On the Ramanujan Modular Equations, Class Invariants and Mock Theta Functions: new mathematical connections with some particle-like solutions, Black Holes entropies, ζ(2) and Golden Ratio

Michele Nardelli[1], Antonio Nardelli

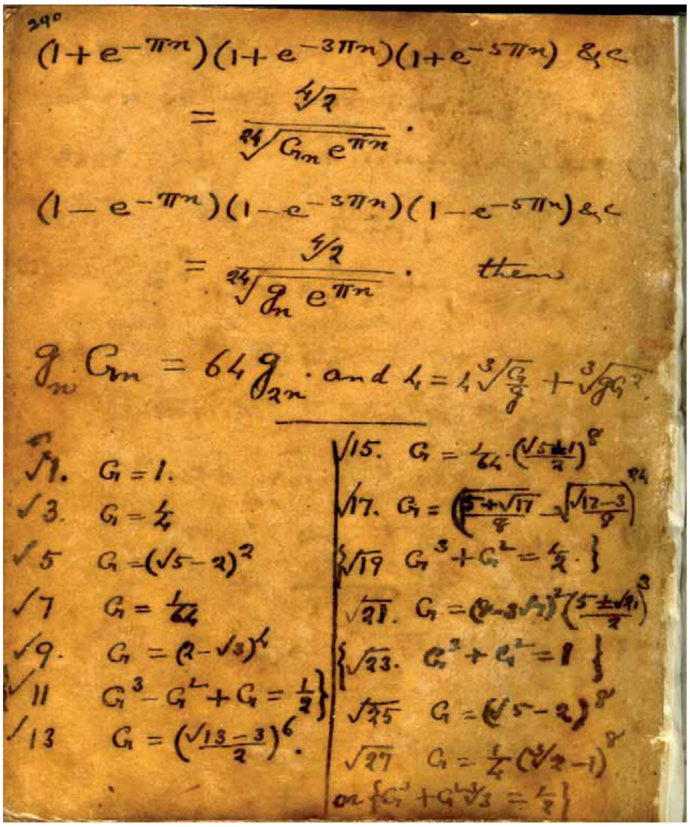
Abstract

In the present research thesis, we have obtained various interesting new possible mathematical connections between the Ramanujan Modular Equations, Class Invariants, the Mock Theta Functions, some particle-like solutions, Black Holes entropies, ζ(2) and Golden Ratio

[1] M.Nardelli have studied by Dipartimento di Scienze della Terra Università degli Studi di Napoli Federico II, Largo S. Marcellino, 10 - 80138 Napoli, Dipartimento di Matematica ed Applicazioni "R. Caccioppoli" - Università degli Studi di Napoli "Federico II" – Polo delle Scienze e delle Tecnologie Monte S. Angelo, Via Cintia (Fuorigrotta), 80126 Napoli, Italy

From:

https://math.stackexchange.com/questions/516203/problems-in-the-ramanujan-class-invariant-g-n



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$$(1+e^{-\pi n})(1+e^{-3\pi n})(1+e^{-5\pi n})\ \&c = \frac{\sqrt[4]{2}}{\sqrt[24]{G_n e^{\pi n}}}.$$

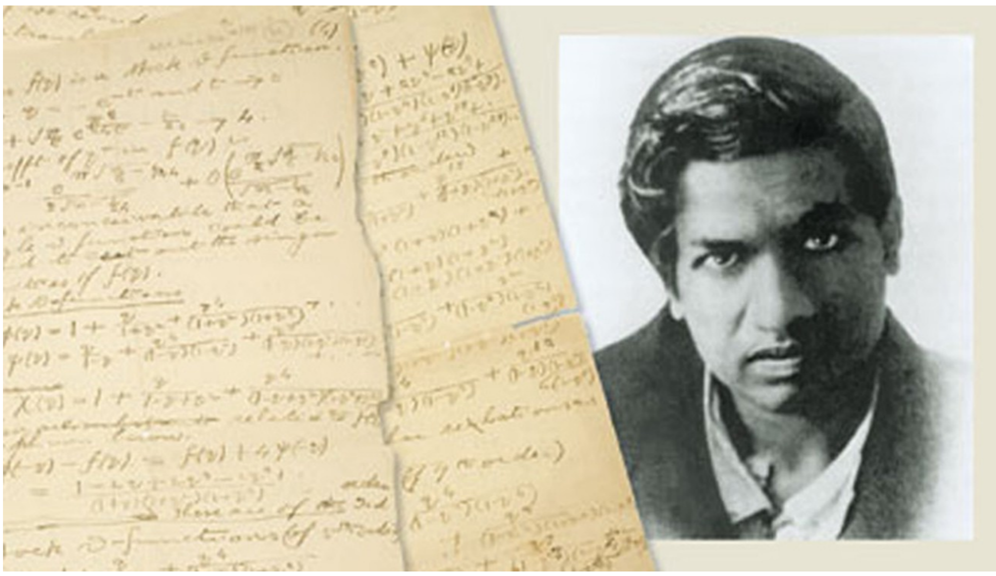
$$(1-e^{-\pi n})(1-e^{-3\pi n})(1-e^{-5\pi n})\ \&c = \frac{\sqrt[4]{2}}{\sqrt[24]{g_n e^{\pi n}}}. \quad \text{then}$$

$$g_n G_n = 64 g_{2n} \cdot \text{ and } 4 = 4\sqrt[3]{\frac{G}{g}} + \sqrt[3]{gG^2}.$$

$\sqrt{1}$. $G = 1$.	$\sqrt{15}$. $G = \frac{1}{64}\left(\frac{\sqrt{5}+1}{2}\right)^8$
$\sqrt{3}$. $G = \frac{1}{4}$	$\sqrt{17}$. $G = \left(\sqrt{\frac{5+\sqrt{17}}{8}} - \sqrt{\frac{\sqrt{17}-3}{8}}\right)^{24}$
$\sqrt{5}$ $G = (\sqrt{5}-2)^2$	$\{\sqrt{19}$ $G^3 + G^2 = \frac{1}{2}.\}$
$\sqrt{7}$ $G = \frac{1}{64}$	$\sqrt{21}$. $G = (8-3\sqrt{7})^2\left(\frac{5\pm\sqrt{21}}{2}\right)^3$
$\sqrt{9}$. $G = (2-\sqrt{3})^4$	$\{\sqrt{23}$. $G^3 + G^2 = 1\}$
$\sqrt{11}$ $\{G^3 - G^2 + G = \frac{1}{2}\}$	$\sqrt{25}$ $G = (\sqrt{5}-2)^8$
$\sqrt{13}$ $G = \left(\frac{\sqrt{13}-3}{2}\right)^6$.	$\sqrt{27}$ $G = \frac{1}{4}(\sqrt[3]{2}-1)^8$
	or $\{G^3 + G^2\sqrt[3]{3} = \frac{1}{2}\}$

From:

https://www.pourlascience.fr/sd/mathematiques/les-notes-de-ramanujan-un-tresor-inepuise-7955.php



We begin this paper by analyzing Ramanujan's modular equations and class invariants according to our interpretation inspired by Ramanujan

From:

MODULAR EQUATIONS IN THE SPIRIT OF RAMANUJAN
M. S. Mahadeva Naika
Department of Mathematics, Central College Campus, Bangalore University, Bengaluru-560 001, INDIA
"IIIT - BANGALORE"
June 25, 2012

If

$$P = \frac{f(-q)}{q^{1/24} f(-q^2)} \qquad and \qquad Q_n = \frac{f(-q^n)}{q^{n/24} f(-q^{2n})}, \tag{12}$$

then

$$(PQ_3)^3 + \frac{8}{(PQ_3)^3} = \left(\frac{Q_3}{P}\right)^6 - \left(\frac{P}{Q_3}\right)^6, \tag{13}$$

Using (12) with $n = 3$ in the above identity, we find that

$$(PQ_3)^6 + \frac{64}{(PQ_3)^6} + 32 = \left(P^{12} + \frac{64}{P^{12}}\right)^{1/2} \left(Q_3^{12} + \frac{64}{Q_3^{12}}\right)^{1/2}.$$

For q = 0.5, we obtain, from (12)

(-0.5)/(0.5^1/24 *0.5^2)

Input:

$$-\frac{0.5}{\sqrt[24]{0.5} \times 0.5^2}$$

Result:

$-2.05860...$

-2.05860…

(-0.5)^3/(0.5^(3/24) *0.5^6)

Input:

$$\frac{(-0.5)^3}{0.5^{3/24} \times 0.5^6}$$

Result:

$-8.72406...$

-8.72406…

(-2.05860 * -8.72406)^3 + 8/(((-2.05860 * -8.72406)^3))

Input interpretation:

$$(-2.05860 \times (-8.72406))^3 + \frac{8}{(-2.05860 \times (-8.72406))^3}$$

Result:

$5792.578663442205228118634186199274133619469045373719515158...$

5792.57866… result very near to the rest mass of bottom Xi baryon 5791.1

(-2.05860 * -8.72406)^6 + 64/(((-2.05860 * -8.72406)^6))+32

Input interpretation:

$$(-2.05860 \times (-8.72406))^6 + \frac{64}{(-2.05860 \times (-8.72406))^6} + 32$$

Result:

$3.355398357216588470732964150313602212371165772076013\,66... \times 10^7$

3.355398… $*10^7$

((((-2.05860 * -8.72406)^3 + 8/(((-2.05860 * -8.72406)^3)))))^1/18

Input interpretation:

$$\sqrt[18]{(-2.05860 \times (-8.72406))^3 + \frac{8}{(-2.05860 \times (-8.72406))^3}}$$

Result:

1.618260528050015977687190912963540280597100599303237610424...

1.61826052…

This result is a very good approximation to the value of the golden ratio 1,618033988749...

Or:

(((((-2.05860 * -8.72406)^6 + 64/(((-2.05860 * -8.72406)^6))+32)))))^1/36

Input interpretation:

$$\sqrt[36]{(-2.05860\times(-8.72406))^6+\frac{64}{(-2.05860\times(-8.72406))^6}+32}$$

Result:

1.618260549484939674642933735554797388483238650931317143813...

1.61826054…

This result is a very good approximation to the value of the golden ratio 1,618033988749...

THEOREM

If $P = \dfrac{f(-q)f(-q^{13})}{q^{14/3}f(-q^9)f(-q^{117})}$ *and* $Q = \dfrac{f(-q)f(-q^{117})}{q^{-4}f(-q^9)f(-q^{13})}$ *then*

$$Q^7+\frac{1}{Q^7}-65\left(Q^6+\frac{1}{Q^6}\right)+910\left(Q^5+\frac{1}{Q^5}\right)-1417\left(Q^4+\frac{1}{Q^4}\right)$$
$$-6994\left(Q^3+\frac{1}{Q^3}\right)+10049\left(Q^2+\frac{1}{Q^2}\right)+6981\left(Q+\frac{1}{Q}\right)=17472$$

$$P^6+\frac{9^6}{P^6}-13\left(\sqrt{P^9}+\frac{3^9}{\sqrt{P^9}}\right)\left[\left(\sqrt{Q}+\frac{1}{\sqrt{Q}}\right)-\left(\sqrt{Q^3}+\frac{1}{\sqrt{Q^3}}\right)\right]$$
$$-13\left(\sqrt{P^3}+\frac{3^3}{\sqrt{P^3}}\right)\left[139\left(\sqrt{Q}+\frac{1}{\sqrt{Q}}\right)-179\left(\sqrt{Q^3}+\frac{1}{\sqrt{Q^3}}\right)\right.$$
$$\left.-2\left(\sqrt{Q^5}+\frac{1}{\sqrt{Q^5}}\right)+52\left(\sqrt{Q^7}+\frac{1}{\sqrt{Q^7}}\right)+10\left(\sqrt{Q^9}+\frac{1}{\sqrt{Q^9}}\right)\right]$$
$$+13\left(P^3+\frac{9^3}{P^3}\right)\left[5\left(Q^3+\frac{1}{Q^3}\right)-12\left(Q^2+\frac{1}{Q^2}\right)-6\left(Q+\frac{1}{Q}\right)+26\right]. \tag{100}$$

Mahadeva Naika (Bangalore University) Modular equations in spirit of Ramanujan 89 / 126

$$Q^7+\frac{1}{Q^7}-65\left(Q^6+\frac{1}{Q^6}\right)+910\left(Q^5+\frac{1}{Q^5}\right)-1417\left(Q^4+\frac{1}{Q^4}\right)$$
$$-6994\left(Q^3+\frac{1}{Q^3}\right)+10049\left(Q^2+\frac{1}{Q^2}\right)+6981\left(Q+\frac{1}{Q}\right)=17472$$

1417 – 910 – 65 + 10049 + 6981 = 17472

17472 – 6981 – 10049 = 1417 – 910 – 65 = 442

(442)^1/12 = 1.6613145…

For P = Q = 1, we obtain:

(1+1-65*2+910*2-1417*2-6994*2+10049*2+6981*2)

Input:

$1+1-65\times2+910\times2-1417\times2-6994\times2+10\,049\times2+6981\times2$

Result:

18930

18930

Note that:

((((1+1-65*2+910*2-1417*2-6994*2+10049*2+6981*2)/2)))-144-21

Input:

$$\frac{1}{2}(1+1-65\times 2+910\times 2-1417\times 2-6994\times 2+10\,049\times 2+6981\times 2)-144-21$$

Result:

9300

9300 result equal to the rest mass of Bottom eta meson

Now:

17472/(1+1-65*2+910*2-1417*2-6994*2+10049*2+6981*2)

Input:

$$\frac{17472}{1+1-65\times 2+910\times 2-1417\times 2-6994\times 2+10\,049\times 2+6981\times 2}$$

Exact result:

$$\frac{2912}{3155}$$

Decimal approximation:

0.922979397781299524564183835182250396196513470681458003169...

0.922979…

And:

17472/0.922979397781299524564183835182250396196513470681458003169

Input interpretation:

$$\frac{17472}{0.922979397781299524564183835182250396196513470681458003169}$$

Result:

18930.00000000000000000000000000000000000000000000000001...

18930

Now, we have also that:

1/((((17472/(1+1-65*2+910*2-1417*2-6994*2+10049*2+6981*2))))

Input:

$$\frac{1}{\frac{17472}{1+1-65\times2+910\times2-1417\times2-6994\times2+10049\times2+6981\times2}}$$

Exact result:

$$\frac{3155}{2912}$$

Decimal approximation:

1.083447802197802197802197802197802197802197802197802...

1.083447802…

[1/((((17472/(1+1-65*2+910*2-1417*2-6994*2+10049*2+6981*2))))]^(2Pi)

Input:

$$\frac{1}{\left(\frac{17472}{1+1-65\times2+910\times2-1417\times2-6994\times2+10049\times2+6981\times2}\right)^{2\pi}}$$

Exact result:

$$\left(\frac{2912}{3155}\right)^{-2\pi}$$

Decimal approximation:

1.654645908717583150250669665694988397816010922617213071439...

1.6546459… is very near to the 14th root of the following Ramanujan's class invariant $Q = \left(G_{505}/G_{101/5}\right)^3$ = 1164,2696 i.e. 1,65578...

Alternate form:

$$\left(\frac{3155}{2912}\right)^{2\pi}$$

Alternative representations:

$$\frac{1}{\left(\frac{17472}{1+1-65\times 2+910\times 2-1417\times 2-6994\times 2+10049\times 2+6981\times 2}\right)^{2\pi}} = \frac{1}{\left(\frac{17472}{18930}\right)^{360\,°}}$$

$$\frac{1}{\left(\frac{17472}{1+1-65\times 2+910\times 2-1417\times 2-6994\times 2+10049\times 2+6981\times 2}\right)^{2\pi}} = \frac{1}{\left(\frac{17472}{18930}\right)^{-2\,i\log(-1)}}$$

$$\frac{1}{\left(\frac{17472}{1+1-65\times 2+910\times 2-1417\times 2-6994\times 2+10049\times 2+6981\times 2}\right)^{2\pi}} = \frac{1}{\left(\frac{17472}{18930}\right)^{2\cos^{-1}(-1)}}$$

$\log(x)$ is the natural logarithm

i is the imaginary unit

$\cos^{-1}(x)$ is the inverse cosine function

Series representations:

$$\frac{1}{\left(\frac{17472}{1+1-65\times 2+910\times 2-1417\times 2-6994\times 2+10049\times 2+6981\times 2}\right)^{2\pi}} = \left(\frac{2912}{3155}\right)^{-8\sum_{k=0}^{\infty}(-1)^k/(1+2k)}$$

$$\frac{1}{\left(\frac{17472}{1+1-65\times 2+910\times 2-1417\times 2-6994\times 2+10049\times 2+6981\times 2}\right)^{2\pi}} = \left(\frac{2912}{3155}\right)^{8\sum_{k=0}^{\infty}\left((-1)^k\,1195^{-1-2k}\left(5^{1+2k}-4\times 239^{1+2k}\right)\right)/(1+2k)}$$

$$\frac{1}{\left(\frac{17472}{1+1-65\times 2+910\times 2-1417\times 2-6994\times 2+10049\times 2+6981\times 2}\right)^{2\pi}} = \left(\frac{2912}{3155}\right)^{-2\sum_{k=0}^{\infty}(-1/4)^k\left(1/(1+2k)+2/(1+4k)+1/(3+4k)\right)}$$

Integral representations:

$$\frac{1}{\left(\frac{17472}{1+1-65\times 2+910\times 2-1417\times 2-6994\times 2+10049\times 2+6981\times 2}\right)^{2\pi}} = \left(\frac{2912}{3155}\right)^{-8\int_0^1\sqrt{1-t^2}\,dt}$$

$$\frac{1}{\left(\frac{17472}{1+1-65\times 2+910\times 2-1417\times 2-6994\times 2+10049\times 2+6981\times 2}\right)^{2\pi}} = \left(\frac{2912}{3155}\right)^{-4\int_0^\infty 1/(1+t^2)\,dt}$$

$$\frac{1}{\left(\frac{17472}{1+1-65\times 2+910\times 2-1417\times 2-6994\times 2+10049\times 2+6981\times 2}\right)^{2\pi}} = \left(\frac{2912}{3155}\right)^{-4\int_0^1 1/\sqrt{1-t^2}\,dt}$$

55+10^3[1/((((17472/(1+1-65*2+910*2-1417*2-6994*2+10049*2+6981*2))))]^6

Input:

$$55+10^3\times\frac{1}{\left(\frac{17472}{1+1-65\times 2+910\times 2-1417\times 2-6994\times 2+10049\times 2+6981\times 2}\right)^6}$$

Exact result:

$$\frac{127475848374720601759765}{76218120810002382848}$$

Decimal approximation:

1672.513662367696158027720527054348874626859874674635042818...

1672.51366…. result practically equal to the rest mass of Omega baryon 1672.45

-2.103786766-34+10^2[1/((((17472/(1+1-65*2+910*2-1417*2-6994*2+10049*2+6981*2))))]^6

where 2.103786766... is a Ramanujan mock theta function

Input interpretation:

$$-2.103786766-34+10^2\times\frac{1}{\left(\frac{17472}{1+1-65\times 2+910\times 2-1417\times 2-6994\times 2+10049\times 2+6981\times 2}\right)^6}$$

Result:

125.6475794707696158027720527054348874626859874674635042818...

125.647579… result very near to the Higgs boson mass 125.18

13-1.22734321771259-34+10^2[1/((((17472/(1+1-65*2+910*2-1417*2-6994*2+10049*2+6981*2))))]^6

here **f(q) = 1.22734321771259... is a Ramanujan mock theta function**

Input interpretation:

$$13 - 1.22734321771259 - 34 + 10^2 \times \frac{1}{\left(\frac{17472}{1+1-65\times2+910\times2-1417\times2-6994\times2+10049\times2+6981\times2}\right)^6}$$

Result:

139.5240230190570258027720527054348874626859874674635042818...

139.52402…. result practically equal to the rest mass of Pion meson 139.57

(-144-13-21^2)+10^3[1/((((17472/(1+1-65*2+910*2-1417*2-6994*2+10049*2+6981*2))))]^6

Input:

$$\left(-144 - 13 - 21^2\right) + 10^3 \times \frac{1}{\left(\frac{17472}{1+1-65\times2+910\times2-1417\times2-6994\times2+10049\times2+6981\times2}\right)^6}$$

Exact result:

$$\frac{77705415485789045760021}{76218120810002382848}$$

Decimal approximation:

1019.5136623676961580277205270543488746268598746746350428 18...

1019.513662… result practically equal to the rest mass of Phi meson 1019.445

[[[[[(-144-13-21^2)+[10^3/((((17472/(1+1-65*2+910*2-1417*2-6994*2+10049*2+6981*2))))]^6)]]]]]^1/14

Input:

$$\sqrt[14]{\left(-144 - 13 - 21^2\right) + \frac{10^3}{\left(\frac{17472}{1+1-65\times2+910\times2-1417\times2-6994\times2+10049\times2+6981\times2}\right)^6}}$$

Result:

$$\frac{\sqrt[14]{77\,705\,415\,485\,789\,045\,760\,021}}{2\times 2^{13/14}\times 91^{3/7}}$$

Decimal approximation:

1.640156229772129765747784256473260022997596705858787698650...

1.64015622… ≈ ζ(2) = $\frac{\pi^2}{6} = 1.644934$ ...

Alternate form:

$$\frac{1}{364}\sqrt[14]{155\,410\,830\,971\,578\,091\,520\,042}\;91^{4/7}$$

(-21-1)/(10^3)+[[[[[(-144-13-21^2)+[10^3/((((17472/(1+1-65*2+910*2-1417*2-6994*2+10049*2+6981*2))))]^6)]]]]]^1/14

Input:

$$\frac{-21-1}{10^3}+\sqrt[14]{\left(-144-13-21^2\right)+\frac{10^3}{\left(\frac{17472}{1+1-65\times 2+910\times 2-1417\times 2-6994\times 2+10\,049\times 2+6981\times 2}\right)^6}}$$

Result:

$$\frac{\sqrt[14]{77\,705\,415\,485\,789\,045\,760\,021}}{2\times 2^{13/14}\times 91^{3/7}}-\frac{11}{500}$$

Decimal approximation:

1.618156229772129765747784256473260022997596705858787698650...

1.61815622…

This result is a very good approximation to the value of the golden ratio 1,618033988749...

Alternate forms:

$$\frac{125\times 91^{4/7}\sqrt[14]{155\,410\,830\,971\,578\,091\,520\,042}-1001}{45\,500}$$

$$-\frac{11\times 2^{13/14}\times 91^{3/7}-250\sqrt[14]{77\,705\,415\,485\,789\,045\,760\,021}}{500\times 2^{13/14}\times 91^{3/7}}$$

$$\frac{1}{500}\left(\sqrt{\left(1000\ \text{root of }\begin{array}{l} 567\,869\,252\,041\,000\,000\,000\,000\,000\,000\,000\,x^7 + \\ 480\,985\,256\,478\,727\,000\,000\,000\,000\,000\,000\,x^6 + \\ 174\,597\,648\,101\,777\,901\,000\,000\,000\,000\,000\,x^5 + \\ 35\,210\,525\,700\,525\,210\,035\,000\,000\,000\,000\,x^4 + \\ 4\,260\,473\,609\,763\,550\,414\,235\,000\,000\,000\,x^3 + \\ 309\,310\,384\,068\,833\,760\,073\,461\,000\,000\,x^2 + \\ 12\,475\,518\,824\,109\,628\,322\,962\,927\,000\,x - \\ 35\,336\,331\,841\,694\,593\,895\,236\,266\,473\,959\,619\,599\,388\,818\,327\,511\,369 \\ \text{near } x = 672.407 \end{array}\right) + 121} - 11\right)$$

Minimal polynomial:

$$\begin{array}{l} 34\,659\,988\,527\,893\,066\,406\,250\,000\,000\,000\,000\,000\,000\,000\,000\,000\,x^{14} + \\ 10\,675\,276\,466\,591\,064\,453\,125\,000\,000\,000\,000\,000\,000\,000\,000\,000\,x^{13} + \\ 1\,526\,564\,534\,722\,522\,216\,796\,875\,000\,000\,000\,000\,000\,000\,000\,000\,x^{12} + \\ 134\,337\,679\,055\,581\,955\,078\,125\,000\,000\,000\,000\,000\,000\,000\,000\,x^{11} + \\ 8\,127\,429\,582\,862\,708\,282\,226\,562\,500\,000\,000\,000\,000\,000\,000\,x^{10} + \\ 357\,606\,901\,645\,959\,164\,417\,968\,750\,000\,000\,000\,000\,000\,000\,x^9 + \\ 11\,801\,027\,754\,316\,652\,425\,792\,968\,750\,000\,000\,000\,000\,000\,x^8 + \\ 296\,711\,554\,965\,675\,832\,419\,937\,500\,000\,000\,000\,000\,000\,x^7 + \\ 5\,711\,697\,433\,089\,259\,774\,083\,796\,875\,000\,000\,000\,000\,x^6 + \\ 83\,771\,562\,351\,975\,810\,019\,895\,687\,500\,000\,000\,000\,x^5 + \\ 921\,487\,185\,871\,733\,910\,218\,852\,562\,500\,000\,000\,x^4 + \\ 7\,371\,897\,486\,973\,871\,281\,750\,820\,500\,000\,000\,x^3 + \\ 40\,545\,436\,178\,356\,292\,049\,629\,512\,750\,000\,x^2 + \\ 137\,230\,707\,065\,205\,911\,552\,592\,197\,000\,x - \\ 35\,336\,331\,841\,694\,593\,895\,236\,266\,473\,959\,619\,599\,388\,818\,327\,511\,369 \end{array}$$

Now, we have that:

If $P := \dfrac{\psi(-q)\psi(-q^7)}{q^4\psi(-q^5)\psi(-q^{35})}$ *and* $Q := \dfrac{\psi(-q)\psi(-q^{35})}{q^{-3}\psi(-q^5)\psi(-q^7)}$, *then*

$$Q^4 - \frac{1}{Q^4} + 14\left[\left(Q^3 + \frac{1}{Q^3}\right) + \left(Q^2 - \frac{1}{Q^2}\right) + 10\left(Q + \frac{1}{Q}\right)\right] + P^3 + \frac{5^3}{P^3} + 7\left\{\left(P^2 + \frac{5^2}{P^2}\right)\left(Q + \frac{1}{Q}\right) + \left(P + \frac{5}{P}\right)\left[2\left(Q^2 + \frac{1}{Q^2}\right) + 9\right]\right\} = 0. \tag{69}$$

For P and Q = 1, we obtain:

1-1+14(2+0+10*2)+1+125+7(((((1+5)(1+1)+6*(2(1+1)+9)))) = 1064

1064 = 0

Thence:

1064 / 0

Input:

$$\frac{1064}{0}$$

Result:

$\tilde{\infty}$ (supersymmetric condition ⟶ ∞)

Or:

0 / 1064

Input:

$$\frac{0}{1064}$$

Exact result:

0

0 (supersymmetric condition ⟶ 0)

If we take only the expression, we obtain 1064. Thence, we can to obtain:

((((1-1+14(2+0+10*2)+1+125+7(((((1+5)(1+1)+6*(2(1+1)+9))))))))^1/14

Input:

$$\sqrt[14]{1-1+14(2+0+10\times 2)+1+125+7((1+5)(1+1)+6(2(1+1)+9))}$$

Result:

$$2^{3/14}\sqrt[14]{133}$$

Decimal approximation:

1.645167480201061406938865705004925835649619237793470364697...

$1.64516748\ldots.. \approx \zeta(2) = \frac{\pi^2}{6} = 1.644934\ldots$

If $P := \dfrac{\psi(-q)}{q^{1/2}\psi(-q^5)}$ and $Q := \dfrac{\psi(-q^5)}{q^{5/2}\psi(-q^{25})}$ then

$$\frac{Q^3}{P^3} - \frac{5Q^2}{P^2} - \frac{15Q}{P} - 5\left(PQ + \frac{5}{PQ}\right) - 5\left(Q^2 + \frac{5}{P^2}\right) - P^2Q^2 + \frac{5^2}{P^2Q^2} - 15 = 0. \quad (68)$$

For P = 1 and Q = 2, we obtain:

(((8-5*4-15*2-5(2+5/2)-5(4+5)-2^2+25/4)))

Input:

$$8 - 5\times 4 - 15\times 2 - 5\left(2 + \frac{5}{2}\right) - 5(4+5) - 2^2 + \frac{25}{4}$$

Exact result:

$$-\frac{429}{4}$$

Decimal form:

−107.25

-107.25

(((8-5*4-15*2-5(2+5/2)-5(4+5)-2^2+25/4)))/0

Input:

$$\frac{1}{0}\left(8 - 5\times 4 - 15\times 2 - 5\left(2 + \frac{5}{2}\right) - 5(4+5) - 2^2 + \frac{25}{4}\right)$$

Result:

$\tilde{\infty}$ (supersymmetric condition $\longrightarrow$ ∞)

$\tilde{\infty}$ is complex infinity

If we take only the result -107.25, we obtain:

55+1/16(((8-5*4-15*2-5(2+5/2)-5(4+5)-2^2+25/4)))^2

Input:

$$55+\frac{1}{16}\left(8-5\times4-15\times2-5\left(2+\frac{5}{2}\right)-5(4+5)-2^2+\frac{25}{4}\right)^2$$

Exact result:

$$\frac{198121}{256}$$

Decimal form:

773.91015625

773.910... result very near to the rest mass of Charged rho meson 775.4

1/84(((8-5*4-15*2-5(2+5/2)-5(4+5)-2^2+25/4)))^2

Input:

$$\frac{1}{84}\left(8-5\times4-15\times2-5\left(2+\frac{5}{2}\right)-5(4+5)-2^2+\frac{25}{4}\right)^2$$

Exact result:

$$\frac{61347}{448}$$

Decimal approximation:

136.935267857142857142857142857142857142857142857142857142857142857...

136.93526…

This result is very near to the inverse of fine-structure constant 137,035

And:

-(((8-5*4-15*2-5(2+5/2)-5(4+5)-2^2+25/4)))+21+8+3

Input:

$$-\left(8-5\times4-15\times2-5\left(2+\frac{5}{2}\right)-5(4+5)-2^2+\frac{25}{4}\right)+21+8+3$$

Exact result:

$$\frac{557}{4}$$

Decimal form:

139.25

139.25 result very near to the rest mass of Pion meson 139.57

From:

Schwarzschild meets Ramanujan:
From quantum black holes to mock modular forms
Boris Pioline, LPTHE, Paris - Math-Physics Colloquium
University of Amsterdam, 7/06/2019

Letter to G. H. Hardy (Jan 1920, Madras): *I am extremely sorry for not writing you a single letter up to now... I discovered very interesting functions recently which I call "Mock" theta-functions. Unlike the "False" theta-functions... they enter into mathematics as beautifully as the ordinary theta functions. I am sending you with this letter some examples.*

$$f(\tau) = \sum_{n=0}^{\infty} \frac{q^{n^2}}{(1+q)^2(1+q^2)^2\dots(1+q^n)^2} = 1 + q - 2q^2 + 3q^3 + \dots$$

- Recall that $f(\tau) = \sum_{n\geq 0} a_n q^{n-\Delta}$ (with $q = e^{2\pi i\tau}$, $\mathrm{Im}\tau > 0$) is a *modular form* of weight k under $\Gamma \subset SL(2,\mathbb{Z})$ if

$$f\left(\frac{a\tau+b}{c\tau+d}\right) = \chi(\gamma)\,(c\tau+d)^k\, f(\tau) \quad \forall\gamma = \begin{pmatrix} a & b \\ c & d \end{pmatrix} \in \Gamma$$

- Examples include *Dedekind*'s function $\eta(\tau) = q^{1/24}\prod_{n\geq 1}(1-q^n)$ and *Jacobi*'s theta function $\theta(\tau) = \sum_{n=0}^{\infty} q^{n^2}$ which are modular forms of weight 1/2 under $SL(2,\mathbb{Z})$ and $\Gamma_0(4)$, respectively.

From:

$$f(\tau) = \sum_{n=0}^{\infty} \frac{q^{n^2}}{(1+q)^2(1+q^2)^2\dots(1+q^n)^2} = 1 + q - 2q^2 + 3q^3 + \dots$$

For n = -1 and $q = e^{-2\pi}$, we obtain:

(((e^(-2Pi)))

Input:

$e^{-2\pi}$

Decimal approximation:

0.001867442731707988814430212934827030393422805002475317199...

