^{20} n^{10}}{60466176} + \frac{5\pi^{18} n^{11}\,\psi^{(2)}(1)}{10077696} + \frac{\pi^{16} n^{12}\left(2\pi^6 + 1215\,\psi^{(2)}(1)^2\right)}{181398528} + \frac{\pi^{14} n^{13}\left(36\pi^6\,\psi^{(2)}(1) + 6480\,\psi^{(2)}(1)^3 + 5\pi^4\,\psi^{(4)}(1)\right)}{120932352} + \frac{1}{38093690880}\pi^{12} n^{14}\left(166\pi^{12} + 136080\pi^6\,\psi^{(2)}(1)^2 + 10716300\,\psi^{(2)}(1)^4 + 42525\pi^4\,\psi^{(2)}(1)\,\psi^{(4)}(1)\right) + O(n^{15})$$

(Taylor series)

Series expansion at n=∞

$$(\log(n)+\gamma)^{10}+\frac{5(\log(n)+\gamma)^9}{n}-\frac{5\left((\log(n)+\gamma)^8(2\log(n)+2\gamma-27)\right)}{12n^2}-\frac{15\left((\log(n)+\gamma-4)(\log(n)+\gamma)^7\right)}{4n^3}+\frac{1}{48n^4}(\log(n)+\gamma)^6\left(4\log^3(n)+3(5+4\gamma)\log^2(n)+6\left(-60+5\gamma+2\gamma^2\right)\log(n)+4\gamma^3+15\gamma^2-360\gamma+630\right)+\frac{1}{8n^5}(\log(n)+\gamma)^5\left(3\log^3(n)+(10+9\gamma)\log^2(n)+\left(-70+20\gamma+9\gamma^2\right)\log(n)+3\gamma^3+10\gamma^2-70\gamma+63\right)+O\left(\left(\frac{1}{n}\right)^6\right)$$

(generalized Puiseux series)

Derivative

$$\frac{d}{dn}\left((H_n)^{10}\right)=\frac{5}{3}(H_n)^9\left(\pi^2-6H_n^{(2)}\right)$$

$H_n^{(r)}$ is the generalized harmonic number

Alternative representations

$$(H_n)^{10}=\left(H_n^{(1)}\right)^{10}$$

$$(H_n)^{10}=(\gamma+\psi(1+n))^{10}$$

$$(H_n)^{10}=(\gamma+\psi(1+n))^{10}$$

$\psi(x)$ is the digamma function

Series representations

$$(H_n)^{10} = n^{10}\left(\sum_{k=0}^{\infty}\frac{1}{(1+k)(1+k+n)}\right)^{10}$$

$$(H_n)^{10} = \left(\sum_{k=0}^{\infty}\sum_{j=0}^{\infty}(-1)^j (1+k)^{-2-j} n^{1+j}\right)^{10} \quad \text{for } |n| < 1$$

$$(H_n)^{10} = \left(H_{z_0} + \sum_{k=0}^{\infty}\sum_{j=0}^{\infty}(-1)^j (n-z_0)^{1+j} (1+k+z_0)^{-2-j}\right)^{10} \quad \text{for } (z_0 \notin \mathbb{Z} \text{ or } z_0 \geq 0)$$

From:

$$\int_{\partial A}\left(|\nabla_{\partial A}\zeta|^2 - \|B_{\partial A}\|^2\zeta^2\right) d\mathscr{H}^{n-1}(x)$$

for $\zeta = e^{\pi\sqrt{22}}$, we obtain:

Integrate(($\nabla * e^{\pi\sqrt{22}}$)^2 – B^2($e^{\pi\sqrt{22}}$)^2 *1540.24) dx

For ∇ = del f(x) = (df(x))/(dx) e_x

Input interpretation

$\nabla(e\_x f'(x))$

Named operator form

$\text{grad}(e\_x f'(x))$

Result in 2D Cartesian coordinates

$$\nabla(e\_x f'(x)) = \left(e\left(\_x \frac{\partial^2 f(x)}{\partial x^2} + \frac{\partial f(x)}{\partial x}\frac{\partial \_x}{\partial x}\right), 0\right)$$

(x: first Cartesian coordinate | y: second Cartesian coordinate)

integrate((((((((e (1 (d^2 f(x))/(dx^2) + (df(x))/(dx) (d)/(dx)))))*((e^(π√22))))^2))) – B^2(e^(π√22))^2 *1540.24)))x

Input interpretation

$$\int\left(\left(\left(e\left(1\times\frac{d^2 f(x)}{d x^2}+\frac{d f(x)}{d x}\times\frac{d}{d x}\right)\right)e^{\pi\sqrt{22}}\right)^2-B^2\left(\left(e^{\pi\sqrt{22}}\right)^2\times 1540.24\right)\right)x\,dx$$

From:

(e (1 (d^2 f(x))/(dx^2) + (df(x))/(dx) (d)/(dx)))

Input

$$e\left(1\times\frac{d^2 f(x)}{d x^2}+\frac{d f(x)}{d x}\times\frac{d}{d x}\right)$$

Exact result

$$e\left(\frac{d f(x)}{x^2}+\frac{f(x)}{x^2}\right)$$

Alternate form

$$\frac{e(d+1)f(x)}{x^2}$$

Expanded form

$$\frac{e\,d\,f(x)}{x^2}+\frac{e\,f(x)}{x^2}$$

Series expansion at x=0

$$\frac{e(d+1)f(0)}{x^2}+\frac{e(d+1)f'(0)}{x}+\frac{1}{2}e(d+1)f''(0)+\frac{1}{6}e(d+1)f^{(3)}(0)\,x+\frac{1}{24}e(d+1)f^{(4)}(0)\,x^2+O\left(x^3\right)$$

(Laurent series)

Derivative

$$\frac{\partial}{\partial x}\left(e\left(\frac{d f(x)}{x^2}+\frac{f(x)}{x^2}\right)\right)=\frac{e(d+1)(x f'(x)-2f(x))}{x^3}$$

Definite integral over a square of edge length 2 L

$$\int_{-L}^{L}\int_{-L}^{L} e\left(\frac{f(x)}{x^2} + \frac{d\,f(x)}{x^2}\right) dx\,dd = \frac{2\,e\,L\,f(x)}{x^2}$$

From:.

$$\frac{e\,(d+1)\,f(0)}{x^2} + \frac{e\,(d+1)\,f'(0)}{x} + \frac{1}{2}\,e\,(d+1)\,f''(0) + \frac{1}{6}\,e\,(d+1)\,f^{(3)}(0)\,x + \frac{1}{24}\,e\,(d+1)\,f^{(4)}(0)\,x^2 + O\left(x^3\right)$$

(Laurent series)

integrate((((((((e (d + 1) f(0))/x^2 + (e (d + 1) f'(0))/x + 1/2 e (d + 1) f''(0) + 1/6 e (d + 1) f^(3)(0) x + 1/24 e (d + 1) f^(4)(0) x^2 + O(2^3))) ((e^(π√22))))^2))) – B^2(e^(π√22))^2 *1540.24))x

Indefinite integral

$$\int\left(\left(\left(\left(\frac{e\,(d+1)\,f(0)}{x^2} + \frac{e\,(d+1)\,f'(0)}{x} + \frac{1}{2}\,e\,(d+1)\,f''(0) + \frac{1}{6}\,e\,(d+1)\left(f^3\,0\right)x + \frac{1}{24}\,e\,(d+1)\left(f^4\,0\right)x^2 + O\left(2^3\right)\right) e^{\pi\sqrt{22}}\right)^2 - B^2\left(e^{\pi\sqrt{22}}\right)^2 1540.24\right) x\,dx =$$

$$-0.5\,x^2\left(9.69556\times10^{15}\,B^2 + \left(-1.71111\times10^{13}\,d - 1.71111\times10^{13}\right)O(8)\,f''(0) - 1.16282\times10^{13}\,(d+1)^2\,f''(0)^2 - 6.29484\times10^{12}\,O(8)^2\right) - \frac{9.30259\times10^{13}\,(d+1)^2\,f(0)\,f'(0)}{x} + x\,f'(0)\left(4.65129\times10^{13}\,(d+1)^2\,f''(0) + \left(3.42223\times10^{13}\,d + 3.42223\times10^{13}\right)O(8)\right) + \log(x)\left(f(0)\left(4.65129\times10^{13}\,(d+1)^2\,f''(0) + \left(3.42223\times10^{13}\,d + 3.42223\times10^{13}\right)O(8)\right) + 4.65129\times10^{13}\,(d+1)^2\,f'(0)^2\right) - \frac{2.32565\times10^{13}\,(d+1)^2\,f(0)^2}{x^2} + \text{constant}$$

$\log(x)$ is the natural logarithm

Alternate form assuming B, d, and x are real

$$-4.84778\times10^{15} B^2 x^2 + f(0)\log(x)\left(4.65129\times10^{13}(d+1)^2 f''(0) + \left(3.42223\times10^{13} d + 3.42223\times10^{13}\right) O(8)\right) - \frac{9.30259\times10^{13}(d+1)^2 f(0) f'(0)}{x} + 4.65129\times10^{13}(d+1)^2 f'(0)^2\log(x) + x\left(x\left(\left(8.55557\times10^{12} d + 8.55557\times10^{12}\right) O(8) f''(0) + 5.81412\times10^{12}(d+1)^2 f''(0)^2 + 3.14742\times10^{12} O(8)^2\right) + f'(0)\left(4.65129\times10^{13}(d+1)^2 f''(0) + \left(3.42223\times10^{13} d + 3.42223\times10^{13}\right)O(8)\right)\right) - \frac{2.32565\times10^{13}(d+1)^2 f(0)^2}{x^2} + \text{constant}$$

Alternate forms of the integral

$$-4.84778\times10^{15} B^2 x^2 + f(0)\log(x)\left(4.65129\times10^{13}(d+1)^2 f''(0) + \left(3.42223\times10^{13} d + 3.42223\times10^{13}\right) O(8)\right) - \frac{9.30259\times10^{13}(d+1)^2 f(0) f'(0)}{x} + 4.65129\times10^{13}(d+1)^2 f'(0)^2\log(x) + x\left(x\left(\left(8.55557\times10^{12} d + 8.55557\times10^{12}\right) O(8) f''(0) + 5.81412\times10^{12}(d+1)^2 f''(0)^2 + 3.14742\times10^{12} O(8)^2\right) + f'(0)\left(4.65129\times10^{13}(d+1)^2 f''(0) + \left(3.42223\times10^{13} d + 3.42223\times10^{13}\right)O(8)\right)\right) - \frac{2.32565\times10^{13}(d+1)^2 f(0)^2}{x^2} + \text{constant}$$

$$\frac{1}{x^2}\left(-4.84778\times10^{15} B^2 x^4 + 4.65129\times10^{13} d^2 x^2 f'(0)^2\log(x) - 9.30259\times10^{13} d^2 f(0)\, x f'(0) - 2.32565\times10^{13} d^2 f(0)^2 + 3.42223\times10^{13} d\, O(8) x^3 f'(0) + 9.30259\times10^{13} d x^2 f'(0)^2 \log(x) - 1.86052\times10^{14} d f(0)\, x f'(0) + 3.42223\times10^{13} d f(0) O(8) x^2\log(x) - 4.65129\times10^{13} d f(0)^2 + 3.42223\times10^{13} O(8) x^3 f'(0) + 4.65129\times10^{13} x^2 f'(0)^2\log(x) - 9.30259\times10^{13} f(0)\, x f'(0) + 3.42223\times10^{13} f(0) O(8) x^2 \log(x) - 2.32565\times10^{13} f(0)^2 + 3.14742\times10^{12} O(8)^2 x^4\right) + \left(5.81412\times10^{12} d^2 + 1.16282\times10^{13} d + 5.81412\times10^{12}\right) x^2 f''(0)^2 + f''(0)\left(4.65129\times10^{13} d^2 x f'(0) + 4.65129\times10^{13} d^2 f(0)\log(x) + 9.30259\times10^{13} d x f'(0) + 9.30259\times10^{13} d f(0)\log(x) + 8.55557\times10^{12} d\, O(8) x^2 + 4.65129\times10^{13} x f'(0) + 4.65129\times10^{13} f(0)\log(x) + 8.55557\times10^{12} O(8) x^2\right) + \text{constant}$$

$$-\frac{1}{x^2}\Big(4.84778\times 10^{15} B^2 x^4 - d^2 \big(5.81412\times 10^{12} x^4 f''(0)^2 - 9.30259\times 10^{13} f(0)\, x\, f'(0) + 4.65129\times 10^{13} x^3 f'(0) f''(0) + x^2 \log(x) \big(4.65129\times 10^{13} f(0) f''(0) + 4.65129\times 10^{13} f'(0)^2\big) - 2.32565\times 10^{13} f(0)^2\big) - d \big(x^4 f''(0) \big(1.16282\times 10^{13} f''(0) + 8.55557\times 10^{12} O(8)\big) - 1.86052\times 10^{14} f(0)\, x\, f'(0) + x^3 f'(0) \big(9.30259\times 10^{13} f''(0) + 3.42223\times 10^{13} O(8)\big) + x^2 \log(x) \big(f(0) \big(9.30259\times 10^{13} f''(0) + 3.42223\times 10^{13} O(8)\big) + 9.30259\times 10^{13} f'(0)^2\big) - 4.65129\times 10^{13} f(0)^2\big) - x^4 \big(8.55557\times 10^{12} O(8) f''(0) + 5.81412\times 10^{12} f''(0)^2 + 3.14742\times 10^{12} O(8)^2\big) + 9.30259\times 10^{13} f(0)\, x\, f'(0) - x^3 f'(0) \big(4.65129\times 10^{13} f''(0) + 3.42223\times 10^{13} O(8)\big) - x^2 \log(x) \big(f(0) \big(4.65129\times 10^{13} f''(0) + 3.42223\times 10^{13} O(8)\big) + 4.65129\times 10^{13} f'(0)^2\big) + 2.32565\times 10^{13} f(0)^2\Big) + \text{constant}$$

Expanded form of the integral

$$-4847782280576693\, B^2 x^2 + 5.81412\times 10^{12} d^2 x^2 f''(0)^2 + 4.65129\times 10^{13} d^2 f(0) f''(0) \log(x) - \frac{9.30259\times 10^{13} d^2 f(0) f'(0)}{x} + 4.65129\times 10^{13} d^2 f'(0)^2 \log(x) + 4.65129\times 10^{13} d^2 x f'(0) f''(0) - \frac{2.32565\times 10^{13} d^2 f(0)^2}{x^2} + 8.55557\times 10^{12} d\, O(8)\, x^2 f''(0) + 1.16282\times 10^{13} d\, x^2 f''(0)^2 + 9.30259\times 10^{13} d f(0) f''(0) \log(x) + 3.42223\times 10^{13} d\, O(8)\, x f'(0) - \frac{1.86052\times 10^{14} d f(0) f'(0)}{x} + 9.30259\times 10^{13} d f'(0)^2 \log(x) + 9.30259\times 10^{13} d\, x f'(0) f''(0) + 3.42223\times 10^{13} d f(0)\, O(8) \log(x) - \frac{4.65129\times 10^{13} d f(0)^2}{x^2} + 8.55557\times 10^{12} O(8)\, x^2 f''(0) + 5.81412\times 10^{12} x^2 f''(0)^2 + 4.65129\times 10^{13} f(0) f''(0) \log(x) + 3.42223\times 10^{13} O(8)\, x f'(0) - \frac{9.30259\times 10^{13} f(0) f'(0)}{x} + 4.65129\times 10^{13} f'(0)^2 \log(x) + 4.65129\times 10^{13} x f'(0) f''(0) + 3.42223\times 10^{13} f(0)\, O(8) \log(x) - \frac{2.32565\times 10^{13} f(0)^2}{x^2} + 3.14742\times 10^{12} O(8)^2 x^2 + \text{constant}$$

Series expansion of the integral at x=0

$$-\frac{2.32565\times 10^{13} \big((d+1)^2 f(0)^2\big)}{x^2} - \frac{9.30259\times 10^{13} \big((d+1)^2 f(0) f'(0)\big)}{x} + \log(x) \big(f(0) \big(4.65129\times 10^{13} (d+1)^2 f''(0) + \big(3.42223\times 10^{13} d + 3.42223\times 10^{13}\big) O(8)\big) + 4.65129\times 10^{13} (d+1)^2 f'(0)^2\big) + x f'(0) \big(4.65129\times 10^{13} (d+1)^2 f''(0) + \big(3.42223\times 10^{13} d + 3.42223\times 10^{13}\big) O(8)\big) + O(x^2)$$

(Puiseux series)

Series expansion of the integral at x=∞

$$x^2 \left(-4.84778\times 10^{15} B^2 + \left(8.55557\times 10^{12} d + 8.55557\times 10^{12}\right) O(8)\, f''(0) + 5.81412\times 10^{12} (d+1)^2 f''(0)^2 + 3.14742\times 10^{12} O(8)^2\right) + x\, f'(0) \left(4.65129\times 10^{13} (d+1)^2 f''(0) + \left(3.42223\times 10^{13} d + 3.42223\times 10^{13}\right) O(8)\right) + \log(x) \left(f(0) \left(4.65129\times 10^{13} (d+1)^2 f''(0) + \left(3.42223\times 10^{13} d + 3.42223\times 10^{13}\right) O(8)\right) + 4.65129\times 10^{13} (d+1)^2 f'(0)^2\right) - \frac{9.30259\times 10^{13} \left((d+1)^2 f(0)\, f'(0)\right)}{x} + O\left(\left(\frac{1}{x}\right)^2\right)$$

(generalized Puiseux series)

From:

$$-4.84778\times 10^{15} B^2 x^2 + f(0) \log(x) \left(4.65129\times 10^{13} (d+1)^2 f''(0) + \left(3.42223\times 10^{13} d + 3.42223\times 10^{13}\right) O(8)\right) - \frac{9.30259\times 10^{13} (d+1)^2 f(0)\, f'(0)}{x} + 4.65129\times 10^{13} (d+1)^2 f'(0)^2 \log(x) + x \left(x \left(\left(8.55557\times 10^{12} d + 8.55557\times 10^{12}\right) O(8)\, f''(0) + 5.81412\times 10^{12} (d+1)^2 f''(0)^2 + 3.14742\times 10^{12} O(8)^2\right) + f'(0) \left(4.65129\times 10^{13} (d+1)^2 f''(0) + \left(3.42223\times 10^{13} d + 3.42223\times 10^{13}\right) O(8)\right)\right) - \frac{2.32565\times 10^{13} (d+1)^2 f(0)^2}{x^2} + \text{constant}$$

For x = 2, B = 4 :

-4.84778×10^15 4^2 2^2 + f(0) log(2) (4.65129×10^13 (d + 1)^2 f"(0) + (3.42223×10^13 d + 3.42223×10^13) O(8)) - (9.30259×10^13 (d + 1)^2 f(0) f'(0))/2 + 4.65129×10^13 (d + 1)^2 f'(0)^2 log(2)

Input interpretation

$$-4.84778\times 10^{15}\times 4^2\times 2^2 + f(0) \log(2) \left(4.65129\times 10^{13} (d+1)^2 f''(0) + \left(3.42223\times 10^{13} d + 3.42223\times 10^{13}\right) O(8)\right) - \frac{1}{2}\left(9.30259\times 10^{13} (d+1)^2 f(0)\, f'(0)\right) + 4.65129\times 10^{13} (d+1)^2 f'(0)^2 \log(2)$$

$\log(x)$ is the natural logarithm

Result

$$f(0)\log(2)\left(4.65129\times10^{13}\,(d+1)^2\,f''(0)+\left(3.42223\times10^{13}\,d+3.42223\times10^{13}\right)O(8)\right)+3.22403\times10^{13}\,(d+1)^2\,f'(0)^2-4.6513\times10^{13}\,(d+1)^2\,f(0)\,f'(0)-3.10258\times10^{17}$$

log(2) (4.65129×10^13 (d + 1)^2 + (3.42223×10^13 d + 3.42223×10^13) (8)) + 3.22403×10^13 (d + 1)^2 - 4.6513×10^13 (d + 1)^2 - 3.10258×10^17