0.001867442731…

Property:

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

Series representations:

$$e^{-2\pi} = e^{-8\sum_{k=0}^{\infty}(-1)^k/(1+2k)}$$

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

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

$n!$ is the factorial function

Integral representations:

$$e^{-2\pi} = e^{-8\int_0^1\sqrt{1-t^2}\,dt}$$

$$e^{-2\pi} = e^{-4\int_0^1 1/\sqrt{1-t^2}\,dt}$$

$$e^{-2\pi} = e^{-4\int_0^{\infty}1/(1+t^2)\,dt}$$

(0.001867442731)/((((((1+0.001867442731)^2 * (1+0.001867442731^2)^2 * (1+1/0.001867442731)^2)))))))

Input interpretation:

$$\frac{0.001867442731}{(1+0.001867442731)^2\,(1+0.001867442731^2)^2\left(1+\frac{1}{0.001867442731}\right)^2}$$

Result:

6.4639470824775064808643561686889066041221937180408037... × 10^{-9}

6.463947…* 10^{-9}

Or:

(((e^(-2Pi))) / ((((((1+ ((e^(-2Pi))))^2 * ((((((1+ [((e^(-2Pi))))]^2))))))))^2 * (((1+(((1/e^(-2Pi))))))^2

Input:

$$\frac{e^{-2\pi}}{\left((1+e^{-2\pi})^2\left(1+\left(e^{-2\pi}\right)^2\right)\right)^2\left(1+\frac{1}{e^{-2\pi}}\right)^2}$$

Exact result:

$$\frac{e^{-2\pi}}{(1+e^{-4\pi})^2(1+e^{-2\pi})^4(1+e^{2\pi})^2}$$

Decimal approximation:

6.4398724457871043047944550696621109774959482098774950... × 10^{-9}

6.43987244…*10^{-9}

Property:

$$\frac{e^{-2\pi}}{(1+e^{-4\pi})^2(1+e^{-2\pi})^4(1+e^{2\pi})^2} \text{ is a transcendental number}$$

Alternate forms:

$$\frac{1}{256}e^{4\pi}\operatorname{sech}^6(\pi)\operatorname{sech}^2(2\pi)$$

$$\frac{e^{14\pi}}{(1+e^{2\pi})^6(1+e^{4\pi})^2}$$

$$-\frac{1}{4(1+e^{2\pi})^6}+\frac{5}{4(1+e^{2\pi})^5}-\frac{9}{4(1+e^{2\pi})^4}+\frac{3}{2(1+e^{2\pi})^3}+\frac{1}{16(1+e^{2\pi})^2}-\frac{3}{16(1+e^{2\pi})}+\frac{1}{8(1+e^{4\pi})^2}+\frac{3e^{2\pi}-4}{16(1+e^{4\pi})}$$

sech(x) is the hyperbolic secant function

Alternative representations:

$$\frac{e^{-2\pi}}{\left((1+e^{-2\pi})^2\left(1+\left(e^{-2\pi}\right)^2\right)\right)^2\left(1+\frac{1}{e^{-2\pi}}\right)^2}=\frac{e^{-360^\circ}}{\left(1+\frac{1}{e^{-360^\circ}}\right)^2\left(\left(1+\left(e^{-360^\circ}\right)^2\right)\left(1+e^{-360^\circ}\right)^2\right)^2}$$

$$\frac{e^{-2\pi}}{\left((1+e^{-2\pi})^2\left(1+\left(e^{-2\pi}\right)^2\right)\right)^2\left(1+\frac{1}{e^{-2\pi}}\right)^2} = \frac{\exp^{-2\pi}(z)}{\left((1+\exp^{-2\pi}(z))^2\left(1+\exp^{-2\pi}(z)^2\right)\right)^2\left(1+\frac{1}{\exp^{-2\pi}(z)}\right)^2} \quad \text{for } z=1$$

$$\frac{e^{-2\pi}}{\left((1+e^{-2\pi})^2\left(1+\left(e^{-2\pi}\right)^2\right)\right)^2\left(1+\frac{1}{e^{-2\pi}}\right)^2} = \frac{e^{2i\log(-1)}}{\left(1+\frac{1}{e^{2i\log(-1)}}\right)^2\left(\left(1+\left(e^{2i\log(-1)}\right)^2\right)\left(1+e^{2i\log(-1)}\right)^2\right)^2}$$

log(x) is the natural logarithm

i is the imaginary unit

Series representations:

$$\frac{e^{-2\pi}}{\left((1+e^{-2\pi})^2\left(1+\left(e^{-2\pi}\right)^2\right)\right)^2\left(1+\frac{1}{e^{-2\pi}}\right)^2} = \frac{e^{56\sum_{k=0}^{\infty}(-1)^k/(1+2k)}}{\left(1+e^{8\sum_{k=0}^{\infty}(-1)^k/(1+2k)}\right)^6\left(1+e^{16\sum_{k=0}^{\infty}(-1)^k/(1+2k)}\right)^2}$$

$$\frac{e^{-2\pi}}{\left((1+e^{-2\pi})^2\left(1+\left(e^{-2\pi}\right)^2\right)\right)^2\left(1+\frac{1}{e^{-2\pi}}\right)^2} = \frac{\left(\sum_{k=0}^{\infty}\frac{1}{k!}\right)^{14\pi}}{\left(1+\left(\sum_{k=0}^{\infty}\frac{1}{k!}\right)^{2\pi}\right)^6\left(1+\left(\sum_{k=0}^{\infty}\frac{1}{k!}\right)^{4\pi}\right)^2}$$

$$\frac{e^{-2\pi}}{\left((1+e^{-2\pi})^2\left(1+\left(e^{-2\pi}\right)^2\right)\right)^2\left(1+\frac{1}{e^{-2\pi}}\right)^2} = \frac{\left(\frac{1}{\sum_{k=0}^{\infty}\frac{(-1)^k}{k!}}\right)^{14\pi}}{\left(1+\left(\frac{1}{\sum_{k=0}^{\infty}\frac{(-1)^k}{k!}}\right)^{2\pi}\right)^6\left(1+\left(\frac{1}{\sum_{k=0}^{\infty}\frac{(-1)^k}{k!}}\right)^{4\pi}\right)^2}$$

n! is the factorial function

Integral representations:

$$\frac{e^{-2\pi}}{\left((1+e^{-2\pi})^2\left(1+\left(e^{-2\pi}\right)^2\right)\right)^2\left(1+\frac{1}{e^{-2\pi}}\right)^2} = \frac{e^{28\int_0^{\infty}1/(1+t^2)\,dt}}{\left(1+e^{4\int_0^{\infty}1/(1+t^2)\,dt}\right)^6\left(1+e^{8\int_0^{\infty}1/(1+t^2)\,dt}\right)^2}$$

$$\frac{e^{-2\pi}}{((1+e^{-2\pi})^2(1+(e^{-2\pi})^2))^2\left(1+\frac{1}{e^{-2\pi}}\right)^2} = \frac{e^{28\int_0^\infty \sin(t)/t\,dt}}{\left(1+e^{4\int_0^\infty \sin(t)/t\,dt}\right)^6\left(1+e^{8\int_0^\infty \sin(t)/t\,dt}\right)^2}$$

$$\frac{e^{-2\pi}}{((1+e^{-2\pi})^2(1+(e^{-2\pi})^2))^2\left(1+\frac{1}{e^{-2\pi}}\right)^2} = \frac{e^{56\int_0^1 \sqrt{1-t^2}\,dt}}{\left(1+e^{8\int_0^1 \sqrt{1-t^2}\,dt}\right)^6\left(1+e^{16\int_0^1 \sqrt{1-t^2}\,dt}\right)^2}$$

- By viewing black holes as black strings wrapped on a circle, micro-states can be viewed as excitations in a 2D superconformal field theory. The partition function $Z_{T^2(\tau)}$ is then manifestly modular. BPS ground states are chiral excitations of the SCFT, counted (with sign) by a weakly holomorphic modular form.
- E.g. in type II string theory compactified on T^6, $\Omega(Q) = c(I_4(Q))$ where I_4 is a quartic polynomial in Q and $c(n)$ are Fourier coefficients of the modular form

$$\frac{\theta(\tau)}{\eta^6(4\tau)} = \sum_{n\geq -1} c(n)\, q^n = \frac{1}{q} + 2 + 8q^3 + 12q^4 + 39q^7 + 56q^8 + \ldots$$

Moore Maldacena Strominger 1999, BP 2005, Shih Strominger Yin 2005

- The Hardy-Ramanujan formula (aka. Cardy's formula in physics) gives $c(n) \sim e^{\pi\sqrt{n}}$, in perfect agreement with gravity's prediction $\Omega(Q) \sim e^{\pi\sqrt{I_4(Q)}}$.

From:

$$\frac{\theta(\tau)}{\eta^6(4\tau)} = \sum_{n\geq -1} c(n)\, q^n = \frac{1}{q} + 2 + 8q^3 + 12q^4 + 39q^7 + 56q^8 + \ldots$$

For $q = e^{-2\pi}$

1/(e^(-2Pi)) + 2 + 8*(e^(-2Pi))^3 + 12*(e^(-2Pi))^4 + 39*(e^(-2Pi))^7 + 56*(e^(-2Pi))^8

Input:

$$\frac{1}{e^{-2\pi}} + 2 + 8\left(e^{-2\pi}\right)^3 + 12\left(e^{-2\pi}\right)^4 + 39\left(e^{-2\pi}\right)^7 + 56\left(e^{-2\pi}\right)^8$$

Exact result:

$$2 + 56\,e^{-16\pi} + 39\,e^{-14\pi} + 12\,e^{-8\pi} + 8\,e^{-6\pi} + e^{2\pi}$$

Decimal approximation:

537.4916555770099722752985714201740043996997680857133693461...

Property:

$2 + 56\,e^{-16\pi} + 39\,e^{-14\pi} + 12\,e^{-8\pi} + 8\,e^{-6\pi} + e^{2\pi}$ is a transcendental number

Alternate forms:

$$2 + e^{-16\pi}\left(56 + 39\,e^{2\pi} + 12\,e^{8\pi} + 8\,e^{10\pi} + e^{18\pi}\right)$$

$$e^{-16\pi}\left(56 + 39\,e^{2\pi} + 12\,e^{8\pi} + 8\,e^{10\pi} + 2\,e^{16\pi} + e^{18\pi}\right)$$

Alternative representations:

$$\frac{1}{e^{-2\pi}} + 2 + 8\left(e^{-2\pi}\right)^3 + 12\left(e^{-2\pi}\right)^4 + 39\left(e^{-2\pi}\right)^7 + 56\left(e^{-2\pi}\right)^8 = \frac{1}{\exp^{-2\pi}(z)} + 2 + 8\exp^{-2\pi}(z)^3 + 12\exp^{-2\pi}(z)^4 + 39\exp^{-2\pi}(z)^7 + 56\exp^{-2\pi}(z)^8 \quad \text{for } z = 1$$

$$\frac{1}{e^{-2\pi}} + 2 + 8\left(e^{-2\pi}\right)^3 + 12\left(e^{-2\pi}\right)^4 + 39\left(e^{-2\pi}\right)^7 + 56\left(e^{-2\pi}\right)^8 = 2 + \frac{1}{e^{-360^\circ}} + 8\left(e^{-360^\circ}\right)^3 + 12\left(e^{-360^\circ}\right)^4 + 39\left(e^{-360^\circ}\right)^7 + 56\left(e^{-360^\circ}\right)^8$$

$$\frac{1}{e^{-2\pi}} + 2 + 8\left(e^{-2\pi}\right)^3 + 12\left(e^{-2\pi}\right)^4 + 39\left(e^{-2\pi}\right)^7 + 56\left(e^{-2\pi}\right)^8 = \frac{1}{\exp^{-2\cos^{-1}(-1)}(z)} + 2 + 8\exp^{-2\cos^{-1}(-1)}(z)^3 + 12\exp^{-2\cos^{-1}(-1)}(z)^4 + 39\exp^{-2\cos^{-1}(-1)}(z)^7 + 56\exp^{-2\cos^{-1}(-1)}(z)^8 \quad \text{for } z = 1$$

$\cos^{-1}(x)$ is the inverse cosine function

Series representations:

$$\frac{1}{e^{-2\pi}} + 2 + 8\left(e^{-2\pi}\right)^3 + 12\left(e^{-2\pi}\right)^4 + 39\left(e^{-2\pi}\right)^7 + 56\left(e^{-2\pi}\right)^8 = 2 + 56\,e^{-64\sum_{k=0}^{\infty}(-1)^k/(1+2k)} + 39\,e^{-56\sum_{k=0}^{\infty}(-1)^k/(1+2k)} + 12\,e^{-32\sum_{k=0}^{\infty}(-1)^k/(1+2k)} + 8\,e^{-24\sum_{k=0}^{\infty}(-1)^k/(1+2k)} + e^{8\sum_{k=0}^{\infty}(-1)^k/(1+2k)}$$

$$\frac{1}{e^{-2\pi}} + 2 + 8\left(e^{-2\pi}\right)^3 + 12\left(e^{-2\pi}\right)^4 + 39\left(e^{-2\pi}\right)^7 + 56\left(e^{-2\pi}\right)^8 = \left(\sum_{k=0}^{\infty}\frac{1}{k!}\right)^{-16\pi} \left(56 + 39\left(\sum_{k=0}^{\infty}\frac{1}{k!}\right)^{2\pi} + 12\left(\sum_{k=0}^{\infty}\frac{1}{k!}\right)^{8\pi} + 8\left(\sum_{k=0}^{\infty}\frac{1}{k!}\right)^{10\pi} + 2\left(\sum_{k=0}^{\infty}\frac{1}{k!}\right)^{16\pi} + \left(\sum_{k=0}^{\infty}\frac{1}{k!}\right)^{18\pi}\right)$$

$$\frac{1}{e^{-2\pi}} + 2 + 8\left(e^{-2\pi}\right)^3 + 12\left(e^{-2\pi}\right)^4 + 39\left(e^{-2\pi}\right)^7 + 56\left(e^{-2\pi}\right)^8 = \left(56 + 39\left(\frac{1}{\sum_{k=0}^{\infty}\frac{(-1)^k}{k!}}\right)^{2\pi} + 12\left(\frac{1}{\sum_{k=0}^{\infty}\frac{(-1)^k}{k!}}\right)^{8\pi} + 8\left(\frac{1}{\sum_{k=0}^{\infty}\frac{(-1)^k}{k!}}\right)^{10\pi} + 2\left(\frac{1}{\sum_{k=0}^{\infty}\frac{(-1)^k}{k!}}\right)^{16\pi} + \left(\frac{1}{\sum_{k=0}^{\infty}\frac{(-1)^k}{k!}}\right)^{18\pi}\right)\left(\frac{1}{\sum_{k=0}^{\infty}\frac{(-1)^k}{k!}}\right)^{-16\pi}$$

$n!$ is the factorial function

Integral representations:

$$\frac{1}{e^{-2\pi}} + 2 + 8\left(e^{-2\pi}\right)^3 + 12\left(e^{-2\pi}\right)^4 + 39\left(e^{-2\pi}\right)^7 + 56\left(e^{-2\pi}\right)^8 = 2 + 56\,e^{-64\int_0^1 \sqrt{1-t^2}\,dt} + 39\,e^{-56\int_0^1 \sqrt{1-t^2}\,dt} + 12\,e^{-32\int_0^1 \sqrt{1-t^2}\,dt} + 8\,e^{-24\int_0^1 \sqrt{1-t^2}\,dt} + e^{8\int_0^1 \sqrt{1-t^2}\,dt}$$

$$\frac{1}{e^{-2\pi}} + 2 + 8\left(e^{-2\pi}\right)^3 + 12\left(e^{-2\pi}\right)^4 + 39\left(e^{-2\pi}\right)^7 + 56\left(e^{-2\pi}\right)^8 = 2 + 56\,e^{-128/3\int_0^\infty \sin^3(t)/t^3\,dt} + 39\,e^{-112/3\int_0^\infty \sin^3(t)/t^3\,dt} + 12\,e^{-64/3\int_0^\infty \sin^3(t)/t^3\,dt} + 8\,e^{-16\int_0^\infty \sin^3(t)/t^3\,dt} + e^{16/3\int_0^\infty \sin^3(t)/t^3\,dt}$$

$$\frac{1}{e^{-2\pi}} + 2 + 8\left(e^{-2\pi}\right)^3 + 12\left(e^{-2\pi}\right)^4 + 39\left(e^{-2\pi}\right)^7 + 56\left(e^{-2\pi}\right)^8 = e^{-32\int_0^\infty 1/(1+t^2)\,dt}\left(56 + 39\,e^{4\int_0^\infty 1/(1+t^2)\,dt} + 12\,e^{16\int_0^\infty 1/(1+t^2)\,dt} + 8\,e^{20\int_0^\infty 1/(1+t^2)\,dt} + 2\,e^{32\int_0^\infty 1/(1+t^2)\,dt} + e^{36\int_0^\infty 1/(1+t^2)\,dt}\right)$$

Note that, inverting the formula, we obtain:

1/((((((1/(e^(-2Pi)) + 2 + 8*(e^(-2Pi))^3 + 12*(e^(-2Pi))^4 + 39*(e^(-2Pi))^7 + 56*(e^(-2Pi))^8))))))

Input:

$$\frac{1}{\frac{1}{e^{-2\pi}} + 2 + 8\left(e^{-2\pi}\right)^3 + 12\left(e^{-2\pi}\right)^4 + 39\left(e^{-2\pi}\right)^7 + 56\left(e^{-2\pi}\right)^8}$$

Exact result:

$$\frac{1}{2+56\,e^{-16\pi}+39\,e^{-14\pi}+12\,e^{-8\pi}+8\,e^{-6\pi}+e^{2\pi}}$$

Decimal approximation:

0.001860493999532841879956621007555187996639000019261084218...

0.0018604939…

Property:

$$\frac{1}{2+56\,e^{-16\pi}+39\,e^{-14\pi}+12\,e^{-8\pi}+8\,e^{-6\pi}+e^{2\pi}}$$ is a transcendental number

Alternate forms:

$$\frac{1}{2+e^{-16\pi}\left(56+39\,e^{2\pi}+12\,e^{8\pi}+8\,e^{10\pi}+e^{18\pi}\right)}$$

$$\frac{e^{16\pi}}{56+39\,e^{2\pi}+12\,e^{8\pi}+8\,e^{10\pi}+2\,e^{16\pi}+e^{18\pi}}$$

Alternative representations:

$$\frac{1}{\frac{1}{e^{-2\pi}}+2+8\left(e^{-2\pi}\right)^3+12\left(e^{-2\pi}\right)^4+39\left(e^{-2\pi}\right)^7+56\left(e^{-2\pi}\right)^8}=\frac{1}{2+\frac{1}{e^{-360^\circ}}+8\left(e^{-360^\circ}\right)^3+12\left(e^{-360^\circ}\right)^4+39\left(e^{-360^\circ}\right)^7+56\left(e^{-360^\circ}\right)^8}$$

$$\frac{1}{\frac{1}{e^{-2\pi}}+2+8\left(e^{-2\pi}\right)^3+12\left(e^{-2\pi}\right)^4+39\left(e^{-2\pi}\right)^7+56\left(e^{-2\pi}\right)^8}=\frac{1}{\frac{1}{\exp^{-2\pi}(z)}+2+8\exp^{-2\pi}(z)^3+12\exp^{-2\pi}(z)^4+39\exp^{-2\pi}(z)^7+56\exp^{-2\pi}(z)^8}\quad\text{for } z=1$$

$$\frac{1}{\frac{1}{e^{-2\pi}}+2+8\left(e^{-2\pi}\right)^3+12\left(e^{-2\pi}\right)^4+39\left(e^{-2\pi}\right)^7+56\left(e^{-2\pi}\right)^8}=1\Big/\left(\frac{1}{\exp^{-2\cos^{-1}(-1)}(z)}+2+8\exp^{-2\cos^{-1}(-1)}(z)^3+12\exp^{-2\cos^{-1}(-1)}(z)^4+39\exp^{-2\cos^{-1}(-1)}(z)^7+56\exp^{-2\cos^{-1}(-1)}(z)^8\right)\quad\text{for } z=1$$

$\cos^{-1}(x)$ is the inverse cosine function

Series representations:

$$\frac{1}{\frac{1}{e^{-2\pi}}+2+8\left(e^{-2\pi}\right)^3+12\left(e^{-2\pi}\right)^4+39\left(e^{-2\pi}\right)^7+56\left(e^{-2\pi}\right)^8} = 1\Big/\left(2+56\,e^{-64\sum_{k=0}^{\infty}(-1)^k/(1+2k)}+39\,e^{-56\sum_{k=0}^{\infty}(-1)^k/(1+2k)}+ 12\,e^{-32\sum_{k=0}^{\infty}(-1)^k/(1+2k)}+8\,e^{-24\sum_{k=0}^{\infty}(-1)^k/(1+2k)}+e^{8\sum_{k=0}^{\infty}(-1)^k/(1+2k)}\right)$$

$$\frac{1}{\frac{1}{e^{-2\pi}}+2+8\left(e^{-2\pi}\right)^3+12\left(e^{-2\pi}\right)^4+39\left(e^{-2\pi}\right)^7+56\left(e^{-2\pi}\right)^8} = \left(\sum_{k=0}^{\infty}\frac{1}{k!}\right)^{16\pi}\Big/ \left(56+39\left(\sum_{k=0}^{\infty}\frac{1}{k!}\right)^{2\pi}+12\left(\sum_{k=0}^{\infty}\frac{1}{k!}\right)^{8\pi}+8\left(\sum_{k=0}^{\infty}\frac{1}{k!}\right)^{10\pi}+2\left(\sum_{k=0}^{\infty}\frac{1}{k!}\right)^{16\pi}+\left(\sum_{k=0}^{\infty}\frac{1}{k!}\right)^{18\pi}\right)$$

$$\frac{1}{\frac{1}{e^{-2\pi}}+2+8\left(e^{-2\pi}\right)^3+12\left(e^{-2\pi}\right)^4+39\left(e^{-2\pi}\right)^7+56\left(e^{-2\pi}\right)^8} = \left(\frac{1}{\sum_{k=0}^{\infty}\frac{(-1)^k}{k!}}\right)^{16\pi}\Big/\left(56+39\left(\frac{1}{\sum_{k=0}^{\infty}\frac{(-1)^k}{k!}}\right)^{2\pi}+12\left(\frac{1}{\sum_{k=0}^{\infty}\frac{(-1)^k}{k!}}\right)^{8\pi}+ 8\left(\frac{1}{\sum_{k=0}^{\infty}\frac{(-1)^k}{k!}}\right)^{10\pi}+2\left(\frac{1}{\sum_{k=0}^{\infty}\frac{(-1)^k}{k!}}\right)^{16\pi}+\left(\frac{1}{\sum_{k=0}^{\infty}\frac{(-1)^k}{k!}}\right)^{18\pi}\right)$$

$n!$ is the factorial function

Integral representations:

$$\frac{1}{\frac{1}{e^{-2\pi}}+2+8\left(e^{-2\pi}\right)^3+12\left(e^{-2\pi}\right)^4+39\left(e^{-2\pi}\right)^7+56\left(e^{-2\pi}\right)^8} = 1\Big/\left(2+56\,e^{-64\int_0^1\sqrt{1-t^2}\,dt}+39\,e^{-56\int_0^1\sqrt{1-t^2}\,dt}+ 12\,e^{-32\int_0^1\sqrt{1-t^2}\,dt}+8\,e^{-24\int_0^1\sqrt{1-t^2}\,dt}+e^{8\int_0^1\sqrt{1-t^2}\,dt}\right)$$

$$\frac{1}{\frac{1}{e^{-2\pi}}+2+8\left(e^{-2\pi}\right)^3+12\left(e^{-2\pi}\right)^4+39\left(e^{-2\pi}\right)^7+56\left(e^{-2\pi}\right)^8} = e^{32\int_0^{\infty}\sin(t)/t\,dt}\Big/\left(56+39\,e^{4\int_0^{\infty}\sin(t)/t\,dt}+12\,e^{16\int_0^{\infty}\sin(t)/t\,dt}+ 8\,e^{20\int_0^{\infty}\sin(t)/t\,dt}+2\,e^{32\int_0^{\infty}\sin(t)/t\,dt}+e^{36\int_0^{\infty}\sin(t)/t\,dt}\right)$$

$$\frac{1}{\frac{1}{e^{-2\pi}}+2+8\left(e^{-2\pi}\right)^3+12\left(e^{-2\pi}\right)^4+39\left(e^{-2\pi}\right)^7+56\left(e^{-2\pi}\right)^8} = e^{32\int_0^\infty 1/(1+t^2)\,dt} \Big/ \left(56+39\,e^{4\int_0^\infty 1/(1+t^2)\,dt}+12\,e^{16\int_0^\infty 1/(1+t^2)\,dt}+8\,e^{20\int_0^\infty 1/(1+t^2)\,dt}+2\,e^{32\int_0^\infty 1/(1+t^2)\,dt}+e^{36\int_0^\infty 1/(1+t^2)\,dt}\right)$$

a result equal to the value of q = 0.0018604939…

From the expression from which we obtain the value **6.43987244…*10^{-9}**, we have:

colog ((((((e^(-2Pi))) / ((((((1+ ((e^(-2Pi))))^2 * ((((((1+ [((e^(-2Pi))))]^2))))))))^2 * (((1+(((1/e^(-2Pi))))))^2)))

Input:

$$-\log\left(\frac{e^{-2\pi}}{\left(\left(1+e^{-2\pi}\right)^2\left(1+\left(e^{-2\pi}\right)^2\right)\right)^2\left(1+\frac{1}{e^{-2\pi}}\right)^2}\right)$$

log(x) is the natural logarithm

Exact result:

$$-\log\left(\frac{e^{-2\pi}}{\left(1+e^{-4\pi}\right)^2\left(1+e^{-2\pi}\right)^4\left(1+e^{2\pi}\right)^2}\right)$$

Decimal approximation:

18.860757103581098774196579202234373902812143312538579494 95…

18.8607571… result very near to the black hole entropy 18.7328

Alternate forms:

$$2\left(-7\pi+3\log\left(1+e^{2\pi}\right)+\log\left(1+e^{4\pi}\right)\right)$$

$$-14\pi+6\log\left(1+e^{2\pi}\right)+2\log\left(1+e^{4\pi}\right)$$

$$-2\left(7\pi-3\log\left(1+e^{2\pi}\right)-\log\left(1+e^{4\pi}\right)\right)$$

Alternative representations:

$$-\log\left(\frac{e^{-2\pi}}{\left(\left(1+e^{-2\pi}\right)^2\left(1+\left(e^{-2\pi}\right)^2\right)\right)^2\left(1+\frac{1}{e^{-2\pi}}\right)^2}\right)=$$
$$-\log_e\left(\frac{e^{-2\pi}}{\left(1+\frac{1}{e^{-2\pi}}\right)^2\left(\left(1+\left(e^{-2\pi}\right)^2\right)\left(1+e^{-2\pi}\right)^2\right)^2}\right)$$

$$-\log\left(\frac{e^{-2\pi}}{\left(\left(1+e^{-2\pi}\right)^2\left(1+\left(e^{-2\pi}\right)^2\right)\right)^2\left(1+\frac{1}{e^{-2\pi}}\right)^2}\right)=$$
$$-\log(a)\log_a\left(\frac{e^{-2\pi}}{\left(1+\frac{1}{e^{-2\pi}}\right)^2\left(\left(1+\left(e^{-2\pi}\right)^2\right)\left(1+e^{-2\pi}\right)^2\right)^2}\right)$$

$$-\log\left(\frac{e^{-2\pi}}{\left(\left(1+e^{-2\pi}\right)^2\left(1+\left(e^{-2\pi}\right)^2\right)\right)^2\left(1+\frac{1}{e^{-2\pi}}\right)^2}\right)=$$
$$\mathrm{Li}_1\left(1-\frac{e^{-2\pi}}{\left(1+\frac{1}{e^{-2\pi}}\right)^2\left(\left(1+\left(e^{-2\pi}\right)^2\right)\left(1+e^{-2\pi}\right)^2\right)^2}\right)$$

$\log_b(x)$ is the base- b logarithm

$\mathrm{Li}_n(x)$ is the polylogarithm function

Series representations:

$$-\log\left(\frac{e^{-2\pi}}{\left(\left(1+e^{-2\pi}\right)^2\left(1+\left(e^{-2\pi}\right)^2\right)\right)^2\left(1+\frac{1}{e^{-2\pi}}\right)^2}\right)=\sum_{k=1}^{\infty}\frac{(-1)^k\left(-1+\frac{e^{14\pi}}{\left(1+e^{2\pi}\right)^6\left(1+e^{4\pi}\right)^2}\right)^k}{k}$$

$$-\log\left(\frac{e^{-2\pi}}{\left(\left(1+e^{-2\pi}\right)^2\left(1+\left(e^{-2\pi}\right)^2\right)\right)^2\left(1+\frac{1}{e^{-2\pi}}\right)^2}\right)=$$
$$\sum_{k=1}^{\infty}\frac{(-1)^k\left(-1+\frac{e^{-2\pi}}{\left(1+e^{-4\pi}\right)^2\left(1+e^{-2\pi}\right)^4\left(1+e^{2\pi}\right)^2}\right)^k}{k}$$

$$-\log\left(\frac{e^{-2\pi}}{\left(\left(1+e^{-2\pi}\right)^2\left(1+\left(e^{-2\pi}\right)^2\right)\right)^2\left(1+\frac{1}{e^{-2\pi}}\right)^2}\right)=-2i\pi\left\lfloor\frac{\pi-\arg\left(\frac{1}{z_0}\right)-\arg(z_0)}{2\pi}\right\rfloor-$$
$$\log(z_0)+\sum_{k=1}^{\infty}\frac{(-1)^k\left(\frac{e^{-2\pi}}{\left(1+e^{-4\pi}\right)^2\left(1+e^{-2\pi}\right)^4\left(1+e^{2\pi}\right)^2}-z_0\right)^k z_0^{-k}}{k}$$

arg(z) is the complex argument

⌊x⌋ is the floor function

Integral representation:

$$-\log\left(\frac{e^{-2\pi}}{((1+e^{-2\pi})^2 (1+(e^{-2\pi})^2))^2 \left(1+\frac{1}{e^{-2\pi}}\right)^2}\right) = -\int_1^{\frac{e^{14\pi}}{(1+e^{2\pi})^6 (1+e^{4\pi})^2}} \frac{1}{t}\, dt$$

We take the result as a value of entropy (indeed we have the value of BH entropy 18.73, see Table) and obtain from the Hawking radiation calculator the following values:

Mass = 4.046535e-8

Radius = 6.008504e-35

Temperature = 3.032726e+30

From the Ramanujan-Nardelli mock formula, we obtain:

sqrt[[[[1/(((((((4*1.962364415e+19)/(5*0.0864055^2)))*1/(4.046535e-8)* sqrt[[-((((3.032726e+30 * 4*Pi*(6.008504e-35)^3-(6.008504e-35)^2))))) / ((6.67*10^-11))]]]]]

Input interpretation:

$$\sqrt{\left(1\Big/\left(\frac{4\times 1.962364415\times 10^{19}}{5\times 0.0864055^2}\times\frac{1}{4.046535\times 10^{-8}}\sqrt{-\frac{3.032726\times 10^{30}\times 4\pi\,(6.008504\times 10^{-35})^3-(6.008504\times 10^{-35})^2}{6.67\times 10^{-11}}}\right)\right)}$$

Result:

1.618249195139212749989026860015151305427028314306734727343...

1.61824919…

From the result 537.49165…, we obtain good approximations to the values of circle length with unitary radius and of ζ(2):

ln((((((1/(e^(-2Pi)) + 2 + 8*(e^(-2Pi))^3 + 12*(e^(-2Pi))^4 + 39*(e^(-2Pi))^7 + 56*(e^(-2Pi))^8))))))

Input:

$$\log\left(\frac{1}{e^{-2\pi}} + 2 + 8\left(e^{-2\pi}\right)^3 + 12\left(e^{-2\pi}\right)^4 + 39\left(e^{-2\pi}\right)^7 + 56\left(e^{-2\pi}\right)^8\right)$$

$\log(x)$ is the natural logarithm

Exact result:

$$\log\left(2 + 56\,e^{-16\pi} + 39\,e^{-14\pi} + 12\,e^{-8\pi} + 8\,e^{-6\pi} + e^{2\pi}\right)$$

Decimal approximation:

6.286913235373423019790878185469644688178126417823403437264...

$6.2869132353 \approx 2\pi$

Alternate forms:

$$\log\left(2 + e^{-16\pi}\left(56 + 39\,e^{2\pi} + 12\,e^{8\pi} + 8\,e^{10\pi} + e^{18\pi}\right)\right)$$

$$\log\left(56 + 39\,e^{2\pi} + 12\,e^{8\pi} + 8\,e^{10\pi} + 2\,e^{16\pi} + e^{18\pi}\right) - 16\pi$$

Alternative representations:

$$\log\left(\frac{1}{e^{-2\pi}} + 2 + 8\left(e^{-2\pi}\right)^3 + 12\left(e^{-2\pi}\right)^4 + 39\left(e^{-2\pi}\right)^7 + 56\left(e^{-2\pi}\right)^8\right) = \log_e\left(2 + \frac{1}{e^{-2\pi}} + 8\left(e^{-2\pi}\right)^3 + 12\left(e^{-2\pi}\right)^4 + 39\left(e^{-2\pi}\right)^7 + 56\left(e^{-2\pi}\right)^8\right)$$

$$\log\left(\frac{1}{e^{-2\pi}} + 2 + 8\left(e^{-2\pi}\right)^3 + 12\left(e^{-2\pi}\right)^4 + 39\left(e^{-2\pi}\right)^7 + 56\left(e^{-2\pi}\right)^8\right) = \log(a)\log_a\left(2 + \frac{1}{e^{-2\pi}} + 8\left(e^{-2\pi}\right)^3 + 12\left(e^{-2\pi}\right)^4 + 39\left(e^{-2\pi}\right)^7 + 56\left(e^{-2\pi}\right)^8\right)$$

$$\log\left(\frac{1}{e^{-2\pi}} + 2 + 8\left(e^{-2\pi}\right)^3 + 12\left(e^{-2\pi}\right)^4 + 39\left(e^{-2\pi}\right)^7 + 56\left(e^{-2\pi}\right)^8\right) = -\mathrm{Li}_1\left(-1 - \frac{1}{e^{-2\pi}} - 8\left(e^{-2\pi}\right)^3 - 12\left(e^{-2\pi}\right)^4 - 39\left(e^{-2\pi}\right)^7 - 56\left(e^{-2\pi}\right)^8\right)$$

$\log_b(x)$ is the base- b logarithm

$\mathrm{Li}_n(x)$ is the polylogarithm function

Series representations:

$$\log\left(\frac{1}{e^{-2\pi}}+2+8\left(e^{-2\pi}\right)^3+12\left(e^{-2\pi}\right)^4+39\left(e^{-2\pi}\right)^7+56\left(e^{-2\pi}\right)^8\right)=$$
$$\log\left(1+56\,e^{-16\pi}+39\,e^{-14\pi}+12\,e^{-8\pi}+8\,e^{-6\pi}+e^{2\pi}\right)-$$
$$\sum_{k=1}^{\infty}\frac{\left(-\frac{1}{1+56\,e^{-16\pi}+39\,e^{-14\pi}+12\,e^{-8\pi}+8\,e^{-6\pi}+e^{2\pi}}\right)^k}{k}$$

$$\log\left(\frac{1}{e^{-2\pi}}+2+8\left(e^{-2\pi}\right)^3+12\left(e^{-2\pi}\right)^4+39\left(e^{-2\pi}\right)^7+56\left(e^{-2\pi}\right)^8\right)=$$
$$2\,i\,\pi\left\lfloor\frac{\pi-\arg\left(\frac{1}{z_0}\right)-\arg(z_0)}{2\,\pi}\right\rfloor+\log(z_0)-$$
$$\sum_{k=1}^{\infty}\frac{(-1)^k\left(2+56\,e^{-16\pi}+39\,e^{-14\pi}+12\,e^{-8\pi}+8\,e^{-6\pi}+e^{2\pi}-z_0\right)^k z_0^{-k}}{k}$$

$$\log\left(\frac{1}{e^{-2\pi}}+2+8\left(e^{-2\pi}\right)^3+12\left(e^{-2\pi}\right)^4+39\left(e^{-2\pi}\right)^7+56\left(e^{-2\pi}\right)^8\right)=$$
$$2\,i\,\pi\left\lfloor\frac{\arg\left(2+56\,e^{-16\pi}+39\,e^{-14\pi}+12\,e^{-8\pi}+8\,e^{-6\pi}+e^{2\pi}-x\right)}{2\,\pi}\right\rfloor+\log(x)-$$
$$\sum_{k=1}^{\infty}\frac{(-1)^k\left(2+56\,e^{-16\pi}+39\,e^{-14\pi}+12\,e^{-8\pi}+8\,e^{-6\pi}+e^{2\pi}-x\right)^k x^{-k}}{k}\quad\text{for } x<0$$

$\arg(z)$ is the complex argument

$\lfloor x\rfloor$ is the floor function

Integral representations:

$$\log\left(\frac{1}{e^{-2\pi}}+2+8\left(e^{-2\pi}\right)^3+12\left(e^{-2\pi}\right)^4+39\left(e^{-2\pi}\right)^7+56\left(e^{-2\pi}\right)^8\right)=$$
$$\int_1^{2+56\,e^{-16\pi}+39\,e^{-14\pi}+12\,e^{-8\pi}+8\,e^{-6\pi}+e^{2\pi}}\frac{1}{t}\,dt$$

$$\log\left(\frac{1}{e^{-2\pi}}+2+8\left(e^{-2\pi}\right)^3+12\left(e^{-2\pi}\right)^4+39\left(e^{-2\pi}\right)^7+56\left(e^{-2\pi}\right)^8\right)=$$
$$-\frac{i}{2\,\pi}\int_{-i\,\infty+\gamma}^{i\,\infty+\gamma}\frac{\left(1+56\,e^{-16\pi}+39\,e^{-14\pi}+12\,e^{-8\pi}+8\,e^{-6\pi}+e^{2\pi}\right)^{-s}\,\Gamma(-s)^2\,\Gamma(1+s)}{\Gamma(1-s)}\,ds$$
$$\text{for } -1<\gamma<0$$

$\Gamma(x)$ is the gamma function

And:

1/24((((((ln((((((1/(e^(-2Pi)) + 2 + 8*(e^(-2Pi))^3 + 12*(e^(-2Pi))^4 + 39*(e^(-2Pi))^7 + 56*(e^(-2Pi))^8)))))))))))^2

Input:

$$\frac{1}{24}\log^2\left(\frac{1}{e^{-2\pi}}+2+8\left(e^{-2\pi}\right)^3+12\left(e^{-2\pi}\right)^4+39\left(e^{-2\pi}\right)^7+56\left(e^{-2\pi}\right)^8\right)$$

log(x) is the natural logarithm

Exact result:

$$\frac{1}{24}\log^2\left(2+56\,e^{-16\pi}+39\,e^{-14\pi}+12\,e^{-8\pi}+8\,e^{-6\pi}+e^{2\pi}\right)$$

Decimal approximation:

1.646886584546396728162221781029730265112214318179980282531...