Input interpretation

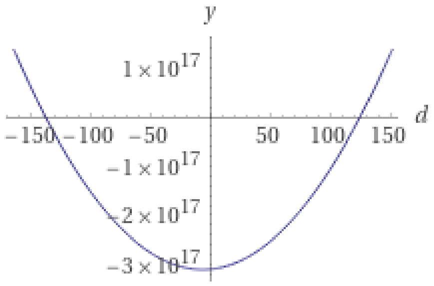
$$\log(2)\left(4.65129\times10^{13}\,(d+1)^2+\left(3.42223\times10^{13}\,d+3.42223\times10^{13}\right)\times8\right)+3.22403\times10^{13}\,(d+1)^2-4.6513\times10^{13}\,(d+1)^2-3.10258\times10^{17}$$

$\log(x)$ is the natural logarithm

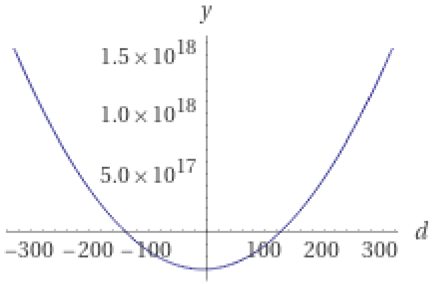
Result

$$-1.42727\times10^{13}\,(d+1)^2+\left(4.65129\times10^{13}\,(d+1)^2+8\left(3.42223\times10^{13}\,d+3.42223\times10^{13}\right)\right)\log(2)-3.10258\times10^{17}$$

Plots **(figures that can be related to the open strings)**



(d from −164.1 to 151.5)



(d from −328.1 to 315.5)

From

$$-1.42727\times10^{13}\,(d+1)^2 + \left(4.65129\times10^{13}\,(d+1)^2 + 8\left(3.42223\times10^{13}\,d + 3.42223\times10^{13}\right)\right)\log(2) - 3.10258\times10^{17}$$

For d = 151.5 :

-1.42727×10^13 (151.5+1)^2 + (4.65129×10^13 (151.5+1)^2 + 8 (3.42223×10^13 151.5 + 3.42223×10^13)) log(2) - 3.10258×10^17

Input interpretation

$$-1.42727\times10^{13}\,(151.5+1)^2 + \left(4.65129\times10^{13}\,(151.5+1)^2 + 8\left(3.42223\times10^{13}\times151.5 + 3.42223\times10^{13}\right)\right)\log(2) - 3.10258\times10^{17}$$

log(x) is the natural logarithm

Result

$$1.36540\ldots\times10^{17}$$

2 (2 ((8.55557×10^12 d + 8.55557×10^12) O(8) f''(0) + 5.81412×10^12 (d + 1)^2 f''(0)^2 + 3.14742×10^12 O(8)^2) + f'(0) (4.65129×10^13 (d + 1)^2 f''(0) + (3.42223×10^13 d + 3.42223×10^13) O(8))) - (2.32565×10^13 (d + 1)^2 f(0)^2)/2^2

Input interpretation

$$2\left(2\left(\left(8.55557\times10^{12}\,d + 8.55557\times10^{12}\right)O(8)\,f''(0) + 5.81412\times10^{12}\,(d+1)^2\,f''(0)^2 + 3.14742\times10^{12}\,O(8)^2\right) + f'(0)\left(4.65129\times10^{13}\,(d+1)^2\,f''(0) + \left(3.42223\times10^{13}\,d + 3.42223\times10^{13}\right)O(8)\right)\right) - \frac{2.32565\times10^{13}\,(d+1)^2\,f(0)^2}{2^2}$$

Result

$$2\left(2\left(\left(8.55557\times10^{12}\,d + 8.55557\times10^{12}\right)O(8)\,f''(0) + 5.81412\times10^{12}\,(d+1)^2\,f''(0)^2 + 3.14742\times10^{12}\,O(8)^2\right) + f'(0)\left(4.65129\times10^{13}\,(d+1)^2\,f''(0) + \left(3.42223\times10^{13}\,d + 3.42223\times10^{13}\right)O(8)\right)\right) - 5.81413\times10^{12}\,(d+1)^2\,f(0)^2$$

2(2((8.55557×10^12 d + 8.55557×10^12)(8) + 5.81412×10^12 (d + 1)^2 + 3.14742×10^12 (8)^2)+(4.65129×10^13 (d+1)^2 + (3.42223×10^13 d + 3.42223×10^13)(8))) - 5.81413×10^12 (d + 1)^2

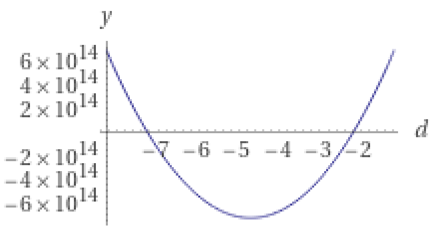
Input interpretation

$$2\left(2\left(\left(8.55557\times 10^{12}\, d + 8.55557\times 10^{12}\right)\times 8 + 5.81412\times 10^{12}\,(d+1)^2 + 3.14742\times 10^{12}\times 8^2\right) + \left(4.65129\times 10^{13}\,(d+1)^2 + \left(3.42223\times 10^{13}\, d + 3.42223\times 10^{13}\right)\times 8\right)\right) - 5.81413\times 10^{12}\,(d+1)^2$$

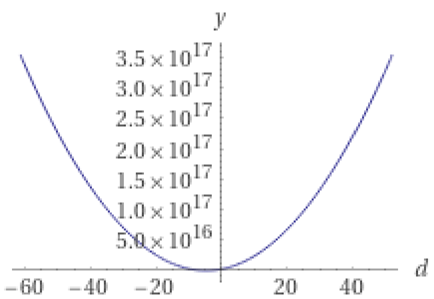
Result

$$2\left(4.65129\times 10^{13}\,(d+1)^2 + 8\left(3.42223\times 10^{13}\, d + 3.42223\times 10^{13}\right) + 2\left(5.81412\times 10^{12}\,(d+1)^2 + 8\left(8.55557\times 10^{12}\, d + 8.55557\times 10^{12}\right) + 2.01435\times 10^{14}\right)\right) - 5.81413\times 10^{12}\,(d+1)^2$$

Plots **(figures that can be related to the open strings)**



(d from −8.3 to −1.2)



(d from −61.3 to 51.9)

From

$$2\left(4.65129\times 10^{13}\,(d+1)^2 + 8\left(3.42223\times 10^{13}\, d + 3.42223\times 10^{13}\right) + 2\left(5.81412\times 10^{12}\,(d+1)^2 + 8\left(8.55557\times 10^{12}\, d + 8.55557\times 10^{12}\right) + 2.01435\times 10^{14}\right)\right) - 5.81413\times 10^{12}\,(d+1)^2$$

For d = 51.9

2(2((8.55557×10^12 51.9 + 8.55557×10^12)(8) + 5.81412×10^12 (51.9+1)^2 + 3.14742×10^12 (8)^2)+(4.65129×10^13 (51.9+1)^2 + (3.42223×10^13 51.9 + 3.42223×10^13)(8))) - 5.81413×10^12 (51.9+1)^2

Input interpretation

$$2\left(2\left(\left(8.55557\times 10^{12}\times 51.9+8.55557\times 10^{12}\right)\times 8+5.81412\times 10^{12}\,(51.9+1)^2+3.14742\times 10^{12}\times 8^2\right)+\left(4.65129\times 10^{13}\,(51.9+1)^2+\left(3.42223\times 10^{13}\times 51.9+3.42223\times 10^{13}\right)\times 8\right)\right)-5.81413\times 10^{12}\,(51.9+1)^2$$

Result

353 389 538 777 500 000

Scientific notation

$3.533895387775\times 10^{17}$

$3.533895387775 \times 10^{17}$

Thence, from:

$$\int\left(\left(\left(e\left(1\times\frac{d^2 f(x)}{d x^2}+\frac{d f(x)}{d x}\times\frac{d}{d x}\right)\right)e^{\pi\sqrt{22}}\right)^2-B^2\left(\left(e^{\pi\sqrt{22}}\right)^2\times 1540.24\right)\right)x\,dx$$

(1.36540 × 10^17+3.533895387775 × 10^17)

Input interpretation

$1.36540\times 10^{17}+3.533895387775\times 10^{17}$

Result

489 929 538 777 500 000

Scientific notation

$4.899295387775\times 10^{17}$

$4.899295387775 \times 10^{17}$

For:

$$+ 8\gamma \int_{\partial A} \int_{\partial A} G(x, y)\zeta(x)\zeta(y)\, d\mathscr{H}^{n-1}(x)\, d\mathscr{H}^{n-1}(y)$$

for γ = 8 :

64((((G(x, y) $*$ ($e^{\pi\sqrt{22}}$)x*($e^{\pi\sqrt{22}}$)y *(1540.24)^2)) dxdy

Input interpretation

$$\int\int 64\left(G(x, y)\, e^{\pi\sqrt{22}\, x}\, e^{\pi\sqrt{22}\, y} \times 1540.24^2\right) dx\, dy$$

$G(z)$ is the Barnes G-function

Result

$$1.5183\times 10^8 \int\int e^{\sqrt{22}\,\pi\,(x+y)}\, G(x, y)\, dx\, dy$$

For x = 2, y = 4 :

1.5183×10^8 integral integral e^(sqrt(22) π (2 + 4)) G(2, 4) dx dy

Input interpretation

$$1.5183\times 10^8 \int\int e^{\sqrt{22}\,\pi\,(2+4)}\, G(2, 4)\, dx\, dy$$

Result

$3.78714\times 10^{46}\, x\, y\, G(2, 4)$

Alternate form

$3.78714\times 10^{46}\, x\, y\, G(2, 4)$

Alternate form assuming x and y are real

$3.78714\times10^{46}\, x\, y\, G(2, 4) + 0$

From:

$3.78714\times10^{46}\, x\, y\, G(2, 4)$

3.78714×10^46 * 8

Input interpretation

$3.78714\times10^{46}\times8$

Result

302 971 200 000 000 000 000 000 000 000 000 000 000 000 000 000

Scientific notation

3.029712×10^{47}

$3.029712*10^{47}$

From:

$$+\,4\gamma\int_{\partial A}\nabla v\cdot v\zeta^2\, d\mathscr{H}^{n-1}(x).$$

32 integrate((((((((e (d + 1) f(0))/x^2 + (e (d + 1) f'(0))/x + 1/2 e (d + 1) f''(0) + 1/6 e (d + 1) f^(3)(0) x + 1/24 e (d + 1) f^(4)(0) x^2 + O(2^3)))*64*64((e^(π√22))))^2 *1540.24)))))dx

Input interpretation

$$32\int\left(\left(\frac{e\,(d+1)\,f(0)}{x^2}+\frac{e\,(d+1)\,f'(0)}{x}+\frac{1}{2}\,e\,(d+1)\,f''(0)+\frac{1}{6}\,e\,(d+1)\,(f^3\times0)\,x+\frac{1}{24}\,e\,(d+1)\,(f^4\times0)\,x^2+O(2^3)\right)\times 64\times64\,e^{\pi\sqrt{22}}\right)^2\times1540.24\,dx$$

Result

$$5.20527\times 10^{24}\left(\frac{e\,(d+1)\,O(8)\left(x^2\,f''(0)-2\,f(0)\right)}{x}+e\,(d+1)\,f'(0)\log(x)\left(e\,(d+1)\,f''(0)+2\,O(8)\right)-\frac{1}{12\,x^3}e^2\,(d+1)^2\left(-3\,x^4\,f''(0)^2+12\,x^2\,f'(0)^2+12\,f(0)\,x\left(x\,f''(0)+f'(0)\right)+4\,f(0)^2\right)+O(8)^2\,x\right)$$

Alternate forms

$$\frac{1.41494\times 10^{25}\,(d+1)\,O(8)\left(x^2\,f''(0)-2\,f(0)\right)}{x}+1.41494\times 10^{25}\,(d+1)\,f'(0)\log(x)\left(e\,(d+1)\,f''(0)+2\,O(8)\right)-\frac{1}{x^3}3.20517\times 10^{24}\,(d+1)^2\left(-3\,x^4\,f''(0)^2+12\,x^2\,f'(0)^2+12\,f(0)\,x\left(x\,f''(0)+f'(0)\right)+4\,f(0)^2\right)+5.20527\times 10^{24}\,O(8)^2\,x$$

$$e^2\left(1.30132\times 10^{24}\,d^2\,x+2.60263\times 10^{24}\,d\,x+1.30132\times 10^{24}\,x\right)f''(0)^2+\frac{1}{x^3}\left(-3.8462\times 10^{25}\,d^2\,x^2\,f'(0)^2-3.8462\times 10^{25}\,d^2\,f(0)\,x\,f'(0)-1.28207\times 10^{25}\,d^2\,f(0)^2+2.82988\times 10^{25}\,d\,O(8)\,x^3\,f'(0)\log(x)-7.6924\times 10^{25}\,d\,x^2\,f'(0)^2-7.6924\times 10^{25}\,d\,f(0)\,x\,f'(0)-2.82988\times 10^{25}\,d\,f(0)\,O(8)\,x^2-2.56413\times 10^{25}\,d\,f(0)^2+2.82988\times 10^{25}\,O(8)\,x^3\,f'(0)\log(x)-3.8462\times 10^{25}\,x^2\,f'(0)^2-3.8462\times 10^{25}\,f(0)\,x\,f'(0)-2.82988\times 10^{25}\,f(0)\,O(8)\,x^2-1.28207\times 10^{25}\,f(0)^2+5.20527\times 10^{24}\,O(8)^2\,x^4\right)+\frac{1}{x}2.71828\,f''(0)\left(1.41494\times 10^{25}\,d^2\,x\,f'(0)\log(x)-1.41494\times 10^{25}\,d^2\,f(0)+2.82988\times 10^{25}\,d\,x\,f'(0)\log(x)-2.82988\times 10^{25}\,d\,f(0)+5.20527\times 10^{24}\,d\,O(8)\,x^2+1.41494\times 10^{25}\,x\,f'(0)\log(x)-1.41494\times 10^{25}\,f(0)+5.20527\times 10^{24}\,O(8)\,x^2\right)$$

$$\frac{1}{x^3}\left(9.6155\times 10^{24}\, d^2\, x^4\, f''(0)^2 - 3.8462\times 10^{25}\, d^2\, f(0)\, x^2\, f''(0) - 3.8462\times 10^{25}\, d^2\, x^2\, f'(0)^2 - 3.8462\times 10^{25}\, d^2\, f(0)\, x\, f'(0) + 3.8462\times 10^{25}\, d^2\, x^3\, f'(0)\, f''(0)\log(x) - 1.28207\times 10^{25}\, d^2\, f(0)^2 + 1.41494\times 10^{25}\, d\, O(8)\, x^4\, f''(0) + 1.9231\times 10^{25}\, d\, x^4\, f''(0)^2 - 7.6924\times 10^{25}\, d\, f(0)\, x^2\, f''(0) + 2.82988\times 10^{25}\, d\, O(8)\, x^3\, f'(0)\log(x) - 7.6924\times 10^{25}\, d\, x^2\, f'(0)^2 - 7.6924\times 10^{25}\, d\, f(0)\, x\, f'(0) + 7.6924\times 10^{25}\, d\, x^3\, f'(0)\, f''(0)\log(x) - 2.82988\times 10^{25}\, d\, f(0)\, O(8)\, x^2 - 2.56413\times 10^{25}\, d\, f(0)^2 + 1.41494\times 10^{25}\, O(8)\, x^4\, f''(0) + 9.6155\times 10^{24}\, x^4\, f''(0)^2 - 3.8462\times 10^{25}\, f(0)\, x^2\, f''(0) + 2.82988\times 10^{25}\, O(8)\, x^3\, f'(0)\log(x) - 3.8462\times 10^{25}\, x^2\, f'(0)^2 - 3.8462\times 10^{25}\, f(0)\, x\, f'(0) + 3.8462\times 10^{25}\, x^3\, f'(0)\, f''(0)\log(x) - 2.82988\times 10^{25}\, f(0)\, O(8)\, x^2 - 1.28207\times 10^{25}\, f(0)^2 + 5.20527\times 10^{24}\, O(8)^2\, x^4\right)$$

Series expansion of the integral at x=∞

$$x\left(\left(1.41494\times 10^{25}\, d + 1.41494\times 10^{25}\right) O(8)\, f''(0) + \left(3.10089\times 10^{12}\, d + 3.10089\times 10^{12}\right)^2 f''(0)^2 + 5.20527\times 10^{24}\, O(8)^2\right) + 1.41494\times 10^{25}\,(d+1)\, f'(0)\log(x)\left(e\,(d+1)\, f''(0) + 2\, O(8)\right) + \frac{1}{x}\left(d^2\left(-3.8462\times 10^{25}\, f(0)\, f''(0) - 3.8462\times 10^{25}\, f'(0)^2\right) + d\, f(0)\left(-7.6924\times 10^{25}\, f''(0) - 2.82988\times 10^{25}\, O(8)\right) - 7.6924\times 10^{25}\, d\, f'(0)^2 + f(0)\left(-3.8462\times 10^{25}\, f''(0) - 2.82988\times 10^{25}\, O(8)\right) - 3.8462\times 10^{25}\, f'(0)^2\right) + O\left(\left(\frac{1}{x}\right)^2\right)$$

(generalized Puiseux series)

Derivative

$$\frac{\partial}{\partial x}\left(5\,205\,266\,588\,301\,298\,113\,708\,032 \left(\frac{e\,(d+1)\,O(8)\left(x^2\,f''(0)-2\,f(0)\right)}{x} + e\,(d+1)\,f'(0)\log(x) \left(e\,(d+1)\,f''(0)+2\,O(8)\right) - \frac{1}{12\,x^3} e^2\,(d+1)^2\left(-3\,x^4\,f''(0)^2 + 12\,x^2\,f'(0)^2 + 12\,f(0)\,x\left(x\,f''(0)+f'(0)\right)+4\,f(0)^2\right) + O(8)^2\,x\right)\right) =$$

$$-\frac{14\,149\,381\,579\,264\,427\,481\,366\,528\,(d+1)\,O(8)\left(x^2\,f''(0)-2\,f(0)\right)}{x^2} + 28\,298\,763\,158\,528\,854\,962\,733\,056\,(d+1)\,O(8)\,f''(0) + \frac{14\,149\,381\,579\,264\,427\,481\,366\,528\,(d+1)\,f'(0)\,(e\,(d+1)\,f''(0)+2\,O(8))}{x} + \frac{1}{x^4} 9\,615\,501\,707\,711\,911\,729\,037\,312\,(d+1)^2 \left(-3\,x^4\,f''(0)^2 + 12\,x^2\,f'(0)^2 + 12\,f(0)\,x\left(x\,f''(0)+f'(0)\right)+4\,f(0)^2\right) + \frac{1}{x^3} 38\,462\,006\,830\,847\,646\,916\,149\,248\,(d+1)^2 \left(x\,f''(0)\left(x^2\,f''(0)-2\,f(0)\right)-2\,x\,f'(0)^2-f(0)\,f'(0)\right) + 5\,205\,266\,588\,301\,298\,113\,708\,032\,O(8)^2$$

Indefinite integral assuming all variables are real

$$7.07469\times 10^{24}\,(d+1)\,O(8)\,x^2\,f''(0) + 4.80775\times 10^{24}\,(d+1)^2\,x^2\,f''(0)^2 + \frac{3.8462\times 10^{25}\,(d+1)^2\,f(0)\,f'(0)}{x} - 1.41494\times 10^{25}\,(d+1)\,x\,f'(0)\left(e\,d\,f''(0)+e\,f''(0)+2\,O(8)\right) + 1.41494\times 10^{25}\,(d+1)\,x\,f'(0)\log(x)\left(e\,d\,f''(0)+e\,f''(0)+2\,O(8)\right) - 3.8462\times 10^{25}\,(d+1)^2\log(x)\left(f(0)\,f''(0)+f'(0)^2\right) - 2.82988\times 10^{25}\,(d+1)\,f(0)\,O(8)\log(x) + \frac{6.41033\times 10^{24}\,(d+1)^2\,f(0)^2}{x^2} + 2.60263\times 10^{24}\,O(8)^2\,x^2 + \text{constant}$$

From:

$$5.20527\times 10^{24}\left(\frac{e\,(d+1)\,O(8)\left(x^2\,f''(0)-2\,f(0)\right)}{x} + e\,(d+1)\,f'(0)\log(x)\left(e\,(d+1)\,f''(0)+2\,O(8)\right) - \frac{1}{12\,x^3} e^2\,(d+1)^2\left(-3\,x^4\,f''(0)^2 + 12\,x^2\,f'(0)^2 + 12\,f(0)\,x\left(x\,f''(0)+f'(0)\right)+4\,f(0)^2\right) + O(8)^2\,x\right)$$

For x = 2 :

5.20527×10^24 (e(d+1) (8) (2^2 - 2))/2+e (d+1) log(2) (e(d+1)+2 (8) - (e^2 (d+1)^2 (-3 2^4 + 12 2^2 + 12 2 (2 + 1) + 4))/(12*8) + (8)^2 2)

Input interpretation

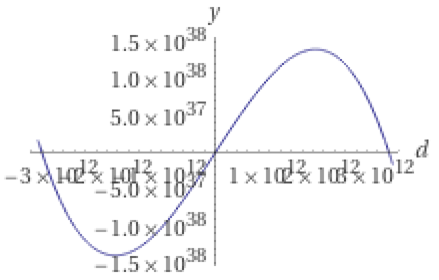
$$5.20527\times 10^{24}\left(\frac{1}{2}\left((e\,(d+1))\times 8\left(2^2-2\right)\right)\right)+e\,(d+1)\log(2)\left(e\,(d+1)+2\times 8-\frac{e^2\,(d+1)^2\left(-3\times 2^4+12\times 2^2+12\times 2\,(2+1)+4\right)}{12\times 8}+8^2\times 2\right)$$

$\log(x)$ is the natural logarithm

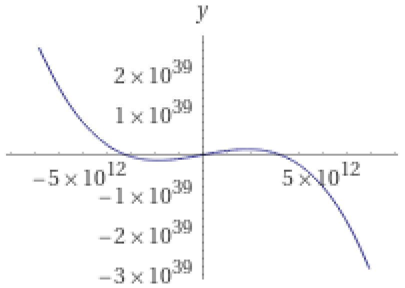
Result

$$1.13195\times 10^{26}\,(d+1)+e\left(-\frac{19}{24}\,e^2\,(d+1)^2+e\,(d+1)+144\right)(d+1)\log(2)$$

Plots **(figures that can be related to the open strings)**



(d from -3.3×10^{12} to 3.3×10^{12})



(d from -7.8×10^{12} to 7.8×10^{12})

Alternate forms

$$-\frac{1}{24}\,e\,(d+1)\left(19\,e^2\,d^2+38\,e^2\,d-24\,e\,d+19\,e^2-24\,e-3456\right)\log(2)+1.13195\times 10^{26}\,d+1.13195\times 10^{26}$$

$$\frac{1}{24}\left(-19\, e^3\, d^3 \log(2) - 3\, e^2\, (19\, e - 8)\, d^2 \log(2) + 2.71668\times 10^{27}\, d + 2.71668\times 10^{27}\right)$$

$$1.88417\left(-5.84967\,(d+1)^2 + 2.71828\,(d+1) + 144\right)(d+1) + 1.13195\times 10^{26}\,(d+1)$$

Expanded form

$$-\frac{19}{24}\, e^3\, d^3 \log(2) - \frac{19}{8}\, e^3\, d^2 \log(2) + e^2\, d^2 \log(2) + 1.13195\times 10^{26}\, d - \frac{19}{8}\, e^3\, d \log(2) + 2\, e^2\, d \log(2) + 144\, e\, d \log(2) + 1.13195\times 10^{26}$$

Roots

$d \approx -3.20471\times 10^{12}$

$d = -1$

$d \approx 3.20471\times 10^{12}$

Polynomial discriminant

$\Delta = 6.39432\times 10^{79}$

Integer root

$d = -1$

Derivative

$$\frac{d}{dd}\left(113\,195\,126\,825\,784\,097\,621\,671\,936\,(d+1) + e\left(-\frac{19}{24}\, e^2\,(d+1)^2 + e\,(d+1) + 144\right)(d+1)\log(2)\right) = -33.0653\, d^2 - 55.8872\, d + 113\,195\,126\,825\,784\,097\,621\,671\,936$$

Indefinite integral

$$\int\left(1.13195\times10^{26}\,(1+d)+(1+d)\,e\left(144+(1+d)\,e-\frac{19}{24}\,(1+d)^2\,e^2\right)\log(2)\right)dd =$$
$$-2.75544\,d^4-9.31453\,d^3+5.65976\times10^{25}\,d^2+1.13195\times10^{26}\,d + \text{constant}$$

Definite integral area below the axis between the smallest and largest real roots

$$\int_{-3.20471\times10^{12}}^{3.20471\times10^{12}}\left(1.13195\times10^{26}\,(1+d)+\right.$$
$$\left.(1+d)\,e\left(144+(1+d)\,e-\frac{19}{24}\,(1+d)^2\,e^2\right)\log(2)\right)$$
$$\theta\left(-1.13195\times10^{26}\,(1+d)-(1+d)\,e\left(144+(1+d)\,e-\frac{19}{24}\,(1+d)^2\,e^2\right)\log(2)\right)$$
$$dd=-2.90633\times10^{50}$$

$\theta(x)$ is the Heaviside step function

Definite integral area above the axis between the smallest and largest real roots

$$\int_{-3.20471\times10^{12}}^{3.20471\times10^{12}}\left(1.13195\times10^{26}\,(1+d)+\right.$$
$$\left.(1+d)\,e\left(144+(1+d)\,e-\frac{19}{24}\,(1+d)^2\,e^2\right)\log(2)\right)$$
$$\theta\left(1.13195\times10^{26}\,(1+d)+(1+d)\,e\left(144+(1+d)\,e-\frac{19}{24}\,(1+d)^2\,e^2\right)\log(2)\right)$$
$$dd=2.90633\times10^{50}$$

From:

$$1.13195\times10^{26}\,(d+1)+e\left(-\frac{19}{24}\,e^2\,(d+1)^2+e\,(d+1)+144\right)(d+1)\log(2)$$

For d = $7.8 * 10^{12}$:

1.13195×10^26 (1 + 7.8*10^12) + (1 + 7.8*10^12) e (144 + (1 + 7.8*10^12) e - 19/24 (1 + 7.8*10^12)^2 e^2) log(2)

Input interpretation

$$1.13195 \times 10^{26} \left(1 + 7.8 \times 10^{12}\right) + \left(1 + 7.8 \times 10^{12}\right) e \left(144 + \left(1 + 7.8 \times 10^{12}\right) e - \frac{19}{24} \left(1 + 7.8 \times 10^{12}\right)^2 e^2\right) \log(2)$$

log(x) is the natural logarithm

Result

$-4.34748... \times 10^{39}$

$-4.34748*10^{39}$

For d = $3.3*10^{12}$:

1.13195×10^26 (1 + 3.3*10^12) + (1 + 3.3*10^12) e (144 + (1 + 3.3*10^12) e - 19/24 (1 + 3.3*10^12)^2 e^2) log(2)

Input interpretation

$$1.13195 \times 10^{26} \left(1 + 3.3 \times 10^{12}\right) + \left(1 + 3.3 \times 10^{12}\right) e \left(144 + \left(1 + 3.3 \times 10^{12}\right) e - \frac{19}{24} \left(1 + 3.3 \times 10^{12}\right)^2 e^2\right) \log(2)$$

log(x) is the natural logarithm

Result

$-2.25458... \times 10^{37}$

$-2.25458*10^{37}$

Thence:

(4.899295387775*10^17 +3.029712*10^47 - 1/2(-4.34748*10^39-2.25458*10^37))

Input interpretation

$4.899295387775\times10^{17}+3.029712\times10^{47}-\frac{1}{2}\left(-4.34748\times10^{39}-2.25458\times10^{37}\right)$

Result

302 971 202 185 012 900 000 000 000 000 489 929 538 777 500 000

Scientific notation

$3.029712021850129000000000000000004899295387775\times10^{47}$

$3.029712\ldots*10^{47}$

From which:

16ln(-3.05053*10^17+3.029712*10^47+1.511314*10^22)-21-(((√(10-2√5) -2))/((√5-1)))

where ((√(10-2√5) -2))/((√5-1)) = 0.28407904384 = κ = 8πG; G =0.011303146014

Input interpretation

$$16\log\left(-3.05053\times10^{17}+3.029712\times10^{47}+1.511314\times10^{22}\right)-21-\frac{\sqrt{10-2\sqrt{5}}-2}{\sqrt{5}-1}$$

log(x) is the natural logarithm

Result

1727.99539…

1727.99539… ≈ 1728

This result is very near to the mass of candidate glueball **f_0(1710) scalar meson.** Furthermore, 1728 occurs in the algebraic formula for the j-invariant of an elliptic curve. (1728 = $8^2 * 3^3$) The number 1728 is one less than the Hardy–Ramanujan number 1729 (taxicab number)

(64/1728((16ln(-3.05053*10^17+3.029712*10^47+1.511314*10^22)-21-(((√(10-2√5) -2))/((√5-1))))))^2

Input interpretation

$$\left(\frac{64}{1728}\left(16\log\left(-3.05053\times 10^{17}+3.029712\times 10^{47}+1.511314\times 10^{22}\right)-21-\frac{\sqrt{10-2\sqrt{5}}-2}{\sqrt{5}-1}\right)\right)^2$$

log(x) is the natural logarithm

Result

4095.9782…

4095.9782… ≈ 4096 = 64^2

(16ln(-3.05053*10^17+3.029712*10^47+1.511314*10^22)-21-(((√(10-2√5) -2))/((√5-1)))+1)^1/15

Input interpretation

$$\left(16\log\left(-3.05053\times 10^{17}+3.029712\times 10^{47}+1.511314\times 10^{22}\right)-21-\frac{\sqrt{10-2\sqrt{5}}-2}{\sqrt{5}-1}+1\right)\hat{}\,(1/15)$$

log(x) is the natural logarithm

Result

1.643814937…

1.643814937…. ≈ ζ(2) = $\frac{\pi^2}{6}$ = 1.644934 ... (trace of the instanton shape)

From:

MINIMALITY VIA SECOND VARIATION FOR A NONLOCAL ISOPERIMETRIC PROBLEM - *E.ACERBI*, *N.FUSCO*, *M.MORINI* - 2013

We have:

$$\eta \in (0,1) \quad \varepsilon > 0. \quad \delta_1 > 0 \quad C > 0$$

$$\eta := \|\psi\|_{W^{2,p}(\partial E)} + \|\psi\|_{L^2(\partial E)} .$$

$$\|\psi\|_{W^{2,p}(\partial E)} \leq \eta_0 ,$$

For $\eta_0 > 0$; $\eta_0 = 4$; $\eta = 0.5$; $\delta_1 = 8$; C = 2 ; $\varepsilon = 2/3$

0.5 = 4 + x; x = -3.5 = $\|\psi\|_{L^2(\partial E)}$

From:

$$\left| \int_{\partial E} \psi \nu \, d\mathcal{H}^{N-1} \right| \leq \frac{\delta_1}{2} \|\psi\|_{L^2(\partial E)} .$$

we obtain:

8/2*(-3.5)

Input

$$\frac{8}{2} \times (-3.5)$$

Result

−14

-14

From:

$$\int_{\partial E} |X(\Phi(x,t))| \, d\mathcal{H}^{N-1} \leq C\|\psi\|_{L^2(\partial E)} \, .$$

we obtain:

2*(-3.5) = - 7

From:

$$\left|\int_{\partial E_t} (X \cdot \nu^{E_t})\nu^{E_t} \, d\mathcal{H}^{N-1}\right| \leq \left|\int_{\partial E} \psi\nu \, d\mathcal{H}^{N-1}\right| + \varepsilon\|\psi\|_{L^2(\partial E)} \leq \left(\frac{\delta_1}{2} + \varepsilon\right)\|\psi\|_{L^2(\partial E)} \, ,$$

we obtain:

(8/2+2/3)*(-3.5)

Input

$$\left(\frac{8}{2} + \frac{2}{3}\right) \times (-3.5)$$

Result

$-16.33333333333333333333333333333333333333333333333333333333333333333\ldots$

-16.33333….

Repeating decimal

$-16.\overline{3}$ (period 1)

Rational approximation

$$-\frac{49}{3}$$

For $m_0 = 1$ and $\|\psi\|_{L^2(\partial E)} = -3.5$

We have:

$$J(F) \geq J(E) + \frac{m_0}{8}\int_0^1 (1-t)\|X \cdot \nu^{E_t}\|^2_{H^1(\partial E_t)}\,dt \geq J(E) + \frac{m_0}{8}\int_0^1 (1-t)\|X \cdot \nu^{E_t}\|^2_{L^2(\partial E_t)}\,dt\,.$$

$$J(F) \geq J(E) + \frac{m_0}{32}\|\psi\|^2_{L^2(\partial E)} \geq J(E) + C_0|E \triangle F|^2\,.$$

From:

$$J(F) \geq J(E) + \frac{m_0}{32}\|\psi\|^2_{L^2(\partial E)}$$

y = x +1/32 * (-3.5)^2

Input

$$y = x + \frac{1}{32}(-3.5)^2$$

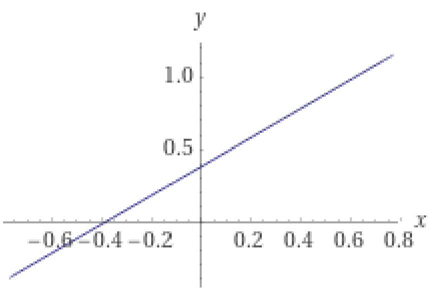
Result

$y = x + 0.382813$

Geometric figure

line

Plot



(x from −0.8 to 0.8)

Alternate forms

$y = x + 0.382813$

$-x + y - 0.382813 = 0$

Root

$x \approx -0.382813$

Properties as a real function

Domain

$\mathbb{R}$ (all real numbers)

Range

$\mathbb{R}$ (all real numbers)

Bijectivity

bijective from its domain to $\mathbb{R}$

$\mathbb{R}$ is the set of real numbers

Partial derivatives

$$\frac{\partial}{\partial x}(x + 0.382813) = 1$$

$$\frac{\partial}{\partial y}(x + 0.382813) = 0$$

For x = J(E) = 0.61803398 :

From:

$y = x + 0.382813$

0.382813 + Φ

Input interpretation

0.382813 + Φ

Φ is the golden ratio conjugate

Result

1.000846988749894848204586834365638117720309179805762862135448622 7...

1.00084698874989….= y = J (F)

As $\nu_i,\, i = 1, \ldots, N.$, $\nu_E = 64$

$X = \nu^E$

X = 64

From:

$$I_t := \left| \int_{\partial E_t} (4\gamma v_{E_t} + H_t)\, \mathrm{div}_{\tau_t}\left(X_{\tau_t}(X \cdot \nu^{E_t})\right) d\mathcal{H}^{N-1} \right| \leq \frac{m_0}{4} \|X \cdot \nu^{E_t}\|^2_{H^1(\partial E_t)}$$

we obtain:

1/4 ||64*64||^2

Input

$$\frac{1}{4} \|64 \times 64\|^2$$

||expr|| gives the norm of a number, vector, or matrix

Result

4194304

4194304

From:

$$J(F) \geq J(E) + \frac{m_0}{32}\|\psi\|^2_{L^2(\partial E)} \geq J(E) + C_0|E\triangle F|^2 .$$

$$J(E) + \frac{m_0}{32}\|\psi\|^2_{L^2(\partial E)} \geq J(E) + C_0|E\triangle F|^2 .$$

0.61803398+1/32*(-3.5)^2 = 0.61803398+x^2

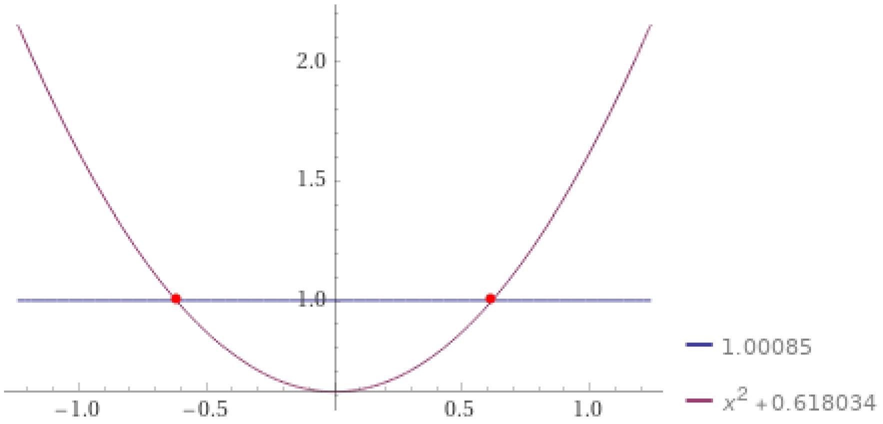
Input interpretation

$$0.61803398 + \frac{1}{32}(-3.5)^2 = 0.61803398 + x^2$$

Result

$1.00085 = x^2 + 0.618034$

Plot **(figure that can be related to an open string)**



Alternate forms

$1.00085 = x^2 + 0.618034$

$0.382812 - x^2 = 0$

Solutions

$x \approx -0.618718$

$x \approx 0.618718$

$\left(C_0|E\triangle F| \right)$ = 0.618718 ≈ 0.61803398 = golden ratio conjugate

We have:

Lemma 4.1. *Let $E \subset \mathbb{T}^N$ be of class C^2 and let $F \subset \mathbb{T}^N$ be a set of finite perimeter. Then there exists $C = C(E) > 0$ such that*

$$P_{\mathbb{T}^N}(F) - P_{\mathbb{T}^N}(E) \geq -C|E\triangle F|\,.$$

Proof. Let $X \in C^1(\mathbb{T}^N;\mathbb{R}^N)$ be a vector field such that $\|X\|_\infty \leq 1$ and $X = \nu^E$ on ∂E. Then,

$$\begin{aligned} P_{\mathbb{T}^N}(F) - P_{\mathbb{T}^N}(E) &\geq \int_{\partial^* F} X \cdot \nu^F \, d\mathcal{H}^{N-1} - \int_{\partial E} X \cdot \nu^E \, d\mathcal{H}^{N-1} \\ &= \int_F \operatorname{div} X \, dx - \int_E \operatorname{div} X \, dx \geq -C|E\triangle F|\,, \end{aligned}$$

where $C := \|\operatorname{div} X\|_\infty$. □

From:

$$\int_F \operatorname{div} X \, dx - \int_E \operatorname{div} X \, dx \geq -C|E\triangle F|\,,$$

we obtain:

$$\left(\int_F \operatorname{div} X \, dx - \int_E \operatorname{div} X \, dx \right) \geq -0.618718$$

$\Omega = \mathbb{T}^N$ is the N-dimensional flat torus of unit volume

E is a subset of the flat torus

We consider (from: **Lipschitz functions on the infinite-dimensional torus** - *Dmitry Faifman and Bo'az Klartag* - November 7, 2014)

Let $\omega_{n,p}$ denote the n-dimensional volume of the ℓ_p-ball $B_p^n = \{x \in \mathbb{R}^n ; \sum_{i=1}^n |x_i|^p \leq 1\}$. In this note, all integrals on tori and subtori are carried out with respect to the the uniform probability measure on the torus. We will need the following variant of Morrey's inequality:

Lemma 3. *Let $n \geq 1, p \in (1, \infty], 0 < \varepsilon < 1/2$ and let $f : \mathbb{T}^n \to \mathbb{R}$ be 1-Lipschitz with respect to the metric* dist_p. *Denote $q = p/(p-1)$, with $q = 1$ in case $p = \infty$. Assume that*

$$\int_{\mathbb{T}^n} \sum_{i=0}^{n-1} \frac{2^{i^2+qi}}{\omega_{i,p}\varepsilon^{i+q}} \cdot \left| \frac{\partial f}{\partial x_{i+1}} \right|^q \leq 1. \tag{3}$$

Then $\text{Osc}(f; \mathbb{T}^n) < 8\varepsilon$.