1.64688658… ≈ ζ(2) = $\frac{\pi^2}{6} = 1.644934$ ...

Alternate forms:

$$\frac{1}{24}\log^2\left(2+e^{-16\pi}\left(56+39\,e^{2\pi}+12\,e^{8\pi}+8\,e^{10\pi}+e^{18\pi}\right)\right)$$

$$\frac{1}{24}\left(16\pi-\log\left(56+39\,e^{2\pi}+12\,e^{8\pi}+8\,e^{10\pi}+2\,e^{16\pi}+e^{18\pi}\right)\right)^2$$

Alternative representations:

$$\frac{1}{24}\log^2\left(\frac{1}{e^{-2\pi}}+2+8\left(e^{-2\pi}\right)^3+12\left(e^{-2\pi}\right)^4+39\left(e^{-2\pi}\right)^7+56\left(e^{-2\pi}\right)^8\right)=\frac{1}{24}\log_e^2\left(2+\frac{1}{e^{-2\pi}}+8\left(e^{-2\pi}\right)^3+12\left(e^{-2\pi}\right)^4+39\left(e^{-2\pi}\right)^7+56\left(e^{-2\pi}\right)^8\right)$$

$$\frac{1}{24}\log^2\left(\frac{1}{e^{-2\pi}}+2+8\left(e^{-2\pi}\right)^3+12\left(e^{-2\pi}\right)^4+39\left(e^{-2\pi}\right)^7+56\left(e^{-2\pi}\right)^8\right)=\frac{1}{24}\left(\log(a)\log_a\left(2+\frac{1}{e^{-2\pi}}+8\left(e^{-2\pi}\right)^3+12\left(e^{-2\pi}\right)^4+39\left(e^{-2\pi}\right)^7+56\left(e^{-2\pi}\right)^8\right)\right)^2$$

$$\frac{1}{24}\log^2\left(\frac{1}{e^{-2\pi}}+2+8\left(e^{-2\pi}\right)^3+12\left(e^{-2\pi}\right)^4+39\left(e^{-2\pi}\right)^7+56\left(e^{-2\pi}\right)^8\right)=\frac{1}{24}\left(-\text{Li}_1\left(-1-\frac{1}{e^{-2\pi}}-8\left(e^{-2\pi}\right)^3-12\left(e^{-2\pi}\right)^4-39\left(e^{-2\pi}\right)^7-56\left(e^{-2\pi}\right)^8\right)\right)^2$$

$\log_b(x)$ is the base- b logarithm

$\text{Li}_n(x)$ is the polylogarithm function

Thence the colog of the result of mock theta function analyzed and equated with the value of an entropy, corresponds to a Black Hole of mass = 4.046535 * 10^{-8} kg equivalent to a mass of 2.26994 * 10^{19} GeV, practically near to the mean value 1.962 * 10^{19} of DM particle that has a Planck scale mass: m ≈ 10^{19} GeV (Planck mass = 1,2209 × 10^{19} GeV/c^2 = 21,76 µg Wikipedia) and is very nearly to the result of the following Ramanujan mock theta function: **χ(q) = 1.962364415**

Indeed:

Input interpretation:

convert 4.046535 × 10^{-8} kg (kilograms)
to gigaelectronvolts per speed of light squared

Result:

$2.26994 \times 10^{19}\ \text{GeV}/c^2$

2.26994 * 10^{19} GeV

From the following 14-th root of Ramanujan class invariant 1164.2696

$$\sqrt[14]{\left(\sqrt{\frac{113+5\sqrt{505}}{8}}+\sqrt{\frac{105+5\sqrt{505}}{8}}\right)^3} = 1{,}65578\ldots$$

((((((((((sqrt((1/8(113+5sqrt(505)))))+sqrt((1/8(105+5sqrt(505))))))^3))))))^1/14

Input:

$$\sqrt[14]{\left(\sqrt{\frac{1}{8}\left(113+5\sqrt{505}\right)}+\sqrt{\frac{1}{8}\left(105+5\sqrt{505}\right)}\right)^3}$$

Exact result:

$$\left(\frac{1}{2}\sqrt{\frac{1}{2}\left(105+5\sqrt{505}\right)}+\frac{1}{2}\sqrt{\frac{1}{2}\left(113+5\sqrt{505}\right)}\right)^{3/14}$$

Decimal approximation:

1.6557845488047447246193495617611076395580681144806979602 39...

1.6557845488…..

Alternate forms:

$$\sqrt[28]{338881+15080\sqrt{505}+4\sqrt{5\left(2871007052+127758137\sqrt{505}\right)}}$$

- $$\frac{\left(5\sqrt{5}+\sqrt{101}+\sqrt{105-40\,i}+\sqrt{105+40\,i}\right)^{3/14}}{2^{3/7}}$$

$$\frac{\left(\sqrt{5\left(21+\sqrt{505}\right)}+\sqrt{113+5\sqrt{505}}\right)^{3/14}}{2^{9/28}}$$

Minimal polynomial:

$$x^{112}-1355524\,x^{84}+400646\,x^{56}-1355524\,x^{28}+1$$

From the mass 2.26994 * 10^{19}, we obtain:

(2.26994×10^19)/((((((((((sqrt((1/8(113+5sqrt(505)))))+sqrt((1/8(105+5sqrt(505))))))^3))))))^1/14)))) * 1/0.69897)))))))

Where 0.69897 is a Hausdorff dimension $\log_{10}(5)$ = 0.698970004336...

Input interpretation:

$$\frac{2.26994\times 10^{19}}{\sqrt[14]{\left(\sqrt{\frac{1}{8}\left(113+5\sqrt{505}\right)}+\sqrt{\frac{1}{8}\left(105+5\sqrt{505}\right)}\right)^{3}}}\times\frac{1}{0.69897}$$

Result:

$1.96134... \times 10^{19}$

1.96134…*10^{19} GeV

practically very near to the mean value 1.962 * 10^{19} of DM particle that has a Planck scale mass: m ≈ 10^{19} GeV (Planck mass = 1,2209 × 10^{19} GeV/c^2 = 21,76 µg Wikipedia)

from:

MODULAR EQUATIONS IN THE SPIRIT OF RAMANUJAN
M. S. Mahadeva Naika

We consider P and Q that are equal to P = -2.05860 Q = -8.72406

If $P = \frac{\varphi(q)}{\varphi(q^2)}\frac{\varphi(q^7)}{\varphi(q^{14})}$ *and* $Q = \frac{\varphi(q)}{\varphi(q^2)}\frac{\varphi(q^{14})}{\varphi(q^7)}$, *then*

$$Q^4 + \frac{1}{Q^4} + 56\left(Q^3 + \frac{1}{Q^3}\right) + 252\left(Q^2 + \frac{1}{Q^2}\right) + 1064\left(Q + \frac{1}{Q}\right) - 64\left(P^3 + \frac{8}{P^3}\right) + 1078 = 112\left\{\left(P + \frac{2}{P}\right)\left[2\left(Q^2 + \frac{1}{Q^2}\right) + 3\left(Q + \frac{1}{Q}\right) + 8\right] - \left(P^2 + \frac{4}{P^2}\right)\left[2\left(Q + \frac{1}{Q}\right) + 1\right]\right\}. \quad (43)$$

112*((((((((-2.05860+2/(-2.05860)*(((2(-8.72406^2)+1/(-8.72406)^2)+3(-8.72406+1/(-8.72406))+8)))))-(((((-2.05860^2+4/(-2.05860^2))*((2(-8.72406+1/(-8.72406))+1)))))))))

Input interpretation:

$$112\left(\left(-2.05860 + -\frac{2}{2.05860}\left(\left(2\left(-8.72406^2\right) + \frac{1}{(-8.72406)^2}\right) + 3\left(-8.72406 + -\frac{1}{8.72406}\right) + 8\right)\right) - \left(-2.05860^2 + -\frac{4}{2.05860^2}\right)\left(2\left(-8.72406 + -\frac{1}{8.72406}\right) + 1\right)\right)$$

Result:

8667.195929413593108789613720368221235040594427173860111278...

8667.1959…

And:

-5+1/5*112*(((((((-2.05860+2/(-2.05860)*(((2(-8.72406^2)+1/(-8.72406)^2)+3(-8.72406+1/(-8.72406))+8)))))-(((((-2.05860^2+4/(-2.05860^2))*((2(-8.72406+1/(-8.72406))+1)))))))))

Input interpretation:

$$-5+\frac{1}{5}\times 112\left(\left(-2.05860+-\frac{2}{2.05860}\left(\left(2\left(-8.72406^2\right)+\frac{1}{(-8.72406)^2}\right)+3\left(-8.72406+-\frac{1}{8.72406}\right)+8\right)\right)-\left(-2.05860^2+-\frac{4}{2.05860^2}\right)\left(2\left(-8.72406+-\frac{1}{8.72406}\right)+1\right)\right)$$

Result:

1728.43918588271862175792274407364424700811888543477202225 5...

1728.43918…

This result is very near to the mass of candidate glueball $f_0(1710)$ meson. Furthermore, 1728 occurs in the algebraic formula for the j-invariant of an elliptic curve. As a consequence, it is sometimes called a Zagier as a pun on the Gross–Zagier theorem. The number 1728 is one less than the Hardy–Ramanujan number 1729

ln[112*(((((((((-2.05860+2/(-2.05860)*(((2(-8.72406^2)+1/(-8.72406)^2)+3(-8.72406+1/(-8.72406))+8)))))-(((((-2.05860^2+4/(-2.05860^2))*((2(-8.72406+1/(-8.72406))+1)))))))))]

Input interpretation:

$$\log\left(112\left(\left(-2.05860+-\frac{2}{2.05860}\left(\left(2\left(-8.72406^2\right)+\frac{1}{(-8.72406)^2}\right)+3\left(-8.72406+-\frac{1}{8.72406}\right)+8\right)\right)-\left(-2.05860^2+-\frac{4}{2.05860^2}\right)\left(2\left(-8.72406+-\frac{1}{8.72406}\right)+1\right)\right)\right)$$

log(x) is the natural logarithm

Result:

9.06730...

9.06730… result near to the black hole entropy 9.3664

Alternative representations:

$$\log\left(112\left(\left(-2.0586+-\frac{\left(\left(2\left(-8.72406^2\right)+\frac{1}{(-8.72406)^2}\right)+3\left(-8.72406+-\frac{1}{8.72406}\right)+8\right)2}{2.0586}\right)-\left(-2.0586^2+-\frac{4}{2.0586^2}\right)\left(2\left(-8.72406+-\frac{1}{8.72406}\right)+1\right)\right)\right)=$$

$$\log_e\left(112\left(-2.0586+-\frac{2\left(8+3\left(-8.72406+-\frac{1}{8.72406}\right)-2\times 8.72406^2+\frac{1}{(-8.72406)^2}\right)}{2.0586}-\left(1+2\left(-8.72406+-\frac{1}{8.72406}\right)\right)\left(-2.0586^2+-\frac{4}{2.0586^2}\right)\right)\right)$$

$$\log\left(112\left(\left(-2.0586+-\frac{\left(\left(2\left(-8.72406^2\right)+\frac{1}{(-8.72406)^2}\right)+3\left(-8.72406+-\frac{1}{8.72406}\right)+8\right)2}{2.0586}\right)-\left(-2.0586^2+-\frac{4}{2.0586^2}\right)\left(2\left(-8.72406+-\frac{1}{8.72406}\right)+1\right)\right)\right)=\log(a)$$

$$\log_a\left(112\left(-2.0586+-\frac{2\left(8+3\left(-8.72406+-\frac{1}{8.72406}\right)-2\times 8.72406^2+\frac{1}{(-8.72406)^2}\right)}{2.0586}-\left(1+2\left(-8.72406+-\frac{1}{8.72406}\right)\right)\left(-2.0586^2+-\frac{4}{2.0586^2}\right)\right)\right)$$

$$\log\left(112\left(\left(-2.0586+-\frac{\left(\left(2\left(-8.72406^2\right)+\frac{1}{(-8.72406)^2}\right)+3\left(-8.72406+-\frac{1}{8.72406}\right)+8\right)2}{2.0586}\right)-\left(-2.0586^2+-\frac{4}{2.0586^2}\right)\left(2\left(-8.72406+-\frac{1}{8.72406}\right)+1\right)\right)\right)=-\mathrm{Li}_1\left(1-112\left(-2.0586+-\frac{2\left(8+3\left(-8.72406+-\frac{1}{8.72406}\right)-2\times 8.72406^2+\frac{1}{(-8.72406)^2}\right)}{2.0586}-\left(1+2\left(-8.72406+-\frac{1}{8.72406}\right)\right)\left(-2.0586^2+-\frac{4}{2.0586^2}\right)\right)\right)$$

$\log_b(x)$ is the base- b logarithm

$\mathrm{Li}_n(x)$ is the polylogarithm function

Series representations:

$$\log\left(112\left(\left(-2.0586 + -\frac{\left(\left(2\left(-8.72406^2\right) + \frac{1}{(-8.72406)^2}\right) + 3\left(-8.72406 + -\frac{1}{8.72406}\right) + 8\right)2}{2.0586}\right) - \left(-2.0586^2 + -\frac{4}{2.0586^2}\right)\left(2\left(-8.72406 + -\frac{1}{8.72406}\right) + 1\right)\right)\right) = \log(8666.2) - \sum_{k=1}^{\infty} \frac{(-1)^k e^{-9.06719 k}}{k}$$

$$\log\left(112\left(\left(-2.0586 + -\frac{\left(\left(2\left(-8.72406^2\right) + \frac{1}{(-8.72406)^2}\right) + 3\left(-8.72406 + -\frac{1}{8.72406}\right) + 8\right)2}{2.0586}\right) - \left(-2.0586^2 + -\frac{4}{2.0586^2}\right)\left(2\left(-8.72406 + -\frac{1}{8.72406}\right) + 1\right)\right)\right) = 2 i \pi \left\lfloor \frac{\arg(8667.2 - x)}{2\pi} \right\rfloor + \log(x) - \sum_{k=1}^{\infty} \frac{(-1)^k (8667.2 - x)^k x^{-k}}{k} \quad \text{for } x < 0$$

$$\log\left(112\left(\left(-2.0586 + -\frac{\left(\left(2\left(-8.72406^2\right) + \frac{1}{(-8.72406)^2}\right) + 3\left(-8.72406 + -\frac{1}{8.72406}\right) + 8\right)2}{2.0586}\right) - \left(-2.0586^2 + -\frac{4}{2.0586^2}\right)\left(2\left(-8.72406 + -\frac{1}{8.72406}\right) + 1\right)\right)\right) = \left\lfloor \frac{\arg(8667.2 - z_0)}{2\pi} \right\rfloor \log\left(\frac{1}{z_0}\right) + \log(z_0) + \left\lfloor \frac{\arg(8667.2 - z_0)}{2\pi} \right\rfloor \log(z_0) - \sum_{k=1}^{\infty} \frac{(-1)^k (8667.2 - z_0)^k z_0^{-k}}{k}$$

$\arg(z)$ is the complex argument

$\lfloor x \rfloor$ is the floor function

i is the imaginary unit

Integral representations:

$$\log\left(112\left(\left(-2.0586+-\frac{\left(\left(2\left(-8.72406^2\right)+\frac{1}{(-8.72406)^2}\right)+3\left(-8.72406+-\frac{1}{8.72406}\right)+8\right)2}{2.0586}\right)-\left(-2.0586^2+-\frac{4}{2.0586^2}\right)\left(2\left(-8.72406+-\frac{1}{8.72406}\right)+1\right)\right)\right)=\int_1^{8667.2}\frac{1}{t}\,dt$$

$$\log\left(112\left(\left(-2.0586+-\frac{\left(\left(2\left(-8.72406^2\right)+\frac{1}{(-8.72406)^2}\right)+3\left(-8.72406+-\frac{1}{8.72406}\right)+8\right)2}{2.0586}\right)-\left(-2.0586^2+-\frac{4}{2.0586^2}\right)\left(2\left(-8.72406+-\frac{1}{8.72406}\right)+1\right)\right)\right)=$$

$$\frac{1}{2 i \pi}\int_{-i\infty+\gamma}^{i\infty+\gamma}\frac{e^{-9.06719 s}\,\Gamma(-s)^2\,\Gamma(1+s)}{\Gamma(1-s)}\,ds \quad \text{for } -1<\gamma<0$$

$\Gamma(x)$ is the gamma function

With an entropy equal to the result 9.067301 that we have obtained from the ln of the value of expression, by the Hawking radiation calculator, we have the following black hole parameters:

Mass = 2.805710e-8

Radius = 4.166063e-35

Temperature = 4.373949e+30

From the Ramanujan-Nardelli mock formula, we obtain:

sqrt[[[[1/(((((((4*1.962364415e+19)/(5*0.0864055^2)))*1/(2.805710e-8)* sqrt[[-((((4.373949e+30 * 4*Pi*(4.166063e-35)^3-(4.166063e-35)^2))))) / ((6.67*10^-11))]]]]]

Input interpretation:

$$\sqrt{\left(1/\left(\frac{4\times 1.962364415\times 10^{19}}{5\times 0.0864055^2}\times\frac{1}{2.805710\times 10^{-8}}\sqrt{-\frac{4.373949\times 10^{30}\times 4\pi(4.166063\times 10^{-35})^3-(4.166063\times 10^{-35})^2}{6.67\times 10^{-11}}}\right)\right)}$$

Result:

1.618249195953930216361799175981036602633174350182042907988...

1.61824919…

Now, we have:

$$h_{4,13} = -\sqrt{\frac{1279+355\sqrt{13}+12\sqrt{a_1}}{2}} + \sqrt{\frac{1281+355\sqrt{13}+12\sqrt{a_1}}{2}},$$

$$h_{4,1/13} = \sqrt{\frac{1279+355\sqrt{13}+12\sqrt{a_1}}{2}} + \sqrt{\frac{1281+355\sqrt{13}+12\sqrt{a_1}}{2}},$$

where $a_1 = 22733 + 6305\sqrt{13}$,

We obtain:

((((((((((1/2*(1279+355sqrt(13)+12*sqrt((22733+6305sqrt(13))))))^0.5))))) + ((((((((((1/2*(1281+355sqrt(13)+12*sqrt((22733+6305sqrt(13))))))^0.5)))))

Input:

$$\sqrt{\frac{1}{2}\left(1279+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}\right)} + \sqrt{\frac{1}{2}\left(1281+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}\right)}$$

Decimal approximation:

101.1800534855957098546733135864456977523922232456688420658...

101.18…

Alternate forms:

$$\text{root of } x^8 - 100x^7 - 120x^6 + 60x^5 + 94x^4 - 60x^3 - 120x^2 + 100x + 1 \text{ near } x = 101.18$$

$$\frac{1}{\sqrt{2}}\left(\sqrt{1279 + 355\sqrt{13} + 12\sqrt{22733 + 6305\sqrt{13}}} + \sqrt{1281 + 355\sqrt{13} + 12\sqrt{22733 + 6305\sqrt{13}}}\right)$$

$$\frac{1}{\sqrt{2}}\left(\sqrt{1279 + 355\sqrt{13} + 6\sqrt{45466 - 12i} + 6\sqrt{45466 + 12i}} + \sqrt{1281 + 355\sqrt{13} + 6\sqrt{45466 - 12i} + 6\sqrt{45466 + 12i}}\right)$$

Minimal polynomial:

$$x^8 - 100x^7 - 120x^6 + 60x^5 + 94x^4 - 60x^3 - 120x^2 + 100x + 1$$

-((((((((((1/2*(1279+355sqrt(13)+12*sqrt((22733+6305sqrt(13))))))^0.5))))) - ((((((((((1/2*(1281+355sqrt(13)+12*sqrt((22733+6305sqrt(13))))))^0.5)))))

Input:

$$-\left(\sqrt{\frac{1}{2}\left(1279 + 355\sqrt{13} + 12\sqrt{22733 + 6305\sqrt{13}}\right)} - \sqrt{\frac{1}{2}\left(1281 + 355\sqrt{13} + 12\sqrt{22733 + 6305\sqrt{13}}\right)}\right)$$

Exact result:

$$\sqrt{\frac{1}{2}\left(1281 + 355\sqrt{13} + 12\sqrt{22733 + 6305\sqrt{13}}\right)} - \sqrt{\frac{1}{2}\left(1279 + 355\sqrt{13} + 12\sqrt{22733 + 6305\sqrt{13}}\right)}$$

Decimal approximation:

0.009883370936766335497016430294461115920248564878851856440...

0.00988337…

Alternate forms:

root of $x^8 + 100 x^7 - 120 x^6 - 60 x^5 + 94 x^4 + 60 x^3 - 120 x^2 - 100 x + 1$ near $x = 0.00988337$

$$-\frac{1}{\sqrt{2}}\left(\sqrt{1279 + 355\sqrt{13} + 12\sqrt{22733 + 6305\sqrt{13}}} - \sqrt{1281 + 355\sqrt{13} + 12\sqrt{22733 + 6305\sqrt{13}}}\right)$$

$$-\frac{1}{\sqrt{2}}\left(\sqrt{1279 + 355\sqrt{13} + 6\sqrt{45466 - 12i} + 6\sqrt{45466 + 12i}} - \sqrt{1281 + 355\sqrt{13} + 6\sqrt{45466 - 12i} + 6\sqrt{45466 + 12i}}\right)$$

Minimal polynomial:

$x^8 + 100 x^7 - 120 x^6 - 60 x^5 + 94 x^4 + 60 x^3 - 120 x^2 - 100 x + 1$

Now, inverting the above expression, we obtain:

1/ (((((-(((((((((1/2*(1279+355sqrt(13)+12*sqrt((22733+6305sqrt(13))))))^0.5))))) - (((((((((1/2*(1281+355sqrt(13)+12*sqrt((22733+6305sqrt(13))))))^0.5))))))))))

Input:

$$-\left(1\Big/\left(\sqrt{\frac{1}{2}\left(1279 + 355\sqrt{13} + 12\sqrt{22733 + 6305\sqrt{13}}\right)} - \sqrt{\frac{1}{2}\left(1281 + 355\sqrt{13} + 12\sqrt{22733 + 6305\sqrt{13}}\right)}\right)\right)$$

Exact result:

$$1/\left(\sqrt{\frac{1}{2}\left(1281+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}\right)}-\sqrt{\frac{1}{2}\left(1279+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}\right)}\right)$$

Decimal approximation:

101.180053485595709854673313586445697752392223245668842065 8...

101.18…

Alternate forms:

root of $x^8-100x^7-120x^6+60x^5+94x^4-60x^3-120x^2+100x+1$ near $x=101.18$

$$-\left(\left(\sqrt{2}\right)/\left(\sqrt{1279+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}}-\sqrt{1281+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}}\right)\right)$$

$$-\left(\left(\sqrt{2}\right)/\left(\sqrt{1279+355\sqrt{13}+6\sqrt{45466-12i}+6\sqrt{45466+12i}}-\sqrt{1281+355\sqrt{13}+6\sqrt{45466-12i}+6\sqrt{45466+12i}}\right)\right)$$

Minimal polynomial:

$x^8-100x^7-120x^6+60x^5+94x^4-60x^3-120x^2+100x+1$

From the sum of the two expressions, we obtain, multiplying by 8 and dividing by 10^3, the following result:

8/10^3*((((101.18005348559570985467331358 6+((((((((((1/2*(1279+355sqrt(13)+12*sqrt((22733+6305sqrt(13))))))^0.5))))) + ((((((((((1/2*(1281+355sqrt(13)+12*sqrt((22733+6305sqrt(13))))))^0.5)))))

Input interpretation:

$$\frac{8}{10^3}\left(101.18005348559570985467331358 6+\left(\sqrt{\frac{1}{2}\left(1279+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}\right)}+\sqrt{\frac{1}{2}\left(1281+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}\right)}\right)\right)$$

Result:

1.618880855769531357674773017 38...

1.6188808...

This result is a very good approximation to the value of the golden ratio 1,618033988749...

From the sum of the two expressions, we obtain also:

(((sqrt(5)+1))/2)))+ln^2((((101.18005+((((((((((1/2*(1279+355sqrt(13)+12*sqrt((22733+6305sqrt(13))))))^0.5))))) + ((((((((((1/2*(1281+355sqrt(13)+12*sqrt((22733+6305sqrt(13))))))^0.5)))))

Input interpretation:

$$\frac{1}{2}\left(\sqrt{5}+1\right)+\log^2\left(101.18005+\left(\sqrt{\frac{1}{2}\left(1279+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}\right)}+\sqrt{\frac{1}{2}\left(1281+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}\right)}\right)\right)$$

log(x) is the natural logarithm

Result:

29.8146523...

29.8146523… result very near to the black hole entropy 29.7668

Alternative representations:

$$\frac{1}{2}\left(\sqrt{5}+1\right)+\log^2\left(101.18+\left(\sqrt{\frac{1}{2}\left(1279+355\sqrt{13}+12\sqrt{22\,733+6305\sqrt{13}}\right)}+\sqrt{\frac{1}{2}\left(1281+355\sqrt{13}+12\sqrt{22\,733+6305\sqrt{13}}\right)}\right)\right)=$$

$$\log_e^2\left(101.18+\sqrt{\frac{1}{2}\left(1279+355\sqrt{13}+12\sqrt{22\,733+6305\sqrt{13}}\right)}+\sqrt{\frac{1}{2}\left(1281+355\sqrt{13}+12\sqrt{22\,733+6305\sqrt{13}}\right)}\right)+\frac{1}{2}\left(1+\sqrt{5}\right)$$

$$\frac{1}{2}\left(\sqrt{5}+1\right)+\log^2\left(101.18+\left(\sqrt{\frac{1}{2}\left(1279+355\sqrt{13}+12\sqrt{22\,733+6305\sqrt{13}}\right)}+\sqrt{\frac{1}{2}\left(1281+355\sqrt{13}+12\sqrt{22\,733+6305\sqrt{13}}\right)}\right)\right)=$$

$$\left(\log(a)\log_a\left(101.18+\sqrt{\frac{1}{2}\left(1279+355\sqrt{13}+12\sqrt{22\,733+6305\sqrt{13}}\right)}+\sqrt{\frac{1}{2}\left(1281+355\sqrt{13}+12\sqrt{22\,733+6305\sqrt{13}}\right)}\right)\right)^2+\frac{1}{2}\left(1+\sqrt{5}\right)$$

$$\frac{1}{2}\left(\sqrt{5}+1\right)+\log^2\left(101.18+\left(\sqrt{\frac{1}{2}\left(1279+355\sqrt{13}+12\sqrt{22\,733+6305\sqrt{13}}\right)}+\sqrt{\frac{1}{2}\left(1281+355\sqrt{13}+12\sqrt{22\,733+6305\sqrt{13}}\right)}\right)\right)=$$

$$\left(-\mathrm{Li}_1\left(-100.18-\sqrt{\frac{1}{2}\left(1279+355\sqrt{13}+12\sqrt{22\,733+6305\sqrt{13}}\right)}-\sqrt{\frac{1}{2}\left(1281+355\sqrt{13}+12\sqrt{22\,733+6305\sqrt{13}}\right)}\right)\right)^2+\frac{1}{2}\left(1+\sqrt{5}\right)$$

$\log_b(x)$ is the base- b logarithm

$\mathrm{Li}_n(x)$ is the polylogarithm function

Series representations:

$$\frac{1}{2}\left(\sqrt{5}+1\right)+\log^2\left(101.18+\left(\sqrt{\frac{1}{2}\left(1279+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}\right)}+\sqrt{\frac{1}{2}\left(1281+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}\right)}\right)\right)=$$

$$\frac{1}{2}\left(1+2\log^2\left(101.18+\frac{1}{\sqrt{2}}\left(\sqrt{\left(1279+\sum_{k=0}^{\infty}\binom{\frac{1}{2}}{k}\left(355\times 12^{-k}\sqrt{12}+12\left(22732+6305\sqrt{13}\right)^{-k}\sqrt{22732+6305\sqrt{13}}\right)\right)}\right)+\frac{1}{\sqrt{2}}\left(\sqrt{\left(1281+\sum_{k=0}^{\infty}\binom{\frac{1}{2}}{k}\left(355\times 12^{-k}\sqrt{12}+12\left(22732+6305\sqrt{13}\right)^{-k}\sqrt{22732+6305\sqrt{13}}\right)\right)}\right)\right)+\sqrt{4}\sum_{k=0}^{\infty}4^{-k}\binom{\frac{1}{2}}{k}\right)$$

$$\frac{1}{2}\left(\sqrt{5}+1\right)+\log^2\left(101.18+\left(\sqrt{\frac{1}{2}\left(1279+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}\right)}+\sqrt{\frac{1}{2}\left(1281+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}\right)}\right)\right)=$$

$$\frac{1}{2}\left(1+2\log^2\left(100.18+\frac{\sqrt{1279+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}}}{\sqrt{2}}+\frac{\sqrt{1281+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}}}{\sqrt{2}}\right)+\sqrt{4}\sum_{k=0}^{\infty}4^{-k}\binom{\frac{1}{2}}{k}-\right.$$

$$4\log\left(100.18+\frac{\sqrt{1279+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}}}{\sqrt{2}}+\frac{\sqrt{1281+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}}}{\sqrt{2}}\right)\sum_{k=1}^{\infty}\frac{1}{k}(-1)^k$$

$$\left(100.18+0.707107\sqrt{1279+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}}+0.707107\sqrt{1281+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}}\right)^{-k}+$$

$$\left.2\left(\sum_{k=1}^{\infty}\frac{1}{k}(-1)^k\left(100.18+0.707107\sqrt{1279+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}}+0.707107\sqrt{1281+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}}\right)^{-k}\right)^2\right)$$

$$\frac{1}{2}\left(\sqrt{5}+1\right)+\log^2\left(101.18+\left(\sqrt{\frac{1}{2}\left(1279+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}\right)}+\sqrt{\frac{1}{2}\left(1281+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}\right)}\right)\right)=$$

$$\frac{1}{2}\left(1+2\log^2\left(100.18+0.707107\sqrt{1279+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}}+0.707107\sqrt{1281+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}}\right)+\right.$$

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

$$4\log\left(100.18+0.707107\sqrt{1279+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}}+0.707107\sqrt{1281+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}}\right)\sum_{k=1}^{\infty}\frac{1}{k}(-1)^k$$

$$\left(100.18+0.707107\sqrt{1279+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}}+0.707107\sqrt{1281+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}}\right)^{-k}+$$

$$\left.2\left(\sum_{k=1}^{\infty}\frac{1}{k}(-1)^k\left(100.18+0.707107\sqrt{1279+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}}+0.707107\sqrt{1281+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}}\right)^{-k}\right)^2\right)$$

$\binom{n}{m}$ is the binomial coefficient

$n!$ is the factorial function

$(a)_n$ is the Pochhammer symbol (rising factorial)

Integral representations:

$$\frac{1}{2}\left(\sqrt{5}+1\right)+\log^2\left(101.18+\left(\sqrt{\frac{1}{2}\left(1279+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}\right)}+\sqrt{\frac{1}{2}\left(1281+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}\right)}\right)\right)=\frac{1}{2}+\left(\int_1^{101.18+0.707107\sqrt{1279+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}}+0.707107\sqrt{1281+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}}}\frac{1}{t}\,dt\right)^2+\frac{\sqrt{5}}{2}$$

$$\frac{1}{2}\left(\sqrt{5}+1\right)+\log^2\left(101.18+\left(\sqrt{\frac{1}{2}\left(1279+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}\right)}+\sqrt{\frac{1}{2}\left(1281+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}\right)}\right)\right)=$$
$$\frac{1}{2}+\frac{1}{4i^2\pi^2}\left(\int_{-i\infty+\gamma}^{i\infty+\gamma}\frac{1}{\Gamma(1-s)}\Gamma(-s)^2\,\Gamma(1+s)\left(100.18+0.707107\sqrt{1279+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}}+0.707107\sqrt{1281+355\sqrt{13}+12\sqrt{22733+6305\sqrt{13}}}\right)^{-s}ds\right)^2+\frac{\sqrt{5}}{2}\quad\text{for } -1<\gamma<0$$

$\Gamma(x)$ is the gamma function

i is the imaginary unit

For the above result 29.81465 considered an entropy, we obtain:

Mass = 5.087666e-8

Radius = 7.554429e-35

Temperature = 2.412114e+30

From the Ramanujan-Nardelli mock formula, we obtain:

sqrt[[[[1/(((((((4*1.962364415e+19)/(5*0.0864055^2)))*1/(5.087666e-8)* sqrt[[-((((2.412114e+30* 4*Pi*(7.554429e-35)^3-(7.554429e-35)^2))))) / ((6.67*10^-11))]]]]]

Input interpretation:

$$\sqrt{\left(1\Big/\left(\frac{4\times 1.962364415\times 10^{19}}{5\times 0.0864055^2}\times\frac{1}{5.087666\times 10^{-8}}\sqrt{-\frac{2.412114\times 10^{30}\times 4\,\pi\,(7.554429\times 10^{-35})^3-(7.554429\times 10^{-35})^2}{6.67\times 10^{-11}}}\right)\right)}$$

Result:

1.618249199205496114879158681348057708738955142401748452971...