By an inductive argument, we see that the last $n - i$ coordinates of the random point P_i are independent random variables that are distributed uniformly over the circle $\mathbb{T}$. Let $A_{i+1} \in \mathbb{T}^i$ be the vector which consists of the first i coordinates of P_{i+1}. We also write $B_p^i(A_{i+1}, r)$ for the dist_p-ball of radius r centered at A_{i+1} in the torus $\mathbb{T}^i$. Since $\varepsilon < 1/2$,

$$\mathbb{E}\left|\frac{\partial f}{\partial x_{i+1}}(P_i)\right| = \mathbb{E}\frac{\int_{B_p^i(A_{i+1},\frac{\varepsilon}{2^i})\times\mathbb{T}^{n-i}} \left|\frac{\partial f}{\partial x_{i+1}}\right|}{\text{Vol}_i\left(B_p^i\left(A_{i+1},\frac{\varepsilon}{2^i}\right)\right)} = \frac{\mathbb{E}\int_{B_p^i(A_{i+1},\frac{\varepsilon}{2^i})\times\mathbb{T}^{n-i}} \left|\frac{\partial f}{\partial x_{i+1}}\right|}{\omega_{i,p}\left(\frac{\varepsilon}{2^i}\right)^i}. \tag{5}$$

From (4), (5) and the Hölder inequality, for $i = 0, \dots, n-1$,

$$\begin{aligned} \mathbb{E}|f(P_i') - f(P_i)| &\leq \left(\int_{\mathbb{T}^n} \left|\frac{\partial f}{\partial x_{i+1}}\right|^q\right)^{\frac{1}{q}} \left(\omega_{i,p}\left(\frac{\varepsilon}{2^i}\right)^i\right)^{-\frac{1}{q}} \\ &\leq \left(\frac{2^{i^2+qi}}{\omega_{i,p}\varepsilon^{i+q}}\right)^{-\frac{1}{q}} \left(\frac{\omega_{i,p}\varepsilon^i}{2^{i^2}}\right)^{-\frac{1}{q}} = \frac{\varepsilon}{2^i}, \end{aligned}$$

Thence, we consider:

$$\left(\text{Vol}_i\left(B_p^i\left(A_{i+1},\frac{\varepsilon}{2^i}\right)\right)\right) = \left(\omega_{i,p}\left(\frac{\varepsilon}{2^i}\right)^i\right)$$

Where i = n = 11

Thence:

$$V_n(R) = \frac{\pi^{n/2}}{\Gamma\left(\frac{n}{2}+1\right)} R^n,$$

For R = 1 , multiplied by

$$\left(\frac{\varepsilon}{2^i}\right)^i$$

we obtain:

(Pi^5.5)/(gamma(5.5+1))*((((2/3)/(2^11))))^11

Input

$$\frac{\pi^{5.5}}{\Gamma(5.5+1)} \left(\frac{\frac{2}{3}}{2^{11}}\right)^{11}$$

$\Gamma(x)$ is the gamma function

Result

$8.19354\ldots \times 10^{-39}$

8.19354…*10^-39

Alternative representations

$$\frac{\left(\frac{2}{3\times 2^{11}}\right)^{11} \pi^{5.5}}{\Gamma(5.5+1)} = \frac{\pi^{5.5} \left(\frac{2}{3\times 2^{11}}\right)^{11}}{e^{5.66256}}$$

$$\frac{\left(\frac{2}{3\times 2^{11}}\right)^{11} \pi^{5.5}}{\Gamma(5.5+1)} = \frac{\pi^{5.5} \left(\frac{2}{3\times 2^{11}}\right)^{11}}{\frac{733\,746.}{2548.75}}$$

$$\frac{\left(\frac{2}{3\times 2^{11}}\right)^{11}\pi^{5.5}}{\Gamma(5.5+1)} = \frac{\pi^{5.5}\left(\frac{2}{3\times 2^{11}}\right)^{11}}{5.5!}$$

Series representations

$$\frac{\left(\frac{2}{3\times 2^{11}}\right)^{11}\pi^{5.5}}{\Gamma(5.5+1)} = \frac{\pi^{5.5}}{229\,949\,952\,899\,717\,277\,477\,822\,958\,308\,088\,086\,528\sum_{k=0}^{\infty}\frac{(6.5-z_0)^k\,\Gamma^{(k)}(z_0)}{k!}}$$

for $(z_0 \notin \mathbb{Z}$ or $z_0 > 0)$

$$\frac{\left(\frac{2}{3\times 2^{11}}\right)^{11}\pi^{5.5}}{\Gamma(5.5+1)} = \frac{\pi^{4.5}\sum_{k=0}^{\infty}(6.5-z_0)^k\sum_{j=0}^{k}\frac{(-1)^j\,\pi^{-j+k}\sin\left(\frac{1}{2}\pi(-j+k+2z_0)\right)\Gamma^{(j)}(1-z_0)}{j!\,(-j+k)!}}{229\,949\,952\,899\,717\,277\,477\,822\,958\,308\,088\,086\,528}$$

Integral representations

$$\frac{\left(\frac{2}{3\times 2^{11}}\right)^{11}\pi^{5.5}}{\Gamma(5.5+1)} = \frac{\pi^{5.5}}{229\,949\,952\,899\,717\,277\,477\,822\,958\,308\,088\,086\,528\int_0^{\infty}e^{-t}\,t^{5.5}\,dt}$$

$$\frac{\left(\frac{2}{3\times 2^{11}}\right)^{11}\pi^{5.5}}{\Gamma(5.5+1)} = \frac{\pi^{5.5}}{229\,949\,952\,899\,717\,277\,477\,822\,958\,308\,088\,086\,528\int_0^{1}\log^{5.5}\left(\frac{1}{t}\right)dt}$$

$$\frac{\left(\frac{2}{3\times 2^{11}}\right)^{11}\pi^{5.5}}{\Gamma(5.5+1)} = \frac{\exp\left(-\int_0^1\frac{5.5-6.5x+x^{6.5}}{(-1+x)\log(x)}\,dx\right)\pi^{5.5}}{229\,949\,952\,899\,717\,277\,477\,822\,958\,308\,088\,086\,528}$$

We note that $2.612280*10^{-70}$ is the Planck area, and:

2.612280*10^-70 < 8.19354*10^-39

Input interpretation

$2.612280 \times 10^{-70} < 8.19354 \times 10^{-39}$

Result

True

Thence E = $2.612280*10^{-70}$

We have:

Theorem 4.3. *Let $E \subset \mathbb{T}^N$ be a smooth set and $p > 1$. Assume that there exists $\delta > 0$ such that*

$$J(F) \geq J(E) \tag{4.1}$$

for all $F \subset \mathbb{T}^N$, with $|F| = |E|$ and such that $\partial F = \{x + \psi(x)\nu(x) : x \in \partial E\}$ for some function ψ with $\|\psi\|_{W^{2,p}(\partial E)} \leq \delta$. Then there exists $\delta_0 > 0$ such that (4.1) holds for all $F \subset \mathbb{T}^N$ of finite perimeter, with $|F| = |E|$ and $\mathcal{I}_{-\delta_0}(E) \subset F \subset \mathcal{I}_{\delta_0}(E)$.

$$\Lambda > 0$$

$$\begin{aligned}
&J(\widetilde{F}_h) + \Lambda\big||\widetilde{F}_h| - |E|\big| - J(F_h) - \Lambda\big||F_h| - |E|\big| \\
&\quad = P_{\mathbb{T}^N}(\widetilde{F}_h) - P_{\mathbb{T}^N}(F_h) + \gamma \int_{\mathbb{T}^N} \left(|\nabla v_{\widetilde{F}_h}|^2 - |\nabla v_{F_h}|^2\right) dx - \Lambda\big(|\widetilde{F}_h| - |F_h|\big) \\
&\quad \leq \int_{\partial^* \widetilde{F}_h} \nu \cdot \nu^{\widetilde{F}_h} \, d\mathcal{H}^{N-1} - \int_{\partial^* F_h} \nu \cdot \nu^{F_h} \, d\mathcal{H}^{N-1} + (\gamma C - \Lambda)\big(|\widetilde{F}_h| - |F_h|\big) \\
&\quad \leq \int_{\widetilde{F}_h \triangle F_h} |\operatorname{div} \nu| \, dx + (\gamma C - \Lambda)\big(|\widetilde{F}_h| - |F_h|\big) \\
&\quad \leq (\|\operatorname{div} \nu\|_\infty + \gamma C - \Lambda)\big(|\widetilde{F}_h| - |F_h|\big) .
\end{aligned} \tag{4.5}$$

For

$$|F_h| > |E|, \quad |\widetilde{F}_h| = |E|$$

$F_h > E$ $F_h >$ $2.612280*10^{-70}$ = $1.616255*10^{-35}$ $\gamma = 1/4$

$\Lambda > 0$ sufficiently large
= 128

From:

$$\int_{\widetilde{F}_h \triangle F_h} |\operatorname{div} \nu| \, dx + (\gamma C - \Lambda)\big(|\widetilde{F}_h| - |F_h|\big) \leq (\|\operatorname{div} \nu\|_\infty + \gamma C - \Lambda)\big(|\widetilde{F}_h| - |F_h|\big)$$

(||div 64|| + 1/4*2 – 128)(2.612280e-70 – 1.616255e-35)

(((df(x))/(dx) e) (64) + 1/4*2 – 128)(2.612280e-70 – 1.616255e-35)

Input interpretation

$$\left(\left(\frac{\partial f(x)}{\partial x} e\right) \times 64 + \frac{1}{4} \times 2 - 128\right)(2.612280 \times 10^{-70} - 1.616255 \times 10^{-35})$$

Result

$$-1.61626 \times 10^{-35} \left(64\, e\, f'(x) - \frac{255}{2}\right)$$

Expanded form

$$2.06073 \times 10^{-33} - 2.8118 \times 10^{-33} f'(x)$$

Series expansion at x=0

$$\left(2.06073 \times 10^{-33} - 2.8118 \times 10^{-33} f'(0)\right) - 2.8118 \times 10^{-33} x f''(0) - 1.4059 \times 10^{-33} f^{(3)}(0) x^2 - 4.68633 \times 10^{-34} f^{(4)}(0) x^3 - 1.17158 \times 10^{-34} f^{(5)}(0) x^4 + O(x^5)$$

(Taylor series)

Derivative

$$\frac{d}{dx}\left(-1.61626 \times 10^{-35} \left(64\, e\, f'(x) - \frac{255}{2}\right)\right) = -2.8118 \times 10^{-33} f''(x)$$

From:

$$\left(2.06073\times10^{-33}-2.8118\times10^{-33}f'(0)\right)-2.8118\times10^{-33}\,x\,f''(0)-1.4059\times10^{-33}f^{(3)}(0)\,x^2-4.68633\times10^{-34}f^{(4)}(0)\,x^3-1.17158\times10^{-34}f^{(5)}(0)\,x^4+O\left(x^5\right)$$

(Taylor series)

For x = 2 :

(2.06073×10^-33 - 2.8118×10^-33) - 2.8118×10^-33*2 - 1.4059×10^-33 * 2^2 - 4.68633×10^-34 * 2^3 - 1.17158×10^-34 * 2^4 + (2^5)

Input interpretation

$$\left(2.06073\times10^{-33}-2.8118\times10^{-33}\right)-2.8118\times10^{-33}\times2-1.4059\times10^{-33}\times2^2-4.68633\times10^{-34}\times2^3-1.17158\times10^{-34}\times2^4+2^5$$

Result

31.99999999999999999999999999999999982378138

31.9999…. ≈ 32

From which:

27*2((2.06073×10^-33 - 2.8118×10^-33) - 2.8118×10^-33*2 - 1.4059×10^-33 * 2^2 - 4.68633×10^-34 * 2^3 - 1.17158×10^-34 * 2^4 + (2^5))+1

Input interpretation

$$27\times2\left(\left(2.06073\times10^{-33}-2.8118\times10^{-33}\right)-2.8118\times10^{-33}\times2-1.4059\times10^{-33}\times2^2-4.68633\times10^{-34}\times2^3-1.17158\times10^{-34}\times2^4+2^5\right)+1$$

Result

1728.999999999999999999999999999999999048419452

≈ 1729

This result is very near to the mass of candidate glueball **f_0(1710) scalar meson.** Furthermore, 1728 occurs in the algebraic formula for the j-invariant of an elliptic curve. (1728 = 8^2 * 3^3) The number 1728 is one less than the Hardy–Ramanujan number 1729 (taxicab number)

((27*2((2.06073×10^-33 - 2.8118×10^-33) - 2.8118×10^-33*2 - 1.4059×10^-33 * 2^2 - 4.68633×10^-34 * 2^3 - 1.17158×10^-34 * 2^4 + (2^5))+1))^1/15

Input interpretation

$$\left(27\times 2\left(\left(2.06073\times 10^{-33}-2.8118\times 10^{-33}\right)-2.8118\times 10^{-33}\times 2-1.4059\times 10^{-33}\times 2^2-4.68633\times 10^{-34}\times 2^3-1.17158\times 10^{-34}\times 2^4+2^5\right)+1\right)\text{ ^ }(1/15)$$

Result

1.643815228748728130580088031324769454016...

1.6438152287…. ≈ ζ(2) = $\frac{\pi^2}{6}$ = 1.644934 ... (trace of the instanton shape)

((2((2.06073×10^-33 - 2.8118×10^-33) - 2.8118×10^-33*2 - 1.4059×10^-33 * 2^2 - 4.68633×10^-34 * 2^3 - 1.17158×10^-34 * 2^4 + (2^5))))^2

Input interpretation

$$\left(2\left(\left(2.06073\times 10^{-33}-2.8118\times 10^{-33}\right)-2.8118\times 10^{-33}\times 2-1.4059\times 10^{-33}\times 2^2-4.68633\times 10^{-34}\times 2^3-1.17158\times 10^{-34}\times 2^4+2^5\right)\right)^2$$

Result

4095.999999999999999999999999999999548880332800000000000000000000...

≈ 4096 = 64^2

While for x = 4 :

(2.06073×10^-33 - 2.8118×10^-33) - 2.8118×10^-33*4 - 1.4059×10^-33 * 4^2 - 4.68633×10^-34 * 4^3 - 1.17158×10^-34 * 4^4 + 4^5

Input interpretation

$$\left(2.06073\times 10^{-33}-2.8118\times 10^{-33}\right)-2.8118\times 10^{-33}\times 4-1.4059\times 10^{-33}\times 4^2-4.68633\times 10^{-34}\times 4^3-1.17158\times 10^{-34}\times 4^4+4^5$$

Result

1023.99999999999999999999999999999990552237

1023.9999…. ≈ 1024

Now, we have:

$$\partial^2 J_h(L)[\varphi] = \int_{\partial L} |D_\tau \varphi|^2 \, d\mathcal{H}^{N-1} + 8\gamma_h \int_{\partial L}\int_{\partial L} G(x,y)\varphi(x)\varphi(y) d\mathcal{H}^{N-1}(x)\, d\mathcal{H}^{N-1}(y)$$
$$+ 4\gamma_h \int_{\partial L} \partial_\nu v \varphi^2 \, d\mathcal{H}^{N-1}$$
$$\geq \int_{\partial L} |D_\tau \varphi|^2 \, d\mathcal{H}^{N-1} - 4\gamma_h \|\nabla v_L\|_{L^\infty} \int_{\partial L} \varphi^2 \, d\mathcal{H}^{N-1}.$$

$$\int_{\partial L} |D_\tau \varphi|^2 \, d\mathcal{H}^{N-1} - 4\gamma_h \|\nabla v_L\|_{L^\infty} \int_{\partial L} \varphi^2 \, d\mathcal{H}^{N-1}$$

Integrate((D*a)^2*(HarmonicNumber(n))^10)dx

Indefinite integral

$$\int (D\,a)^2 \,(H_n)^{10}\, dx = a^2 D^2 x\,(H_n)^{10} + \text{constant}$$

H_n is the n^{th} harmonic number

Alternate form of the integral

$$a^2 D^2 x\left(\psi^{(0)}(n+1)^{10} + 10\,\gamma\,\psi^{(0)}(n+1)^9 + 45\,\gamma^2\,\psi^{(0)}(n+1)^8 + 120\,\gamma^3\,\psi^{(0)}(n+1)^7 + 210\,\gamma^4\,\psi^{(0)}(n+1)^6 + 252\,\gamma^5\,\psi^{(0)}(n+1)^5 + 210\,\gamma^6\,\psi^{(0)}(n+1)^4 + 120\,\gamma^7\,\psi^{(0)}(n+1)^3 + 45\,\gamma^8\,\psi^{(0)}(n+1)^2 + 10\,\gamma^9\,\psi^{(0)}(n+1) + \gamma^{10}\right) + \text{constant}$$

$\psi^{(n)}(x)$ is the n^{th} derivative of the digamma function

γ is the Euler-Mascheroni constant

a^2 D^2 x (polygamma(0, 12)^10+10 gamma polygamma(0, 12)^9+45gamma^2polygamma(0, 12)^8+120gamma^3 polygamma(0, 12)^7+210gamma^4 polygamma(0, 12)^6

Input

$$a^2 D^2 x \left(\psi^{(0)}(12)^{10} + 10\,\gamma\,\psi^{(0)}(12)^9 + 45\,\gamma^2\,\psi^{(0)}(12)^8 + 120\,\gamma^3\,\psi^{(0)}(12)^7 + 210\,\gamma^4\,\psi^{(0)}(12)^6\right)$$

$\psi^{(n)}(x)$ is the n^{th} derivative of the digamma function

Exact result

$$a^2 \left(210\left(\frac{83711}{27720} - \gamma\right)^6 \gamma^4 + 120\left(\frac{83711}{27720} - \gamma\right)^7 \gamma^3 + 45\left(\frac{83711}{27720} - \gamma\right)^8 \gamma^2 + 10\left(\frac{83711}{27720} - \gamma\right)^9 \gamma + \left(\frac{83711}{27720} - \gamma\right)^{10}\right) D^2 x$$

γ is the Euler-Mascheroni constant

a^2 (210(83711/27720-0.57721)^6 0.57721^4+120(83711/27720-0.57721)^7 0.57721^3 +45(83711/27720 - 0.57721)^8 0.57721^2+10(83711/27720 - 0.57721)^9 0.57721+(83711/27720 - 0.57721)^10) D^2 x

Input

$$a^2 \left(210\left(\frac{83711}{27720} - 0.57721\right)^6 \times 0.57721^4 + 120\left(\frac{83711}{27720} - 0.57721\right)^7 \times 0.57721^3 + 45\left(\frac{83711}{27720} - 0.57721\right)^8 \times 0.57721^2 + 10\left(\frac{83711}{27720} - 0.57721\right)^9 \times 0.57721 + \left(\frac{83711}{27720} - 0.57721\right)^{10}\right) D^2 x$$

Result

$61358.8\, a^2 D^2 x$

a^2 D^2 x(252gamma^5 polygamma(0, 12)^5+210 gamma^6 polygamma(0, 12)^4+120 gamma^7 polygamma(0, 12)^3+45 gamma^8 polygamma(0, 12)^2+10 gamma^9 polygamma(0, 12)+gamma^10)

Input

$$a^2 D^2 \left(x \left(252 \gamma^5 \psi^{(0)}(12)^5 + 210 \gamma^6 \psi^{(0)}(12)^4 + 120 \gamma^7 \psi^{(0)}(12)^3 + 45 \gamma^8 \psi^{(0)}(12)^2 + 10 \gamma^9 \psi^{(0)}(12) + \gamma^{10}\right)\right)$$

$\psi^{(n)}(x)$ is the n^{th} derivative of the digamma function

Exact result

$$a^2 \left(\gamma^{10} + 10 \left(\frac{83711}{27720} - \gamma\right) \gamma^9 + 45 \left(\frac{83711}{27720} - \gamma\right)^2 \gamma^8 + 120 \left(\frac{83711}{27720} - \gamma\right)^3 \gamma^7 + 210 \left(\frac{83711}{27720} - \gamma\right)^4 \gamma^6 + 252 \left(\frac{83711}{27720} - \gamma\right)^5 \gamma^5\right) D^2 x$$

a^2(0.57721^10+10(83711/27720-0.57721)0.57721^9+45(83711/27720-0.57721)^2 0.57721^8+120(83711/27720-0.57721)^3 0.57721^7+210(83711/27720-0.57721)^4 0.57721^6+252(83711/27720-0.57721)^5 0.57721^5)D^2 x