1.61824919…

Now, we have that:

If $P = \dfrac{\varphi(q)}{\varphi(q^3)}$ and $Q = \dfrac{\varphi(q^9)}{\varphi(q^{27})}$, then

$$\frac{Q^5}{P^5} + 9\left(\frac{Q^3}{P^3} - \frac{Q^4}{P^4}\right) + 9\left(\frac{5Q}{P} + \frac{9P}{Q}\right) + 9\left(Q^4 + \frac{9}{P^4}\right) + 3\left(Q^2 + 3P^2\right)\left(PQ + \frac{9}{P^3Q^3}\right) = 135 + 3\left(\frac{Q^2}{P^2} + \frac{9P^2}{Q^2}\right) + \left(P^4Q^4 + \frac{3^4}{P^4Q^4}\right) + 9\left(P^2Q^2 + \frac{3^2}{P^2Q^2}\right). \tag{52}$$

We consider P and Q that are equal to P = -2.05860 Q = -8.72406

135+3(8.72406^2/2.05860^2+9*2.05860^2/8.72406^2)+(((2.05860^4*8.72406^4+3^4/(2.05860^4*8.72406^4)))+9(((2.05860^2*8.72406^2+3^2/(2.05860^2*8.72406^2)))

135+3(8.72406^2/2.05860^2+9*2.05860^2/8.72406^2)+(((2.05860^4*8.72406^4+3^4/(2.05860^4*8.72406^4)))+9(((2.05860^2*8.72406^2+3^2/(2.05860^2*8.72406^2)))

Input interpretation:

$$135 + 3\left(\frac{8.72406^2}{2.05860^2} + 9\times\frac{2.05860^2}{8.72406^2}\right) + \left(\left(2.05860^4\times 8.72406^4 + \frac{3^4}{2.05860^4\times 8.72406^4}\right) + 9\left(2.05860^2\times 8.72406^2 + \frac{3^2}{2.05860^2\times 8.72406^2}\right)\right)$$

Result:

107124.40026089785740129365631759665598649046685720818546 53...

107124.40026…

(((((135+3(8.72406^2/2.05860^2+9*2.05860^2/8.72406^2)+(((2.05860^4*8.72406^4+3^4/(2.05860^4*8.72406^4)))+9(((2.05860^2*8.72406^2+3^2/(2.05860^2*8.72406^2)))))))^1/4

Input interpretation:

$$\left(135 + 3\left(\frac{8.72406^2}{2.05860^2} + 9\times\frac{2.05860^2}{8.72406^2}\right) + \left(\left(2.05860^4\times 8.72406^4 + \frac{3^4}{2.05860^4\times 8.72406^4}\right) + 9\left(2.05860^2\times 8.72406^2 + \frac{3^2}{2.05860^2\times 8.72406^2}\right)\right)\right)^{\wedge}(1/4)$$

Result:

18.0914...

18.0914…. result very near to the black hole entropy 18.0524

Now, we have:

$$\text{If } X = \frac{\varphi(q)\varphi(q^5)}{\varphi(q^4)\varphi(q^{20})} \text{ and } Y = \frac{\varphi(q)\varphi(q^{20})}{\varphi(q^4)\varphi(q^5)}, \text{ then}$$

$$Y^3 + \frac{1}{Y^3} - 70\left[Y^2 + \frac{1}{Y^2}\right] - 785\left[Y + \frac{1}{Y}\right] + 160\left[\sqrt{Y^3} + \frac{1}{\sqrt{Y^3}}\right] \times \left[\sqrt{X} + \frac{2}{\sqrt{X}}\right] + 80\left[\sqrt{Y} + \frac{1}{\sqrt{Y}}\right]\left[\sqrt{X^3} + \frac{8}{\sqrt{X^3}} + 10\left(\sqrt{X} + \frac{2}{\sqrt{X}}\right)\right] = 80\left[X + \frac{4}{X}\right]\left[5 + 2\left(Y + \frac{1}{Y}\right)\right] + 16\left[X^2 + \frac{16}{X^2}\right] + 1620. \quad (61)$$

For X and Y equal to 8, we obtain:

$$Y^3 + \frac{1}{Y^3} - 70\left[Y^2 + \frac{1}{Y^2}\right] - 785\left[Y + \frac{1}{Y}\right] + 160\left[\sqrt{Y^3} + \frac{1}{\sqrt{Y^3}}\right] \times \left[\sqrt{X} + \frac{2}{\sqrt{X}}\right] + 80\left[\sqrt{Y} + \frac{1}{\sqrt{Y}}\right]\left[\sqrt{X^3} + \frac{8}{\sqrt{X^3}} + 10\left(\sqrt{X} + \frac{2}{\sqrt{X}}\right)\right]$$

512+1/512 – 70 (64+1/64) – 785 (8+1/8) +160 (sqrt(512)+1/(sqrt(512))* (sqrt(8)+2/(sqrt(8)) + 80 (sqrt(8)+1/(sqrt(8))*((((sqrt(512)+8/(sqrt(512)+10 ((sqrt(8)+2/(sqrt(8))))

80 (sqrt(8)+1/sqrt(8))*((((sqrt(512)+8/sqrt(512)+10 ((sqrt(8)+2/sqrt(8))))

Input:

$$80\left(\sqrt{8} + \frac{1}{\sqrt{8}}\right)\left(\sqrt{512} + \frac{8}{\sqrt{512}} + 10\left(\sqrt{8} + \frac{2}{\sqrt{8}}\right)\right)$$

Result:

14850

512+1/512 – 70 (64+1/64) – 785 (8+1/8) +160 (sqrt(512)+1/sqrt(512))*(sqrt(8)+2/sqrt(8))

Input:

$$512 + \frac{1}{512} - 70\left(64 + \frac{1}{64}\right) - 785\left(8 + \frac{1}{8}\right) + 160\left(\sqrt{512} + \frac{1}{\sqrt{512}}\right)\left(\sqrt{8} + \frac{2}{\sqrt{8}}\right)$$

Result:

$$\frac{1268625}{512}$$

Decimal form:

2477.783203125

2477.783203125 + 14850

Input interpretation:

2477.783203125 + 14850

Result:

17327.783203125

17327.783203125

Note that:

17327.783203125 / 10 = 1732.778... result very near to the mass of candidate glueball $f_0(1710)$ meson.

$$80\left[X + \frac{4}{X}\right]\left[5 + 2\left(Y + \frac{1}{Y}\right)\right] + 16\left[X^2 + \frac{16}{X^2}\right] + 1620.$$

[(((16(64+1/4))))] + 1620 + 80(((8+1/2)*(5+16+1/4)))

Input:

$$16\left(64 + \frac{1}{4}\right) + 1620 + 80\left(\left(8 + \frac{1}{2}\right)\left(5 + 16 + \frac{1}{4}\right)\right)$$

Exact result:

17098

17098

We have that:

((((((((16(64+1/4)))) + 1620 + 80(((8+1/2)*(5+16+1/4))))))) / (1.0061571663) +233+89+8

Where 1.0061571663 is a Ramanujan mock theta function

Input interpretation:

$$\frac{16\left(64+\frac{1}{4}\right)+1620+80\left(\left(8+\frac{1}{2}\right)\left(5+16+\frac{1}{4}\right)\right)}{1.0061571663}+233+89+8$$

Result:

17323.36900106318906809937015304246111594782565531680793436...

17323.369…

Note that:

17098 / (PI^2/10)

Input:

$$\frac{17098}{\frac{\pi^2}{10}}$$

Result:

$$\frac{170980}{\pi^2}$$

Decimal approximation:

17323.89597916691216147451061959923169986726329346071492162...

17323.89597…

Alternative representations:

$$\frac{17098}{\frac{\pi^2}{10}}=\frac{17098}{\frac{1}{10}(180°)^2}$$

$$\frac{17098}{\frac{\pi^2}{10}} = \frac{17098}{\frac{6\zeta(2)}{10}}$$

$$\frac{17098}{\frac{\pi^2}{10}} = \frac{17098}{\frac{1}{10}(-i\log(-1))^2}$$

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

$\log(x)$ is the natural logarithm

i is the imaginary unit

Series representations:

$$\frac{17098}{\frac{\pi^2}{10}} = \frac{42745}{4\left(\sum_{k=0}^{\infty}\frac{(-1)^k}{1+2k}\right)^2}$$

$$\frac{17098}{\frac{\pi^2}{10}} = \frac{42745}{4\left(\sum_{k=0}^{\infty}\frac{(-1)^k\,1195^{-1-2k}\left(5^{1+2k}-4\times 239^{1+2k}\right)}{1+2k}\right)^2}$$

$$\frac{17098}{\frac{\pi^2}{10}} = \frac{170980}{\left(\sum_{k=0}^{\infty}\left(-\frac{1}{4}\right)^k\left(\frac{1}{1+2k}+\frac{2}{1+4k}+\frac{1}{3+4k}\right)\right)^2}$$

Integral representations:

$$\frac{17098}{\frac{\pi^2}{10}} = \frac{42745}{\left(\int_0^{\infty}\frac{1}{1+t^2}\,dt\right)^2}$$

$$\frac{17098}{\frac{\pi^2}{10}} = \frac{42745}{\left(\int_0^{1}\frac{1}{\sqrt{1-t^2}}\,dt\right)^2}$$

$$\frac{17098}{\frac{\pi^2}{10}} = \frac{42745}{4\left(\int_0^1 \sqrt{1-t^2}\, dt\right)^2}$$

Now, we have that:

ln 17327.783203125

Input interpretation:

$\log(17327.783203125)$

$\log(x)$ is the natural logarithm

Result:

9.76006645780084...

9.76006… result near to the black hole entropy 9.9340

Alternative representations:

$$\log(17327.7832031250000) = \log_e(17327.7832031250000)$$

$$\log(17327.7832031250000) = \log(a)\log_a(17327.7832031250000)$$

$$\log(17327.7832031250000) = -\text{Li}_1(-17326.7832031250000)$$

$\log_b(x)$ is the base- b logarithm

$\text{Li}_n(x)$ is the polylogarithm function

Series representations:

$$\log(17327.7832031250000) = \log(17326.7832031250000) - \sum_{k=1}^{\infty} \frac{(-1)^k e^{-9.76000874534882782\,k}}{k}$$

$$\log(17327.7832031250000) = 2 i \pi \left\lfloor \frac{\arg(17327.7832031250000 - x)}{2\pi} \right\rfloor + \log(x) - \sum_{k=1}^{\infty} \frac{(-1)^k (17327.7832031250000 - x)^k x^{-k}}{k} \quad \text{for } x < 0$$

$$\log(17327.7832031250000) = \left\lfloor \frac{\arg(17327.7832031250000 - z_0)}{2\pi} \right\rfloor \log\left(\frac{1}{z_0}\right) + \log(z_0) + \left\lfloor \frac{\arg(17327.7832031250000 - z_0)}{2\pi} \right\rfloor \log(z_0) - \sum_{k=1}^{\infty} \frac{(-1)^k (17327.7832031250000 - z_0)^k z_0^{-k}}{k}$$

$\arg(z)$ is the complex argument

$\lfloor x \rfloor$ is the floor function

i is the imaginary unit

Integral representations:

$$\log(17327.7832031250000) = \int_1^{17327.7832031250000} \frac{1}{t}\, dt$$

$$\log(17327.7832031250000) = \frac{1}{2 i \pi} \int_{-i\infty+\gamma}^{i\infty+\gamma} \frac{e^{-9.76000874534882782 s}\, \Gamma(-s)^2\, \Gamma(1+s)}{\Gamma(1-s)}\, ds \quad \text{for } -1 < \gamma < 0$$

For X and Y equal to 5, we obtain:

$$Y^3 + \frac{1}{Y^3} - 70\left[Y^2 + \frac{1}{Y^2}\right] - 785\left[Y + \frac{1}{Y}\right] + 160\left[\sqrt{Y^3} + \frac{1}{\sqrt{Y^3}}\right] \times \left[\sqrt{X} + \frac{2}{\sqrt{X}}\right] + 80\left[\sqrt{Y} + \frac{1}{\sqrt{Y}}\right]\left[\sqrt{X^3} + \frac{8}{\sqrt{X^3}} + 10\left(\sqrt{X} + \frac{2}{\sqrt{X}}\right)\right]$$

125+1/125 – 70 (25+1/25) – 785 (5+1/5) +160 ((sqrt(125)+1/(sqrt(125))*(sqrt(5)+2/(sqrt(5))) + 80 (sqrt(5)+1/(sqrt(5))*((((sqrt(125)+8/(sqrt(125)))+10 ((sqrt(5)+2/(sqrt(5))))

Input:

$$125+\frac{1}{125}-70\left(25+\frac{1}{25}\right)-785\left(5+\frac{1}{5}\right)+160\left(\sqrt{125}+\frac{1}{\sqrt{125}}\left(\sqrt{5}+\frac{2}{\sqrt{5}}\right)+80\left(\sqrt{5}+\frac{1}{\sqrt{5}}\left(\left(\sqrt{125}+\frac{8}{\sqrt{125}}\right)+10\left(\sqrt{5}+\frac{2}{\sqrt{5}}\right)\right)\right)\right)$$

Result:

$$160\left(5\sqrt{5}+\frac{\frac{2}{\sqrt{5}}+\sqrt{5}}{5\sqrt{5}}+80\left(\sqrt{5}+\frac{\frac{8}{5\sqrt{5}}+5\sqrt{5}+10\left(\frac{2}{\sqrt{5}}+\sqrt{5}\right)}{\sqrt{5}}\right)\right)-\frac{713724}{125}$$

Decimal approximation:

272041.5324939971398711647618947453568019924096907167498500...

272041…

Alternate forms:

$$\frac{4}{125}\left(7550969+425000\sqrt{5}\right)$$

$$\frac{30203876}{125}+13600\sqrt{5}$$

$$13600\sqrt{5}+\frac{30203876}{125}$$

Minimal polynomial:

$$15625x^2-7550969000x+897824125423376$$

$$80\left[X+\frac{4}{X}\right]\left[5+2\left(Y+\frac{1}{Y}\right)\right]+16\left[X^2+\frac{16}{X^2}\right]+1620.$$

80(((5+4/5)*(5+10+2/5)))+ [((((16(25+16/25))))]+1620

Input:

$$80\left(\left(5+\frac{4}{5}\right)\left(5+10+\frac{2}{5}\right)\right)+16\left(25+\frac{16}{25}\right)+1620$$

Exact result:

$$\frac{229\,396}{25}$$

Decimal form:

9175.84

9175.84

Now, we have that:

1.7168646^(2Pi) * ((((((80(((5+4/5)*(5+10+2/5)))+ [((((16(25+16/25))))]+1620))))))

Where 1.7168646 is a Ramanujan mock theta function

Input interpretation:

$$1.7168646^{2\pi}\left(80\left(\left(5+\frac{4}{5}\right)\left(5+10+\frac{2}{5}\right)\right)+16\left(25+\frac{16}{25}\right)+1620\right)$$

Result:

273864.6...

273864.6

Alternative representations:

$$1.71686^{2\pi}\left(80\left(5+\frac{4}{5}\right)\left(5+10+\frac{2}{5}\right)+16\left(25+\frac{16}{25}\right)+1620\right)=$$
$$1.71686^{360^\circ}\left(1620+80\left(15+\frac{2}{5}\right)\left(5+\frac{4}{5}\right)+16\left(25+\frac{16}{25}\right)\right)$$

$$1.71686^{2\pi}\left(80\left(5+\frac{4}{5}\right)\left(5+10+\frac{2}{5}\right)+16\left(25+\frac{16}{25}\right)+1620\right)=$$
$$1.71686^{-2i\log(-1)}\left(1620+80\left(15+\frac{2}{5}\right)\left(5+\frac{4}{5}\right)+16\left(25+\frac{16}{25}\right)\right)$$

$$1.71686^{2\pi}\left(80\left(5+\frac{4}{5}\right)\left(5+10+\frac{2}{5}\right)+16\left(25+\frac{16}{25}\right)+1620\right)=$$
$$1.71686^{2\cos^{-1}(-1)}\left(1620+80\left(15+\frac{2}{5}\right)\left(5+\frac{4}{5}\right)+16\left(25+\frac{16}{25}\right)\right)$$

$\log(x)$ is the natural logarithm

i is the imaginary unit

$\cos^{-1}(x)$ is the inverse cosine function

Series representations:

$$1.71686^{2\pi}\left(80\left(5+\frac{4}{5}\right)\left(5+10+\frac{2}{5}\right)+16\left(25+\frac{16}{25}\right)+1620\right)=\frac{229\,396}{25}\times 1.71686^{8\sum_{k=0}^{\infty}(-1)^k/(1+2k)}$$

$$1.71686^{2\pi}\left(80\left(5+\frac{4}{5}\right)\left(5+10+\frac{2}{5}\right)+16\left(25+\frac{16}{25}\right)+1620\right)=1056.09\,e^{2.162\times\sum_{k=1}^{\infty}2^k/\binom{2k}{k}}$$

$$1.71686^{2\pi}\left(80\left(5+\frac{4}{5}\right)\left(5+10+\frac{2}{5}\right)+16\left(25+\frac{16}{25}\right)+1620\right)=\frac{229\,396}{25}\times 1.71686^{2\sum_{k=0}^{\infty}\left(2^{-k}(-6+50k)\right)/\binom{3k}{k}}$$

$\binom{n}{m}$ is the binomial coefficient

Integral representations:

$$1.71686^{2\pi}\left(80\left(5+\frac{4}{5}\right)\left(5+10+\frac{2}{5}\right)+16\left(25+\frac{16}{25}\right)+1620\right)=\frac{229\,396}{25}\,e^{2.162\int_0^{\infty}1/(1+t^2)\,dt}$$

$$1.71686^{2\pi}\left(80\left(5+\frac{4}{5}\right)\left(5+10+\frac{2}{5}\right)+16\left(25+\frac{16}{25}\right)+1620\right)=\frac{229\,396}{25}\,e^{4.324\int_0^{1}\sqrt{1-t^2}\,dt}$$

$$1.71686^{2\pi}\left(80\left(5+\frac{4}{5}\right)\left(5+10+\frac{2}{5}\right)+16\left(25+\frac{16}{25}\right)+1620\right)=\frac{229\,396}{25}\,e^{2.162\int_0^{\infty}\sin(t)/t\,dt}$$

9175.84*((9Pi+sqrt(2)))

Input interpretation:

$$9175.84\left(9\pi+\sqrt{2}\right)$$

Result:

$$2.72417\ldots\times 10^5$$

272417…

Series representations:

$$9175.84\left(9\pi+\sqrt{2}\right)=82582.6\,\pi+9175.84\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k(2-z_0)^k z_0^{-k}}{k!}$$

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

$$9175.84\left(9\pi+\sqrt{2}\right)=$$
$$82582.6\,\pi+9175.84\exp\left(i\pi\left\lfloor\frac{\arg(2-x)}{2\pi}\right\rfloor\right)\sqrt{x}\sum_{k=0}^{\infty}\frac{(-1)^k(2-x)^k x^{-k}\left(-\frac{1}{2}\right)_k}{k!}$$

for $(x\in\mathbb{R}$ and $x<0)$

$$9175.84\left(9\pi+\sqrt{2}\right)=82582.6\,\pi+$$
$$9175.84\left(\frac{1}{z_0}\right)^{1/2\lfloor\arg(2-z_0)/(2\pi)\rfloor}z_0^{1/2(1+\lfloor\arg(2-z_0)/(2\pi)\rfloor)}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k(2-z_0)^k z_0^{-k}}{k!}$$

Now, we have that:

ln 272041.5324939971398711647618947453568019924096907167498500

Input interpretation:

log(272041.5324939971398711647618947453568019924096907167498500)

log(x) is the natural logarithm

Result:

12.51371002661438246425795557965170346312224343945379598480…

12.51371… result very near to the black hole entropy 12.5664

Alternative representations:

$$\log(272\,041.532493997139871164761894745356801992409690716749850000000) = \log_e(272\,041.532493997139871164761894745356801992409690716749850000000)$$

$$\log(272\,041.532493997139871164761894745356801992409690716749850000000) = \log(a)\log_a(272\,041.532493997139871164761894745356801992409690716749850000000)$$

$$\log(272\,041.532493997139871164761894745356801992409690716749850000000) = -\text{Li}_1(-272\,040.532493997139871164761894745356801992409690716749850000000)$$

$\log_b(x)$ is the base- b logarithm

$\text{Li}_n(x)$ is the polylogarithm function

Series representations:

$$\log(272\,041.532493997139871164761894745356801992409690716749850000000) = \log(272\,040.532493997139871164761894745356801992409690716749850000000) - \sum_{k=1}^{\infty} \frac{(-1)^k e^{-12.5137063506983236498875908724238963677044530078367515941068384\,k}}{k}$$

$$\log(272\,041.532493997139871164761894745356801992409690716749850000000) = 2\,i\,\pi \left\lfloor \frac{1}{2\,\pi} \arg(272\,041.532493997139871164761894745356801992409690716749850000000 - x) \right\rfloor + \log(x) - \sum_{k=1}^{\infty} \frac{1}{k} (-1)^k (272\,041.532493997139871164761894745356801992409690716749850000000 - x)^k x^{-k} \quad \text{for } x < 0$$

$$\log(272041.5324939971398711647618947453568019924096907167498500000 0) = \left\lfloor \frac{1}{2\pi} \arg(272041.53249399713987116476189474535680199240969071674985000000 - z_0) \right\rfloor \log\left(\frac{1}{z_0}\right) + \log(z_0) + \left\lfloor \frac{1}{2\pi} \arg(272041.53249399713987116476189474535680199240969071674985000000 - z_0) \right\rfloor \log(z_0) - \sum_{k=1}^{\infty} \frac{1}{k} (-1)^k (272041.53249399713987116476189474535680199240969071674985000000 - z_0)^k z_0^{-k}$$

arg(z) is the complex argument

⌊x⌋ is the floor function

i is the imaginary unit

Integral representations:

$$\log(272041.53249399713987116476189474535680199240969071674985000000) = \int_1^{272041.53249399713987116476189474535680199240969071674985000000} \frac{1}{t}\, dt$$

$$\log(272041.53249399713987116476189474535680199240969071674985000000) = \frac{1}{2 i \pi} \int_{-i\infty+\gamma}^{i\infty+\gamma} \frac{1}{\Gamma(1-s)} e^{-12.513706350698323649887590872423896367704453007836751594106838 4 s} \Gamma(-s)^2 \Gamma(1+s)\, ds \quad \text{for } -1 < \gamma < 0$$

Γ(x) is the gamma function

For X and Y equal to 0.5, we obtain:

0.125+1/0.125 – 70 (0.25+1/0.25) – 785 (0.5+1/0.5) +160 ((sqrt(0.125)+1/(sqrt(0.125))* (sqrt(0.5)+2/(sqrt(0.5)))

Input:

$$0.125 + \frac{1}{0.125} - 70\left(0.25 + \frac{1}{0.25}\right) - 785\left(0.5 + \frac{1}{0.5}\right) + 160\left(\sqrt{0.125} + \frac{1}{\sqrt{0.125}}\left(\sqrt{0.5} + \frac{2}{\sqrt{0.5}}\right)\right)$$

Result:

-595.306...

-595.306 + 80 (sqrt(0.5)+1/(sqrt(0.5))*((((sqrt(0.125)+8/(sqrt(0.125)))+10 ((sqrt(0.5)+2/(sqrt(0.5))))

Input interpretation:

$$-595.306 + 80\left(\sqrt{0.5} + \frac{1}{\sqrt{0.5}}\left(\left(\sqrt{0.125} + \frac{8}{\sqrt{0.125}}\right) + 10\left(\sqrt{0.5} + \frac{2}{\sqrt{0.5}}\right)\right)\right)$$

Result:

6061.26...

6061.26...

(((([80*(((0.5+4/0.5)*(0.5+2(0.5+1/0.5)))]+ [((((16*(0.25+16/0.25))))])))) + 1620

Input:

$$80\left(\left(0.5 + \frac{4}{0.5}\right)\left(0.5 + 2\left(0.5 + \frac{1}{0.5}\right)\right) + 16\left(0.25 + \frac{16}{0.25}\right)\right) + 1620$$

Result:

87600

87600

The ratio of the two results is:

87600/ (((((((-595.306 + 80 (sqrt(0.5)+1/(sqrt(0.5))*((((sqrt(0.125)+8/(sqrt(0.125)))+10 ((sqrt(0.5)+2/(sqrt(0.5)))))))))

Input interpretation:

$$\frac{87600}{-595.306 + 80\left(\sqrt{0.5} + \frac{1}{\sqrt{0.5}}\left(\left(\sqrt{0.125} + \frac{8}{\sqrt{0.125}}\right) + 10\left(\sqrt{0.5} + \frac{2}{\sqrt{0.5}}\right)\right)\right)}$$

Result:

14.4524...

14.4524...

Note that:

14.4524 + 2*1.61803398 = 17.68846796 result very near to the black hole entropy 17.7715

Now, we have that:

exp(2.6709253774829) (((((((-595.306 + 80 (sqrt(0.5)+1/(sqrt(0.5))*((((sqrt(0.125)+8/(sqrt(0.125)))+10 ((sqrt(0.5)+2/(sqrt(0.5)))))))))

where 2.67092537... is a Ramanujan mock theta function

Input interpretation:

$$\exp(2.6709253774829)\left(-595.306 + 80\left(\sqrt{0.5} + \frac{1}{\sqrt{0.5}}\left(\left(\sqrt{0.125} + \frac{8}{\sqrt{0.125}}\right) + 10\left(\sqrt{0.5} + \frac{2}{\sqrt{0.5}}\right)\right)\right)\right)$$

Result:

87605.5...

87605.5...

For X and Y equal to 1, we obtain:

1+1 – 70 (1+1) – 785 (1+1) +160 (1+1)) (((1+2))) + 80 ((((1+1))*((((1+8) + 10 ((1+2))

Input:

$$1 + 1 - 70(1+1) - 785(1+1) + 160(1+1)(1+2) + 80((1+1)((1+8) + 10(1+2)))$$

Result:

5492

5492

80(1+4)*(5+2(1+1)) + 16(1+16) + 1620

Input:

$$80(1+4)(5+2(1+1))+16(1+16)+1620$$

Result:

5492

5492

13+1/Pi[1+1 – 70 (1+1) – 785 (1+1) +160 (1+1)) (((1+2))) + 80 ((((1+1))*((((1+8) + 10 ((1+2))]

Input:

$$13+\frac{1}{\pi}(1+1-70(1+1)-785(1+1)+160(1+1)(1+2)+80((1+1)((1+8)+10(1+2))))$$

Result:

$$13+\frac{5492}{\pi}$$

Decimal approximation:

1761.157894921378368085419256883697752586504748813173633044...

1761.15789… result in the range of the mass of candidate "glueball" $f_0(1710)$ ("glueball" =1760 ± 15 MeV).

Property:

$13+\frac{5492}{\pi}$ is a transcendental number

Alternate form:

$$\frac{13\pi+5492}{\pi}$$

Alternative representations:

$$13 + \frac{1 + 1 - 70 (1 + 1) - 785 (1 + 1) + 160 (1 + 1) (1 + 2) + 80 ((1 + 1) ((1 + 8) + 10 (1 + 2)))}{\pi} = 13 + \frac{5492}{180^\circ}$$

$$13 + \frac{1 + 1 - 70 (1 + 1) - 785 (1 + 1) + 160 (1 + 1) (1 + 2) + 80 ((1 + 1) ((1 + 8) + 10 (1 + 2)))}{\pi} = 13 + -\frac{5492}{i \log(-1)}$$

$$13 + \frac{1 + 1 - 70 (1 + 1) - 785 (1 + 1) + 160 (1 + 1) (1 + 2) + 80 ((1 + 1) ((1 + 8) + 10 (1 + 2)))}{\pi} = 13 + \frac{5492}{\cos^{-1}(-1)}$$

$\log(x)$ is the natural logarithm

i is the imaginary unit

$\cos^{-1}(x)$ is the inverse cosine function

Series representations:

$$13 + \frac{1 + 1 - 70 (1 + 1) - 785 (1 + 1) + 160 (1 + 1) (1 + 2) + 80 ((1 + 1) ((1 + 8) + 10 (1 + 2)))}{\pi} = 13 + \frac{1373}{\sum_{k=0}^{\infty} \frac{(-1)^k}{1+2k}}$$

$$13 + \frac{1 + 1 - 70 (1 + 1) - 785 (1 + 1) + 160 (1 + 1) (1 + 2) + 80 ((1 + 1) ((1 + 8) + 10 (1 + 2)))}{\pi} = 13 + \frac{1373}{\sum_{k=0}^{\infty} \frac{(-1)^{1+k} 1195^{-1-2k} \left(5^{1+2k} - 4 \times 239^{1+2k}\right)}{1+2k}}$$

$$13 + \frac{1+1-70(1+1)-785(1+1)+160(1+1)(1+2)+80((1+1)((1+8)+10(1+2)))}{\pi} = 13 + \frac{5492}{\sum_{k=0}^{\infty}\left(-\frac{1}{4}\right)^k\left(\frac{1}{1+2k}+\frac{2}{1+4k}+\frac{1}{3+4k}\right)}$$

Integral representations:

$$13 + \frac{1+1-70(1+1)-785(1+1)+160(1+1)(1+2)+80((1+1)((1+8)+10(1+2)))}{\pi} = 13 + \frac{1373}{\int_0^1 \sqrt{1-t^2}\,dt}$$

$$13 + \frac{1+1-70(1+1)-785(1+1)+160(1+1)(1+2)+80((1+1)((1+8)+10(1+2)))}{\pi} = 13 + \frac{2746}{\int_0^{\infty} \frac{1}{1+t^2}\,dt}$$

$$13 + \frac{1+1-70(1+1)-785(1+1)+160(1+1)(1+2)+80((1+1)((1+8)+10(1+2)))}{\pi} = 13 + \frac{2746}{\int_0^1 \frac{1}{\sqrt{1-t^2}}\,dt}$$

e ln[1+1 – 70 (1+1) – 785 (1+1) +160 (1+1)) (((1+2))) + 80 ((((1+1))*((((1+8) + 10 ((1+2))]

Input:

$$e \log(1+1-70(1+1)-785(1+1)+160(1+1)(1+2)+80((1+1)((1+8)+10(1+2))))$$

log(x) is the natural logarithm

Exact result:

$$e \log(5492)$$

Decimal approximation:

23.407254668724114935409993225706094281582434999954257923 66...

23.40725… result very near to the black hole entropy 23.3621

Alternate forms:

$e\,(2\log(2)+\log(1373))$

$2\,e\log(2)+e\log(1373)$

Alternative representations:

$$e\log(1+1-70(1+1)-785(1+1)+160(1+1)(1+2)+80(1+1)((1+8)+10(1+2))) = e\log_e(5492)$$

$$e\log(1+1-70(1+1)-785(1+1)+160(1+1)(1+2)+80(1+1)((1+8)+10(1+2))) = e\log(a)\log_a(5492)$$

$$e\log(1+1-70(1+1)-785(1+1)+160(1+1)(1+2)+80(1+1)((1+8)+10(1+2))) = -e\,\mathrm{Li}_1(-5491)$$

$\log_b(x)$ is the base- b logarithm

$\mathrm{Li}_n(x)$ is the polylogarithm function

Series representations:

$$e\log(1+1-70(1+1)-785(1+1)+160(1+1)(1+2)+80(1+1)((1+8)+10(1+2))) = e\log(5491)-e\sum_{k=1}^{\infty}\frac{\left(-\frac{1}{5491}\right)^k}{k}$$

$$e\log(1+1-70(1+1)-785(1+1)+160(1+1)(1+2)+80(1+1)((1+8)+10(1+2))) = 2\,i\,e\,\pi\left\lfloor\frac{\arg(5492-x)}{2\pi}\right\rfloor+e\log(x)-e\sum_{k=1}^{\infty}\frac{(-1)^k(5492-x)^k x^{-k}}{k}\quad\text{for } x<0$$

$$e \log(1+1-70(1+1)-785(1+1)+160(1+1)(1+2)+80(1+1)((1+8)+10(1+2))) = e \left\lfloor \frac{\arg(5492-z_0)}{2\pi} \right\rfloor \log\left(\frac{1}{z_0}\right) + e \log(z_0) + e \left\lfloor \frac{\arg(5492-z_0)}{2\pi} \right\rfloor \log(z_0) - e \sum_{k=1}^{\infty} \frac{(-1)^k (5492-z_0)^k z_0^{-k}}{k}$$

$\arg(z)$ is the complex argument

$\lfloor x \rfloor$ is the floor function

Integral representations:

$$e \log(1+1-70(1+1)-785(1+1)+160(1+1)(1+2)+80(1+1)((1+8)+10(1+2))) = e \int_1^{5492} \frac{1}{t}\, dt$$

$$e \log(1+1-70(1+1)-785(1+1)+160(1+1)(1+2)+80(1+1)((1+8)+10(1+2))) = -\frac{i e}{2\pi} \int_{-i\infty+\gamma}^{i\infty+\gamma} \frac{5491^{-s}\,\Gamma(-s)^2\,\Gamma(1+s)}{\Gamma(1-s)}\, ds \quad \text{for } -1 < \gamma < 0$$

$\Gamma(x)$ is the gamma function

Now, we have:

(Formula 62)

If $X = \frac{\varphi(q)\varphi(q^7)}{\varphi(q^4)\varphi(q^{28})}$ and $Y = \frac{\varphi(q)\varphi(q^{28})}{\varphi(q^4)\varphi(q^7)}$, then

$$\begin{aligned} &Y^4 + \frac{1}{Y^4} - 280\left(Y^3 + \frac{1}{Y^3}\right) - 28\left(Y^2 + \frac{1}{Y^2}\right)\left[349 + 78\left(X + \frac{4}{X}\right)\right] \\ &- 56\left(Y + \frac{1}{Y}\right)\left[1079 + 310\left(X + \frac{4}{X}\right) + 24\left(X^2 + \frac{16}{X^2}\right)\right] \\ &+ 112\left(\sqrt{Y} + \frac{1}{\sqrt{Y}}\right)\left[515\left(\sqrt{X} + \frac{2}{\sqrt{X}}\right) + 90\left(\sqrt{X^3} + \frac{8}{\sqrt{X^3}}\right)\right. \\ &\left. +4\left(\sqrt{X^5} + \frac{32}{\sqrt{X^5}}\right)\right] + 56\left(\sqrt{Y^3} + \frac{1}{\sqrt{Y^3}}\right)\left[40\left(\sqrt{X^3} + \frac{8}{\sqrt{X^3}}\right)\right. \\ &\left. +313\left(\sqrt{X} + \frac{2}{\sqrt{X}}\right)\right] + 1176\left(\sqrt{Y^5} + \frac{1}{\sqrt{Y^5}}\right)\left(\sqrt{X} + \frac{2}{\sqrt{X}}\right) \\ &= 16\left[4\left(X^3 + \frac{64}{X^3}\right) + 203\left(X^2 + \frac{16}{X^2}\right) + 2023\left(X + \frac{4}{X}\right)\right] + 106330. \end{aligned}$$

From:

$$16\left[4\left(X^3+\frac{64}{X^3}\right)+203\left(X^2+\frac{16}{X^2}\right)+2023\left(X+\frac{4}{X}\right)\right]+106330.$$

For X = 2, we obtain:

16[(4(8+8)+203(4+4)+2023(2+2)]+106330

(((((16((((((4(8+8)+203(4+4)+2023(2+2))))))))))+106330

Input:

16 (4 (8 + 8) + 203 (4 + 4) + 2023 (2 + 2)) + 106 330

Result:

262 810

262810

ln((((((((((16((((((4(8+8)+203(4+4)+2023(2+2))))))))))+106330)))))

Input:

log(16 (4 (8 + 8) + 203 (4 + 4) + 2023 (2 + 2)) + 106 330)

log(x) is the natural logarithm

Exact result:

log(262 810)

Decimal approximation:

12.479186616619023527718161365723371981845745787423032885 16...