Input

$$a^2 \left(0.57721^{10} + 10 \left(\frac{83711}{27720} - 0.57721\right) \times 0.57721^9 + 45 \left(\frac{83711}{27720} - 0.57721\right)^2 \times 0.57721^8 + 120 \left(\frac{83711}{27720} - 0.57721\right)^3 \times 0.57721^7 + 210 \left(\frac{83711}{27720} - 0.57721\right)^4 \times 0.57721^6 + 252 \left(\frac{83711}{27720} - 0.57721\right)^5 \times 0.57721^5\right) D^2 x$$

Result

$$1721.39 a^2 D^2 x$$

(61358.8 a^2 D^2 x+1721.39 a^2 D^2 x)

Input interpretation

$$61358.8 a^2 D^2 x + 1721.39 a^2 D^2 x$$

Result

$63\,080.2\, a^2\, D^2\, x$

63080.2 a^2 D^2 x

For $\nu_L = 64$; $\gamma_h = 1/24$

From:

$-\, 4\gamma_h \|\nabla v_L\|_{L^\infty}$

we obtain:

-4*1/24*((df(x))/(dx) e) (64)

Input interpretation

$-4 \times \frac{1}{24} \left(\frac{\partial f(x)}{\partial x}\, e\right) \times 64$

Result

$-\frac{32}{3}\, e\, f'(x)$

-32/3 *e* f'(x)

Series expansion at x=0

$-\frac{32}{3}\left(e\, f'(0)\right) - \frac{32}{3}\, x \left(e\, f''(0)\right) - \frac{16}{3}\left(e\, f^{(3)}(0)\right) x^2 - \frac{16}{9}\left(e\, f^{(4)}(0)\right) x^3 - \frac{4}{9}\left(e\, f^{(5)}(0)\right) x^4 + O\left(x^5\right)$

(Taylor series)

Derivative

$\frac{d}{dx}\left(-\frac{32}{3}\, e\, f'(x)\right) = -\frac{32}{3}\, e\, f''(x)$

From:

$$\int_{\partial L} \varphi^2 \, d\mathcal{H}^{N-1} .$$

we consider:

Integrate((a)^2*(HarmonicNumber(n))^10)dx

Indefinite integral

$$\int a^2 (H_n)^{10} \, dx = a^2 \, x \, (H_n)^{10} + \text{constant}$$

H_n is the n^{th} harmonic number

Alternate form of the integral

$$a^2 \, x \left(\psi^{(0)}(n+1)^{10} + 10\,\gamma\,\psi^{(0)}(n+1)^9 + 45\,\gamma^2\,\psi^{(0)}(n+1)^8 + 120\,\gamma^3\,\psi^{(0)}(n+1)^7 + 210\,\gamma^4\,\psi^{(0)}(n+1)^6 + 252\,\gamma^5\,\psi^{(0)}(n+1)^5 + 210\,\gamma^6\,\psi^{(0)}(n+1)^4 + 120\,\gamma^7\,\psi^{(0)}(n+1)^3 + 45\,\gamma^8\,\psi^{(0)}(n+1)^2 + 10\,\gamma^9\,\psi^{(0)}(n+1) + \gamma^{10}\right) + \text{constant}$$

a^2 x (polygamma(0, 12)^10 + 10 gamma polygamma(0, 12)^9 + 45 gamma ^2 polygamma(0, 12)^8 + 120 gamma ^3 polygamma(0, 12)^7 + 210 gamma ^4 polygamma(0, 12)^6 + 252 gamma ^5 polygamma(0, 12)^5 + 210 gamma ^6 polygamma(0, 12)^4 + 120 gamma ^7 polygamma(0, 12)^3 + 45 gamma ^8 polygamma(0, 12)^2 + 10 gamma ^9 polygamma(0, 12) + gamma ^10)

Input

$$a^2 \, x \left(\psi^{(0)}(12)^{10} + 10\,\gamma\,\psi^{(0)}(12)^9 + 45\,\gamma^2\,\psi^{(0)}(12)^8 + 120\,\gamma^3\,\psi^{(0)}(12)^7 + 210\,\gamma^4\,\psi^{(0)}(12)^6 + 252\,\gamma^5\,\psi^{(0)}(12)^5 + 210\,\gamma^6\right)$$

$\psi^{(n)}(x)$ is the n^{th} derivative of the digamma function

Exact result

$$a^2 \left(210\,\gamma^6 + 252\left(\frac{83\,711}{27\,720} - \gamma\right)^5 \gamma^5 + 210\left(\frac{83\,711}{27\,720} - \gamma\right)^6 \gamma^4 + 120\left(\frac{83\,711}{27\,720} - \gamma\right)^7 \gamma^3 + 45\left(\frac{83\,711}{27\,720} - \gamma\right)^8 \gamma^2 + 10\left(\frac{83\,711}{27\,720} - \gamma\right)^9 \gamma + \left(\frac{83\,711}{27\,720} - \gamma\right)^{10}\right) x$$

a^2 (210 γ^6 + 252 (3.019877 - γ)^5 γ^5 + 210 (3.019877 - γ)^6 γ^4 + 120 (3.019877 - γ)^7 γ^3 + 45 (3.019877 - γ)^8 γ^2 + 10 (3.019877- γ)^9 γ + (3.019877 - γ)^10) x

Input interpretation

$$a^2 \left(210 \gamma^6 + 252 (3.019877 - \gamma)^5 \gamma^5 + 210 (3.019877 - \gamma)^6 \gamma^4 + 120 (3.019877 - \gamma)^7 \gamma^3 + 45 (3.019877 - \gamma)^8 \gamma^2 + 10 (3.019877 - \gamma)^9 \gamma + (3.019877 - \gamma)^{10}\right) x$$

γ is the Euler-Mascheroni constant

Result

$62770.6 a^2 x$

62770.6

a^2 x (polygamma(0, 12)^4 + 120 gamma ^7 polygamma(0, 12)^3 + 45 gamma ^8 polygamma(0, 12)^2 + 10 gamma ^9 polygamma(0, 12) + gamma ^10)

Input

$$a^2 x \left(\psi^{(0)}(12)^4 + 120 \gamma^7 \psi^{(0)}(12)^3 + 45 \gamma^8 \psi^{(0)}(12)^2 + 10 \gamma^9 \psi^{(0)}(12) + \gamma^{10}\right)$$

$\psi^{(n)}(x)$ is the n^{th} derivative of the digamma function

Exact result

$$a^2 \left(\gamma^{10} + 10 \left(\frac{83711}{27720} - \gamma\right) \gamma^9 + 45 \left(\frac{83711}{27720} - \gamma\right)^2 \gamma^8 + 120 \left(\frac{83711}{27720} - \gamma\right)^3 \gamma^7 + \left(\frac{83711}{27720} - \gamma\right)^4\right) x$$

a^2 (γ^10 + 10 (3.019877 - γ) γ^9 + 45 (3.019877 - γ)^2 γ^8 + 120 (3.019877- γ)^3 γ^7 + (3.019877 - γ)^4) x

Input interpretation

$$a^2 \left(\gamma^{10} + 10 (3.019877 - \gamma) \gamma^9 + 45 (3.019877 - \gamma)^2 \gamma^8 + 120 (3.019877 - \gamma)^3 \gamma^7 + (3.019877 - \gamma)^4\right) x$$

γ is the Euler-Mascheroni constant

Result

$76.4236 a^2 x$

(62770.6 a^2 x+76.4236 a^2 x)

Input interpretation

$62770.6 a^2 x + 76.4236 a^2 x$

Result

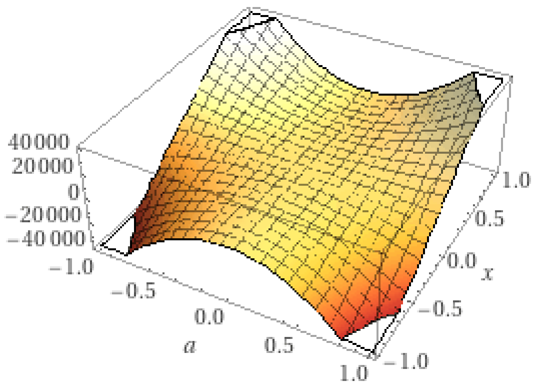
$62847. a^2 x$

62847 a^2 x

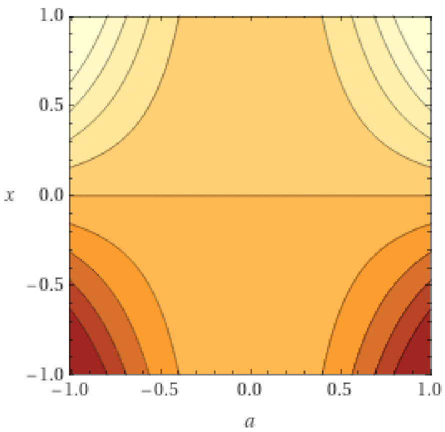
Geometric figure

line

3D plot **(figure that can be related to a D-brane/Instanton)**



Contour plot



Alternate form assuming a and x are real

$62847. a^2 x + 0$

Roots

$a = 0$

$x \approx 0$

Polynomial discriminant

$\Delta = 0$

Properties as a real function

Domain

$\mathbb{R}$ (all real numbers)

Range

$\{y \in \mathbb{R} : a \neq 0$ or $y = 0\}$

Injectivity

injective (one-to-one)

Parity

odd

$\mathbb{R}$ is the set of real numbers

Derivative

$$\frac{\partial}{\partial x}(62847.\, a^2\, x) = 62847.\, a^2$$

Indefinite integral

$$\int 62847.\, a^2\, x\, dx = 31423.5\, a^2\, x^2 + \text{constant}$$

Definite integral over a disk of radius R

$$\iint_{a^2+x^2<R^2} 62847.\, a^2\, x\, da\, dx = 0$$

Definite integral over a square of edge length 2 L

$$\int_{-L}^{L}\int_{-L}^{L} 62847.\, a^2\, x\, dx\, da = 0$$

Thence, from:

$$\int_{\partial L} |D_\tau \varphi|^2\, d\mathcal{H}^{N-1} - 4\gamma_h \|\nabla v_L\|_{L^\infty} \int_{\partial L} \varphi^2\, d\mathcal{H}^{N-1}\, .$$

we obtain:

(63080.2 a^2 D^2 x) - ((-4*1/24*((df(x))/(dx) e) (64)))*(62847 a^2 x)

Input interpretation

$$63080.2\, a^2\, D^2\, x - \left(-4 \times \frac{1}{24}\left(\frac{\partial f(x)}{\partial x}\, e\right) \times 64\right)(62847\, a^2\, x)$$

Result

$$63080.2\, a^2\, D^2\, x + 670368\, e\, a^2\, x\, f'(x)$$

Alternate forms

$63\,080.2\,a^2\,x\,(D^2 + 28.8878\,f'(x))$

$a^2\,x\,(63\,080.2\,D^2 + 1.82225\times 10^6\,f'(x))$

$a^2\,x\,(63\,080.2\,D^2 + 670\,368\,e\,f'(x))$

Alternate form assuming a, D, and x are positive

$63\,080.2\,a^2\,x\,(D^2 + 28.8878\,f'(x))$

Series expansion at x=0

$$x\,(63\,080.2\,a^2\,D^2 + 1.82225\times 10^6\,a^2\,f'(0)) + 1.82225\times 10^6\,a^2\,x^2\,f''(0) + 911\,125.\,a^2\,f^{(3)}(0)\,x^3 + 303\,708.\,a^2\,f^{(4)}(0)\,x^4 + 75\,927.\,a^2\,f^{(5)}(0)\,x^5 + O(x^6)$$

(Taylor series)

Derivative

$$\frac{\partial}{\partial x}(63\,080.2\,a^2\,D^2\,x + 670\,368\,e\,a^2\,x\,f'(x)) = 63\,080.2\,a^2\,(D^2 + 28.8878\,x\,f''(x) + 28.8878\,f'(x))$$

From:

$63\,080.2\,a^2\,D^2\,x + 670\,368\,e\,a^2\,x\,f'(x)$

For x = 2 , a = 4 :

63080.2 *16* D^2 *2 + 670368 *e 16* 2

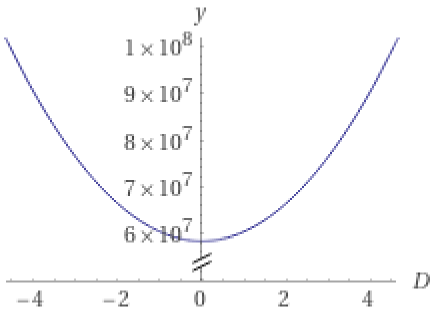
Input interpretation

$63\,080.2 \times 16\, D^2 \times 2 + 670\,368\, e\,(16 \times 2)$

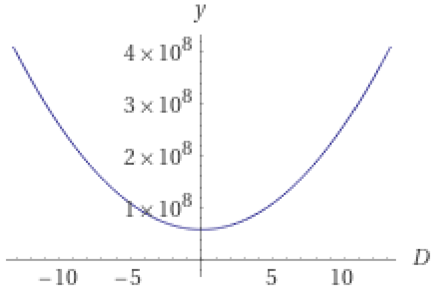
Result

$2.01857 \times 10^6\, D^2 + 21\,451\,776\, e$

Plots **(figures that can be related to the open strings)**



(D from −4.6 to 4.6)



(D from −13.2 to 13.2)

Geometric figure

parabola

Alternate forms

$2.01857 \times 10^6\,(D^2 + 28.8878)$

$2.01857\times 10^{6}\ D^{2}+5.8312\times 10^{7}$

$6.4\left(315\,401\ D^{2}+3\,351\,840\ e\right)$

Complex roots

$D=-5.37474\ i$

$D=5.37474\ i$

Polynomial discriminant

$\Delta=-4.70826\times 10^{14}$

Property as a function

Parity

even

Derivative

$\frac{d}{dD}\left(2.01857\times 10^{6}\ D^{2}+21\,451\,776\ e\right)=4.03713\times 10^{6}\ D$

Indefinite integral

$\int\left(2.01857\times 10^{6}\ D^{2}+21\,451\,776\ e\right)dD=672\,855.\ D^{3}+5.8312\times 10^{7}\ D+\text{constant}$

Global minimum

$\min\left\{2.01857\times 10^{6}\ D^{2}+21\,451\,776\ e\right\}=21\,451\,776\ e\ \text{ at }\ D=0$

From:

$$63080.2 \times 16 D^2 \times 2 + 670368 e (16 \times 2)$$

For D = 4.6 :

(63080.2 *16* 4.6^2 *2 + 670368 *e 16* 2)

Input interpretation

$$63080.2 \times 16 \times 4.6^2 \times 2 + 670368 e (16 \times 2)$$

Result

$$1.01025\ldots \times 10^8$$

$1.01025\ldots*10^8$

For D = 13.2 :

(63080.2 *16* 13.2^2 *2 + 670368 *e 16* 2)

Input interpretation

$$63080.2 \times 16 \times 13.2^2 \times 2 + 670368 e (16 \times 2)$$

Result

$$4.10027\ldots \times 10^8$$

$4.10027\ldots*10^8$

From the sum and the mean of the two expressions, after some calculations, we obtain:

((1/2((((63080.2 *16* 4.6^2 *2 + 670368 *e 16* 2) + (63080.2 *16* 13.2^2 *2 + 670368 *e 16* 2))))))^1/4+φ

Input interpretation

$$\left(\frac{1}{2}\left((63\,080.2\times 16\times 4.6^2\times 2+670\,368\,e\,(16\times 2))+(63\,080.2\times 16\times 13.2^2\times 2+670\,368\,e\,(16\times 2))\right)\right)\text{^}(1/4)+\phi$$

ϕ is the golden ratio

Result

128.051…

128.051….

Alternative representations

$$\left(\frac{1}{2}\left((63\,080.2\times 16\times 4.6^2\times 2+670\,368\,e\,(16\times 2))+(63\,080.2\times 16\times 13.2^2\times 2+670\,368\,e\,(16\times 2))\right)\right)\text{^}(1/4)+\phi=-2\cos(216\,°)+\sqrt[4]{\frac{1}{2}\left(42\,903\,552\,e+2.01857\times 10^6\times 4.6^2+2.01857\times 10^6\times 13.2^2\right)}$$

$$\left(\frac{1}{2}\left((63\,080.2\times 16\times 4.6^2\times 2+670\,368\,e\,(16\times 2))+(63\,080.2\times 16\times 13.2^2\times 2+670\,368\,e\,(16\times 2))\right)\right)\text{^}(1/4)+\phi=2\cos\left(\frac{\pi}{5}\right)+\sqrt[4]{\frac{1}{2}\left(42\,903\,552\,e+2.01857\times 10^6\times 4.6^2+2.01857\times 10^6\times 13.2^2\right)}$$

$$\left(\frac{1}{2}\left((63\,080.2\times 16\times 4.6^2\times 2+670\,368\,e\,(16\times 2))+(63\,080.2\times 16\times 13.2^2\times 2+670\,368\,e\,(16\times 2))\right)\right)\text{^}(1/4)+\phi=\sqrt[4]{\frac{1}{2}\left(42\,903\,552\,e+2.01857\times 10^6\times 4.6^2+2.01857\times 10^6\times 13.2^2\right)}+\left(\text{root of } -1-x+x^2 \text{ near } x=1.61803\right)$$

Series representations

$$\left(\frac{1}{2}\left(\left(63\,080.2\times16\times4.6^2\times2+670\,368\,e\,(16\times2)\right)+\left(63\,080.2\times16\times13.2^2\times2+670\,368\,e\,(16\times2)\right)\right)\right)^\wedge(1/4)+\phi=\phi+68.0559\sqrt[4]{9.19336+\sum_{k=0}^{\infty}\frac{1}{k!}}$$

$$\left(\frac{1}{2}\left(\left(63\,080.2\times16\times4.6^2\times2+670\,368\,e\,(16\times2)\right)+\left(63\,080.2\times16\times13.2^2\times2+670\,368\,e\,(16\times2)\right)\right)\right)^\wedge(1/4)+\phi=\phi+57.228\sqrt[4]{18.3867+\sum_{k=0}^{\infty}\frac{1+k}{k!}}$$

$$\left(\frac{1}{2}\left(\left(63\,080.2\times16\times4.6^2\times2+670\,368\,e\,(16\times2)\right)+\left(63\,080.2\times16\times13.2^2\times2+670\,368\,e\,(16\times2)\right)\right)\right)^\wedge(1/4)+\phi=\phi+68.0559\sqrt[4]{9.19336+\sum_{k=0}^{\infty}\frac{(-1+k)^2}{k!}}$$

Dividing the two previous expressions:

$$\frac{1}{2}\left(\left(63\,080.2\times16\times4.6^2\times2+670\,368\,e\,(16\times2)\right)+\left(63\,080.2\times16\times13.2^2\times2+670\,368\,e\,(16\times2)\right)\right)$$

And

$$\left(2.06073\times10^{-33}-2.8118\times10^{-33}\right)-2.8118\times10^{-33}\times4-1.4059\times10^{-33}\times4^2-4.68633\times10^{-34}\times4^3-1.17158\times10^{-34}\times4^4+4^5$$

= 1023.9999…. ≈ 1024

we obtain:

(([1/2((63080.2*16*4.6^2*2+670368*e *32)+(63080.2 *16* 13.2^2 *2+670368 *e *32))] / 1023.999999999))^1/5

Input interpretation

$$\left(\frac{1}{1023.999999999}\,\frac{1}{2}\left((63\,080.2\times 16\times 4.6^2\times 2+670\,368\,e\times 32)+(63\,080.2\times 16\times 13.2^2\times 2+670\,368\,e\times 32)\right)\right)\hat{}\,(1/5)$$

Result

12.0068…

12.0068….