12.479186… result very near to the black hole entropy 12.5663

Property:

log(262 810) is a transcendental number

Alternate form:

log(2) + log(5) + log(41) + log(641)

Alternative representations:

$$\log(16(4(8+8)+203(4+4)+2023(2+2))+106\,330) = \log_e(262\,810)$$

$$\log(16(4(8+8)+203(4+4)+2023(2+2))+106\,330) = \log(a)\log_a(262\,810)$$

$$\log(16(4(8+8)+203(4+4)+2023(2+2))+106\,330) = -\text{Li}_1(-262\,809)$$

$\log_b(x)$ is the base- b logarithm

$\text{Li}_n(x)$ is the polylogarithm function

Integral representations:

$$\log(16(4(8+8)+203(4+4)+2023(2+2))+106\,330) = \int_1^{262\,810} \frac{1}{t}\,dt$$

$$\log(16(4(8+8)+203(4+4)+2023(2+2))+106\,330) = -\frac{i}{2\pi}\int_{-i\infty+\gamma}^{i\infty+\gamma} \frac{262\,809^{-s}\,\Gamma(-s)^2\,\Gamma(1+s)}{\Gamma(1-s)}\,ds \quad \text{for } -1<\gamma<0$$

We have also:

e^e*Pi^(-1-e)sin(e*Pi)
(((((((1/4*ln((((((((((16((((((4(8+8)+203(4+4)+2023(2+2))))))))))+106330))))))))))^2

Input:

$$e^e\,\pi^{-1-e}\sin(e\,\pi)\left(\frac{1}{4}\log(16(4(8+8)+203(4+4)+2023(2+2))+106\,330)\right)^2$$

$\log(x)$ is the natural logarithm

Exact result:

$$\frac{1}{16}\,e^e\,\pi^{-1-e}\log^2(262\,810)\sin(e\,\pi)$$

Decimal approximation:

1.617904327401028985503733217552857226635659278696535559569...

1.61790432…

This result is a very good approximation to the value of the golden ratio 1,618033988749...

Alternate forms:

$$\frac{1}{32} i e^{e-i e \pi} \pi^{-1-e} \log^2(262810) - \frac{1}{32} i e^{e+i e \pi} \pi^{-1-e} \log^2(262810)$$

$$\frac{1}{16} e^e \pi^{-1-e} (\log(2) + \log(5) + \log(41) + \log(641))^2 \sin(e \pi)$$

Alternative representations:

$$e^e \pi^{-1-e} \sin(e \pi) \left(\frac{1}{4} \log(16 (4 (8+8) + 203 (4+4) + 2023 (2+2)) + 106330)\right)^2 = \cos\left(\frac{\pi}{2} - e \pi\right) e^e \pi^{-1-e} \left(\frac{\log(262810)}{4}\right)^2$$

$$e^e \pi^{-1-e} \sin(e \pi) \left(\frac{1}{4} \log(16 (4 (8+8) + 203 (4+4) + 2023 (2+2)) + 106330)\right)^2 = \cos\left(\frac{\pi}{2} - e \pi\right) e^e \pi^{-1-e} \left(\frac{\log_e(262810)}{4}\right)^2$$

$$e^e \pi^{-1-e} \sin(e \pi) \left(\frac{1}{4} \log(16 (4 (8+8) + 203 (4+4) + 2023 (2+2)) + 106330)\right)^2 = -\cos\left(\frac{\pi}{2} + e \pi\right) e^e \pi^{-1-e} \left(\frac{\log_e(262810)}{4}\right)^2$$

$\log_b(x)$ is the base- b logarithm

Series representations:

$$e^e \pi^{-1-e} \sin(e \pi) \left(\frac{1}{4} \log(16 (4 (8+8) + 203 (4+4) + 2023 (2+2)) + 106330)\right)^2 = \frac{1}{16} e^e \pi^{-1-e} \log^2(262810) \sum_{k=0}^{\infty} \frac{(-1)^k (e \pi)^{1+2k}}{(1+2k)!}$$

$$e^e \pi^{-1-e} \sin(e \pi) \left(\frac{1}{4} \log(16 (4 (8+8) + 203 (4+4) + 2023 (2+2)) + 106330)\right)^2 = \frac{1}{16} e^e \pi^{-1-e} \log^2(262810) \sum_{k=0}^{\infty} \frac{(-1)^k \left(\left(-\frac{1}{2} + e\right) \pi\right)^{2k}}{(2k)!}$$

$$e^e \pi^{-1-e} \sin(e\pi) \left(\frac{1}{4} \log(16(4(8+8)+203(4+4)+2023(2+2))+106330)\right)^2 =$$
$$\frac{1}{16} e^e \pi^{-1-e} \sin(e\pi) \left(\log(262809) - \sum_{k=1}^{\infty} \frac{\left(-\frac{1}{262809}\right)^k}{k}\right)^2$$

$n!$ is the factorial function

Integral representations:

$$e^e \pi^{-1-e} \sin(e\pi) \left(\frac{1}{4} \log(16(4(8+8)+203(4+4)+2023(2+2))+106330)\right)^2 =$$
$$\frac{1}{16} e^{1+e} \pi^{-e} \log^2(262810) \int_0^1 \cos(e\pi t)\, dt$$

$$e^e \pi^{-1-e} \sin(e\pi) \left(\frac{1}{4} \log(16(4(8+8)+203(4+4)+2023(2+2))+106330)\right)^2 =$$
$$\frac{1}{16} e^{1+e} \pi^{-e} \left(\int_1^{262810} \frac{1}{t}\, dt\right)^2 \int_0^1 \cos(e\pi t)\, dt$$

$$e^e \pi^{-1-e} \sin(e\pi) \left(\frac{1}{4} \log(16(4(8+8)+203(4+4)+2023(2+2))+106330)\right)^2 =$$
$$-\frac{1}{64} i e^{1+e} \pi^{-1/2-e} \log^2(262810) \int_{-i\infty+\gamma}^{i\infty+\gamma} \frac{e^{-(e^2\pi^2)/(4s)+s}}{s^{3/2}}\, ds \quad \text{for } \gamma > 0$$

Multiple-argument formulas:

$$e^e \pi^{-1-e} \sin(e\pi) \left(\frac{1}{4} \log(16(4(8+8)+203(4+4)+2023(2+2))+106330)\right)^2 =$$
$$-\frac{1}{32} i e^e \left((-1)^e + (-1)^{1+e} e^{-2ie\pi}\right) \pi^{-1-e} \log^2(262810)$$

$$e^e \pi^{-1-e} \sin(e\pi) \left(\frac{1}{4} \log(16(4(8+8)+203(4+4)+2023(2+2))+106330)\right)^2 =$$
$$\frac{1}{8} e^e \pi^{-1-e} \cos\left(\frac{e\pi}{2}\right) \log^2(262810) \sin\left(\frac{e\pi}{2}\right)$$

$$e^e \pi^{-1-e} \sin(e\pi) \left(\frac{1}{4} \log(16(4(8+8)+203(4+4)+2023(2+2))+106330)\right)^2 =$$
$$\frac{1}{16} e^e \pi^{-1-e} \log^2(262810) (-\sin((-2+e)\pi) - 2\sin((-1+e)\pi))$$

$$e^e \pi^{-1-e} \sin(e \pi) \left(\frac{1}{4} \log(16 (4 (8+8) + 203 (4+4) + 2023 (2+2)) + 106330)\right)^2 = \frac{1}{16} e^e \pi^{-1-e} \left(1 + 2 \cos\left(\frac{2 e \pi}{3}\right)\right) \log^2(262810) \sin\left(\frac{e \pi}{3}\right)$$

From 12.479186 as entropy, we obtain:

Mass = 3.291523e-8 (equivalent to 1.846409×10^19 GeV, practically near to the mean value 1.962 * 10^{19} of DM particle that has a Planck scale mass: m ≈ 10^{19} GeV (Planck mass = 1,2209 × 10^{19} GeV/c^2 = 21,76 µg Wikipedia) and is very nearly to the result of the following Ramanujan mock theta function: **χ(q) = 1.962364415**)

Radius = 4.887423e-35

Temperature = 3.728375e+30

From the Ramanujan-Nardelli mock formula, we obtain:

sqrt[[[[1/(((((((4*1.962364415e+19)/(5*0.0864055^2)))*1/(3.291523e-8)* sqrt[[-((((3.728375e+30* 4*Pi*(4.887423e-35)^3-(4.887423e-35)^2))))) / ((6.67*10^-11))]]]]]

Input interpretation:

$$\sqrt{\left(1 \middle/ \left(\frac{4 \times 1.962364415 \times 10^{19}}{5 \times 0.0864055^2} \times \frac{1}{3.291523 \times 10^{-8}} \sqrt{-\frac{3.728375 \times 10^{30} \times 4 \pi (4.887423 \times 10^{-35})^3 - (4.887423 \times 10^{-35})^2}{6.67 \times 10^{-11}}}\right)\right)}$$

Result:

1.618249231206197105000126055818074317231564893932325563655...

1.6182492…

From:

$$Q^2+\frac{1}{Q^2}+\left(P^2+\frac{9^2}{P^2}\right)+2\left(P+\frac{9}{P}\right)\left[4+3\left(Q+\frac{1}{Q}\right)\right]=8\left(Q+\frac{1}{Q}\right)$$
$$+4\left[\left(\sqrt{P^3}+\frac{3^3}{\sqrt{P^3}}\right)\left(\sqrt{Q}+\frac{1}{\sqrt{Q}}\right)-\left(\sqrt{P}+\frac{3}{\sqrt{P}}\right)\left(\sqrt{Q^3}+\frac{1}{\sqrt{Q^3}}\right)+3\right]. \tag{92}$$

Q = 2, P = 3

4+1/4 + (9+9) + 2(3+3) (4+3(2+1/2))

8(2+1/2)+4[(((((((sqrt(27)+27/(sqrt(27))))*((((sqrt(2)+1/(sqrt(2))))-((((sqrt(3)+3/(sqrt(3))))* ((((2+1/2)+3))))))))]

Input:

$$8\left(2+\frac{1}{2}\right)+4\left(\left(\sqrt{27}+\frac{27}{\sqrt{27}}\right)\left(\left(\sqrt{2}+\frac{1}{\sqrt{2}}\right)-\left(\sqrt{3}+\frac{3}{\sqrt{3}}\right)\left(\left(2+\frac{1}{2}\right)+3\right)\right)\right)$$

Result:

$$20+24\sqrt{3}\left(\frac{1}{\sqrt{2}}+\sqrt{2}-11\sqrt{3}\right)$$

Decimal approximation:

−683.818369259805588464897773310587909889225890696359875376...

-683.81836…

Alternate forms:

$$4\left(9\sqrt{6}-193\right)$$

$$36\sqrt{6}-772$$

$$36\sqrt{6}-772$$

Minimal polynomial:

$$x^2+1544x+588208$$

4+1/4 + (9+9) + 2(3+3) (4+3(2+1/2))

Input:

$$4+\frac{1}{4}+(9+9)+2(3+3)\left(4+3\left(2+\frac{1}{2}\right)\right)$$

Exact result:

$$\frac{641}{4}$$

Decimal form:

160.25

160.25

-683.8183692598055884648977733105879098892258906963598753 76/160.25

Input interpretation:

$$-\frac{683.818369259805588464897773310587909889225890696359875376}{160.25}$$

Result:

−4.267197312073669818813714654044230326921846431802557724 65...

-4.2671973…

(-4.26719731207366981881371465404423032692184643180255772465)^2

Input interpretation:

$$(-4.26719731207366981881371465404423032692184643180255772465)^2$$

Result:

18.2089729001687526496402476431491447058964430182044785747 4...

18.208972… result very near to the black hole entropy 18.2773

24/exp (-4.2671973120736698)

Input interpretation:

$$\frac{24}{\exp(-4.2671973120736698)}$$

Result:

1711.715122457020...

1711.715... result very near to the mass of candidate glueball $f_0(1710)$ meson.

(((((24/exp (-4.2671973120736698))))))^1/15

Input interpretation:

$$\sqrt[15]{\frac{24}{\exp(-4.2671973120736698)}}$$

Result:

1.64271453236822648...

1.642714... ≈ ζ(2) = $\frac{\pi^2}{6} = 1.644934 ...$

2*((((((6*(((((24/exp (-4.2671973120736698))))))^1/15)))))))^1/2

Input interpretation:

$$2\sqrt{6\sqrt[15]{\frac{24}{\exp(-4.2671973120736698)}}}$$

Result:

6.27894487767152129...

6.2789448... ≈ 2π

-24/(10^3)+(((((24/exp (-4.2671973120736698))))))^1/15

Input interpretation:

$$-\frac{24}{10^3}+\sqrt[15]{\frac{24}{\exp(-4.2671973120736698)}}$$

Result:

1.61871453236822648...

1.618714...

This result is a very good approximation to the value of the golden ratio 1,618033988749...

Now, we have that:

$$\text{If } P=\frac{\varphi(q)\varphi(q^5)}{\varphi(q^9)\varphi(q^{45})} \text{ and } Q=\frac{\varphi(q)\varphi(q^{45})}{\varphi(q^9)\varphi(q^5)}, \text{ then}$$

$$Q^3+\frac{1}{Q^3}-15\left(Q^2+\frac{1}{Q^2}\right)-45\left(Q+\frac{1}{Q}\right)-\left(P^2+\frac{81}{P^2}\right)-10\left(P+\frac{9}{P}\right)$$
$$\times\left[2+Q+\frac{1}{Q}\right]+5\left(\sqrt{P^3}+\frac{3^3}{\sqrt{P^3}}\right)\left(\sqrt{Q}+\frac{1}{\sqrt{Q}}\right)+15\left(\sqrt{P}+\frac{3}{\sqrt{P}}\right)$$
$$\times\left[\left(\sqrt{Q^3}+\frac{1}{\sqrt{Q^3}}\right)+2\left(\sqrt{Q}+\frac{1}{\sqrt{Q}}\right)\right]=40. \tag{95}$$

For P and Q = 1, we obtain:

(2-30-90-82–10(10)*(4)+5*28*2+15*4*6

Input:

$2-30-90-82-10\times10\times4+5\times28\times2+15\times4\times6$

Result:

40

40

Now, we have that:

$$\text{If } P=\frac{f(-q)f(-q^7)}{q^{8/3}f(-q^9)f(-q^{63})} \text{ and } Q=\frac{f(-q)f(-q^{63})}{q^{-2}f(-q^9)f(-q^7)} \text{ then}$$

$$Q^4+\frac{1}{Q^4}-14\left(Q^3+\frac{1}{Q^3}\right)+28\left(Q^2+\frac{1}{Q^2}\right)+7\left(Q+\frac{1}{Q}\right)=P^3+\frac{9^3}{P^3}$$
$$+7\left(\sqrt{P^3}+\frac{27}{\sqrt{P^3}}\right)\left[\left(\sqrt{Q^3}+\frac{1}{\sqrt{Q^3}}\right)-\left(\sqrt{Q}+\frac{1}{\sqrt{Q}}\right)\right]+98. \tag{98}$$

For Q and P = 1, we obtain:

2-14*2+28*2+7*2

Input:

$2 - 14\times 2 + 28\times 2 + 7\times 2$

Result:

44

44

1+9^3+7*28*(2-2)+98

Input:

$1 + 9^3 + 7\times 28\,(2 - 2) + 98$

Result:

828

828

(((1+9^3+7*28*(2-2)+98)))/44

Input:

$\frac{1}{44}\,(1 + 9^3 + 7\times 28\,(2 - 2) + 98)$

Exact result:

$\frac{207}{11}$

Decimal approximation:

18.818181818181818181818181818181818181818181818181818181...

18.81… result very near to the black hole entropy 18.7328

55+13+10^3((((((((((((ln(((((1+9^3+7*28*(2-2)+98)) /44)))))))))))))^1/2

Input:

$55 + 13 + 10^3 \sqrt{\log\left(\frac{1}{44}\,(1 + 9^3 + 7\times 28\,(2 - 2) + 98)\right)}$

log(x) is the natural logarithm

Exact result:

$$68 + 1000 \sqrt{\log\left(\frac{207}{11}\right)}$$

Decimal approximation:

1781.132662833500040068869287279782048923999774828652698398...

1781.13266… result in the range of the hypothetical mass of Gluino (gluino = 1785.16 GeV).

Property:

$$68 + 1000 \sqrt{\log\left(\frac{207}{11}\right)} \text{ is a transcendental number}$$

Alternate forms:

$$4\left(17 + 250 \sqrt{\log\left(\frac{207}{11}\right)}\right)$$

$$4\left(17 + 250 \sqrt{\log\left(\frac{23}{11}\right) + 2 \log(3)}\right)$$

$$68 + 1000 \sqrt{2 \log(3) - \log(11) + \log(23)}$$

Alternative representations:

$$55 + 13 + 10^3 \sqrt{\log\left(\frac{1}{44} \left(1 + 9^3 + 7 \times 28 (2 - 2) + 98\right)\right)} = 68 + 10^3 \sqrt{\log_e\left(\frac{1}{44} \left(99 + 9^3\right)\right)}$$

$$55 + 13 + 10^3 \sqrt{\log\left(\frac{1}{44} \left(1 + 9^3 + 7 \times 28 (2 - 2) + 98\right)\right)} =$$
$$68 + 10^3 \sqrt{\log(a) \log_a\left(\frac{1}{44} \left(99 + 9^3\right)\right)}$$

$$55 + 13 + 10^3 \sqrt{\log\left(\frac{1}{44}\left(1 + 9^3 + 7 \times 28 (2-2) + 98\right)\right)} =$$
$$68 + 10^3 \sqrt{-\text{Li}_1\left(1 - \frac{1}{44}\left(99 + 9^3\right)\right)}$$

$\log_b(x)$ is the base- b logarithm

$\text{Li}_n(x)$ is the polylogarithm function

Series representations:

$$55 + 13 + 10^3 \sqrt{\log\left(\frac{1}{44}\left(1 + 9^3 + 7 \times 28 (2-2) + 98\right)\right)} =$$
$$68 + 1000 \sqrt{\log\left(\frac{196}{11}\right) - \sum_{k=1}^{\infty} \frac{\left(-\frac{11}{196}\right)^k}{k}}$$

$$55 + 13 + 10^3 \sqrt{\log\left(\frac{1}{44}\left(1 + 9^3 + 7 \times 28 (2-2) + 98\right)\right)} =$$
$$68 + 1000 \sqrt{2 i \pi \left\lfloor \frac{\arg\left(\frac{207}{11} - x\right)}{2\pi} \right\rfloor + \log(x) - \sum_{k=1}^{\infty} \frac{(-1)^k \left(\frac{207}{11} - x\right)^k x^{-k}}{k}} \quad \text{for } x < 0$$

$$55 + 13 + 10^3 \sqrt{\log\left(\frac{1}{44}\left(1 + 9^3 + 7 \times 28 (2-2) + 98\right)\right)} =$$
$$68 + 1000 \sqrt{\log(z_0) + \left\lfloor \frac{\arg\left(\frac{207}{11} - z_0\right)}{2\pi} \right\rfloor \left(\log\left(\frac{1}{z_0}\right) + \log(z_0)\right) - \sum_{k=1}^{\infty} \frac{(-1)^k \left(\frac{207}{11} - z_0\right)^k z_0^{-k}}{k}}$$

$\arg(z)$ is the complex argument

$\lfloor x \rfloor$ is the floor function

Integral representations:

$$55 + 13 + 10^3 \sqrt{\log\left(\frac{1}{44}\left(1 + 9^3 + 7 \times 28 (2-2) + 98\right)\right)} = 68 + 1000 \sqrt{\int_1^{\frac{207}{11}} \frac{1}{t} \, dt}$$

$$55 + 13 + 10^3 \sqrt{\log\left(\frac{1}{44}\left(1 + 9^3 + 7 \times 28(2-2) + 98\right)\right)} =$$

$$68 + 500 \sqrt{\frac{2}{\pi}} \sqrt{-i \int_{-i\infty+\gamma}^{i\infty+\gamma} \frac{\left(\frac{11}{196}\right)^s \Gamma(-s)^2 \Gamma(1+s)}{\Gamma(1-s)} \, ds} \quad \text{for } -1 < \gamma < 0$$

$\Gamma(x)$ is the gamma function

We have also that:

(((1+9^3+7*28*(2-2)+98)))-(((2-14*2+28*2+7*2)))

Input:

$$(1 + 9^3 + 7 \times 28(2-2) + 98) - (2 - 14 \times 2 + 28 \times 2 + 7 \times 2)$$

Result:

784

784 result very near to the rest mass of Omega meson 782.65

And:

10^3+(((1+9^3+7*28*(2-2)+98)))-(((2-14*2+28*2+7*2)))-55

Input:

$$10^3 + (1 + 9^3 + 7 \times 28(2-2) + 98) - (2 - 14 \times 2 + 28 \times 2 + 7 \times 2) - 55$$

Result:

1729

1729

This result is very near to the mass of candidate glueball $f_0(1710)$ meson. Furthermore, 1728 occurs in the algebraic formula for the j-invariant of an elliptic curve. As a consequence, it is sometimes called a Zagier as a pun on the Gross–Zagier theorem. The number 1728 is one less than the Hardy–Ramanujan number 1729

Now, we have that:

If $P = \frac{f(-q)f(-q^{11})}{q^4 f(-q^9)f(-q^{99})}$ and $Q = \frac{f(-q)f(-q^{99})}{q^{-10/3} f(-q^9)f(-q^{11})}$ then

$$Q^6 + \frac{1}{Q^6} = 165\left(P + \frac{9}{P}\right) + 66\left(P^2 + \frac{9^2}{P^2}\right) + 11\left(P^3 + \frac{9^3}{P^3}\right) + 1848$$
$$+ \left(P^5 + \frac{9^5}{P^5}\right) + 22\left(Q^3 + \frac{1}{Q^3}\right)\left[2\left(P^2 + \frac{9^2}{P^2}\right) + 3\left(P + \frac{9}{P}\right) + 26\right]$$
$$+ 11\left(\sqrt{Q^3} + \frac{1}{\sqrt{Q^3}}\right)\left[15\left(\sqrt{P} + \frac{3}{\sqrt{P}}\right) + 14\left(\sqrt{P^3} + \frac{3^3}{\sqrt{P^3}}\right)\right.$$
$$\left. + \left(\sqrt{P^5} + \frac{3^5}{\sqrt{P^5}}\right) + \left(\sqrt{P^7} + \frac{3^7}{\sqrt{P^7}}\right)\right] + 55\left(\sqrt{P} + \frac{3}{P}\right)\left(\sqrt{Q^9} + \frac{1}{\sqrt{Q^9}}\right). \qquad (99)$$

For P = Q = 1, we obtain:

165*10+66*82+11*(1+9^3)+1848+1+9^5+22*2*(((2*82)+3*(10)+26)))+11*2*(((15*4+14*28+1+243+1+2187)))+55*4*2

Input:

$165 \times 10 + 66 \times 82 + 11(1 + 9^3) + 1848 + 1 + 9^5 + 22 \times 2(2 \times 82 + 3 \times 10 + 26) + 11 \times 2(15 \times 4 + 14 \times 28 + 1 + 243 + 1 + 2187) + 55 \times 4 \times 2$

Result:

149 558

149558

For Q = 1, we have 2x = 149558, thence:

(((((((165*10+66*82+11*(1+9^3)+1848+1+9^5+22*2*(((2*82)+3*(10)+26)))+11*2*(((15*4+14*28+1+243+1+2187)))+55*4*2))))))))/2

Input:

$\frac{1}{2}((165 \times 10 + 66 \times 82 + 11(1 + 9^3) + 1848 + 1 + 9^5 + 22 \times 2(2 \times 82 + 3 \times 10 + 26)) + 11 \times 2(15 \times 4 + 14 \times 28 + 1 + 243 + 1 + 2187) + 55 \times 4 \times 2)$

Result:

74 779

74779

0.61803398+ln((((((((((((165*10+66*82+11*(1+9^3)+1848+1+9^5+22*2*(((2*82)+3*(10)+26)))+11*2*(((15*4+14*28+1+243+1+2187)))+55*4*2))))))))/2))))))

Input interpretation:

$$0.61803398 + \log\left(\frac{1}{2}\left((165\times 10+66\times 82+11\left(1+9^3\right)+1848+1+9^5+22\times 2\,(2\times 82+3\times 10+26)\right)+11\times 2\,(15\times 4+14\times 28+1+243+1+2187)+55\times 4\times 2\right)\right)$$

log(x) is the natural logarithm

Result:

11.8403264...

11.8403264… result practically equal to the black hole entropy 11.8458

Alternative representations:

$$0.618034 + \log\left(\frac{1}{2}\left((165\times 10+66\times 82+11\left(1+9^3\right)+1848+1+9^5+22\times 2\,(2\times 82+3\times 10+26)\right)+11\times 2\,(15\times 4+14\times 28+1+243+1+2187)+55\times 4\times 2\right)\right) = 0.618034 + \log_e\left(\frac{1}{2}\left(82\,479+11\left(1+9^3\right)+9^5\right)\right)$$

$$0.618034 + \log\left(\frac{1}{2}\left((165\times 10+66\times 82+11\left(1+9^3\right)+1848+1+9^5+22\times 2\,(2\times 82+3\times 10+26)\right)+11\times 2\,(15\times 4+14\times 28+1+243+1+2187)+55\times 4\times 2\right)\right) = 0.618034 + \log(a)\log_a\left(\frac{1}{2}\left(82\,479+11\left(1+9^3\right)+9^5\right)\right)$$

$$0.618034 + \log\left(\frac{1}{2}\left((165\times 10+66\times 82+11\left(1+9^3\right)+1848+1+9^5+22\times 2\,(2\times 82+3\times 10+26)\right)+11\times 2\,(15\times 4+14\times 28+1+243+1+2187)+55\times 4\times 2\right)\right) = 0.618034 - \mathrm{Li}_1\left(1+\frac{1}{2}\left(-82\,479-11\left(1+9^3\right)-9^5\right)\right)$$

$\log_b(x)$ is the base- b logarithm

$\text{Li}_n(x)$ is the polylogarithm function

Series representations:

$$0.618034 + \log\left(\frac{1}{2}\left(\left(165\times 10 + 66\times 82 + 11\left(1+9^3\right) + 1848 + 1 + 9^5 + 22\times 2\,(2\times 82 + 3\times 10 + 26)\right) + 11\times 2\,(15\times 4 + 14\times 28 + 1 + 243 + 1 + 2187) + 55\times 4\times 2\right)\right) = 0.618034 + \log(74\,778) - \sum_{k=1}^{\infty} \frac{\left(-\frac{1}{74\,778}\right)^k}{k}$$

$$0.618034 + \log\left(\frac{1}{2}\left(\left(165\times 10 + 66\times 82 + 11\left(1+9^3\right) + 1848 + 1 + 9^5 + 22\times 2\,(2\times 82 + 3\times 10 + 26)\right) + 11\times 2\,(15\times 4 + 14\times 28 + 1 + 243 + 1 + 2187) + 55\times 4\times 2\right)\right) = 0.618034 + 2\,i\,\pi \left\lfloor \frac{\arg(74\,779 - x)}{2\,\pi} \right\rfloor + \log(x) - \sum_{k=1}^{\infty} \frac{(-1)^k\,(74\,779 - x)^k\,x^{-k}}{k}$$

for $x < 0$

$$0.618034 + \log\left(\frac{1}{2}\left(\left(165\times 10 + 66\times 82 + 11\left(1+9^3\right) + 1848 + 1 + 9^5 + 22\times 2\,(2\times 82 + 3\times 10 + 26)\right) + 11\times 2\,(15\times 4 + 14\times 28 + 1 + 243 + 1 + 2187) + 55\times 4\times 2\right)\right) = 0.618034 + \left\lfloor \frac{\arg(74\,779 - z_0)}{2\,\pi} \right\rfloor \log\left(\frac{1}{z_0}\right) + \log(z_0) + \left\lfloor \frac{\arg(74\,779 - z_0)}{2\,\pi} \right\rfloor \log(z_0) - \sum_{k=1}^{\infty} \frac{(-1)^k\,(74\,779 - z_0)^k\,z_0^{-k}}{k}$$

$\arg(z)$ is the complex argument

$\lfloor x \rfloor$ is the floor function

i is the imaginary unit

Integral representations:

$$0.618034 + \log\left(\frac{1}{2}((165\times 10 + 66\times 82 + 11(1+9^3) + 1848 + 1 + 9^5 + 22\times 2(2\times 82 + 3\times 10 + 26)) + 11\times 2(15\times 4 + 14\times 28 + 1 + 243 + 1 + 2187) + 55\times 4\times 2)\right) = 0.618034 + \int_1^{74779} \frac{1}{t}\,dt$$

$$0.618034 + \log\left(\frac{1}{2}((165\times 10 + 66\times 82 + 11(1+9^3) + 1848 + 1 + 9^5 + 22\times 2(2\times 82 + 3\times 10 + 26)) + 11\times 2(15\times 4 + 14\times 28 + 1 + 243 + 1 + 2187) + 55\times 4\times 2)\right) = 0.618034 + \frac{1}{2 i \pi}\int_{-i\infty+\gamma}^{i\infty+\gamma} \frac{74778^{-s}\,\Gamma(-s)^2\,\Gamma(1+s)}{\Gamma(1-s)}\,ds \quad \text{for } -1<\gamma<0$$

From the entropy 11.84033, we obtain:

Mass = 3.206163e-8 (equivalent to 1.798526×10^19 GeV, practically near to the mean value 1.962 * 10^{19} of DM particle that has a Planck scale mass: m ≈ 10^{19} GeV (Planck mass = 1,2209 × 10^{19} GeV/c^2 = 21,76 μg Wikipedia) and is very nearly to the result of the following Ramanujan mock theta function: **χ(q) = 1.962364415**)

Radius = 4.760676e-35

Temperature = 3.827638e+30

From the Ramanujan-Nardelli mock formula, we obtain:

sqrt[[[[1/((((((((4*1.962364415e+19)/(5*0.0864055^2)))*1/(3.206163e-8)* sqrt[[-((((3.827638e+30* 4*Pi*(4.760676e-35)^3-(4.760676e-35)^2))))) / ((6.67*10^-11))]]]]]

Input interpretation:

$$\sqrt{1\Big/\left(\frac{4\times 1.962364415\times 10^{19}}{5\times 0.0864055^2}\times\frac{1}{3.206163\times 10^{-8}}\sqrt{-\frac{3.827638\times 10^{30}\times 4\pi(4.760676\times 10^{-35})^3-(4.760676\times 10^{-35})^2}{6.67\times 10^{-11}}}\right)}$$

Result:

1.618249243446674171830932681608481937883915561867254129325...

1.6182492….

Now, we have that:

$$l'_{9,28} = 7\sqrt{7} + 11\sqrt{3} + 4\sqrt{21} + 18 + (2+\sqrt{7})(2+\sqrt{3})\sqrt{9+2\sqrt{21}}.$$

7*sqrt(7)+11*sqrt(3)+4*sqrt(21)+18+(2+sqrt(7))(2+sqrt(3))((((sqrt(9+2sqrt(21)))

Input:

$$7\sqrt{7} + 11\sqrt{3} + 4\sqrt{21} + 18 + \left(2+\sqrt{7}\right)\left(2+\sqrt{3}\right)\sqrt{9+2\sqrt{21}}$$

Decimal approximation:

147.799475757203048926025842213327241402497116450515604324 4...

147.79947…

Alternate forms:

$$4\sqrt{9+2\sqrt{21}} + 11\sqrt{3} + 7\sqrt{7} + 4\sqrt{21} + 2\sqrt{3\left(9+2\sqrt{21}\right)} + 2\sqrt{7\left(9+2\sqrt{21}\right)} + \sqrt{21\left(9+2\sqrt{21}\right)} + 18$$

root of $x^8 - 144x^7 - 556x^6 - 816x^5 - 858x^4 - 816x^3 - 556x^2 - 144x + 1$ near $x = 147.799$

$$\frac{1}{\sqrt{2}}\left(\sqrt{9-i\sqrt{3}}\left(2+\sqrt{3}\right)\left(2+\sqrt{7}\right) + \sqrt{2}\left(18 + 11\sqrt{3} + 7\sqrt{7} + 4\sqrt{21} + \sqrt{\frac{1}{2}\,i\left(\sqrt{3} + -9\,i\right)}\left(2+\sqrt{3}\right)\left(2+\sqrt{7}\right)\right)\right)$$

Minimal polynomial:

$$x^8 - 144x^7 - 556x^6 - 816x^5 - 858x^4 - 816x^3 - 556x^2 - 144x + 1$$

(((((7*sqrt(7)+11*sqrt(3)+4*sqrt(21)+18+(2+sqrt(7))(2+sqrt(3))((((sqrt(9+2sqrt(21))))))))-13

Input:

$$\left(7\sqrt{7}+11\sqrt{3}+4\sqrt{21}+18+\left(2+\sqrt{7}\right)\left(2+\sqrt{3}\right)\sqrt{9+2\sqrt{21}}\right)-13$$

Result:

$$5+11\sqrt{3}+7\sqrt{7}+4\sqrt{21}+\left(2+\sqrt{3}\right)\left(2+\sqrt{7}\right)\sqrt{9+2\sqrt{21}}$$

Decimal approximation:

134.79947575720304892602584221332724140249711645051560432 44...