From which:

(((([1/2((63080.2*16*4.6^2*2+670368*e *32)+(63080.2 *16* 13.2^2 *2+670368 *e *32))] / 1023.999999999))^1/5))^3-3

Input interpretation

$$\left(\frac{1}{1023.999999999}\,\frac{1}{2}\left((63\,080.2\times 16\times 4.6^2\times 2+670\,368\,e\times 32)+(63\,080.2\times 16\times 13.2^2\times 2+670\,368\,e\times 32)\right)\right)\hat{}\,(1/5)^3-3$$

Result

1727.94…

1727.94…. ≈ 1728

This result is very near to the mass of candidate glueball **f_0(1710) scalar meson.** Furthermore, 1728 occurs in the algebraic formula for the j-invariant of an elliptic curve. (1728 = $8^2 * 3^3$) The number 1728 is one less than the Hardy–Ramanujan number 1729 (taxicab number)

Alternative representation

$$(((63\,080.2\times16\times4.6^2\times2+670\,368\,e\,32)+(63\,080.2\times16\times13.2^2\times2+670\,368\,e\,32))/(1023.9999999990000\times2))\verb|^|(1/5)^3-3=(((63\,080.2\times16\times4.6^2\times2+670\,368\exp(z)\,32)+(63\,080.2\times16\times13.2^2\times2+670\,368\exp(z)\,32))/(1023.9999999990000\times2))\verb|^|(1/5)^3-3 \text{ for } z=1$$

Series representations

$$(((63\,080.2\times16\times4.6^2\times2+670\,368\,e\,32)+(63\,080.2\times16\times13.2^2\times2+670\,368\,e\,32))/(1023.9999999990000\times2))\verb|^|(1/5)^3-3=-3+0.0103086555529192766\left(3.94428\times10^8+4.29036\times10^7\sum_{k=0}^{\infty}\frac{1}{k!}\right)^{3/5}$$

$$(((63\,080.2\times16\times4.6^2\times2+670\,368\,e\,32)+(63\,080.2\times16\times13.2^2\times2+670\,368\,e\,32))/(1023.9999999990000\times2))\verb|^|(1/5)^3-3=-3+0.0103086555529192766\left(3.94428\times10^8+2.14518\times10^7\sum_{k=0}^{\infty}\frac{1+k}{k!}\right)^{3/5}$$

$$(((63\,080.2\times16\times4.6^2\times2+670\,368\,e\,32)+(63\,080.2\times16\times13.2^2\times2+670\,368\,e\,32))/(1023.9999999990000\times2))\verb|^|(1/5)^3-3=-3+0.0103086555529192766\left(3.94428\times10^8+4.29036\times10^7\sum_{k=0}^{\infty}\frac{(-1+k)^2}{k!}\right)^{3/5}$$

(1/27(((((([1/2((63080.2*16*4.6^2*2+670368*e *32)+(63080.2 *16* 13.2^2 *2+670368 *e *32))] / 1023.999999999))^1/5))^3-3))^2+Φ/2

Input interpretation

$$\left(\frac{1}{27}\left(\left(\left(\left(\frac{1}{2}\left((63080.2\times 16\times 4.6^2\times 2+670368\,e\times 32)+(63080.2\times 16\times 13.2^2\times 2+670368\,e\times 32)\right)\right)\Big/1023.999999999\right)\hat{}\,(1/5)^3-3\right)\right)^2+\frac{\Phi}{2}$$

Φ is the golden ratio conjugate

Result

4096.01…

4096.01… ≈ 4096 = 64^2

(((((((([1/2((63080.2*16*4.6^2*2+670368*e *32)+(63080.2 *16* 13.2^2 *2+670368 *e *32))] / 1023.999999999))^1/5))^3-3))+1)^1/15

Input interpretation

$$\left(\left(\left(\left(\frac{1}{2}\left((63080.2\times 16\times 4.6^2\times 2+670368\,e\times 32)+(63080.2\times 16\times 13.2^2\times 2+670368\,e\times 32)\right)\right)\Big/1023.999999999\right)\hat{}\,(1/5)^3-3\right)+1\right)\hat{}\,(1/15)$$

Result

1.643811…

1.643811…. ≈ ζ(2) = $\frac{\pi^2}{6}$ = 1.644934 ... (trace of the instanton shape)

Now, we have the following expression:

$$\begin{aligned}\|D_{\tau_t}X_{\tau_t}\|^2_{L^2(\partial E_t)} &\le C\|D_{\tau_t}(X\cdot\nu^{E_t})\|^2_{L^2(\partial E_t)} + C\int_{\partial E_t}|X\cdot\nu^{E_t}|^2\big[|D_{\tau_t}\nu_\sigma| + |D_{\tau_t}\nu^{E_t}|\big]^2\,d\mathcal{H}^{N-1}\\ &\le C\|X\cdot\nu^{E_t}\|^2_{H^1(\partial E_t)} + C\|X\cdot\nu^{E_t}\|^2_{L^{\frac{2p}{p-2}}(\partial E_t)}\big\||D_{\tau_t}\nu_\sigma| + |D_{\tau_t}\nu^{E_t}|\big\|^2_{L^p(\partial E_t)}\\ &\le C\|X\cdot\nu^{E_t}\|^2_{H^1(\partial E_t)},\end{aligned}$$

From:

$$C\|X\cdot\nu^{E_t}\|^2_{H^1(\partial E_t)},$$

For : C = 2 ; ν_E = X = 64 , we obtain:

2(64*64)^2

Input

$2\,(64\times 64)^2$

Result

33 554 432

Scientific notation

3.3554432×10^7

$3.3554432*10^7$

Thence, from:

$$\|D_{\tau_t}X_{\tau_t}\|^2_{L^2(\partial E_t)} \le C\|D_{\tau_t}(X\cdot\nu^{E_t})\|^2_{L^2(\partial E_t)} + C\int_{\partial E_t}|X\cdot\nu^{E_t}|^2\big[|D_{\tau_t}\nu_\sigma| + |D_{\tau_t}\nu^{E_t}|\big]^2\,d\mathcal{H}^{N-1}$$

= 3.3554432×10^7

From

$2\,(64\times 64)^2$

we obtain also:

27*2((2(64*64)^2))^1/5+1

Input

$$27\times 2\sqrt[5]{2(64\times 64)^2}+1$$

Exact result

1729

1729

This result is very near to the mass of candidate glueball **f_0(1710) scalar meson.** Furthermore, 1728 occurs in the algebraic formula for the j-invariant of an elliptic curve. ($1728 = 8^2 * 3^3$) The number 1728 is one less than the Hardy–Ramanujan number 1729 (taxicab number)

((27*2((2(64*64)^2))^1/5+1))^1/15

Input

$$\sqrt[15]{27\times 2\sqrt[5]{2(64\times 64)^2}+1}$$

Result

$$\sqrt[15]{1729}$$

Decimal approximation

1.6438152287487281305800880313247695143292831436999401726452126788...

$1.6438152287\ldots \approx \zeta(2) = \frac{\pi^2}{6} = 1.644934\ldots$ (trace of the instanton shape)

((2((2(64*64)^2))^1/5))^2

Input

$$\left(2\sqrt[5]{2\,(64\times 64)^2}\right)^2$$

Exact result

4096

$4096 = 64^2$

Observations

We note that, from the number 8, we obtain as follows:

8^2

64

$8^2 \times 2 \times 8$

1024

$8^4 = 8^2 \times 2^6$

True

$8^4 = 4096$

$8^2 \times 2^6 = 4096$

$2^{13} = 2 \times 8^4$

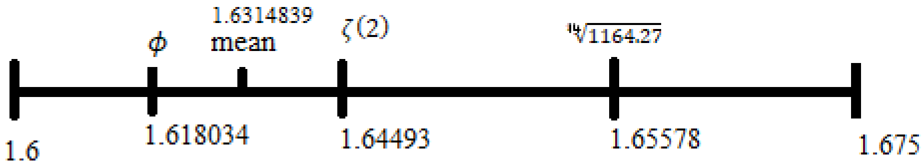
True

$2^{13} = 8192$

$2 \times 8^4 = 8192$

We notice how from the numbers 8 and 2 we get 64, 1024, 4096 and 8192, and that 8 is the fundamental number. In fact $8^2 = 64$, $8^3 = 512$, $8^4 = 4096$. We define it "fundamental number", since 8 is a Fibonacci number, which by rule, divided by the previous one, which is 5, gives 1.6 , a value that tends to the golden ratio, as for all numbers in the Fibonacci sequence

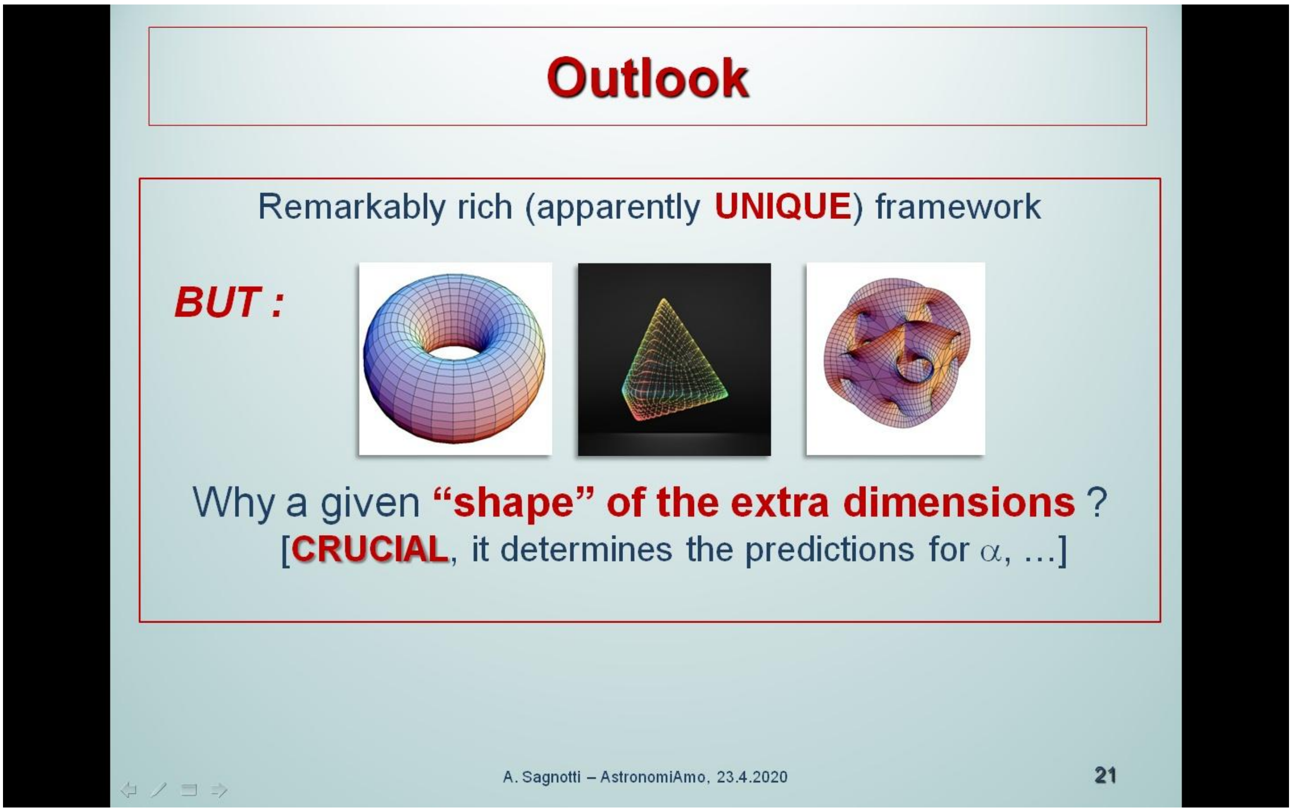
“Golden” Range



Finally we note how $8^2 = 64$, multiplied by 27, to which we add 1, is equal to 1729, the so-called "Hardy-Ramanujan number". Then taking the 15th root of 1729, we obtain a value close to $\zeta(2)$ that 1.6438 ..., which, in turn, is included in the range of what we call "golden numbers"

Furthermore for all the results very near to 1728 or 1729, adding $64 = 8^2$, one obtain values about equal to 1792 or 1793. These are values almost equal to the Planck multipole spectrum frequency 1792.35 and to the hypothetical Gluino mass

Appendix



From: *A. Sagnotti – AstronomiAmo, 23.04.2020*

In the above figure, it is said that: "why a given shape of the extra dimensions? Crucial, it determines the predictions for α".

We propose that whatever shape the compactified dimensions are, their geometry must be based on the values of the golden ratio and ζ(2), (the latter connected to 1728 or 1729, whose fifteenth root provides an excellent approximation to the above mentioned value) which are recurrent as solutions of the equations that we are going to develop. It is important to specify that the initial conditions are **always** values belonging to a fundamental chapter of the work of S. Ramanujan "Modular equations and Appoximations to Pi" (see references). These values are some multiples of 8 (64 and 4096), 276, which added to 4096, is equal to 4372, and finally $e^{\pi\sqrt{22}}$

We have, in certain cases, the following connections:

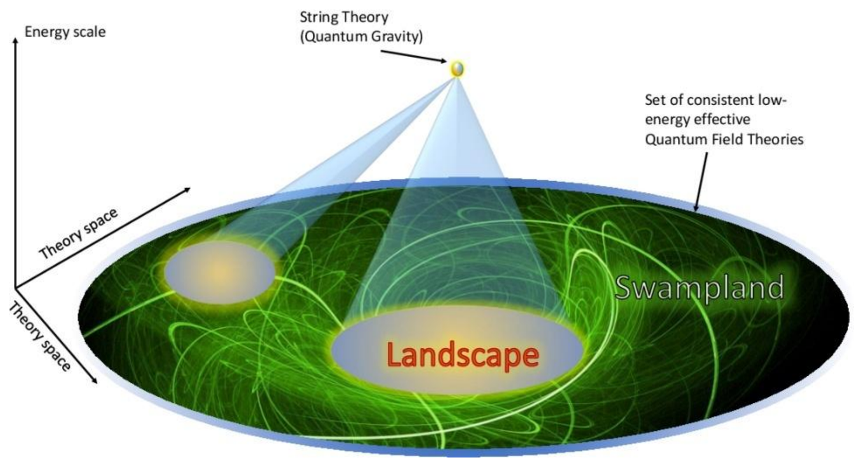


Fig. 1

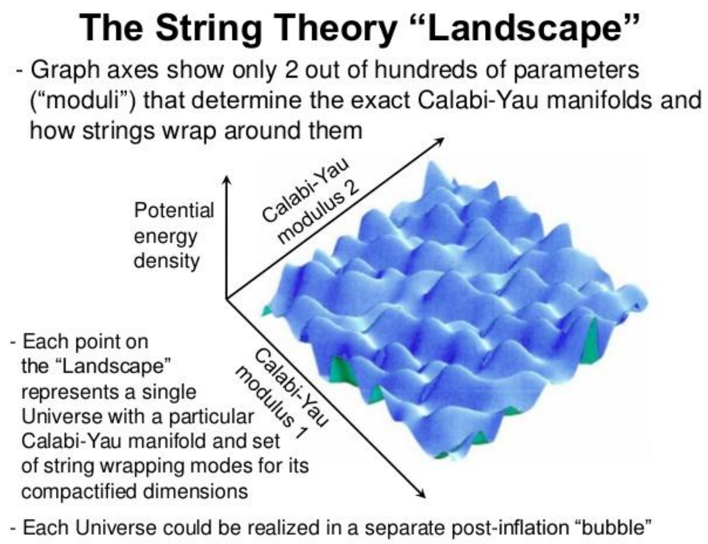


Fig. 2

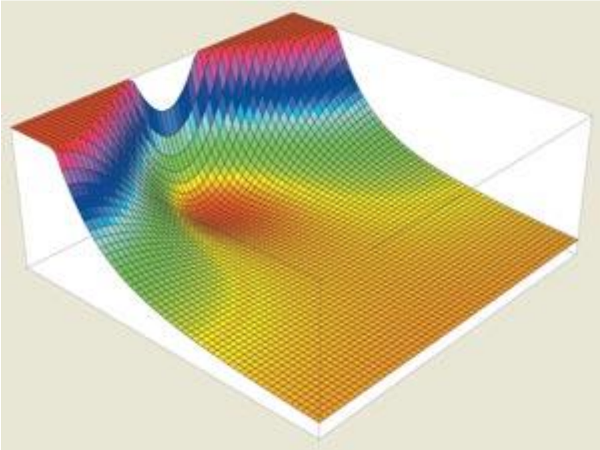


Fig. 3

Stringscape - a small part of the string-theory landscape showing the new de Sitter solution as a local minimum of the energy (vertical axis). The global minimum occurs at the infinite size of the extra dimensions on the extreme right of the figure.

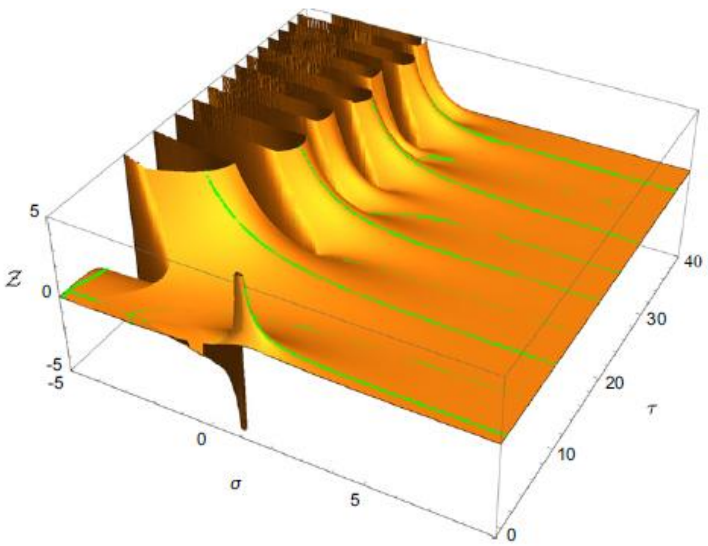


Figure 2. Lines in the complex plane where the Riemann zeta function ζ is real (green) depicted on a relief representing the positive absolute value of ζ for arguments $s \equiv \sigma + \mathrm{i}\tau$ where the real part of ζ is positive, and the negative absolute value of ζ where the real part of ζ is negative. This representation brings out most clearly that the lines of constant phase corresponding to phases of integer multiples of 2π run down the hills on the left-hand side, turn around on the right and terminate in the non-trivial zeros. This pattern repeats itself infinitely many times. The points of arrival and departure on the right-hand side of the picture are equally spaced and given by equation (11).

Fig. 4

From: https://www.mdpi.com/2227-7390/6/12/285/htm

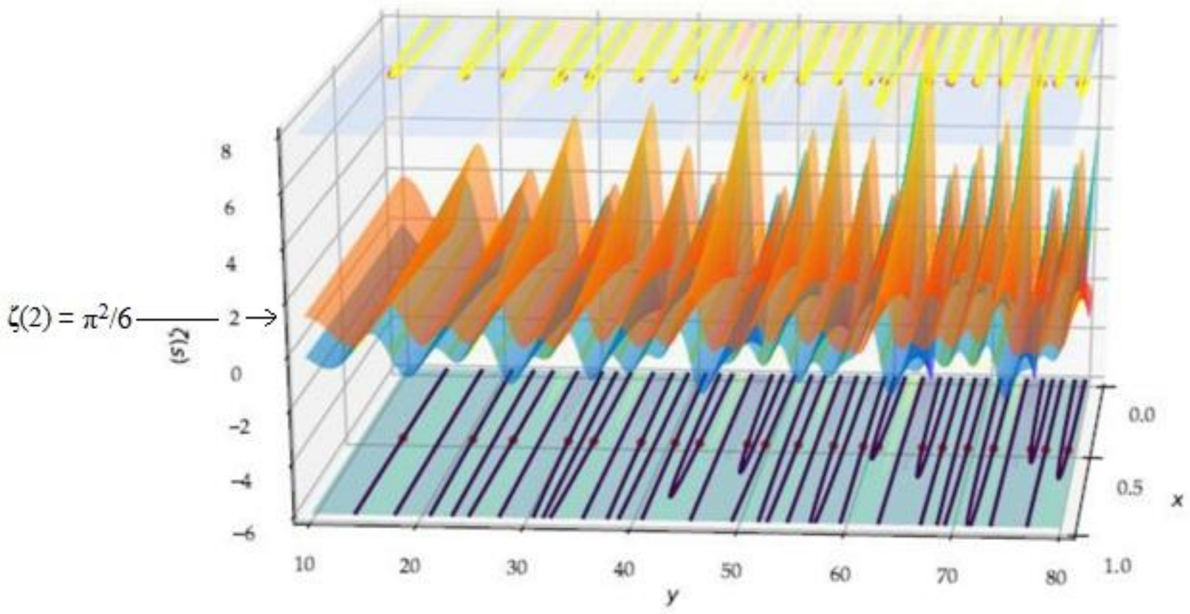


Figure 1. $C(x,y)$ and $S(x,y)$ surfaces of the Riemann $\zeta(x,y) = C - i\,S$ function, in the critical strip $\boldsymbol{s}$: $0 \leqslant x \leqslant 1; 10 \leqslant y \leqslant 80$. On the top and bottom planes, the C and S common zeros are the red points.

Fig. 5

3D plot	$\zeta(2 + i\,t)$

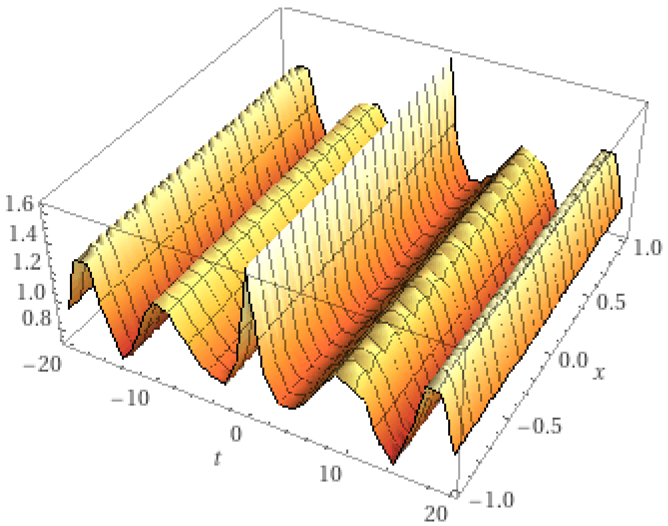


Fig. 6

Where ζ(2+it) :

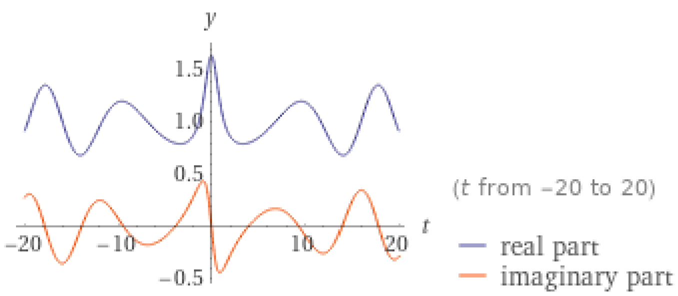
Input

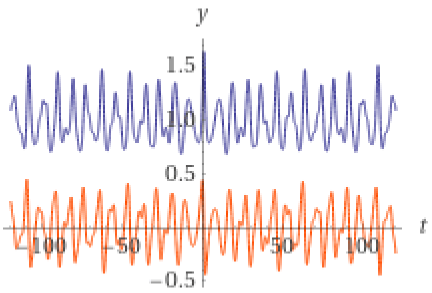
$\zeta(2 + i\,t)$

$\zeta(s)$ is the Riemann zeta function

i is the imaginary unit

Plots





(t from -120 to 120)

Roots

$t = 2\,i\,(n+1)\,,\quad n \in \mathbb{Z}\,,\quad n \geq 1$

$t = -i\,(\rho_n - 2)\,,\quad n \neq 0\,,\quad n \in \mathbb{Z}$

$\mathbb{Z}$ is the set of integers

ρ_n is the nontrivial n^{th} zero of the Riemann zeta function

Series expansion at t=0

$$\frac{\pi^2}{6} + i\,t\,\zeta'(2) - \frac{1}{2}\,t^2\,\zeta''(2) - \frac{1}{6}\,i\,\zeta^{(3)}(2)\,t^3 + \frac{1}{24}\,\zeta^{(4)}(2)\,t^4 + O\left(t^5\right)$$

(Taylor series)

Alternative representations

$\zeta(2 + i\,t) = \zeta(2 + i\,t,\,1)$

$\zeta(2 + i\,t) = S_{1+i\,t,1}(1)$

$$\zeta(2 + i\,t) = \frac{\zeta\left(2 + i\,t,\,\frac{1}{2}\right)}{-1 + 2^{2+i\,t}}$$

$\zeta(s,\,a)$ is the generalized Riemann zeta function

$S_{n,p}(x)$ is the Nielsen generalized polylogarithm function

Series representations

$$\zeta(2+i\,t) = \sum_{k=1}^{\infty} k^{-2-i\,t} \quad \text{for } \operatorname{Im}(t) < 1$$

$$\zeta(2+i\,t) = \frac{\sum_{k=0}^{\infty} (1+2\,k)^{-2-i\,t}}{1-2^{-2-i\,t}} \quad \text{for } \operatorname{Im}(t) < 1$$

$$\zeta(2+i\,t) = e^{\sum_{k=1}^{\infty} P(k\,(2+i\,t))/k} \quad \text{for } \operatorname{Im}(t) < 1$$

$\operatorname{Im}(z)$ is the imaginary part of z

$P(z)$ gives the prime zeta function

Integral representations

$$\zeta(2+i\,t) = \frac{1}{\Gamma(2+i\,t)} \int_0^{\infty} \frac{\tau^{1+i\,t}}{-1+e^{\tau}}\, d\tau \quad \text{for } \operatorname{Im}(t) < 1$$

$$\zeta(2+i\,t) = \frac{2^{1+i\,t}}{\Gamma(3+i\,t)} \int_0^{\infty} \tau^{2+i\,t} \operatorname{csch}^2(\tau)\, d\tau \quad \text{for } \operatorname{Im}(t) < 1$$

$$\zeta(2+i\,t) = \frac{2^{1+i\,t}}{\Gamma(2+i\,t)} \int_0^{\infty} e^{-\tau}\, \tau^{1+i\,t} \operatorname{csch}(\tau)\, d\tau \quad \text{for } \operatorname{Im}(t) < 1$$

$\Gamma(x)$ is the gamma function

$\operatorname{csch}(x)$ is the hyperbolic cosecant function

Functional equations

$$\zeta(2+i\,t) = -i\,2^{2+i\,t}\,\pi^{1+i\,t}\,\Gamma(-1-i\,t)\sinh\left(\frac{\pi\,t}{2}\right)\zeta(-1-i\,t)$$

$$\zeta(2+i\,t) = \frac{\pi^{3/2+i\,t}\,\Gamma\left(-\frac{1}{2}-\frac{i\,t}{2}\right)\zeta(-1-i\,t)}{\Gamma\left(1+\frac{i\,t}{2}\right)}$$

$$\zeta(2+i\,t) = -\frac{i\sum_{k=0}^{\infty}\frac{\Gamma\left(k-\frac{i\,t}{2}\right)\sum_{j=0}^{k}(-1)^j\,(1+2\,j)\binom{k}{j}\zeta(2+2\,j)}{k!}}{(-i+t)\,\Gamma\left(-\frac{i\,t}{2}\right)}$$

With regard the Fig. 4 the points of arrival and departure on the right-hand side of the picture are equally spaced and given by the following equation:

$$\tau'_k \equiv k\,\frac{\pi}{\ln 2},$$
$$\text{with } k = \ldots, -2, -1, 0, 1, 2, \ldots.$$

we obtain:

2Pi/(ln(2))

Input:

$$2\times\frac{\pi}{\log(2)}$$

Exact result:

$$\frac{2\,\pi}{\log(2)}$$

Decimal approximation:

9.0647202836543876192553658914333336203437229354475911683720330958 …

9.06472028365….

Alternative representations:

$$\frac{2\pi}{\log(2)} = \frac{2\pi}{\log_e(2)}$$

$$\frac{2\pi}{\log(2)} = \frac{2\pi}{\log(a)\log_a(2)}$$

$$\frac{2\pi}{\log(2)} = \frac{2\pi}{2\coth^{-1}(3)}$$

Series representations:

$$\frac{2\pi}{\log(2)} = \frac{2\pi}{2\,i\,\pi\left\lfloor\frac{\arg(2-x)}{2\pi}\right\rfloor + \log(x) - \sum_{k=1}^{\infty}\frac{(-1)^k (2-x)^k x^{-k}}{k}} \quad \text{for } x < 0$$

$$\frac{2\pi}{\log(2)} = \frac{2\pi}{\log(z_0) + \left\lfloor\frac{\arg(2-z_0)}{2\pi}\right\rfloor\left(\log\left(\frac{1}{z_0}\right) + \log(z_0)\right) - \sum_{k=1}^{\infty}\frac{(-1)^k (2-z_0)^k z_0^{-k}}{k}}$$

$$\frac{2\pi}{\log(2)} = \frac{2\pi}{2\,i\,\pi\left\lfloor\frac{\pi-\arg\left(\frac{1}{z_0}\right)-\arg(z_0)}{2\pi}\right\rfloor + \log(z_0) - \sum_{k=1}^{\infty}\frac{(-1)^k (2-z_0)^k z_0^{-k}}{k}}$$

Integral representations:

$$\frac{2\pi}{\log(2)} = \frac{2\pi}{\int_1^2 \frac{1}{t}\,dt}$$

$$\frac{2\pi}{\log(2)} = \frac{4\,i\,\pi^2}{\int_{-i\,\infty+\gamma}^{i\,\infty+\gamma} \frac{\Gamma(-s)^2\,\Gamma(1+s)}{\Gamma(1-s)}\,ds} \quad \text{for } -1 < \gamma < 0$$

From which:

(2Pi/(ln(2)))*(1/12 π log(2))

Input:

$$\left(2\times\frac{\pi}{\log(2)}\right)\left(\frac{1}{12}\,\pi\log(2)\right)$$

log(x) is the natural logarithm

Exact result:

$$\frac{\pi^2}{6}$$

Decimal approximation:

1.644934066848226436472415166646025189218949901206798437735558229 3...

$1.6449340668\ldots. = \zeta(2) = \frac{\pi^2}{6} = 1.644934\ldots$

From:

Modular equations and approximations to π - *Srinivasa Ramanujan*
Quarterly Journal of Mathematics, XLV, 1914, 350 – 372

We have that:

Hence

$$\begin{aligned} 64g_{22}^{24} &= e^{\pi\sqrt{22}} - 24 + 276e^{-\pi\sqrt{22}} - \cdots, \\ 64g_{22}^{-24} &= 4096e^{-\pi\sqrt{22}} + \cdots, \end{aligned}$$

so that

$$64(g_{22}^{24} + g_{22}^{-24}) = e^{\pi\sqrt{22}} - 24 + 4372e^{-\pi\sqrt{22}} + \cdots = 64\{(1+\sqrt{2})^{12} + (1-\sqrt{2})^{12}\}.$$

Hence

$$e^{\pi\sqrt{22}} = 2508951.9982\ldots.$$

Again

$$G_{37} = (6+\sqrt{37})^{\frac{1}{4}},$$

$$\begin{aligned} 64G_{37}^{24} &= e^{\pi\sqrt{37}} + 24 + 276e^{-\pi\sqrt{37}} + \cdots, \\ 64G_{37}^{-24} &= 4096e^{-\pi\sqrt{37}} - \cdots, \end{aligned}$$

so that

$$64(G_{37}^{24} + G_{37}^{-24}) = e^{\pi\sqrt{37}} + 24 + 4372e^{-\pi\sqrt{37}} - \cdots = 64\{(6+\sqrt{37})^{6} + (6-\sqrt{37})^{6}\}.$$

Hence

$$e^{\pi\sqrt{37}} = 199148647.999978\ldots.$$

Similarly, from

$$g_{58} = \sqrt{\left(\frac{5+\sqrt{29}}{2}\right)},$$

we obtain

$$64(g_{58}^{24} + g_{58}^{-24}) = e^{\pi\sqrt{58}} - 24 + 4372e^{-\pi\sqrt{58}} + \cdots = 64\left\{\left(\frac{5+\sqrt{29}}{2}\right)^{12} + \left(\frac{5-\sqrt{29}}{2}\right)^{12}\right\}.$$

Hence

$$e^{\pi\sqrt{58}} = 24591257751.99999982\ldots.$$

We note that, with regard 4372, we can to obtain the following results:

27((4372)^1/2-2-1/2(((√(10-2√5) -2))⁄((√5-1))))+φ

Input

$$27\left(\sqrt{4372}-2-\frac{1}{2}\times\frac{\sqrt{10-2\sqrt{5}}-2}{\sqrt{5}-1}\right)+\phi$$

ϕ is the golden ratio

Result

$$\phi+27\left(-2+2\sqrt{1093}-\frac{\sqrt{10-2\sqrt{5}}-2}{2\left(\sqrt{5}-1\right)}\right)$$

Decimal approximation

1729.0526944170905625170637208637148763684189306538457854815447023...

1729.0526944….

This result is very near to the mass of candidate glueball **f_0(1710) scalar meson.** Furthermore, 1728 occurs in the algebraic formula for the j-invariant of an elliptic curve. (1728 = $8^2 * 3^3$) The number 1728 is one less than the Hardy–Ramanujan number 1729 (taxicab number)

Alternate forms

$$\frac{1}{8}\left(-27\sqrt{5\left(10-2\sqrt{5}\right)}+58\sqrt{5}+432\sqrt{1093}-27\sqrt{2\left(5-\sqrt{5}\right)}-374\right)$$

$$\phi-54+54\sqrt{1093}+\frac{27}{4}\left(1+\sqrt{5}-\sqrt{2\left(5+\sqrt{5}\right)}\right)$$

$$\phi - 54 + 54\sqrt{1093} - \frac{27\left(\sqrt{10-2\sqrt{5}} - 2\right)}{2\left(\sqrt{5}-1\right)}$$

Minimal polynomial

$$256x^8 + 95744x^7 - 3248750080x^6 - 914210725504x^5 + 15498355554921184x^4 + 2911478392539914656x^3 - 32941144911224677091680x^2 - 3092528914069760354714456x + 26320050609744039027169013041$$

Expanded forms

$$-\frac{187}{4} + \frac{29\sqrt{5}}{4} + 54\sqrt{1093} - \frac{27}{8}\sqrt{10-2\sqrt{5}} - \frac{27}{8}\sqrt{5\left(10-2\sqrt{5}\right)}$$

$$-\frac{107}{2} + \frac{\sqrt{5}}{2} + 54\sqrt{1093} + \frac{27}{\sqrt{5}-1} - \frac{27\sqrt{10-2\sqrt{5}}}{2\left(\sqrt{5}-1\right)}$$

Series representations

$$27\left(\sqrt{4372} - 2 - \frac{\sqrt{10-2\sqrt{5}} - 2}{\left(\sqrt{5}-1\right)2}\right) + \phi = \left(162 - 108\sqrt{1093} - 2\phi - 108\sqrt{4}\sum_{k=0}^{\infty} 4^{-k}\binom{\frac{1}{2}}{k} + 108\sqrt{1093}\sqrt{4}\sum_{k=0}^{\infty} 4^{-k}\binom{\frac{1}{2}}{k} + 2\phi\sqrt{4}\sum_{k=0}^{\infty} 4^{-k}\binom{\frac{1}{2}}{k} - 27\sqrt{9-2\sqrt{5}}\sum_{k=0}^{\infty}\binom{\frac{1}{2}}{k}\left(9-2\sqrt{5}\right)^{-k}\right) \Big/ \left(2\left(-1 + \sqrt{4}\sum_{k=0}^{\infty} 4^{-k}\binom{\frac{1}{2}}{k}\right)\right)$$

$$27\left(\sqrt{4372}-2-\frac{\sqrt{10-2\sqrt{5}}-2}{\left(\sqrt{5}-1\right)2}\right)+\phi=$$

$$\left(162-108\sqrt{1093}-2\phi-108\sqrt{4}\sum_{k=0}^{\infty}\frac{\left(-\frac{1}{4}\right)^k\left(-\frac{1}{2}\right)_k}{k!}+\right.$$

$$108\sqrt{1093}\sqrt{4}\sum_{k=0}^{\infty}\frac{\left(-\frac{1}{4}\right)^k\left(-\frac{1}{2}\right)_k}{k!}+2\phi\sqrt{4}\sum_{k=0}^{\infty}\frac{\left(-\frac{1}{4}\right)^k\left(-\frac{1}{2}\right)_k}{k!}-$$

$$\left.27\sqrt{9-2\sqrt{5}}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(9-2\sqrt{5}\right)^{-k}}{k!}\right)\Big/$$

$$\left(2\left(-1+\sqrt{4}\sum_{k=0}^{\infty}\frac{\left(-\frac{1}{4}\right)^k\left(-\frac{1}{2}\right)_k}{k!}\right)\right)$$

$$27\left(\sqrt{4372}-2-\frac{\sqrt{10-2\sqrt{5}}-2}{\left(\sqrt{5}-1\right)2}\right)+\phi=$$

$$\left(162-108\sqrt{1093}-2\phi-108\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k(5-z_0)^k z_0^{-k}}{k!}+\right.$$

$$108\sqrt{1093}\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k(5-z_0)^k z_0^{-k}}{k!}+$$

$$2\phi\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k(5-z_0)^k z_0^{-k}}{k!}-$$

$$\left.27\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(10-2\sqrt{5}-z_0\right)^k z_0^{-k}}{k!}\right)\Big/$$

$$\left(2\left(-1+\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k(5-z_0)^k z_0^{-k}}{k!}\right)\right)$$

for (not ($z_0 \in \mathbb{R}$ and $-\infty < z_0 \leq 0$))

Or:

27((4096+276)^1/2-2-1/2(((√(10-2√5) -2))⁄((√5-1))))+φ

Input

$$27\left(\sqrt{4096+276}-2-\frac{1}{2}\times\frac{\sqrt{10-2\sqrt{5}}-2}{\sqrt{5}-1}\right)+\phi$$

ϕ is the golden ratio

Result

$$\phi+27\left(-2+2\sqrt{1093}-\frac{\sqrt{10-2\sqrt{5}}-2}{2\left(\sqrt{5}-1\right)}\right)$$

Decimal approximation

1729.0526944170905625170637208637148763684189306538457854815447023
…

1729.0526944…. as above

Alternate forms

$$\frac{1}{8}\left(-27\sqrt{5\left(10-2\sqrt{5}\right)}+58\sqrt{5}+432\sqrt{1093}-27\sqrt{2\left(5-\sqrt{5}\right)}-374\right)$$

$$\phi-54+54\sqrt{1093}+\frac{27}{4}\left(1+\sqrt{5}-\sqrt{2\left(5+\sqrt{5}\right)}\right)$$

$$\phi-54+54\sqrt{1093}-\frac{27\left(\sqrt{10-2\sqrt{5}}-2\right)}{2\left(\sqrt{5}-1\right)}$$

Minimal polynomial

$$256 x^8 + 95744 x^7 - 3248750080 x^6 - 914210725504 x^5 + 15498355554921184 x^4 + 2911478392539914656 x^3 - 32941144911224677091680 x^2 - 3092528914069760354714456 x + 26320050609744039027169013041$$

Expanded forms

$$-\frac{187}{4} + \frac{29\sqrt{5}}{4} + 54\sqrt{1093} - \frac{27}{8}\sqrt{10 - 2\sqrt{5}} - \frac{27}{8}\sqrt{5\left(10 - 2\sqrt{5}\right)}$$

$$-\frac{107}{2} + \frac{\sqrt{5}}{2} + 54\sqrt{1093} + \frac{27}{\sqrt{5} - 1} - \frac{27\sqrt{10 - 2\sqrt{5}}}{2\left(\sqrt{5} - 1\right)}$$