134.79947… result very near to the rest mass of Pion meson 134.9766

Alternate forms:

$$4\sqrt{9+2\sqrt{21}}+11\sqrt{3}+7\sqrt{7}+4\sqrt{21}+2\sqrt{3\left(9+2\sqrt{21}\right)}+2\sqrt{7\left(9+2\sqrt{21}\right)}+\sqrt{21\left(9+2\sqrt{21}\right)}+5$$

root of $x^8-40x^7-8928x^6-432\,208x^5-10\,536\,968x^4-149\,010\,144x^3-1\,244\,668\,032x^2-5\,726\,566\,080x-11\,233\,130\,544$ near $x=134.799$

$$\frac{1}{\sqrt{2}}\left(\sqrt{9-i\sqrt{3}}\left(2+\sqrt{3}\right)\left(2+\sqrt{7}\right)+\sqrt{2}\left(5+11\sqrt{3}+7\sqrt{7}+4\sqrt{21}+\sqrt{\frac{1}{2}i\left(\sqrt{3}+-9i\right)}\left(2+\sqrt{3}\right)\left(2+\sqrt{7}\right)\right)\right)$$

Minimal polynomial:

$$x^8-40x^7-8928x^6-432\,208x^5-10\,536\,968x^4-149\,010\,144x^3-1\,244\,668\,032x^2-5\,726\,566\,080x-11\,233\,130\,544$$

Pi*ln(((((7*sqrt(7)+11*sqrt(3)+4*sqrt(21)+18+(2+sqrt(7))(2+sqrt(3))((((sqrt(9+2sqrt(21))))))))

Input:

$$\pi\log\left(7\sqrt{7}+11\sqrt{3}+4\sqrt{21}+18+\left(2+\sqrt{7}\right)\left(2+\sqrt{3}\right)\sqrt{9+2\sqrt{21}}\right)$$

$\log(x)$ is the natural logarithm

Decimal approximation:

15.694945957942874769412232994761014988967399517282749102 93...

15.694945… result practically equal to the black hole entropy 15.6730

Alternate forms:

$$\pi \log\left(\text{root of } x^8 - 144x^7 - 556x^6 - 816x^5 - 858x^4 - 816x^3 - 556x^2 - 144x + 1 \text{ near } x = 147.799\right)$$

$$\pi\left(-\frac{\log(2)}{2} + \log\left(18\sqrt{2} + 11\sqrt{6} + 7\sqrt{14} + 4\sqrt{42} + 4\sqrt{9 - i\sqrt{3}} + 2\sqrt{3\left(9 - i\sqrt{3}\right)} + 2\sqrt{7\left(9 - i\sqrt{3}\right)} + \sqrt{21\left(9 - i\sqrt{3}\right)} + 4\sqrt{9 + i\sqrt{3}} + 2\sqrt{3\left(9 + i\sqrt{3}\right)} + 2\sqrt{7\left(9 + i\sqrt{3}\right)} + \sqrt{21\left(9 + i\sqrt{3}\right)}\right)\right)$$

Alternative representations:

$$\pi \log\left(7\sqrt{7} + 11\sqrt{3} + 4\sqrt{21} + 18 + \left(2 + \sqrt{7}\right)\left(2 + \sqrt{3}\right)\sqrt{9 + 2\sqrt{21}}\right) = \pi \log_e\left(18 + 11\sqrt{3} + 7\sqrt{7} + 4\sqrt{21} + \left(2 + \sqrt{3}\right)\left(2 + \sqrt{7}\right)\sqrt{9 + 2\sqrt{21}}\right)$$

$$\pi \log\left(7\sqrt{7} + 11\sqrt{3} + 4\sqrt{21} + 18 + \left(2 + \sqrt{7}\right)\left(2 + \sqrt{3}\right)\sqrt{9 + 2\sqrt{21}}\right) = \pi \log(a) \log_a\left(18 + 11\sqrt{3} + 7\sqrt{7} + 4\sqrt{21} + \left(2 + \sqrt{3}\right)\left(2 + \sqrt{7}\right)\sqrt{9 + 2\sqrt{21}}\right)$$

$$\pi \log\left(7\sqrt{7} + 11\sqrt{3} + 4\sqrt{21} + 18 + \left(2 + \sqrt{7}\right)\left(2 + \sqrt{3}\right)\sqrt{9 + 2\sqrt{21}}\right) = -\pi \operatorname{Li}_1\left(-17 - 11\sqrt{3} - 7\sqrt{7} - 4\sqrt{21} - \left(2 + \sqrt{3}\right)\left(2 + \sqrt{7}\right)\sqrt{9 + 2\sqrt{21}}\right)$$

$\log_b(x)$ is the base- b logarithm

$\operatorname{Li}_n(x)$ is the polylogarithm function

Series representations:

$$\pi\log\left(7\sqrt{7}+11\sqrt{3}+4\sqrt{21}+18+\left(2+\sqrt{7}\right)\left(2+\sqrt{3}\right)\sqrt{9+2\sqrt{21}}\right)=$$

$$\pi\log\left(17+11\sqrt{3}+7\sqrt{7}+4\sqrt{21}+\left(2+\sqrt{3}\right)\left(2+\sqrt{7}\right)\sqrt{9+2\sqrt{21}}\right)-\pi\sum_{k=1}^{\infty}\frac{\left(-\frac{1}{17+11\sqrt{3}+7\sqrt{7}+4\sqrt{21}+\left(2+\sqrt{3}\right)\left(2+\sqrt{7}\right)\sqrt{9+2\sqrt{21}}}\right)^k}{k}$$

$$\pi\log\left(7\sqrt{7}+11\sqrt{3}+4\sqrt{21}+18+\left(2+\sqrt{7}\right)\left(2+\sqrt{3}\right)\sqrt{9+2\sqrt{21}}\right)=$$

$$2\,i\,\pi^2\left\lfloor\frac{\arg\left(18+11\sqrt{3}+7\sqrt{7}+4\sqrt{21}+(2+\sqrt{3})(2+\sqrt{7})\sqrt{9+2\sqrt{21}}-x\right)}{2\pi}\right\rfloor+\pi\log(x)-\pi\sum_{k=1}^{\infty}\frac{1}{k}(-1)^k\left(18+11\sqrt{3}+7\sqrt{7}+4\sqrt{21}+\left(2+\sqrt{3}\right)\left(2+\sqrt{7}\right)\sqrt{9+2\sqrt{21}}-x\right)^k x^{-k}\quad\text{for } x<0$$

$$\pi\log\left(7\sqrt{7}+11\sqrt{3}+4\sqrt{21}+18+\left(2+\sqrt{7}\right)\left(2+\sqrt{3}\right)\sqrt{9+2\sqrt{21}}\right)=$$

$$2\,i\,\pi^2\left\lfloor\frac{\pi-\arg\left(\frac{1}{z_0}\right)-\arg(z_0)}{2\pi}\right\rfloor+\pi\log(z_0)-\pi\sum_{k=1}^{\infty}\frac{1}{k}(-1)^k\left(18+11\sqrt{3}+7\sqrt{7}+4\sqrt{21}+\left(2+\sqrt{3}\right)\left(2+\sqrt{7}\right)\sqrt{9+2\sqrt{21}}-z_0\right)^k z_0^{-k}$$

$\arg(z)$ is the complex argument

$\lfloor x\rfloor$ is the floor function

Integral representations:

$$\pi\log\left(7\sqrt{7}+11\sqrt{3}+4\sqrt{21}+18+\left(2+\sqrt{7}\right)\left(2+\sqrt{3}\right)\sqrt{9+2\sqrt{21}}\right)=$$

$$\pi\int_1^{18+11\sqrt{3}+7\sqrt{7}+4\sqrt{21}+\left(2+\sqrt{3}\right)\left(2+\sqrt{7}\right)\sqrt{9+2\sqrt{21}}}\frac{1}{t}\,dt$$

$$\pi \log\left(7\sqrt{7} + 11\sqrt{3} + 4\sqrt{21} + 18 + \left(2+\sqrt{7}\right)\left(2+\sqrt{3}\right)\sqrt{9+2\sqrt{21}}\right) =$$

$$-\frac{i}{2}\int_{-i\,\infty+\gamma}^{i\,\infty+\gamma} \frac{1}{\Gamma(1-s)} \left(17 + 11\sqrt{3} + 7\sqrt{7} + 4\sqrt{21} + \left(2+\sqrt{3}\right)\left(2+\sqrt{7}\right)\sqrt{9+2\sqrt{21}}\right)^{-s} \Gamma(-s)^2\,\Gamma(1+s)\,ds \quad \text{for } -1<\gamma<0$$

$\Gamma(x)$ is the gamma function

From the entropy 15.69495, we obtain:

Mass = 3.691337e-8 (equivalent to 2.070689×10^19 GeV, practically near to the mean value 1.962 * 10^{19} of DM particle that has a Planck scale mass: m ≈ 10^{19} GeV (Planck mass = 1,2209 × 10^{19} GeV/c^2 = 21,76 μg Wikipedia) and is very nearly to the result of the following Ramanujan mock theta function: **χ(q) = 1.962364415**)

Radius = 5.481087e-35

Temperature = 3.324550e+30

From the Ramanujan-Nardelli mock formula, we obtain:

sqrt[[[[1/((((((((4*1.962364415e+19)/(5*0.0864055^2)))*1/(3.691337e-8)* sqrt[[-((((3.324550e+30* 4*Pi*(5.481087e-35)^3-(5.481087e-35)^2))))) / ((6.67*10^-11))]]]]]

Input interpretation:

$$\sqrt{\left(1\Big/\left(\frac{4\times 1.962364415\times 10^{19}}{5\times 0.0864055^2}\times\frac{1}{3.691337\times 10^{-8}}\sqrt{-\frac{3.324550\times 10^{30}\times 4\pi\,(5.481087\times 10^{-35})^3-(5.481087\times 10^{-35})^2}{6.67\times 10^{-11}}}\right)\right)}$$

Result:

1.618249295402398408610748086813731512731385001452972280144...

1.6182492…

We have that:

If $P = \frac{\varphi(q)}{\varphi(q^2)} \frac{\varphi(q^8)}{\varphi(q^{16})}$ and $Q = \frac{\varphi(q)}{\varphi(q^2)} \frac{\varphi(q^{16})}{\varphi(q^8)}$, then

$$\begin{aligned} &16Q^4 + \frac{1}{Q^4} + 8\left(8Q^3 - \frac{11}{Q^3}\right) + 64\left(4Q^2 + \frac{13}{Q^2}\right) + 16\left(74Q + \frac{113}{Q}\right) \\ &+ \left(P^4 + \frac{16}{P^4}\right) - 4\left(P^3 + \frac{8}{P^3}\right)\left[\left(2Q + \frac{1}{Q}\right) + 6\right] + 2\left(P^2 + \frac{4}{P^2}\right) \\ &\times \left[4\left(14Q + \frac{19}{Q}\right) + 3\left(4Q^2 + \frac{1}{Q^2}\right) + 160\right] + 1936 - 4\left(P + \frac{2}{P}\right) \\ &\times \left[12\left(10Q + \frac{21}{Q}\right) + 2\left(20Q^2 + \frac{21}{Q^2}\right) + \left(8Q^3 + \frac{1}{Q^3}\right) + 168\right] = 0. \end{aligned} \tag{44}$$

16+1+8(8-11)+64(4+13)+16(74+113)+(1+16)-4(1+8)[(3+6)]+2(1+4)*[(((4(14+19)+3(4+1)+160)))]+1936-4(1+2)*[(((12(10+21)+2(20+21)+(8+1)+168)))]

Input:

16 + 1 + 8 (8 − 11) + 64 (4 + 13) + 16 (74 + 113) + (1 + 16) − 4 (1 + 8) (3 + 6) + 2 (1 + 4) (4 (14 + 19) + 3 (4 + 1) + 160) + 1936 − 4 (1 + 2) (12 (10 + 21) + 2 (20 + 21) + (8 + 1) + 168)

Result:

1200

1200

We have:

(((((16+1+8(-3)+64(17)+16(187)+(1+16)-4(9)(9)+2(5)*(((4(33)+3(5)+160)))+1936-4(3)*(((12(31)+2(41)+(9)+168)))))))-144-34-3

Input:

(16 + 1 + 8 × (−3) + 64 × 17 + 16 × 187 + (1 + 16) − 4 × 9 × 9 + 2 × 5 (4 × 33 + 3 × 5 + 160) + 1936 − 4 × 3 (12 × 31 + 2 × 41 + 9 + 168)) − 144 − 34 − 3

Result:

1019

1019 result practically equal to the rest mass of Phi meson 1019.445

(((((16+1+8(-3)+64(17)+16(187)+(1+16)-4(9)(9)+2(5)*(((4(33)+3(5)+160)))+1936-4(3)*(((12(31)+2(41)+(9)+168))))))))+233+144+89+34+21+8

Input:

$(16 + 1 + 8 \times (-3) + 64 \times 17 + 16 \times 187 + (1 + 16) - 4 \times 9 \times 9 + 2 \times 5 (4 \times 33 + 3 \times 5 + 160) + 1936 - 4 \times 3 (12 \times 31 + 2 \times 41 + 9 + 168)) + 233 + 144 + 89 + 34 + 21 + 8$

Result:

1729

1729

This result is very near to the mass of candidate glueball $f_0(1710)$ meson. Furthermore, 1728 occurs in the algebraic formula for the j-invariant of an elliptic curve. As a consequence, it is sometimes called a Zagier as a pun on the Gross–Zagier theorem. The number 1728 is one less than the Hardy–Ramanujan number 1729

[(((((16+1+8(-3)+64(17)+16(187)+(1+16)-4(9)(9)+2(5)*(((4(33)+3(5)+160)))+1936-4(3)*(((12(31)+2(41)+(9)+168))))))))+233+144+89+34+21+8]^1/15

Input:

$((16 + 1 + 8 \times (-3) + 64 \times 17 + 16 \times 187 + (1 + 16) - 4 \times 9 \times 9 + 2 \times 5 (4 \times 33 + 3 \times 5 + 160) + 1936 - 4 \times 3 (12 \times 31 + 2 \times 41 + 9 + 168)) + 233 + 144 + 89 + 34 + 21 + 8) \text{^} (1/15)$

Result:

$\sqrt[15]{1729}$

Decimal approximation:

1.643815228748728130580088031324769514329283143699940172645...

$1.6438152287.... \approx \zeta(2) = \frac{\pi^2}{6} = 1.644934 ...$

sqrt((((((6*[(((((16+1+8(-3)+64(17)+16(187)+(1+16)-4(9)(9)+2(5)*(((4(33)+3(5)+160)))+1936-4(3)*(((12(31)+2(41)+(9)+168))))))))+233+144+89+34+21+8]^1/15))))))

Input:

$$\sqrt{(6((16+1+8\times(-3)+64\times 17+16\times 187+(1+16)-4\times 9\times 9+2\times 5(4\times 33+3\times 5+160)+1936-4\times 3(12\times 31+2\times 41+9+168))+233+144+89+34+21+8)\wedge(1/15))}$$

Result:

$$\sqrt{6}\sqrt[30]{1729}$$

Decimal approximation:

3.140524060167724424861180128206628582126936767544347593022...

3.140524060… ≈ π

(((((16+1+8(-3)+64(17)+16(187)+(1+16)-4(9)(9)+2(5)*(((4(33)+3(5)+160)))+1936-4(3)*(((12(31)+2(41)+(9)+168))))))))+233+144+89+55+34+21+8

Input:

$$(16+1+8\times(-3)+64\times 17+16\times 187+(1+16)-4\times 9\times 9+2\times 5(4\times 33+3\times 5+160)+1936-4\times 3(12\times 31+2\times 41+9+168))+233+144+89+55+34+21+8$$

Result:

1784

1784 result in the range of the hypothetical mass of Gluino (gluino = 1785.16 GeV).

We have also that:

(((((16+1+8(-3)+64(17)+16(187)+(1+16)-4(9)(9)+2(5)*(((4(33)+3(5)+160)))+1936-4(3)*(((12(31)+2(41)+(9)+168))))))))^1/14

Input:

$$(16+1+8\times(-3)+64\times 17+16\times 187+(1+16)-4\times 9\times 9+2\times 5(4\times 33+3\times 5+160)+1936-4\times 3(12\times 31+2\times 41+9+168))\wedge(1/14)$$

Result:

$$2^{2/7}\sqrt[14]{3}\sqrt[7]{5}$$

Decimal approximation:

1.659363441249059998468894975666886829865439502419041316767...

1.65936344… is very near to the 14th root of the following Ramanujan's class invariant $Q = \left(G_{505}/G_{101/5}\right)^3$ = 1164,2696 i.e. 1,65578...

And:

(((((16+1+8(-3)+64(17)+16(187)+(1+16)-4(9)(9)+2(5)*(((4(33)+3(5)+160)))+1936-4(3)*(((12(31)+2(41)+(9)+168))))))))^((4Pi)/185)

Input:

$$(16+1+8\times(-3)+64\times17+16\times187+(1+16)-4\times9\times9+2\times5\,(4\times33+3\times5+160)+1936-4\times3\,(12\times31+2\times41+9+168))^{(4\pi)/185}$$

Exact result:

$$2^{(16\pi)/185}\times3^{(4\pi)/185}\times5^{(8\pi)/185}$$

Decimal approximation:

1.618666856192106955432768780240541038186971636705943653845...

1.618666856… This result is a very good approximation to the value of the golden ratio 1,618033988749...

Alternative representations:

$$(16+1+8(-3)+64\times17+16\times187+(1+16)-4\times9\times9+2\times5\,(4\times33+3\times5+160)+1936-4\times3\,(12\times31+2\times41+9+168))^{(4\pi)/185}=1200^{(720\,^{\circ})/185}$$

$$(16+1+8(-3)+64\times17+16\times187+(1+16)-4\times9\times9+2\times5\,(4\times33+3\times5+160)+1936-4\times3\,(12\times31+2\times41+9+168))^{(4\pi)/185}=1200^{-4/185\,i\log(-1)}$$

$$(16+1+8(-3)+64\times17+16\times187+(1+16)-4\times9\times9+2\times5\,(4\times33+3\times5+160)+1936-4\times3\,(12\times31+2\times41+9+168))^{(4\pi)/185}=1200^{4/185\cos^{-1}(-1)}$$

$\log(x)$ is the natural logarithm

i is the imaginary unit

$\cos^{-1}(x)$ is the inverse cosine function

Series representations:

$$(16+1+8(-3)+64\times17+16\times187+(1+16)-4\times9\times9+2\times5\,(4\times33+3\times5+160)+1936-4\times3\,(12\times31+2\times41+9+168))^{(4\pi)/185}=2^{64/185\sum_{k=0}^{\infty}(-1)^k/(1+2k)}\times3^{16/185\sum_{k=0}^{\infty}(-1)^k/(1+2k)}\times5^{32/185\sum_{k=0}^{\infty}(-1)^k/(1+2k)}$$

$$(16 + 1 + 8(-3) + 64 \times 17 + 16 \times 187 + (1 + 16) - 4 \times 9 \times 9 + 2 \times 5(4 \times 33 + 3 \times 5 + 160) + 1936 - 4 \times 3(12 \times 31 + 2 \times 41 + 9 + 168))^{(4\pi)/185} = 2^{16/185 \sum_{k=0}^{\infty} -\left(4(-1)^k 1195^{-1-2k}\left(5^{1+2k} - 4 \times 239^{1+2k}\right)\right)/(1+2k)} \times 3^{4/185 \sum_{k=0}^{\infty} -\left(4(-1)^k 1195^{-1-2k}\left(5^{1+2k} - 4 \times 239^{1+2k}\right)\right)/(1+2k)} \times 5^{8/185 \sum_{k=0}^{\infty} -\left(4(-1)^k 1195^{-1-2k}\left(5^{1+2k} - 4 \times 239^{1+2k}\right)\right)/(1+2k)}$$

$$(16 + 1 + 8(-3) + 64 \times 17 + 16 \times 187 + (1 + 16) - 4 \times 9 \times 9 + 2 \times 5(4 \times 33 + 3 \times 5 + 160) + 1936 - 4 \times 3(12 \times 31 + 2 \times 41 + 9 + 168))^{(4\pi)/185} = 2^{16/185 \sum_{k=0}^{\infty} (-1/4)^k (1/(1+2k) + 2/(1+4k) + 1/(3+4k))} \times 3^{4/185 \sum_{k=0}^{\infty} (-1/4)^k (1/(1+2k) + 2/(1+4k) + 1/(3+4k))} \times 5^{8/185 \sum_{k=0}^{\infty} (-1/4)^k (1/(1+2k) + 2/(1+4k) + 1/(3+4k))}$$

Integral representations:

$$(16 + 1 + 8(-3) + 64 \times 17 + 16 \times 187 + (1 + 16) - 4 \times 9 \times 9 + 2 \times 5(4 \times 33 + 3 \times 5 + 160) + 1936 - 4 \times 3(12 \times 31 + 2 \times 41 + 9 + 168))^{(4\pi)/185} = 2^{64/185 \int_0^1 \sqrt{1-t^2}\, dt} \times 3^{16/185 \int_0^1 \sqrt{1-t^2}\, dt} \times 5^{32/185 \int_0^1 \sqrt{1-t^2}\, dt}$$

$$(16 + 1 + 8(-3) + 64 \times 17 + 16 \times 187 + (1 + 16) - 4 \times 9 \times 9 + 2 \times 5(4 \times 33 + 3 \times 5 + 160) + 1936 - 4 \times 3(12 \times 31 + 2 \times 41 + 9 + 168))^{(4\pi)/185} = 2^{32/185 \int_0^\infty 1/(1+t^2)\, dt} \times 3^{8/185 \int_0^\infty 1/(1+t^2)\, dt} \times 5^{16/185 \int_0^\infty 1/(1+t^2)\, dt}$$

$$(16 + 1 + 8(-3) + 64 \times 17 + 16 \times 187 + (1 + 16) - 4 \times 9 \times 9 + 2 \times 5(4 \times 33 + 3 \times 5 + 160) + 1936 - 4 \times 3(12 \times 31 + 2 \times 41 + 9 + 168))^{(4\pi)/185} = 2^{32/185 \int_0^1 1/\sqrt{1-t^2}\, dt} \times 3^{8/185 \int_0^1 1/\sqrt{1-t^2}\, dt} \times 5^{16/185 \int_0^1 1/\sqrt{1-t^2}\, dt}$$

We have also:

$$\text{If } P = \frac{\varphi(q)}{\varphi(q^2)}\frac{\varphi(q^8)}{\varphi(q^{16})} \quad \text{and} \quad Q = \frac{\varphi(q)}{\varphi(q^2)}\frac{\varphi(q^{16})}{\varphi(q^8)}, \text{ then}$$

$$16Q^4 + \frac{1}{Q^4} + 8\left(8Q^3 - \frac{11}{Q^3}\right) + 64\left(4Q^2 + \frac{13}{Q^2}\right) + 16\left(74Q + \frac{113}{Q}\right)$$
$$+ \left(P^4 + \frac{16}{P^4}\right) - 4\left(P^3 + \frac{8}{P^3}\right)\left[\left(2Q + \frac{1}{Q}\right) + 6\right] + 2\left(P^2 + \frac{4}{P^2}\right)$$
$$\times\left[4\left(14Q + \frac{19}{Q}\right) + 3\left(4Q^2 + \frac{1}{Q^2}\right) + 160\right] + 1936 - 4\left(P + \frac{2}{P}\right) \tag{44}$$
$$\times\left[12\left(10Q + \frac{21}{Q}\right) + 2\left(20Q^2 + \frac{21}{Q^2}\right) + \left(8Q^3 + \frac{1}{Q^3}\right) + 168\right] = 0.$$

For P = 2 and Q = 1/2, we obtain:

16*1/16+16+8(8*1/8-88)+64(4*1/4+13*4)+16(74*1/2+226)+(16+16/16)-4(8+8/8)[(2*1/2+2)]+2(4+4/4)*[(((4(14*1/2+38)+3(4*1/4+4)+160)))]+1936-4(2+2/2)*[(((12(10*1/2+42)+2(20*1/4+84)+(8*1/8+8)+168)))]

Input:

$$16\times\frac{1}{16}+16+8\left(8\times\frac{1}{8}-88\right)+64\left(4\times\frac{1}{4}+13\times4\right)+16\left(74\times\frac{1}{2}+226\right)+\left(16+\frac{16}{16}\right)-4\left(8+\frac{8}{8}\right)\left(2\times\frac{1}{2}+2\right)+2\left(4+\frac{4}{4}\right)\left(4\left(14\times\frac{1}{2}+38\right)+3\left(4\times\frac{1}{4}+4\right)+160\right)+1936-4\left(2+\frac{2}{2}\right)\left(12\left(10\times\frac{1}{2}+42\right)+2\left(20\times\frac{1}{4}+84\right)+\left(8\times\frac{1}{8}+8\right)+168\right)$$

Exact result:

1288

1288

We note that:

-55 + 16*1/16+16+8(8*1/8-88)+64(4*1/4+13*4)+16(74*1/2+226)+(16+16/16)-4(8+8/8)[(2*1/2+2)]+2(4+4/4)*[(((4(14*1/2+38)+3(4*1/4+4)+160)))]+1936-4(2+2/2)*[(((12(10*1/2+42)+2(20*1/4+84)+(8*1/8+8)+168)))]

Input:

$$-55+16\times\frac{1}{16}+16+8\left(8\times\frac{1}{8}-88\right)+64\left(4\times\frac{1}{4}+13\times4\right)+16\left(74\times\frac{1}{2}+226\right)+$$
$$\left(16+\frac{16}{16}\right)-4\left(8+\frac{8}{8}\right)\left(2\times\frac{1}{2}+2\right)+2\left(4+\frac{4}{4}\right)\left(4\left(14\times\frac{1}{2}+38\right)+3\left(4\times\frac{1}{4}+4\right)+160\right)+$$
$$1936-4\left(2+\frac{2}{2}\right)\left(12\left(10\times\frac{1}{2}+42\right)+2\left(20\times\frac{1}{4}+84\right)+\left(8\times\frac{1}{8}+8\right)+168\right)$$

Exact result:

1233

1233 result practically equal to the rest mass of Delta baryon 1232

We have that:

If $P=\frac{\psi(q)\psi(q^{17})}{q^{9/2}\psi(q^3)\psi(q^{51})}$ and $Q=\frac{\psi(q)\psi(q^{51})}{q^{-4}\psi(q^3)\psi(q^{17})}$, then

$$Q^9-\frac{1}{Q^9}+34\left(Q^8+\frac{1}{Q^8}\right)+272\left(Q^7-\frac{1}{Q^7}\right)+238\left(Q^6+\frac{1}{Q^6}\right)$$
$$-595\left(Q^5-\frac{1}{Q^5}\right)-510\left(Q^4+\frac{1}{Q^4}\right)+16303\left(Q^3-\frac{1}{Q^3}\right)$$
$$-5202\left(Q^2+\frac{1}{Q^2}\right)-26911\left(Q-\frac{1}{Q}\right)+\left(P^8+\frac{3^8}{P^8}\right)+20230=$$
$$17\left\{\left(P^2+\frac{3^2}{P^2}\right)\left[7\left(Q^6+\frac{1}{Q^6}\right)+28\left(Q^5-\frac{1}{Q^5}\right)+34\left(Q^4+\frac{1}{Q^4}\right)\right.\right. \quad (56)$$
$$\left.-168\left(Q^3-\frac{1}{Q^3}\right)+160\left(Q^2+\frac{1}{Q^2}\right)+378\left(Q-\frac{1}{Q}\right)-210\right]$$
$$-\left(P^4+\frac{3^4}{P^4}\right)\left[5\left(Q^4+\frac{1}{Q^4}\right)+21\left(Q^3-\frac{1}{Q^3}\right)-35\left(Q^2+\frac{1}{Q^2}\right)\right.$$
$$\left.\left.-14\left(Q-\frac{1}{Q}\right)-30\right]-\left(P^6+\frac{3^6}{P^6}\right)\left[\left(Q^2+\frac{1}{Q^2}\right)-2\left(Q-\frac{1}{Q}\right)-2\right]\right\}.$$

From:

$$Q^9-\frac{1}{Q^9}+34\left(Q^8+\frac{1}{Q^8}\right)+272\left(Q^7-\frac{1}{Q^7}\right)+238\left(Q^6+\frac{1}{Q^6}\right)$$
$$-595\left(Q^5-\frac{1}{Q^5}\right)-510\left(Q^4+\frac{1}{Q^4}\right)+16303\left(Q^3-\frac{1}{Q^3}\right)$$
$$-5202\left(Q^2+\frac{1}{Q^2}\right)-26911\left(Q-\frac{1}{Q}\right)+\left(P^8+\frac{3^8}{P^8}\right)+20230-$$

We obtain, for P and Q = 1:

15912

ln 15912

Input:

$\log(15\,912)$

$\log(x)$ is the natural logarithm

Decimal approximation:

9.674828820533808127345208897658026253914952476072216569547...

9.67482882…. result very near to the mean of the following black hole entropies:

9,934 + 9,3664 = 19,3004 / 2 = 9.6502

Property:

$\log(15\,912)$ is a transcendental number

Alternate forms:

$3\log(2) + 2\log(3) + \log(221)$

$3\log(2) + 2\log(3) + \log(13) + \log(17)$

Alternative representations:

$\log(15\,912) = \log_e(15\,912)$

$\log(15\,912) = \log(a)\log_a(15\,912)$

$\log(15\,912) = -\text{Li}_1(-15\,911)$

$\log_b(x)$ is the base- b logarithm

$\text{Li}_n(x)$ is the polylogarithm function

Integral representations:

$$\log(15\,912) = \int_1^{15912} \frac{1}{t}\,dt$$

$$\log(15912) = -\frac{i}{2\pi} \int_{-i\infty+\gamma}^{i\infty+\gamma} \frac{15911^{-s}\,\Gamma(-s)^2\,\Gamma(1+s)}{\Gamma(1-s)}\,ds \quad \text{for } -1 < \gamma < 0$$

$\Gamma(x)$ is the gamma function

1/6 (ln 15912)

Input:

$$\frac{1}{6}\log(15912)$$

$\log(x)$ is the natural logarithm

Exact result:

$$\frac{\log(15912)}{6}$$

Decimal approximation:

1.612471470088968021224201482943004375652492079345369428257...

1.61247147… result that is a golden number

Property:

$\frac{\log(15912)}{6}$ is a transcendental number

Alternate forms:

$$\frac{1}{6}(3\log(2) + 2\log(3) + \log(13) + \log(17))$$

$$\frac{\log(2)}{2} + \frac{\log(3)}{3} + \frac{\log(221)}{6}$$

$$\frac{\log(2)}{2} + \frac{\log(3)}{3} + \frac{\log(13)}{6} + \frac{\log(17)}{6}$$

Alternative representations:

$$\frac{\log(15912)}{6} = \frac{\log_e(15912)}{6}$$

$$\frac{\log(15912)}{6} = \frac{1}{6}\log(a)\log_a(15912)$$

$$\frac{\log(15912)}{6} = -\frac{\mathrm{Li}_1(-15911)}{6}$$

$\log_b(x)$ is the base- b logarithm

$\mathrm{Li}_n(x)$ is the polylogarithm function

Series representations:

$$\frac{\log(15912)}{6} = \frac{\log(15911)}{6} - \frac{1}{6}\sum_{k=1}^{\infty}\frac{\left(-\frac{1}{15911}\right)^k}{k}$$

$$\frac{\log(15912)}{6} = \frac{1}{3} i \pi \left\lfloor \frac{\arg(15912-x)}{2\pi} \right\rfloor + \frac{\log(x)}{6} - \frac{1}{6}\sum_{k=1}^{\infty}\frac{(-1)^k (15912-x)^k x^{-k}}{k} \quad \text{for } x < 0$$

$$\frac{\log(15912)}{6} = \frac{1}{6}\left\lfloor \frac{\arg(15912-z_0)}{2\pi} \right\rfloor \log\left(\frac{1}{z_0}\right) + \frac{\log(z_0)}{6} + \frac{1}{6}\left\lfloor \frac{\arg(15912-z_0)}{2\pi} \right\rfloor \log(z_0) - \frac{1}{6}\sum_{k=1}^{\infty}\frac{(-1)^k (15912-z_0)^k z_0^{-k}}{k}$$

$\arg(z)$ is the complex argument

$\lfloor x \rfloor$ is the floor function

Integral representations:

$$\frac{\log(15912)}{6} = \frac{1}{6}\int_1^{15912}\frac{1}{t}\,dt$$

$$\frac{\log(15912)}{6} = -\frac{i}{12\pi}\int_{-i\infty+\gamma}^{i\infty+\gamma}\frac{15911^{-s}\,\Gamma(-s)^2\,\Gamma(1+s)}{\Gamma(1-s)}\,ds \quad \text{for } -1 < \gamma < 0$$

$\Gamma(x)$ is the gamma function

We have that:

$$\text{If } X = \frac{\varphi(q)\varphi(q^9)}{\varphi(q^4)\varphi(q^{36})} \text{ and } Y = \frac{\varphi(q)\varphi(q^{36})}{\varphi(q^4)\varphi(q^9)}, \text{ then}$$

$$Y^6 + \frac{1}{Y^6} - 908\left[Y^5 + \frac{1}{Y^5}\right] - 83582\left[Y^4 + \frac{1}{Y^4}\right] - 1369692\left[Y^3 + \frac{1}{Y^3}\right]$$
$$-3\left[Y^2 + \frac{1}{Y^2}\right]\left\{2657883 + 96832\left[X^2 + \frac{16}{X^2}\right]\right\} - 24\left[Y + \frac{1}{Y}\right]$$
$$\times\left\{892353 + 289628\left[X + \frac{4}{X}\right]\right\} + 17323008\left[\sqrt{Y} + \frac{1}{\sqrt{Y}}\right]\left[\sqrt{X} + \frac{2}{\sqrt{X}}\right]$$
$$+1831776\left[\sqrt{Y^3} + \frac{1}{\sqrt{Y^3}}\right]\left[\sqrt{X^3} + \frac{8}{\sqrt{X^3}}\right] + 21504\left[\sqrt{Y^5} + \frac{1}{\sqrt{Y^5}}\right]$$
$$\times\left[\sqrt{X^5} + \frac{32}{\sqrt{X^5}}\right] - 29469924 = 128\left\{2\left[X^4 + \frac{256}{X^4}\right]\right.$$
$$\left.+420\left[X^3 + \frac{64}{X^3}\right] + 9987\left[X^2 + \frac{16}{X^2}\right] + 75426\left[X + \frac{4}{X}\right]\right\}. \quad (63)$$

For X = 1, we have that:

128[((((2((1+256)+420(1+64)+9987(1+16)+75426(1+4))))]

Input:

128 (2 ((1 + 256) + 420 (1 + 64) + 9987 (1 + 16) + 75 426 (1 + 4)))

Result:

147 063 296

147063296

Scientific notation:

1.47063296×10^8

ln (((((128[((((2((1+256)+420(1+64)+9987(1+16)+75426(1+4))))])))))

Input:

log(128 (2 ((1 + 256) + 420 (1 + 64) + 9987 (1 + 16) + 75 426 (1 + 4))))

log(x) is the natural logarithm

Exact result:

log(147 063 296)

Decimal approximation:

18.806373637101890315617605895279059356775545657587494123 75...