Series representations

$$27\left(\sqrt{4096 + 276} - 2 - \frac{\sqrt{10 - 2\sqrt{5}} - 2}{\left(\sqrt{5} - 1\right) 2}\right) + \phi = \left(162 - 108\sqrt{1093} - 2\phi - 108\sqrt{4}\sum_{k=0}^{\infty} 4^{-k}\binom{\frac{1}{2}}{k} + 108\sqrt{1093}\sqrt{4}\sum_{k=0}^{\infty} 4^{-k}\binom{\frac{1}{2}}{k} + 2\phi\sqrt{4}\sum_{k=0}^{\infty} 4^{-k}\binom{\frac{1}{2}}{k} - 27\sqrt{9 - 2\sqrt{5}}\sum_{k=0}^{\infty}\binom{\frac{1}{2}}{k}\left(9 - 2\sqrt{5}\right)^{-k}\right) \Big/ \left(2\left(-1 + \sqrt{4}\sum_{k=0}^{\infty} 4^{-k}\binom{\frac{1}{2}}{k}\right)\right)$$

$$27\left(\sqrt{4096+276}-2-\frac{\sqrt{10-2\sqrt{5}}-2}{\left(\sqrt{5}-1\right)2}\right)+\phi=$$

$$\left(162-108\sqrt{1093}-2\phi-108\sqrt{4}\sum_{k=0}^{\infty}\frac{\left(-\frac{1}{4}\right)^k\left(-\frac{1}{2}\right)_k}{k!}+108\sqrt{1093}\sqrt{4}\sum_{k=0}^{\infty}\frac{\left(-\frac{1}{4}\right)^k\left(-\frac{1}{2}\right)_k}{k!}+2\phi\sqrt{4}\sum_{k=0}^{\infty}\frac{\left(-\frac{1}{4}\right)^k\left(-\frac{1}{2}\right)_k}{k!}-27\sqrt{9-2\sqrt{5}}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(9-2\sqrt{5}\right)^{-k}}{k!}\right)\Bigg/\left(2\left(-1+\sqrt{4}\sum_{k=0}^{\infty}\frac{\left(-\frac{1}{4}\right)^k\left(-\frac{1}{2}\right)_k}{k!}\right)\right)$$

$$27\left(\sqrt{4096+276}-2-\frac{\sqrt{10-2\sqrt{5}}-2}{\left(\sqrt{5}-1\right)2}\right)+\phi=$$

$$\left(162-108\sqrt{1093}-2\phi-108\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k(5-z_0)^k z_0^{-k}}{k!}+108\sqrt{1093}\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k(5-z_0)^k z_0^{-k}}{k!}+2\phi\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k(5-z_0)^k z_0^{-k}}{k!}-27\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(10-2\sqrt{5}-z_0\right)^k z_0^{-k}}{k!}\right)\Bigg/\left(2\left(-1+\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k(5-z_0)^k z_0^{-k}}{k!}\right)\right)$$

for (not ($z_0 \in \mathbb{R}$ and $-\infty < z_0 \leq 0$))

From which:

(27((4372)^1/2-2-1/2(((√(10-2√5) -2))⁄((√5-1))))+φ)^1/15

Input

$$\sqrt[15]{27\left(\sqrt{4372}-2-\frac{1}{2}\times\frac{\sqrt{10-2\sqrt{5}}-2}{\sqrt{5}-1}\right)+\phi}$$

ϕ is the golden ratio

Exact result

$$\sqrt[15]{\phi+27\left(-2+2\sqrt{1093}-\frac{\sqrt{10-2\sqrt{5}}-2}{2\left(\sqrt{5}-1\right)}\right)}$$

Decimal approximation

1.643818568584986279990230131703681005418575687350518480483418312 4

…

$1.64381856858.... \approx \zeta(2) = \frac{\pi^2}{6} = 1.644934...$

Alternate forms

$$\sqrt[15]{\phi-54+54\sqrt{1093}-\frac{27\left(\sqrt{10-2\sqrt{5}}-2\right)}{2\left(\sqrt{5}-1\right)}}$$

$$\frac{1}{\sqrt[15]{\frac{2\left(\sqrt{5}-1\right)}{166-108\sqrt{5}-108\sqrt{1093}+108\sqrt{5465}-27\sqrt{2\left(5-\sqrt{5}\right)}}}}$$

$$\sqrt[15]{\text{root of } 256 x^8 + 95\,744 x^7 - 3\,248\,750\,080 x^6 - 914\,210\,725\,504 x^5 + 15\,498\,355\,554\,921\,184 x^4 + 2\,911\,478\,392\,539\,914\,656 x^3 - 32\,941\,144\,911\,224\,677\,091\,680 x^2 - 3\,092\,528\,914\,069\,760\,354\,714\,456 x + 26\,320\,050\,609\,744\,039\,027\,169\,013\,041 \text{ near } x = 1729.05}$$

Minimal polynomial

$$256 x^{120} + 95\,744 x^{105} - 3\,248\,750\,080 x^{90} - 914\,210\,725\,504 x^{75} + 15\,498\,355\,554\,921\,184 x^{60} + 2\,911\,478\,392\,539\,914\,656 x^{45} - 32\,941\,144\,911\,224\,677\,091\,680 x^{30} - 3\,092\,528\,914\,069\,760\,354\,714\,456 x^{15} + 26\,320\,050\,609\,744\,039\,027\,169\,013\,041$$

Expanded forms

$$\sqrt[15]{\frac{1}{2}\left(1+\sqrt{5}\right) + 27\left(-2 + 2\sqrt{1093} - \frac{\sqrt{10-2\sqrt{5}} - 2}{2\left(\sqrt{5}-1\right)}\right)}$$

$$\sqrt[15]{-\frac{187}{4} + \frac{29\sqrt{5}}{4} + 54\sqrt{1093} - \frac{27}{8}\sqrt{10-2\sqrt{5}} - \frac{27}{8}\sqrt{5\left(10-2\sqrt{5}\right)}}$$

All 15th roots of ϕ + 27 (-2 + 2 sqrt(1093) - (sqrt(10 - 2 sqrt(5)) - 2)/(2 (sqrt(5) - 1)))

$$e^0 \sqrt[15]{\phi + 27\left(-2 + 2\sqrt{1093} - \frac{\sqrt{10-2\sqrt{5}} - 2}{2\left(\sqrt{5}-1\right)}\right)} \approx 1.64382 \text{ (real, principal root)}$$

$$e^{(2 i \pi)/15} \sqrt[15]{\phi + 27\left(-2 + 2\sqrt{1093} - \frac{\sqrt{10-2\sqrt{5}} - 2}{2\left(\sqrt{5}-1\right)}\right)} \approx 1.50170 + 0.6686 i$$

$$e^{(4 i \pi)/15} \sqrt[15]{\phi + 27 \left(-2 + 2 \sqrt{1093} - \frac{\sqrt{10 - 2 \sqrt{5}} - 2}{2 \left(\sqrt{5} - 1\right)}\right)} \approx 1.0999 + 1.2216 i$$

$$e^{(2 i \pi)/5} \sqrt[15]{\phi + 27 \left(-2 + 2 \sqrt{1093} - \frac{\sqrt{10 - 2 \sqrt{5}} - 2}{2 \left(\sqrt{5} - 1\right)}\right)} \approx 0.5080 + 1.5634 i$$

$$e^{(8 i \pi)/15} \sqrt[15]{\phi + 27 \left(-2 + 2 \sqrt{1093} - \frac{\sqrt{10 - 2 \sqrt{5}} - 2}{2 \left(\sqrt{5} - 1\right)}\right)} \approx -0.17183 + 1.63481 i$$

Series representations

$$\sqrt[15]{27 \left(\sqrt{4372} - 2 - \frac{\sqrt{10 - 2 \sqrt{5}} - 2}{\left(\sqrt{5} - 1\right) 2}\right) + \phi} =$$

$$\frac{1}{\sqrt[15]{2}} \left(\left(\left(162 - 108 \sqrt{1093} - 2 \phi - 108 \sqrt{4} \sum_{k=0}^{\infty} 4^{-k} \binom{\frac{1}{2}}{k} + 108 \sqrt{1093} \sqrt{4} \sum_{k=0}^{\infty} 4^{-k} \binom{\frac{1}{2}}{k} + 2 \phi \sqrt{4} \sum_{k=0}^{\infty} 4^{-k} \binom{\frac{1}{2}}{k} - 27 \sqrt{9 - 2 \sqrt{5}} \sum_{k=0}^{\infty} \binom{\frac{1}{2}}{k} \left(9 - 2 \sqrt{5}\right)^{-k}\right) \Big/ \left(-1 + \sqrt{4} \sum_{k=0}^{\infty} 4^{-k} \binom{\frac{1}{2}}{k}\right)\right) \wedge (1/15)\right)$$

$$\sqrt[15]{27\left(\sqrt{4372}-2-\frac{\sqrt{10-2\sqrt{5}}-2}{(\sqrt{5}-1)2}\right)+\phi} =$$

$$\frac{1}{\sqrt[15]{2}}\left(\left(\left(162-108\sqrt{1093}-2\phi-108\sqrt{4}\sum_{k=0}^{\infty}\frac{\left(-\frac{1}{4}\right)^k\left(-\frac{1}{2}\right)_k}{k!}+108\sqrt{1093}\sqrt{4}\sum_{k=0}^{\infty}\frac{\left(-\frac{1}{4}\right)^k\left(-\frac{1}{2}\right)_k}{k!}+2\phi\sqrt{4}\sum_{k=0}^{\infty}\frac{\left(-\frac{1}{4}\right)^k\left(-\frac{1}{2}\right)_k}{k!}-27\sqrt{9-2\sqrt{5}}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(9-2\sqrt{5}\right)^{-k}}{k!}\right)\Big/\left(-1+\sqrt{4}\sum_{k=0}^{\infty}\frac{\left(-\frac{1}{4}\right)^k\left(-\frac{1}{2}\right)_k}{k!}\right)\right)\text{^}(1/15)\right)$$

$$\sqrt[15]{27\left(\sqrt{4372}-2-\frac{\sqrt{10-2\sqrt{5}}-2}{(\sqrt{5}-1)2}\right)+\phi} =$$

$$\frac{1}{\sqrt[15]{2}}\left(\left(\left(162-108\sqrt{1093}-2\phi-108\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k(5-z_0)^k z_0^{-k}}{k!}+108\sqrt{1093}\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k(5-z_0)^k z_0^{-k}}{k!}+2\phi\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k(5-z_0)^k z_0^{-k}}{k!}-27\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(10-2\sqrt{5}-z_0\right)^k z_0^{-k}}{k!}\right)\Big/\left(-1+\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k(5-z_0)^k z_0^{-k}}{k!}\right)\right)\text{^}(1/15)\right)$$

for (not ($z_0 \in \mathbb{R}$ and $-\infty < z_0 \le 0$))

Integral representation

$$(1+z)^a = \frac{\int_{-i\,\infty+\gamma}^{i\,\infty+\gamma}\frac{\Gamma(s)\,\Gamma(-a-s)}{z^s}\,ds}{(2\pi i)\,\Gamma(-a)} \quad \text{for } (0 < \gamma < -\text{Re}(a) \text{ and } |\arg(z)| < \pi)$$

From:

An Update on Brane Supersymmetry Breaking
J. Mourad and A. Sagnotti - arXiv:1711.11494v1 [hep-th] 30 Nov 2017

From the following vacuum equations:

$$T\, e^{\gamma_E\, \phi} \;=\; -\, \frac{\beta_E^{(p)}\, h^2}{\gamma_E}\; e^{-\,2\,(8\,-\,p)\,C\,+\,2\,\beta_E^{(p)}\,\phi}$$

$$16\, k'\, e^{-\,2\,C} \;=\; \frac{h^2 \left(p\,+\,1\,-\,\frac{2\,\beta_E^{(p)}}{\gamma_E}\right) e^{-\,2\,(8\,-\,p)\,C\,+\,2\,\beta_E^{(p)}\,\phi}}{(7\,-\,p)}$$

$$(A')^2 \;=\; k\, e^{-\,2\,A} \;+\; \frac{h^2}{16(p\,+\,1)} \left(7\,-\,p\,+\,\frac{2\,\beta_E^{(p)}}{\gamma_E}\right) e^{-\,2\,(8\,-\,p)\,C\,+\,2\,\beta_E^{(p)}\,\phi}$$

we have obtained, from the results almost equals of the equations, putting

$4096\, e^{-\pi\sqrt{18}}$ instead of

$$e^{-\,2\,(8\,-\,p)\,C\,+\,2\,\beta_E^{(p)}\,\phi}$$

a new possible mathematical connection between the two exponentials. Thence, also the values concerning p, C, β_E and ϕ correspond to the exponents of e (i.e. of exp). Thence we obtain for p = 5 and $\beta_E = 1/2$:

$$e^{-6C+\phi} = 4096e^{-\pi\sqrt{18}}$$

Therefore, with respect to the exponentials of the vacuum equations, the Ramanujan’s exponential has a coefficient of 4096 which is equal to 64^2, while -6C+ϕ is equal to -$\pi\sqrt{18}$. From this it follows that it is possible to establish mathematically, the dilaton value.

For

exp((-Pi*sqrt(18)) we obtain:

Input:

$\exp\left(-\pi\sqrt{18}\right)$

Exact result:

$e^{-3\sqrt{2}\pi}$

Decimal approximation:

$1.6272016226072509292942156739117979541838581136954016\ldots \times 10^{-6}$

$1.6272016\ldots * 10^{-6}$

Property:

$e^{-3\sqrt{2}\pi}$ is a transcendental number

Series representations:

$$e^{-\pi\sqrt{18}} = e^{-\pi\sqrt{17}\sum_{k=0}^{\infty} 17^{-k}\binom{1/2}{k}}$$

$$e^{-\pi\sqrt{18}} = \exp\left(-\pi\sqrt{17}\sum_{k=0}^{\infty}\frac{\left(-\frac{1}{17}\right)^k\left(-\frac{1}{2}\right)_k}{k!}\right)$$

$$e^{-\pi\sqrt{18}} = \exp\left(-\frac{\pi\sum_{j=0}^{\infty}\text{Res}_{s=-\frac{1}{2}+j}\, 17^{-s}\,\Gamma\left(-\frac{1}{2}-s\right)\Gamma(s)}{2\sqrt{\pi}}\right)$$

Now, we have the following calculations:

$$e^{-6C+\phi} = 4096e^{-\pi\sqrt{18}}$$

$$e^{-\pi\sqrt{18}} = 1.6272016\ldots * 10^{-6}$$

from which:

$$\frac{1}{4096}e^{-6C+\phi} = 1.6272016\ldots * 10^{-6}$$

$$0.000244140625\, e^{-6C+\phi} = e^{-\pi\sqrt{18}} = 1.6272016\ldots * 10^{-6}$$

Now:

$$\ln\left(e^{-\pi\sqrt{18}}\right) = -13.328648814475 = -\pi\sqrt{18}$$

And:

(1.6272016* 10^-6) *1/ (0.000244140625)

Input interpretation:

$$\frac{1.6272016}{10^6} \times \frac{1}{0.000244140625}$$

Result:

0.0066650177536

0.006665017...

Thence:

$$0.000244140625\, e^{-6C+\phi} = e^{-\pi\sqrt{18}}$$

Dividing both sides by 0.000244140625, we obtain:

$$\frac{0.000244140625}{0.000244140625} e^{-6C+\phi} = \frac{1}{0.000244140625} e^{-\pi\sqrt{18}}$$

$$e^{-6C+\phi} = 0.0066650177536$$

((((exp((-Pi*sqrt(18)))))))*1/0.000244140625

Input interpretation:

$$\exp\left(-\pi\sqrt{18}\right) \times \frac{1}{0.000244140625}$$

Result:

0.00666501785…

0.00666501785…

Series representations:

$$\frac{\exp(-\pi\sqrt{18})}{0.000244141} = 4096 \exp\left(-\pi\sqrt{17} \sum_{k=0}^{\infty} 17^{-k} \binom{\frac{1}{2}}{k}\right)$$

$$\frac{\exp(-\pi\sqrt{18})}{0.000244141} = 4096 \exp\left(-\pi\sqrt{17} \sum_{k=0}^{\infty} \frac{\left(-\frac{1}{17}\right)^k \left(-\frac{1}{2}\right)_k}{k!}\right)$$

$$\frac{\exp(-\pi\sqrt{18})}{0.000244141} = 4096 \exp\left(-\frac{\pi \sum_{j=0}^{\infty} \text{Res}_{s=-\frac{1}{2}+j} 17^{-s}\, \Gamma\left(-\frac{1}{2}-s\right)\Gamma(s)}{2\sqrt{\pi}}\right)$$

Now:

$$e^{-6C+\phi} = 0.0066650177536$$

$$\exp\left(-\pi\sqrt{18}\right) \times \frac{1}{0.000244140625} =$$

$$e^{-\pi\sqrt{18}} \times \frac{1}{0.000244140625}$$

$$= 0.00666501785\ldots$$

From:

ln(0.00666501784619)

Input interpretation:

log(0.00666501784619)

Result:

−5.010882647757…

-5.010882647757…

Alternative representations:

$$\log(0.006665017846190000) = \log_e(0.006665017846190000)$$

$$\log(0.006665017846190000) = \log(a)\log_a(0.006665017846190000)$$

$$\log(0.006665017846190000) = -\text{Li}_1(0.993334982153810000)$$

Series representations:

$$\log(0.006665017846190000) = -\sum_{k=1}^{\infty} \frac{(-1)^k (-0.993334982153810000)^k}{k}$$

$$\log(0.006665017846190000) = 2 i \pi \left\lfloor \frac{\arg(0.006665017846190000 - x)}{2\pi} \right\rfloor + \log(x) - \sum_{k=1}^{\infty} \frac{(-1)^k (0.006665017846190000 - x)^k x^{-k}}{k} \quad \text{for } x < 0$$

$$\log(0.006665017846190000) = \left\lfloor \frac{\arg(0.006665017846190000 - z_0)}{2\pi} \right\rfloor \log\left(\frac{1}{z_0}\right) + \log(z_0) + \left\lfloor \frac{\arg(0.006665017846190000 - z_0)}{2\pi} \right\rfloor \log(z_0) - \sum_{k=1}^{\infty} \frac{(-1)^k (0.006665017846190000 - z_0)^k z_0^{-k}}{k}$$

Integral representation:

$$\log(0.006665017846190000) = \int_1^{0.006665017846190000} \frac{1}{t}\, dt$$

In conclusion:

$$-6C + \phi = -5.010882647757 \ldots$$

and for C = 1, we obtain:

$\phi = -5.010882647757 + 6 = \mathbf{0.989117352243} = \boldsymbol{\phi}$

Note that the values of n_s (spectral index) 0.965, of the average of the Omega mesons Regge slope 0.987428571 and of the dilaton 0.989117352243, are also connected to the following two Rogers-Ramanujan continued fractions:

$$\frac{e^{-\frac{\pi}{5}}}{\sqrt{(\varphi-1)\sqrt{5}}-\varphi+1} = 1-\frac{e^{-\pi}}{1+\frac{e^{-2\pi}}{1+\frac{e^{-3\pi}}{1+\frac{e^{-4\pi}}{1+\ldots}}}} \approx 0.9568666373$$

$$\frac{e^{-\frac{\pi}{\sqrt{5}}}}{\frac{\sqrt{5}}{1+\sqrt[5]{\sqrt{\varphi^5\sqrt[4]{5^3}}-1}}-\varphi+1} = 1-\frac{e^{-\pi\sqrt{5}}}{1+\frac{e^{-2\pi\sqrt{5}}}{1+\frac{e^{-3\pi\sqrt{5}}}{1+\frac{e^{-4\pi\sqrt{5}}}{1+\ldots}}}} \approx 0.9991104684$$

(http://www.bitman.name/math/article/102/109/)

Also performing the 512th root of the inverse value of the Pion meson rest mass 139.57, we obtain:

((1/(139.57)))^1/512

Input interpretation:

$$\sqrt[512]{\frac{1}{139.57}}$$

Result:

0.9904007327086440275509737557133014154607327961785555516 84...

0.99040073.... result very near to the dilaton value **0.989117352243** = $\boldsymbol{\phi}$ and to the value of the following Rogers-Ramanujan continued fraction:

$$\frac{e^{-\frac{\pi}{\sqrt{5}}}}{\frac{\sqrt{5}}{1+\sqrt[5]{\sqrt{\varphi^5\sqrt[4]{5^3}}-1}}-\varphi+1}=1-\frac{e^{-\pi\sqrt{5}}}{1+\frac{e^{-2\pi\sqrt{5}}}{1+\frac{e^{-3\pi\sqrt{5}}}{1+\frac{e^{-4\pi\sqrt{5}}}{1+\ldots}}}}\approx 0.9991104684$$

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