18.80637... result very near to the black hole entropy 18.7328

Property:

log(147063296) is a transcendental number

Alternate form:

$9\log(2)+\log(287233)$

Alternative representations:

$$\log(128\times 2((1+256)+420(1+64)+9987(1+16)+75426(1+4)))=\log_e(147063296)$$

$$\log(128\times 2((1+256)+420(1+64)+9987(1+16)+75426(1+4)))=\log(a)\log_a(147063296)$$

$$\log(128\times 2((1+256)+420(1+64)+9987(1+16)+75426(1+4)))=-\text{Li}_1(-147063295)$$

$\log_b(x)$ is the base- b logarithm

$\text{Li}_n(x)$ is the polylogarithm function

Integral representations:

$$\log(128\times 2((1+256)+420(1+64)+9987(1+16)+75426(1+4)))=\int_1^{147063296}\frac{1}{t}\,dt$$

$$\log(128\times 2((1+256)+420(1+64)+9987(1+16)+75426(1+4)))=-\frac{i}{2\pi}\int_{-i\infty+\gamma}^{i\infty+\gamma}\frac{147063295^{-s}\,\Gamma(-s)^2\,\Gamma(1+s)}{\Gamma(1-s)}\,ds \quad \text{for } -1<\gamma<0$$

$\Gamma(x)$ is the gamma function

128[((((2((16+256/16)+420(8+64/8)+9987(4+16/4)+75426(2+4/2))))]

Input:

$$128\left(2\left(\left(16+\frac{256}{16}\right)+420\left(8+\frac{64}{8}\right)+9987\left(4+\frac{16}{4}\right)+75\,426\left(2+\frac{4}{2}\right)\right)\right)$$

Exact result:

99418112

99418112

Scientific notation:

9.9418112×10^{7}

For X = 2, we obtain:

ln(((((128[(((((2((16+256/16)+420(8+64/8)+9987(4+16/4)+75426(2+4/2))))]))))))

Input:

$$\log\left(128\left(2\left(\left(16+\frac{256}{16}\right)+420\left(8+\frac{64}{8}\right)+9987\left(4+\frac{16}{4}\right)+75\,426\left(2+\frac{4}{2}\right)\right)\right)\right)$$

$\log(x)$ is the natural logarithm

Exact result:

$\log(99\,418\,112)$

Decimal approximation:

18.414844868307657198910572987399679841484490206331021863l9...

18.41484... result very near to the black hole entropy 18.2773

Property:

$\log(99\,418\,112)$ is a transcendental number

Alternate forms:

$16\log(2)+\log(1517)$

$16\log(2)+\log(37)+\log(41)$

Alternative representations:

$$\log\left(128\times2\left(\left(16+\frac{256}{16}\right)+420\left(8+\frac{64}{8}\right)+9987\left(4+\frac{16}{4}\right)+75\,426\left(2+\frac{4}{2}\right)\right)\right)=$$

$$\log_e\left(256\left(301\,720+9987\left(4+\frac{16}{4}\right)+420\left(8+\frac{64}{8}\right)+\frac{256}{16}\right)\right)$$

$$\log\left(128\times 2\left(\left(16+\frac{256}{16}\right)+420\left(8+\frac{64}{8}\right)+9987\left(4+\frac{16}{4}\right)+75\,426\left(2+\frac{4}{2}\right)\right)\right) = \log(a)\log_a\left(256\left(301\,720+9987\left(4+\frac{16}{4}\right)+420\left(8+\frac{64}{8}\right)+\frac{256}{16}\right)\right)$$

$$\log\left(128\times 2\left(\left(16+\frac{256}{16}\right)+420\left(8+\frac{64}{8}\right)+9987\left(4+\frac{16}{4}\right)+75\,426\left(2+\frac{4}{2}\right)\right)\right) = -\text{Li}_1\left(1-256\left(301\,720+9987\left(4+\frac{16}{4}\right)+420\left(8+\frac{64}{8}\right)+\frac{256}{16}\right)\right)$$

$\log_b(x)$ is the base- b logarithm

$\text{Li}_n(x)$ is the polylogarithm function

Integral representations:

$$\log\left(128\times 2\left(\left(16+\frac{256}{16}\right)+420\left(8+\frac{64}{8}\right)+9987\left(4+\frac{16}{4}\right)+75\,426\left(2+\frac{4}{2}\right)\right)\right) = \int_1^{99\,418\,112}\frac{1}{t}\,dt$$

$$\log\left(128\times 2\left(\left(16+\frac{256}{16}\right)+420\left(8+\frac{64}{8}\right)+9987\left(4+\frac{16}{4}\right)+75\,426\left(2+\frac{4}{2}\right)\right)\right) = -\frac{i}{2\pi}\int_{-i\infty+\gamma}^{i\infty+\gamma}\frac{99\,418\,111^{-s}\,\Gamma(-s)^2\,\Gamma(1+s)}{\Gamma(1-s)}\,ds \quad \text{for } -1<\gamma<0$$

$\Gamma(x)$ is the gamma function

Now, we have that:

If $X = \dfrac{\varphi(q)\varphi(q^2)}{\varphi(q^4)\varphi(q^8)}$ *and* $Y = \dfrac{\varphi(q)\varphi(q^8)}{\varphi(q^4)\varphi(q^2)}$, *then*

$$X^2-2X^3Y+X^4Y^2-4XY+4Y^2-4XY^3+4X^2Y^2-2X^3Y^3+2X^2Y^4=0. \quad (58)$$

For X = Y = 1, from the (58), we obtain:

1 – 2 + 1 – 4 + 4 – 4 + 4 – 2 + 2 = 0 (supersymmetric condition ⟶ 0)

For X = Y = 2, we obtain:

2^2 – 2*2^3*2 + 2^4*2^2 – 4*2*2 + 4*2^2 – 4*2*2^3 + 4*2^2*2^2 – 2*2^3*2^3 + 2*2^2*2^4

Input:

$$2^2 - 2\times 2^3\times 2 + 2^4\times 2^2 - 4\times 2\times 2 + 4\times 2^2 - 4\times 2\times 2^3 + 4\times 2^2\times 2^2 - 2\times 2^3\times 2^3 + 2\times 2^2\times 2^4$$

Result:

36

36

And:

48*(2^2 – 2*2^3*2 + 2^4*2^2 – 4*2*2 + 4*2^2 – 4*2*2^3 + 4*2^2*2^2 – 2*2^3*2^3 + 2*2^2*2^4)

Input:

$$48\left(2^2 - 2\times 2^3\times 2 + 2^4\times 2^2 - 4\times 2\times 2 + 4\times 2^2 - 4\times 2\times 2^3 + 4\times 2^2\times 2^2 - 2\times 2^3\times 2^3 + 2\times 2^2\times 2^4\right)$$

Result:

1728

1728

This result is very near to the mass of candidate glueball $f_0(1710)$ meson. Furthermore, 1728 occurs in the algebraic formula for the j-invariant of an elliptic curve. As a consequence, it is sometimes called a Zagier as a pun on the Gross–Zagier theorem. The number 1728 is one less than the Hardy–Ramanujan number 1729

[48*(2^2 – 2*2^3*2 + 2^4*2^2 – 4*2*2 + 4*2^2 – 4*2*2^3 + 4*2^2*2^2 – 2*2^3*2^3 + 2*2^2*2^4)]^1/15

Input:

$$(48\,(2^2 - 2\times 2^3\times 2 + 2^4\times 2^2 - 4\times 2\times 2 + 4\times 2^2 - 4\times 2\times 2^3 + 4\times 2^2\times 2^2 - 2\times 2^3\times 2^3 + 2\times 2^2\times 2^4))\ \hat{}\ (1/15)$$

Result:

$2^{2/5}\sqrt[5]{3}$

Decimal approximation:

1.643751829517225762308497936230979517383492589945475200411...

$1.6437518... \approx \zeta(2) = \frac{\pi^2}{6} = 1.644934...$

55+[48*(2^2 – 2*2^3*2 + 2^4*2^2 – 4*2*2 + 4*2^2 – 4*2*2^3 + 4*2^2*2^2 – 2*2^3*2^3 + 2*2^2*2^4)]

Input:

$55 + 48\left(2^2 - 2\times 2^3\times 2 + 2^4\times 2^2 - 4\times 2\times 2 + 4\times 2^2 - 4\times 2\times 2^3 + 4\times 2^2\times 2^2 - 2\times 2^3\times 2^3 + 2\times 2^2\times 2^4\right)$

Result:

1783

1783 result in the range of the hypothetical mass of Gluino (gluino = 1785.16 GeV).

We note that:

ln^2 (2^2 – 2*2^3*2 + 2^4*2^2 – 4*2*2 + 4*2^2 – 4*2*2^3 + 4*2^2*2^2 – 2*2^3*2^3 + 2*2^2*2^4)

Input:

$\log^2\left(2^2 - 2\times 2^3\times 2 + 2^4\times 2^2 - 4\times 2\times 2 + 4\times 2^2 - 4\times 2\times 2^3 + 4\times 2^2\times 2^2 - 2\times 2^3\times 2^3 + 2\times 2^2\times 2^4\right)$

$\log(x)$ is the natural logarithm

Exact result:

$\log^2(36)$

Decimal approximation:

12.84160798227360550147650833539615462653447817971397330954...

12.8416079… result near to the value of black hole entropy 12,5664

Property:

$\log^2(36)$ is a transcendental number

-

Alternate forms:

$4\log^2(6)$

-

$(2\log(2)+2\log(3))^2$

Alternative representations:

$$\log^2(2^2-2\times 2^3\times 2+2^4\times 2^2-4\times 2\times 2+4\times 2^2-4\times 2\times 2^3+4\times 2^2\times 2^2-2\times 2^3\times 2^3+2\times 2^2\times 2^4)=\log_e^2(-156+12\times 2^4)$$

-

$$\log^2(2^2-2\times 2^3\times 2+2^4\times 2^2-4\times 2\times 2+4\times 2^2-4\times 2\times 2^3+4\times 2^2\times 2^2-2\times 2^3\times 2^3+2\times 2^2\times 2^4)=(\log(a)\log_a(-156+12\times 2^4))^2$$

-

$$\log^2(2^2-2\times 2^3\times 2+2^4\times 2^2-4\times 2\times 2+4\times 2^2-4\times 2\times 2^3+4\times 2^2\times 2^2-2\times 2^3\times 2^3+2\times 2^2\times 2^4)=(-\text{Li}_1(157-12\times 2^4))^2$$

$\log_b(x)$ is the base- b logarithm

$\text{Li}_n(x)$ is the polylogarithm function

Series representations:

$$\log^2(2^2-2\times 2^3\times 2+2^4\times 2^2-4\times 2\times 2+4\times 2^2-4\times 2\times 2^3+4\times 2^2\times 2^2-2\times 2^3\times 2^3+2\times 2^2\times 2^4)=\left(\log(35)-\sum_{k=1}^{\infty}\frac{\left(-\frac{1}{35}\right)^k}{k}\right)^2$$

-

$$\log^2(2^2-2\times 2^3\times 2+2^4\times 2^2-4\times 2\times 2+4\times 2^2-4\times 2\times 2^3+4\times 2^2\times 2^2-2\times 2^3\times 2^3+2\times 2^2\times 2^4)=\left(2 i\pi\left\lfloor\frac{\arg(36-x)}{2\pi}\right\rfloor+\log(x)-\sum_{k=1}^{\infty}\frac{(-1)^k(36-x)^k x^{-k}}{k}\right)^2 \quad \text{for } x<0$$

-

$$\log^2(2^2 - 2\times 2^3 \times 2 + 2^4 \times 2^2 - 4\times 2\times 2 + 4\times 2^2 - 4\times 2\times 2^3 + 4\times 2^2 \times 2^2 - 2\times 2^3 \times 2^3 + 2\times 2^2 \times 2^4) = \left(\log(z_0) + \left\lfloor \frac{\arg(36 - z_0)}{2\pi} \right\rfloor \left(\log\left(\frac{1}{z_0}\right) + \log(z_0)\right) - \sum_{k=1}^{\infty} \frac{(-1)^k (36 - z_0)^k z_0^{-k}}{k}\right)^2$$

$\arg(z)$ is the complex argument

$\lfloor x \rfloor$ is the floor function

Integral representations:

$$\log^2(2^2 - 2\times 2^3 \times 2 + 2^4 \times 2^2 - 4\times 2\times 2 + 4\times 2^2 - 4\times 2\times 2^3 + 4\times 2^2 \times 2^2 - 2\times 2^3 \times 2^3 + 2\times 2^2 \times 2^4) = \left(\int_1^{36} \frac{1}{t}\, dt\right)^2$$

•

$$\log^2(2^2 - 2\times 2^3 \times 2 + 2^4 \times 2^2 - 4\times 2\times 2 + 4\times 2^2 - 4\times 2\times 2^3 + 4\times 2^2 \times 2^2 - 2\times 2^3 \times 2^3 + 2\times 2^2 \times 2^4) = -\frac{\left(\int_{-i\infty+\gamma}^{i\infty+\gamma} \frac{35^{-s}\,\Gamma(-s)^2\,\Gamma(1+s)}{\Gamma(1-s)}\, ds\right)^2}{4\pi^2} \quad \text{for } -1 < \gamma < 0$$

$\Gamma(x)$ is the gamma function

Now, for X = Y = 1, from (59), we obtain:

If $X = \dfrac{\varphi(q)\varphi(q^3)}{\varphi(q^4)\varphi(q^{12})}$ *and* $Y = \dfrac{\varphi(q)\varphi(q^{12})}{\varphi(q^4)\varphi(q^3)}$, *then*

$$Y^2 + \frac{1}{Y^2} - 12\left(Y + \frac{1}{Y}\right) + 12\left(\sqrt{X} + \frac{2}{\sqrt{X}}\right)\left(\sqrt{Y} + \frac{1}{\sqrt{Y}}\right) = 4\left(X + \frac{4}{X}\right) + 30. \quad (59)$$

1 + 1 – 12 (1+1) + 12 (1+2)(1+1) and

4(1+4)+30

We obtain:

1 + 1 – 12 (1+1) + 12 (1+2)(1+1)

Input:

$1 + 1 - 12 (1 + 1) + 12 (1 + 2) (1 + 1)$

Result:

50

50

And:

4 (1+4) + 30

Input:

$4 (1 + 4) + 30$

Result:

50

50

Note that:

[1 + 1 – 12 (1+1) + 12 (1+2)(1+1)]^1/8

Input:

$\sqrt[8]{1 + 1 - 12 (1 + 1) + 12 (1 + 2) (1 + 1)}$

Result:

$\sqrt[8]{2} \sqrt[4]{5}$

Decimal approximation:

1.630689408953309633325441386540290377805497589955618125005...

1.6306894… result that is a golden number

ln^2 [1 + 1 – 12 (1+1) + 12 (1+2)(1+1)]

Input:

$\log^2(1 + 1 - 12 (1 + 1) + 12 (1 + 2) (1 + 1))$

$\log(x)$ is the natural logarithm

Exact result:

$\log^2(50)$

Decimal approximation:

15.30392399499906448681657226084668020224925553986996573637...

15.30392399… result near to the black hole entropy 15.6730

Property:

$\log^2(50)$ is a transcendental number

-

Alternate form:

$(\log(2) + 2\log(5))^2$

Alternative representations:

$\log^2(1+1-12(1+1)+12(1+2)(1+1)) = \log_e^2(50)$

-

$\log^2(1+1-12(1+1)+12(1+2)(1+1)) = (\log(a)\log_a(50))^2$

-

$\log^2(1+1-12(1+1)+12(1+2)(1+1)) = (-\mathrm{Li}_1(-49))^2$

$\log_b(x)$ is the base- b logarithm

$\mathrm{Li}_n(x)$ is the polylogarithm function

Series representations:

$$\log^2(1+1-12(1+1)+12(1+2)(1+1)) = \left(\log(49) - \sum_{k=1}^{\infty} \frac{\left(-\frac{1}{49}\right)^k}{k}\right)^2$$

-

$$\log^2(1+1-12(1+1)+12(1+2)(1+1)) = \left(2 i \pi \left\lfloor \frac{\arg(50-x)}{2\pi} \right\rfloor + \log(x) - \sum_{k=1}^{\infty} \frac{(-1)^k (50-x)^k x^{-k}}{k}\right)^2 \quad \text{for } x < 0$$

-

$$\log^2(1+1-12(1+1)+12(1+2)(1+1)) = \left(\log(z_0) + \left\lfloor \frac{\arg(50-z_0)}{2\pi} \right\rfloor \left(\log\left(\frac{1}{z_0}\right) + \log(z_0)\right) - \sum_{k=1}^{\infty} \frac{(-1)^k (50-z_0)^k z_0^{-k}}{k}\right)^2$$

$\arg(z)$ is the complex argument

$\lfloor x \rfloor$ is the floor function

Integral representations:

$$\log^2(1+1-12(1+1)+12(1+2)(1+1)) = \left(\int_1^{50} \frac{1}{t}\, dt\right)^2$$

- $$\log^2(1+1-12(1+1)+12(1+2)(1+1)) = -\frac{\left(\int_{-i\infty+\gamma}^{i\infty+\gamma} \frac{49^{-s}\,\Gamma(-s)^2\,\Gamma(1+s)}{\Gamma(1-s)}\, ds\right)^2}{4\pi^2} \quad \text{for } -1<\gamma<0$$

$\Gamma(x)$ is the gamma function

From:

If $X = \dfrac{\varphi(q)\varphi(q^4)}{\varphi(q^4)\varphi(q^{16})}$ *and* $Y = \dfrac{\varphi(q)\varphi(q^{16})}{\varphi(q^4)\varphi(q^4)}$, *then*

$$X^4Y^2 + 6X^3Y + X^2 + 16Y^2 + 24XY - 4\sqrt{XY}\left(X^3Y + X^2 + 2X + 8Y\right) = 0. \tag{60}$$

For X = Y = 1, we obtain:

1 + 6 + 1 + 16 + 24 – 4(1+1+2+8)

Input:

$1+6+1+16+24-4(1+1+2+8)$

Result:

0

0 (supersymmetric condition ⟶ 0)

For X = Y = 2, we obtain:

2^4*2^2+6*2^3*2+2^2+16*2^2+24*2*2-4*(sqrt(4))(2^3*2+2^2+2*2+8*2)

Input:

$2^4\times 2^2+6\times 2^3\times 2+2^2+16\times 2^2+24\times 2\times 2-4\sqrt{4}\,(2^3\times 2+2^2+2\times 2+8\times 2)$

Result:

4

4

9*ln(((2^4*2^2+6*2^3*2+2^2+16*2^2+24*2*2-4*(sqrt(4))(2^3*2+2^2+2*2+8*2)))

Input:

$$9 \log\left(2^4 \times 2^2 + 6 \times 2^3 \times 2 + 2^2 + 16 \times 2^2 + 24 \times 2 \times 2 - 4 \sqrt{4}\ (2^3 \times 2 + 2^2 + 2 \times 2 + 8 \times 2)\right)$$

log(x) is the natural logarithm

Exact result:

$9 \log(4)$

Decimal approximation:

12.476649250079015569510178186247178225359002418484594574 17...

12.47664… result very near to the value of black hole entropy 12,5664

Property:

$9 \log(4)$ is a transcendental number

-

Alternate form:

$18 \log(2)$

Alternative representations:

- More

$$9 \log\left(2^4 \times 2^2 + 6 \times 2^3 \times 2 + 2^2 + 16 \times 2^2 + 24 \times 2 \times 2 - 4 \sqrt{4}\ (2^3 \times 2 + 2^2 + 2 \times 2 + 8 \times 2)\right) = 9 \log_e\left(260 + 4 \times 2^4 - 160 \sqrt{4}\right)$$

-

$$9 \log\left(2^4 \times 2^2 + 6 \times 2^3 \times 2 + 2^2 + 16 \times 2^2 + 24 \times 2 \times 2 - 4 \sqrt{4}\ (2^3 \times 2 + 2^2 + 2 \times 2 + 8 \times 2)\right) = 9 \log(a) \log_a\left(260 + 4 \times 2^4 - 160 \sqrt{4}\right)$$

-

$$9 \log\left(2^4 \times 2^2 + 6 \times 2^3 \times 2 + 2^2 + 16 \times 2^2 + 24 \times 2 \times 2 - 4 \sqrt{4}\ (2^3 \times 2 + 2^2 + 2 \times 2 + 8 \times 2)\right) = -9 \operatorname{Li}_1\left(-259 - 4 \times 2^4 + 160 \sqrt{4}\right)$$

$\log_b(x)$ is the base- b logarithm

$\text{Li}_n(x)$ is the polylogarithm function

Series representations:

$$9\log\left(2^4\times 2^2+6\times 2^3\times 2+2^2+16\times 2^2+24\times 2\times 2-4\sqrt{4}\left(2^3\times 2+2^2+2\times 2+8\times 2\right)\right)=$$
$$9\log(3)-9\sum_{k=1}^{\infty}\frac{\left(-\frac{1}{3}\right)^k}{k}$$

-

$$9\log\left(2^4\times 2^2+6\times 2^3\times 2+2^2+16\times 2^2+24\times 2\times 2-4\sqrt{4}\left(2^3\times 2+2^2+2\times 2+8\times 2\right)\right)=$$
$$18\,i\,\pi\left\lfloor\frac{\arg(4-x)}{2\pi}\right\rfloor+9\log(x)-9\sum_{k=1}^{\infty}\frac{(-1)^k(4-x)^k x^{-k}}{k}\quad\text{for } x<0$$

-

$$9\log\left(2^4\times 2^2+6\times 2^3\times 2+2^2+16\times 2^2+24\times 2\times 2-4\sqrt{4}\left(2^3\times 2+2^2+2\times 2+8\times 2\right)\right)=$$
$$9\left\lfloor\frac{\arg(4-z_0)}{2\pi}\right\rfloor\log\left(\frac{1}{z_0}\right)+9\log(z_0)+9\left\lfloor\frac{\arg(4-z_0)}{2\pi}\right\rfloor\log(z_0)-9\sum_{k=1}^{\infty}\frac{(-1)^k(4-z_0)^k z_0^{-k}}{k}$$

$\arg(z)$ is the complex argument

$\lfloor x\rfloor$ is the floor function

Integral representations:

$$9\log\left(2^4\times 2^2+6\times 2^3\times 2+2^2+16\times 2^2+24\times 2\times 2-4\sqrt{4}\left(2^3\times 2+2^2+2\times 2+8\times 2\right)\right)=$$
$$9\int_1^4\frac{1}{t}\,dt$$

-

$$9\log\left(2^4\times 2^2+6\times 2^3\times 2+2^2+16\times 2^2+24\times 2\times 2-4\sqrt{4}\left(2^3\times 2+2^2+2\times 2+8\times 2\right)\right)=$$
$$-\frac{9\,i}{2\pi}\int_{-i\,\infty+\gamma}^{i\,\infty+\gamma}\frac{3^{-s}\,\Gamma(-s)^2\,\Gamma(1+s)}{\Gamma(1-s)}\,ds\quad\text{for } -1<\gamma<0$$

$\Gamma(x)$ is the gamma function

34+16*2 * exp(((2^4*2^2+6*2^3*2+2^2+16*2^2+24*2*2-4*(sqrt(4))(2^3*2+2^2+2*2+8*2)))

Input:

$$34 + 16\times 2 \exp\left(2^4\times 2^2 + 6\times 2^3\times 2 + 2^2 + 16\times 2^2 + 24\times 2\times 2 - 4\sqrt{4}\,(2^3\times 2 + 2^2 + 2\times 2 + 8\times 2)\right)$$

Exact result:

$$34 + 32 e^4$$

Decimal approximation:

1781.140801060615650499528358491548108889303585235650199226...

1781.1408… result in the range of the hypothetical mass of Gluino (gluino = 1785.16 GeV).

Property:

$34 + 32 e^4$ is a transcendental number

- **Alternate form:**

$$2\,(17 + 16 e^4)$$

Series representations:

$$34 + 16\times 2 \exp\left(2^4\times 2^2 + 6\times 2^3\times 2 + 2^2 + 16\times 2^2 + 24\times 2\times 2 - 4\sqrt{4}\,(2^3\times 2 + 2^2 + 2\times 2 + 8\times 2)\right) = 34 + 32 \sum_{k=0}^{\infty} \frac{4^k}{k!}$$

-

$$34 + 16\times 2 \exp\left(2^4\times 2^2 + 6\times 2^3\times 2 + 2^2 + 16\times 2^2 + 24\times 2\times 2 - 4\sqrt{4}\,(2^3\times 2 + 2^2 + 2\times 2 + 8\times 2)\right) = 34 + 32 \left(\sum_{k=0}^{\infty} \frac{1}{k!}\right)^4$$

-

$$34 + 16\times 2 \exp\left(2^4\times 2^2 + 6\times 2^3\times 2 + 2^2 + 16\times 2^2 + 24\times 2\times 2 - 4\sqrt{4}\,(2^3\times 2 + 2^2 + 2\times 2 + 8\times 2)\right) = 34 + \frac{32}{\left(\sum_{k=0}^{\infty} \frac{(-1)^k}{k!}\right)^4}$$

$n!$ is the factorial function

(((((34+16*2 * exp(((2^4*2^2+6*2^3*2+2^2+16*2^2+24*2*2-4*(sqrt(4))(2^3*2+2^2+2*2+8*2)))))))^1/15

Input:

$$\left(34 + 16 \times 2 \exp\left(2^4 \times 2^2 + 6 \times 2^3 \times 2 + 2^2 + 16 \times 2^2 + 24 \times 2 \times 2 - 4\sqrt{4}\,\left(2^3 \times 2 + 2^2 + 2 \times 2 + 8 \times 2\right)\right)\right) \text{^} (1/15)$$

Exact result:

$$\sqrt[15]{34 + 32\, e^4}$$

Decimal approximation:

1.647074398815548255993322448035971780412937233384321777791...

1.64707439… ≈ ζ(2) = $\frac{\pi^2}{6} = 1.644934$ ...

Property:

$\sqrt[15]{34 + 32\, e^4}$ is a transcendental number

-

Alternate form:

$$\sqrt[15]{2\left(17 + 16\, e^4\right)}$$

All 15th roots of 34 + 32 e^4:

$\sqrt[15]{34 + 32\, e^4}\; e^0 \approx 1.64707$ (real, principal root)

- $\sqrt[15]{34 + 32\, e^4}\; e^{(2 i \pi)/15} \approx 1.5047 + 0.6699\, i$

- $\sqrt[15]{34 + 32\, e^4}\; e^{(4 i \pi)/15} \approx 1.1021 + 1.2240\, i$

- $\sqrt[15]{34 + 32\, e^4}\; e^{(2 i \pi)/5} \approx 0.5090 + 1.5665\, i$

- $\sqrt[15]{34 + 32\, e^4}\; e^{(8 i \pi)/15} \approx -0.17217 + 1.63805\, i$

Series representations:

$$\left(34+16\times 2\exp\left(2^4\times 2^2+6\times 2^3\times 2+2^2+16\times 2^2+24\times 2\times 2-4\sqrt{4}\,(2^3\times 2+2^2+2\times 2+8\times 2)\right)\right)\wedge(1/15)=\sqrt[15]{34+32\sum_{k=0}^{\infty}\frac{4^k}{k!}}$$

- $$\left(34+16\times 2\exp\left(2^4\times 2^2+6\times 2^3\times 2+2^2+16\times 2^2+24\times 2\times 2-4\sqrt{4}\,(2^3\times 2+2^2+2\times 2+8\times 2)\right)\right)\wedge(1/15)=\sqrt[15]{34+32\left(\sum_{k=0}^{\infty}\frac{1}{k!}\right)^4}$$

- $$\left(34+16\times 2\exp\left(2^4\times 2^2+6\times 2^3\times 2+2^2+16\times 2^2+24\times 2\times 2-4\sqrt{4}\,(2^3\times 2+2^2+2\times 2+8\times 2)\right)\right)\wedge(1/15)=\sqrt[15]{34+\frac{32}{\left(\sum_{k=0}^{\infty}\frac{(-1)^k}{k!}\right)^4}}$$

$n!$ is the factorial function

- **Integral representation:**

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

$\Gamma(x)$ is the gamma function

$\mathrm{Re}(z)$ is the real part of z

$\arg(z)$ is the complex argument

$|z|$ is the absolute value of z

i is the imaginary unit

If $P := \frac{\psi(-q)\psi(-q^{11})}{q^6\psi(-q^5)\psi(-q^{55})}$ and $Q := \frac{\psi(-q)\psi(-q^{55})}{q^{-5}\psi(-q^5)\psi(-q^{11})}$, then

$$\begin{aligned}
&Q^6+\frac{1}{Q^6}-33\left(Q^5+\frac{1}{Q^5}\right)-99\left(Q^4+\frac{1}{Q^4}\right)-1529\left(Q^3+\frac{1}{Q^3}\right)\\
&-1683\left(Q^2+\frac{1}{Q^2}\right)-8800\left(Q+\frac{1}{Q}\right)-6534-\left(P^5+\frac{5^5}{P^5}\right)\\
&-11\left\{\left(P^4+\frac{5^4}{P^4}\right)\left(Q+\frac{1}{Q}\right)+\left(P^3+\frac{5^3}{P^3}\right)\left[11+4\left(Q^2+\frac{1}{Q^2}\right)\right]\right.\\
&+\left(P^2+\frac{5^2}{P^2}\right)\left[18+56\left(Q+\frac{1}{Q}\right)+3\left(Q^2+\frac{1}{Q^2}\right)+8\left(Q^3+\frac{1}{Q^3}\right)\right]\\
&+\left(P+\frac{5}{P}\right)\left[324+126\left(Q+\frac{1}{Q}\right)+160\left(Q^2+\frac{1}{Q^2}\right)+18\left(Q^3+\frac{1}{Q^3}\right)\right.\\
&\left.\left.+9\left(Q^4+\frac{1}{Q^4}\right)\right]+\left(P^3+\frac{5^3}{P^3}\right)\left[11+4\left(Q^2+\frac{1}{Q^2}\right)\right]\right\}=0.
\end{aligned}\tag{70}$$

(((1+1-66-198-1529*2-1683*2-17600-6534-(1+5^5)-11((((((((((((((1+625)*2+(1+125)))((11+8))+(1+25)(18+112+6+16)+6(324+252+320+36+18)+(1+125)(11+8))))))))))

Input:

$$1+1-66-198-1529\times 2-1683\times 2-17600-6534-(1+5^5)-11\,(((1+625)\times 2+(1+125))\,(11+8)+(1+25)\,(18+112+6+16)+6\,(324+252+320+36+18)+(1+125)\,(11+8))$$

Result:

-454454

-454454

-454454*0 = 0 ⟶ 0 or -454454/0 = $\tilde{\infty}$ (complex infinity = supersymmetric condition ⟶ ∞)

If we take only the result -454454 we obtain:

1.61803398^2+ ln(-(((1+1-66-198-1529*2-1683*2-17600-6534-(1+5^5)-11((((((((((((((1+625)*2+(1+125)))((11+8))+(1+25)(18+112+6+16)+6(324+252+320+36+18)+(1+125)(11+8))))))))))

Where 1.61803398... is the golden ratio

Input interpretation:

$$1.61803398^2 + \log(-(1+1-66-198-1529\times 2-1683\times 2-17600-6534-(1+5^5)-11(((1+625)\times 2+(1+125))(11+8)+(1+25)(18+112+6+16)+6(324+252+320+36+18)+(1+125)(11+8))))$$

log(x) is the natural logarithm

Result:

15.6448859...

15.6448… result practically equal to the black hole entropy 15.6730

Alternative representations:

$$1.61803^2 + \log(-(1+1-66-198-1529\times 2-1683\times 2-17600-6534-(1+5^5)-11(((1+625)2+(1+125))(11+8)+(1+25)(18+112+6+16)+6(324+252+320+36+18)+(1+125)(11+8)))) = \log_e(451329+5^5)+1.61803^2$$

- $$1.61803^2 + \log(-(1+1-66-198-1529\times 2-1683\times 2-17600-6534-(1+5^5)-11(((1+625)2+(1+125))(11+8)+(1+25)(18+112+6+16)+6(324+252+320+36+18)+(1+125)(11+8)))) = \log(a)\log_a(451329+5^5)+1.61803^2$$

- $$1.61803^2 + \log(-(1+1-66-198-1529\times 2-1683\times 2-17600-6534-(1+5^5)-11(((1+625)2+(1+125))(11+8)+(1+25)(18+112+6+16)+6(324+252+320+36+18)+(1+125)(11+8)))) = -\text{Li}_1(-451328-5^5)+1.61803^2$$

$\log_b(x)$ is the base- b logarithm

$\text{Li}_n(x)$ is the polylogarithm function

Series representations:

$$1.61803^2 + \log(-(1+1-66-198-1529\times 2-1683\times 2-17600-6534-(1+5^5)-11(((1+625)2+(1+125))(11+8)+(1+25)(18+112+6+16)+6(324+252+320+36+18)+(1+125)(11+8)))) = 2.61803+\log(454453)-\sum_{k=1}^{\infty}\frac{\left(-\frac{1}{454453}\right)^k}{k}$$

-

$$1.61803^2 + \log(-(1 + 1 - 66 - 198 - 1529 \times 2 - 1683 \times 2 - 17600 - 6534 - (1 + 5^5) - 11\,(((1 + 625)\,2 + (1 + 125))\,(11 + 8) + (1 + 25)\,(18 + 112 + 6 + 16) + 6\,(324 + 252 + 320 + 36 + 18) + (1 + 125)\,(11 + 8)))) = 2.61803 + 2\,i\,\pi \left\lfloor \frac{\arg(454454 - x)}{2\,\pi} \right\rfloor + \log(x) - \sum_{k=1}^{\infty} \frac{(-1)^k\,(454454 - x)^k\,x^{-k}}{k}$$

for

$x < 0$

-

$$1.61803^2 + \log(-(1 + 1 - 66 - 198 - 1529 \times 2 - 1683 \times 2 - 17600 - 6534 - (1 + 5^5) - 11\,(((1 + 625)\,2 + (1 + 125))\,(11 + 8) + (1 + 25)\,(18 + 112 + 6 + 16) + 6\,(324 + 252 + 320 + 36 + 18) + (1 + 125)\,(11 + 8)))) = 2.61803 + \left\lfloor \frac{\arg(454454 - z_0)}{2\,\pi} \right\rfloor \log\left(\frac{1}{z_0}\right) + \log(z_0) + \left\lfloor \frac{\arg(454454 - z_0)}{2\,\pi} \right\rfloor \log(z_0) - \sum_{k=1}^{\infty} \frac{(-1)^k\,(454454 - z_0)^k\,z_0^{-k}}{k}$$

$\arg(z)$ is the complex argument

$\lfloor x \rfloor$ is the floor function

i is the imaginary unit

Integral representations:

$$1.61803^2 + \log(-(1 + 1 - 66 - 198 - 1529 \times 2 - 1683 \times 2 - 17600 - 6534 - (1 + 5^5) - 11\,(((1 + 625)\,2 + (1 + 125))\,(11 + 8) + (1 + 25)\,(18 + 112 + 6 + 16) + 6\,(324 + 252 + 320 + 36 + 18) + (1 + 125)\,(11 + 8)))) = 2.61803 + \int_1^{454454} \frac{1}{t}\,dt$$

-

$$1.61803^2 + \log(-(1 + 1 - 66 - 198 - 1529 \times 2 - 1683 \times 2 - 17600 - 6534 - (1 + 5^5) - 11\,(((1 + 625)\,2 + (1 + 125))\,(11 + 8) + (1 + 25)\,(18 + 112 + 6 + 16) + 6\,(324 + 252 + 320 + 36 + 18) + (1 + 125)\,(11 + 8)))) = 2.61803 + \frac{1}{2\,i\,\pi} \int_{-i\,\infty+\gamma}^{i\,\infty+\gamma} \frac{454453^{-s}\,\Gamma(-s)^2\,\Gamma(1 + s)}{\Gamma(1 - s)}\,ds \quad \text{for}$$

$-1 < \gamma < 0$

1/16^2(-(((1+1-66-198-1529*2-1683*2-17600-6534-(1+5^5)-11(((((((((((((1+625)*2+(1+125)))((11+8))+(1+25)(18+112+6+16)+6(324+252+320+36+18)+(1+125)(11+8))))))))))))

Input:

$$\frac{1}{16^2}\left(-\left(1+1-66-198-1529\times 2-1683\times 2-17600-6534-\left(1+5^5\right)-11\left(\left(\left(1+625\right)\times 2+\left(1+125\right)\right)\left(11+8\right)+\left(1+25\right)\left(18+112+6+16\right)+6\left(324+252+320+36+18\right)+\left(1+125\right)\left(11+8\right)\right)\right)\right)$$

Exact result:

$$\frac{227227}{128}$$

Decimal form:

1775.2109375

1775.2109... result in the range of the mass of candidate "glueball" $f_0(1710)$ and the hypothetical mass of Gluino ("glueball" =1760 ± 15 MeV; gluino = 1785.16 GeV).

Now, we have that:

If $P := \frac{\varphi(q)\varphi(q^4)}{\varphi(q^5)\varphi(q^{20})}$ and $Q := \frac{\varphi(q)\varphi(q^{20})}{\varphi(q^5)\varphi(q^4)}$, then

$$Q^4+\frac{1}{Q^4}-112\left(Q^3+\frac{1}{Q^3}\right)+1440\left(Q^2+\frac{1}{Q^2}\right)-3184\left(Q+\frac{1}{Q}\right)+7316$$
$$=8\left(P+\frac{1}{P}\right)\left[22\left(Q^2+\frac{1}{Q^2}\right)-31\left(Q+\frac{1}{Q}\right)+170\right]-2\left(P^2+\frac{5^2}{P^2}\right)$$
$$\times\left[3\left(Q^2+\frac{1}{Q^2}\right)+24\left(Q+\frac{1}{Q}\right)+64\right]+4\left(P^3+\frac{5^3}{P^3}\right)\left[\left(Q+\frac{1}{Q}\right)+4\right]. \quad (73)$$

For X = Y = 1, we obtain:

1+1-112(1+1)+1440(1+1)-3184(1+1)+7316

8*2(22*2-31*2+170)-2(1+25)*(3*2+24*2+64)+4(1+125)(1+1+4)

1+1-112(1+1)+1440(1+1)-3184(1+1)+7316

Input:

$1+1-112(1+1)+1440(1+1)-3184(1+1)+7316$

Result:

3606

3606

8*2(22*2-31*2+170)-2(1+25)*(3*2+24*2+64)+4(1+125)(1+1+4)

Input:

$8\times 2(22\times 2-31\times 2+170)-2(1+25)(3\times 2+24\times 2+64)+4(1+125)(1+1+4)$

Result:

-680

-680

3606 = -680 ; thence

((((((((((16(44-62+170)-2*(26)*(6+48+64)+4*126*6))))/3606))))))

Input:

$$\frac{16(44-62+170)-2\times 26(6+48+64)+4\times 126\times 6}{3606}$$

Exact result:

$$-\frac{340}{1803}$$

Decimal approximation:

$-0.18857459789240155296727676095396561286744315030504714364...$

-0.1885745978924…

2 exp((((((((((16(44-62+170)-2*(26)*(6+48+64)+4*126*6))))/3606))))))

Input:

$$2 \exp\left(\frac{16(44-62+170)-2\times 26(6+48+64)+4\times 126\times 6}{3606}\right)$$

Exact result:

$$\frac{2}{e^{340/1803}}$$

Decimal approximation:

1.656277447461892529037520343846480063201508336177366775283...

1.65627744… is very near to the 14th root of the following Ramanujan's class invariant $Q = \left(G_{505}/G_{101/5}\right)^3$ = 1164,2696 i.e. 1,65578...

Property:

$\frac{2}{e^{340/1803}}$ is a transcendental number

Series representations:

$$2 \exp\left(\frac{16(44-62+170)-2\times 26(6+48+64)+4\times 126\times 6}{3606}\right) = \frac{2}{\left(\sum_{k=0}^{\infty} \frac{1}{k!}\right)^{340/1803}}$$

- $$2 \exp\left(\frac{16(44-62+170)-2\times 26(6+48+64)+4\times 126\times 6}{3606}\right) = \frac{2}{\left(\sum_{k=0}^{\infty} \frac{(-1+k)^2}{k!}\right)^{340/1803}}$$

- $$2 \exp\left(\frac{16(44-62+170)-2\times 26(6+48+64)+4\times 126\times 6}{3606}\right) = \frac{2}{\left(\frac{\sum_{k=0}^{\infty} \frac{-1+k+z}{k!}}{z}\right)^{340/1803}}$$

$n!$ is the factorial function

12 exp(((((((((((16(44-62+170)-2*(26)*(6+48+64)+4*126*6))))/3606))))))

Input:

$$12\exp\left(\frac{16(44-62+170)-2\times 26(6+48+64)+4\times 126\times 6}{3606}\right)$$

Exact result:

$$\frac{12}{e^{340/1803}}$$

Decimal approximation:

9.937664684771355174225122063078880379209050017064200651699...

9.93766468 result practically equal to the black hole entropy 9.9340

Property:

$\frac{12}{e^{340/1803}}$ is a transcendental number

Series representations:

$$12\exp\left(\frac{16(44-62+170)-2\times 26(6+48+64)+4\times 126\times 6}{3606}\right)=\frac{12}{\left(\sum_{k=0}^{\infty}\frac{1}{k!}\right)^{340/1803}}$$

- $$12\exp\left(\frac{16(44-62+170)-2\times 26(6+48+64)+4\times 126\times 6}{3606}\right)=\frac{12}{\left(\sum_{k=0}^{\infty}\frac{(-1+k)^2}{k!}\right)^{340/1803}}$$

- $$12\exp\left(\frac{16(44-62+170)-2\times 26(6+48+64)+4\times 126\times 6}{3606}\right)=\frac{12}{\left(\frac{\sum_{k=0}^{\infty}\frac{-1+k+z}{k!}}{z}\right)^{340/1803}}$$

$n!$ is the factorial function

21 exp((((((((((16(44-62+170)-2*(26)*(6+48+64)+4*126*6))))/3606))))))

Input:

$$21\exp\left(\frac{16(44-62+170)-2\times 26(6+48+64)+4\times 126\times 6}{3606}\right)$$

Exact result:

$$\frac{21}{e^{340/1803}}$$

Decimal approximation:

17.39091319834987155489396361038804066361583752986235114047...

17.390913198… result near to the black hole entropy 17.5764

Property:

$\frac{21}{e^{340/1803}}$ is a transcendental number

Series representations:

$$21 \exp\left(\frac{16(44-62+170)-2\times 26(6+48+64)+4\times 126\times 6}{3606}\right) = \frac{21}{\left(\sum_{k=0}^{\infty} \frac{1}{k!}\right)^{340/1803}}$$

- $$21 \exp\left(\frac{16(44-62+170)-2\times 26(6+48+64)+4\times 126\times 6}{3606}\right) = \frac{21}{\left(\sum_{k=0}^{\infty} \frac{(-1+k)^2}{k!}\right)^{340/1803}}$$

- $$21 \exp\left(\frac{16(44-62+170)-2\times 26(6+48+64)+4\times 126\times 6}{3606}\right) = \frac{21}{\left(\frac{\sum_{k=0}^{\infty} \frac{-1+k+z}{k!}}{z}\right)^{340/1803}}$$

$n!$ is the factorial function

55+ (((((1+1-112(1+1)+1440(1+1)-3184(1+1)+7316)))) + (((((8*2(22*2-31*2+170)-2(1+25)*(3*2+24*2+64)+4(1+125)(1+1+4))))))

Input:

$$55 + ((1+1-112(1+1)+1440(1+1)-3184(1+1)+7316) + (8\times 2(22\times 2-31\times 2+170) - 2(1+25)(3\times 2+24\times 2+64)+4(1+125)(1+1+4)))$$

Result:

2981

2981 result very near to the rest mass of Charmed eta meson 2980.3

((((((([(((((1+1-112(1+1)+1440(1+1)-3184(1+1)+7316)))) + (((((8*2(22*2-31*2+170)-2(1+25)*(3*2+24*2+64)+4(1+125)(1+1+4))))))])))))))^1/16

Input:

$$((1 + 1 - 112 (1 + 1) + 1440 (1 + 1) - 3184 (1 + 1) + 7316) + (8 \times 2 (22 \times 2 - 31 \times 2 + 170) - 2 (1 + 25) (3 \times 2 + 24 \times 2 + 64) + 4 (1 + 125) (1 + 1 + 4)))\,\hat{}\,(1/16)$$

Result:

$$\sqrt[16]{2926}$$

Decimal approximation:

1.646804879368820108738038118226988389858063818164587196200...

$1.646804879... \approx \zeta(2) = \frac{\pi^2}{6} = 1.644934 ...$

(-288/10^4)+(((((([(((((1+1-112(1+1)+1440(1+1)-3184(1+1)+7316)))) + (((((8*2(22*2-31*2+170)-2(1+25)*(3*2+24*2+64)+4(1+125)(1+1+4))))))])))))))^1/16

Input:

$$-\frac{288}{10^4} + ((1 + 1 - 112 (1 + 1) + 1440 (1 + 1) - 3184 (1 + 1) + 7316) + (8 \times 2 (22 \times 2 - 31 \times 2 + 170) - 2 (1 + 25) (3 \times 2 + 24 \times 2 + 64) + 4 (1 + 125) (1 + 1 + 4)))\,\hat{}\,(1/16)$$

Result:

$$\sqrt[16]{2926} - \frac{18}{625}$$

Decimal approximation:

1.618004879368820108738038118226988389858063818164587196200...

1.61800487…

This result is a very good approximation to the value of the golden ratio 1,618033988749...

Alternate form:

$$\frac{1}{625}\left(625\sqrt[16]{2926}-18\right)$$

- **Minimal polynomial:**

$$\begin{aligned}&542\,101\,086\,242\,752\,217\,003\,726\,400\,434\,970\,855\,712\,890\,625\,x^{16}+\\&249\,800\,180\,540\,660\,221\,595\,317\,125\,320\,434\,570\,312\,500\,000\,x^{15}+\\&53\,956\,838\,996\,782\,607\,864\,588\,499\,069\,213\,867\,187\,500\,000\,x^{14}+\\&7\,251\,799\,161\,167\,582\,497\,000\,694\,274\,902\,343\,750\,000\,000\,x^{13}+\\&678\,768\,401\,485\,285\,721\,719\,264\,984\,130\,859\,375\,000\,000\,x^{12}+\\&46\,916\,471\,910\,662\,949\,085\,235\,595\,703\,125\,000\,000\,000\,x^{11}+\\&2\,477\,189\,716\,883\,003\,711\,700\,439\,453\,125\,000\,000\,000\,x^{10}+\\&101\,918\,662\,637\,472\,152\,709\,960\,937\,500\,000\,000\,000\,x^{9}+\\&3\,302\,164\,669\,454\,097\,747\,802\,734\,375\,000\,000\,000\,x^{8}+\\&84\,535\,415\,538\,024\,902\,343\,750\,000\,000\,000\,000\,x^{7}+\\&1\,704\,233\,977\,246\,582\,031\,250\,000\,000\,000\,000\,x^{6}+\\&26\,771\,966\,478\,928\,125\,000\,000\,000\,000\,000\,x^{5}+\\&321\,263\,597\,747\,137\,500\,000\,000\,000\,000\,x^{4}+\\&2\,846\,889\,727\,728\,480\,000\,000\,000\,000\,x^{3}+\\&17\,569\,376\,605\,410\,048\,000\,000\,000\,x^{2}+67\,466\,406\,164\,774\,584\,320\,000\,x-\\&1\,586\,187\,778\,346\,292\,986\,952\,903\,447\,551\,285\,192\,719\,323\,716\,974\end{aligned}$$

-

Now, we have that:

If $P=\dfrac{\phi(q)\phi(q^{11})}{\phi(q^5)\phi(q^{55})}$ *and* $Q=\dfrac{\phi(q)\phi(q^{55})}{\phi(q^5)\phi(q^{11})}$, *then*

$$\begin{aligned}&Q^6+\frac{1}{Q^6}+33\left(Q^5+\frac{1}{Q^5}\right)-99\left(Q^4+\frac{1}{Q^4}\right)+1529\left(Q^3+\frac{1}{Q^3}\right)\\&-1683\left(Q^2+\frac{1}{Q^2}\right)+8800\left(Q+\frac{1}{Q}\right)=6534+\left(P^5+\frac{5^5}{P^5}\right)\\&-11\left\{\left(P^4+\frac{5^4}{P^4}\right)\left(Q+\frac{1}{Q}\right)-\left(P^3+\frac{5^3}{P^3}\right)\left[11+4\left(Q^2+\frac{1}{Q^2}\right)\right]\right.\\&-\left(P^2+\frac{5^2}{P^2}\right)\left[18-56\left(Q+\frac{1}{Q}\right)+3\left(Q^2+\frac{1}{Q^2}\right)-8\left(Q^3+\frac{1}{Q^3}\right)\right]\\&-\left(P+\frac{5}{P}\right)\left[324-126\left(Q+\frac{1}{Q}\right)+160\left(Q^2+\frac{1}{Q^2}\right)-18\left(Q^3+\frac{1}{Q^3}\right)\right.\\&\left.\left.+9\left(Q^4+\frac{1}{Q^4}\right)\right]-\left(P^3+\frac{5^3}{P^3}\right)\left[11+4\left(Q^2+\frac{1}{Q^2}\right)\right]\right\}.\end{aligned}\tag{76}$$

For P = Q = 1, we obtain:

1+1+33*2-99*2+1529*2-1683*2+8800*2

6534+(1+3125)-11[((((1+625)2-(1+125)(11+8)-(1+25)(18-112+5-8)-(1+5)(324-252+320-36+18)-(1+125)(11+8))))]

1+1+33*2-99*2+1529*2-1683*2+8800*2

Input:

$$1 + 1 + 33 \times 2 - 99 \times 2 + 1529 \times 2 - 1683 \times 2 + 8800 \times 2$$

Result:

$$17162$$

17162

6534+(1+3125)-11[((((1+625)2-(1+125)(11+8)-(1+25)(18-112+5-8)-(1+5)(324-252+320-36+18)-(1+125)(11+8))))]

Input:

$$6534 + (1 + 3125) - 11\,((1 + 625) \times 2 - (1 + 125)\,(11 + 8) - (1 + 25)\,(18 - 112 + 5 - 8) - (1 + 5)\,(324 - 252 + 320 - 36 + 18) - (1 + 125)\,(11 + 8))$$

Result:

$$45498$$

45498

Thence:

17162x = 45498;

And:

1/17162((((((6534+(1+3125)-11[((((1+625)2-(1+125)(11+8)-(1+25)(18-112+5-8)-(1+5)(324-252+320-36+18)-(1+125)(11+8))))]))))))

Input:

$$\frac{1}{17162}\,(6534 + (1 + 3125) - 11\,((1 + 625) \times 2 - (1 + 125)\,(11 + 8) - (1 + 25)\,(18 - 112 + 5 - 8) - (1 + 5)\,(324 - 252 + 320 - 36 + 18) - (1 + 125)\,(11 + 8)))$$

Exact result:

$$\frac{22749}{8581}$$

Decimal approximation:

2.651089616594802470574525113623120848385969001281901876238...

2.6510896….

-0.0089-0.0013+((((((((((1/17162((((((6534+(1+3125)-11[(((((1+625)2-(1+125)(11+8)-(1+25)(18-112+5-8)-(1+5)(324-252+320-36+18)-(1+125)(11+8))))])))))))))))))))))^1/2

Input:

$$-0.0089-0.0013+\sqrt{\left(\frac{1}{17162}(6534+(1+3125)-11((1+625)\times 2-(1+125)(11+8)-(1+25)(18-112+5-8)-(1+5)(324-252+320-36+18)-(1+125)(11+8)))\right)}$$

Result:

1.6180167...

1.6180167…

This result is a very good approximation to the value of the golden ratio 1,618033988749...

1.61803398+ln((((((((-17162+((((((6534+(1+3125)-11[(((((1+625)2-(1+125)(11+8)-(1+25)(18-112+5-8)-(1+5)(324-252+320-36+18)-(1+125)(11+8))))])))))))))))))

Input interpretation:

$$1.61803398+\log(-17162+(6534+(1+3125)-11((1+625)\times 2-(1+125)(11+8)-(1+25)(18-112+5-8)-(1+5)(324-252+320-36+18)-(1+125)(11+8))))$$

$\log(x)$ is the natural logarithm

Result:

11.86992234...

11.86992234… result practically equal to the black hole entropy 11.8458

Alternative representations:

$$1.61803 + \log(-17162 + (6534 + (1 + 3125) - 11((1 + 625)2 - (1 + 125)(11 + 8) - (1 + 25)(18 - 112 + 5 - 8) - (1 + 5)(324 - 252 + 320 - 36 + 18) - (1 + 125)(11 + 8)))) = 1.61803 + \log_e(28336)$$

$$1.61803 + \log(-17162 + (6534 + (1 + 3125) - 11((1 + 625)2 - (1 + 125)(11 + 8) - (1 + 25)(18 - 112 + 5 - 8) - (1 + 5)(324 - 252 + 320 - 36 + 18) - (1 + 125)(11 + 8)))) = 1.61803 + \log(a)\log_a(28336)$$

$$1.61803 + \log(-17162 + (6534 + (1 + 3125) - 11((1 + 625)2 - (1 + 125)(11 + 8) - (1 + 25)(18 - 112 + 5 - 8) - (1 + 5)(324 - 252 + 320 - 36 + 18) - (1 + 125)(11 + 8)))) = 1.61803 - \text{Li}_1(-28335)$$

$\log_b(x)$ is the base- b logarithm

$\text{Li}_n(x)$ is the polylogarithm function

Series representations:

$$1.61803 + \log(-17162 + (6534 + (1 + 3125) - 11((1 + 625)2 - (1 + 125)(11 + 8) - (1 + 25)(18 - 112 + 5 - 8) - (1 + 5)(324 - 252 + 320 - 36 + 18) - (1 + 125)(11 + 8)))) = 1.61803 + \log(28335) - \sum_{k=1}^{\infty} \frac{\left(-\frac{1}{28335}\right)^k}{k}$$

$$1.61803 + \log(-17162 + (6534 + (1 + 3125) - 11((1 + 625)2 - (1 + 125)(11 + 8) - (1 + 25)(18 - 112 + 5 - 8) - (1 + 5)(324 - 252 + 320 - 36 + 18) - (1 + 125)(11 + 8)))) = 1.61803 + 2 i \pi \left\lfloor \frac{\arg(28336 - x)}{2\pi} \right\rfloor + \log(x) - \sum_{k=1}^{\infty} \frac{(-1)^k (28336 - x)^k x^{-k}}{k}$$

for $x < 0$

$$1.61803 + \log(-17162 + (6534 + (1 + 3125) - 11 ((1 + 625) 2 - (1 + 125) (11 + 8) - (1 + 25) (18 - 112 + 5 - 8) - (1 + 5) (324 - 252 + 320 - 36 + 18) - (1 + 125) (11 + 8)))) = 1.61803 + \left\lfloor \frac{\arg(28336 - z_0)}{2\pi} \right\rfloor \log\left(\frac{1}{z_0}\right) + \log(z_0) + \left\lfloor \frac{\arg(28336 - z_0)}{2\pi} \right\rfloor \log(z_0) - \sum_{k=1}^{\infty} \frac{(-1)^k (28336 - z_0)^k z_0^{-k}}{k}$$

$\arg(z)$ is the complex argument

$\lfloor x \rfloor$ is the floor function

i is the imaginary unit

Integral representations:

$$1.61803 + \log(-17162 + (6534 + (1 + 3125) - 11 ((1 + 625) 2 - (1 + 125) (11 + 8) - (1 + 25) (18 - 112 + 5 - 8) - (1 + 5) (324 - 252 + 320 - 36 + 18) - (1 + 125) (11 + 8)))) = 1.61803 + \int_1^{28336} \frac{1}{t} \, dt$$

$$1.61803 + \log(-17162 + (6534 + (1 + 3125) - 11 ((1 + 625) 2 - (1 + 125) (11 + 8) - (1 + 25) (18 - 112 + 5 - 8) - (1 + 5) (324 - 252 + 320 - 36 + 18) - (1 + 125) (11 + 8)))) = 1.61803 + \frac{1}{2 i \pi} \int_{-i\infty+\gamma}^{i\infty+\gamma} \frac{28335^{-s} \Gamma(-s)^2 \Gamma(1+s)}{\Gamma(1-s)} \, ds \quad \text{for } -1 < \gamma < 0$$

$\Gamma(x)$ is the gamma function

From:

Quantum Black Holes, Localization & Mock Modular Forms

ATISH DABHOLKAR
CNRS - University of Paris VI
VII Regional Meeting in String Theory - 19 June 2013

Now, we have that:

Ramanujan's example

In Ramanujan's famous last letter to Hardy in 1920, he gives 17 examples of mock theta functions, without giving any complete definition of this term. A typical example (Ramanujan's second mock theta function of "order 7" — a notion that he also does not define) is

$$\begin{aligned}\mathcal{F}_7(\tau) &= -q^{-25/168} \sum_{n=1}^{\infty} \frac{q^{n^2}}{(1-q^n)\cdots(1-q^{2n-1})} \\ &= -q^{143/168}\left(1+q+q^2+2q^3+\cdots\right) .\end{aligned}$$

Hints of modularity such as Cardy behavior of Fourier coefficients but not quite modular! Despite much work, this fascinating 'hidden' modular symmetry remained mysterious until the thesis of Zwegers [2005].

A mock modular form $h(\tau)$ of weight k is the first of the pair (h, g)

1. $g(\tau)$ is a modular form of weight $2-k$,
2. the sum $\widehat{h} = h + g^*$, of h is modular with weight k with

$$g^*(\tau, \bar{\tau}) = \left(\frac{i}{2\pi}\right)^{k-1} \int_{-\bar{\tau}}^{\infty} (z+\tau)^{-k}\,\overline{g(-\bar{z})}\, dz .$$

Then g is called the *shadow* of h and $\widehat{h}$ is called *modular completion* of h which obeys a 'holomorphic anomaly' equation

$$(4\pi\tau_2)^k \frac{\partial \widehat{h}(\tau)}{\partial \bar{\tau}} = -2\pi i\, \overline{g(\tau)}.$$

Ramanujan never specified the shadow which was part of the mystery.

"My dream is that I will live to see the day when our young physicists, struggling to bring the predictions of superstring theory into correspondence with the facts of nature, will be led to enlarge their analytic machinery to include not only theta-functions but mock theta-functions... But before this can happen, the purely mathematical exploration of the mock-modular forms and their mock-symmetries must be carried a great deal further."

Freeman Dyson (1987 Ramanujan Centenary Conference)

We will encounter mock modular forms naturally while dealing with **quantum black holes and holography in situations with wall-crossing.**

$$\mathcal{F}_7(\tau) = -q^{-25/168} \sum_{n=1}^{\infty} \frac{q^{n^2}}{(1-q^n)\cdots(1-q^{2n-1})}$$
$$= -q^{143/168}\left(1+q+q^2+2q^3+\cdots\right) .$$

(Ramanujan's second mock theta function of "order 7" - a notion that he also does not define)

-q^(-0.1488) sum ((q^(n^2))/(1-q^n)((1-q^(2n-1)), n = 1 to infinity

For q = 0.60653 and n = -0.1488, we obtain:

-0.60653^(-0.1488)* ((0.60653^(-0.1488^2)) *1/(((1-0.60653^(-0.1488)*(1-0.60653^(-1.2976)))

Input interpretation:

$$-\frac{0.60653^{-0.1488^2} \times \frac{1}{1-\frac{1-\frac{1}{0.60653^{1.2976}}}{0.60653^{0.1488}}}}{0.60653^{0.1488}}$$

Result:

−0.549067...

-0.549067...

3* -(((((-0.60653^(-0.1488)* ((0.60653^(-0.1488^2)) *1/(((1-0.60653^(-0.1488)*(1-0.60653^(-1.2976)))))

Input interpretation:

$$\frac{3\times(-1)\left(-\left(0.60653^{-0.1488^2}\times\frac{1}{1-\frac{1}{1-\frac{0.60653^{1.2976}}{0.60653^{0.1488}}}}\right)\right)}{0.60653^{0.1488}}$$

Result:

1.6472008205462314820409465622748190905772274541759119929 02...

1.64720082... ≈ ζ(2) = $\frac{\pi^2}{6} = 1.644934$ ...

For n = 2, we obtain:

-0.60653^(-0.1488)* ((0.60653^4) *1/(((1-0.60653^2*(1-0.60653^3)))

Input:

$$-\frac{0.60653^4\times\frac{1}{1-0.60653^2\,(1-0.60653^3)}}{0.60653^{0.1488}}$$

Result:

-0.204126...

-0.204126...

-8 * ((((-0.60653^(-0.1488)* ((0.60653^4) *1/(((1-0.60653^2*(1-0.60653^3))))))

Input:

$$-\frac{8\left(-\left(0.60653^4\times\frac{1}{1-0.60653^2\,(1-0.60653^3)}\right)\right)}{0.60653^{0.1488}}$$

Result:

1.63300...

1.63300... result that is a golden number

Or:

(-1/3) / ((((-0.60653^(-0.1488)* ((0.60653^4) *1/(((1-0.60653^2*(1-0.60653^3))))))

Input:

$$-\frac{1}{3\left(-\frac{0.60653^4\times\frac{1}{1-0.60653^2\,(1-0.60653^3)}}{0.60653^{0.1488}}\right)}$$

Result:

1.63298...

1.63298... result that is a golden number

From the result -0.204126..., we obtain:

8 colog -((((-0.60653^(-0.1488)* ((0.60653^4) *1/(((1-0.60653^2*(1-0.60653^3)))))))

Input:

$$8\left(-\log\left(-\frac{-\left(0.60653^4\times\frac{1}{1-0.60653^2\,(1-0.60653^3)}\right)}{0.60653^{0.1488}}\right)\right)$$

log(x) is the natural logarithm

Result:

12.7122...

12.7122… result very near to the black hole entropy 12.5664

Alternative representations:

$$8\,(-1)\log\left(-\frac{-0.60653^4}{0.60653^{0.1488}\,(1-0.60653^2\,(1-0.60653^3))}\right) = -8\log_e\left(\frac{0.60653^4}{0.60653^{0.1488}\,(1-0.60653^2\,(1-0.60653^3))}\right)$$

$$8\,(-1)\log\left(-\frac{-0.60653^4}{0.60653^{0.1488}\,(1-0.60653^2\,(1-0.60653^3))}\right) = -8\log(a)\log_a\left(\frac{0.60653^4}{0.60653^{0.1488}\,(1-0.60653^2\,(1-0.60653^3))}\right)$$

$$8(-1)\log\left(-\frac{-0.60653^4}{0.60653^{0.1488}\left(1-0.60653^2\left(1-0.60653^3\right)\right)}\right) = 8\,\mathrm{Li}_1\left(1-\frac{0.60653^4}{0.60653^{0.1488}\left(1-0.60653^2\left(1-0.60653^3\right)\right)}\right)$$

$\log_b(x)$ is the base- b logarithm

$\mathrm{Li}_n(x)$ is the polylogarithm function

Series representations:

$$8(-1)\log\left(-\frac{-0.60653^4}{0.60653^{0.1488}\left(1-0.60653^2\left(1-0.60653^3\right)\right)}\right) = 8\sum_{k=1}^{\infty}\frac{(-1)^k\,(-0.795874)^k}{k}$$

$$8(-1)\log\left(-\frac{-0.60653^4}{0.60653^{0.1488}\left(1-0.60653^2\left(1-0.60653^3\right)\right)}\right) = -16\,i\,\pi\left\lfloor\frac{\arg(0.204126-x)}{2\pi}\right\rfloor - 8\log(x) + 8\sum_{k=1}^{\infty}\frac{(-1)^k\,(0.204126-x)^k\,x^{-k}}{k} \quad \text{for } x<0$$

$$8(-1)\log\left(-\frac{-0.60653^4}{0.60653^{0.1488}\left(1-0.60653^2\left(1-0.60653^3\right)\right)}\right) = -8\left\lfloor\frac{\arg(0.204126-z_0)}{2\pi}\right\rfloor\log\left(\frac{1}{z_0}\right) - 8\log(z_0) - 8\left\lfloor\frac{\arg(0.204126-z_0)}{2\pi}\right\rfloor\log(z_0) + 8\sum_{k=1}^{\infty}\frac{(-1)^k\,(0.204126-z_0)^k\,z_0^{-k}}{k}$$

$\arg(z)$ is the complex argument

$\lfloor x\rfloor$ is the floor function

i is the imaginary unit

Integral representation:

$$8(-1)\log\left(-\frac{-0.60653^4}{0.60653^{0.1488}\left(1-0.60653^2\left(1-0.60653^3\right)\right)}\right) = -8\int_1^{0.204126}\frac{1}{t}\,dt$$

$$\text{(ii)} \qquad \frac{q}{1-q} + \frac{q^4}{(1-q^2)(1-q^3)} + \frac{q^9}{(1-q^3)(1-q^4)(1-q^5)} + \ldots$$

For instance when $q = e^{-t}$ and $t \to 0$

When $q = -e^{-t}$ and $t \to 0$

If we take $q = e^{-t}$ for t = 0.5, we obtain: $q = e^{-0.5}$ = 0,6065306597126334236....

$q = e^{0.5}$ = 1,6487212707001281468486507878142 or

$1/q = 1/e^{-0.5}$ = 1,6487212707001281468486507878142

Now let's develop the above formula directly with the parameters provided by Ramanujan. We obtain the following interesting results:

-0.60653/(1+0.60653) - 0.60653^4/(((1+0.60653^2)(1+0.60653^3))) - 0.60653^9/(((1+0.60653^3)(1+0.60653^4)(1+0.60653^5)))

Input:

$$-\frac{0.60653}{1+0.60653} - \frac{0.60653^4}{(1+0.60653^2)(1+0.60653^3)} - \frac{0.60653^9}{(1+0.60653^3)(1+0.60653^4)(1+0.60653^5)}$$

Result:

−0.46582222623447136636580377333045672125872851787626590863...

-0.465822…

-(0.55+0.21+0.01) / (-0.46582222623447136636580377333045672125872851787626590863))))))

Input interpretation:

$$\frac{-(0.55+0.21+0.01)}{-0.46582222623447136636580377333045672125872851787626590863}$$

Result:

1.652991112563231182633112566373934524808676757442302329030...

1.65299111… is very near to the 14th root of the following Ramanujan's class invariant $Q = \left(G_{505}/G_{101/5}\right)^3$ = 1164,2696 i.e. 1,65578...

(13+2) exp -(-0.46582222623447136636580377333045672125872851787626590863)

Input interpretation:

(13 + 2) exp(−(−0.46582222623447136636580377333045672125872851787626590863))

Result:

23.899855845176015752737469922654492089477170533858921145...

23.8998558… result practically equal to the black hole entropy 23.9078

13 exp -(-0.46582222623447136636580377333045672125872851787626590863)

Input interpretation:

13 exp(−(−0.46582222623447136636580377333045672125872851787626590863))

Result:

20.713208399152546985705807266300559810880214462677731659...

20.7132… result very near to the black hole entropy 20.5520

8 exp -(-0.46582222623447136636580377333045672125872851787626590863)

Input interpretation:

8 exp(−(−0.46582222623447136636580377333045672125872851787626590863))

Result:

12.746589784093875068126650625415729114387824284724757944...

12.7465… result very near to the black hole entropy 12.5664

(8+2) exp -(-0.46582222623447136636580377333045672125872851787626590863)

Input interpretation:

(8 + 2) exp(−(−0.46582222623447136636580377333045672125872851787626590863))

Result:

15.933237230117343835158313281769661392984780355905947430...

15.93323… result very near to the black hole entropy 15.8174

(8+3) exp -(-0.46582222623447136636580377333045672125872851787626590863)

Input interpretation:

(8 + 3) exp(−(−0.46582222623447136636580377333045672125872851787626590863))

Result:

17.526560953129078218674144609946627532283258391496542173...

17.5265… result very near to the black hole entropy 17.5764

(2*8) exp -(-0.46582222623447136636580377333045672125872851787626590863)

Input interpretation:

(2 × 8) exp(−(−0.46582222623447136636580377333045672125872851787626590863))

Result:

25.493179568187750136253301250831458228775648569449515888...

25.493179… result very near to the black hole entropy 25.1327

For the following value 23.8998558, considered as entropy, we obtain:

Mass = 4.555136e-8 kg

Radius = 6.763701e-35 m

Temperature = 2.694109e+30 K

From the Ramanujan-Nardelli mock formula, we obtain:

sqrt[[[[1/(((((((4*1.962364415e+19)/(5*0.0864055^2)))*1/(4.555136e-8)* sqrt[[-((((2.694109e+30 * 4*Pi*(6.763701e-35)^3-(6.763701e-35)^2))))) / ((6.67*10^-11))]]]]]

Input interpretation:

$$\sqrt{\left(1/\left(\frac{4\times 1.962364415\times 10^{19}}{5\times 0.0864055^2}\times\frac{1}{4.555136\times 10^{-8}}\sqrt{-\frac{2.694109\times 10^{30}\times 4\pi(6.763701\times 10^{-35})^3-(6.763701\times 10^{-35})^2}{6.67\times 10^{-11}}}\right)\right)}$$

Result:

1.618249196705554406508987110241162708382294892231060572383...

1.61824919…

From::

The Mordell integral, quantum modular forms, and mock Jacobi forms

Bobbie Chern1* and Robert C Rhoades2 - Chern and Rhoades *Research in Number Theory* (2015) 1:1 DOI 10.1007/s40993-015-0002-x

It is explained how the Mordell integral

$$\int_{\mathbb{R}}\frac{e^{\pi i\tau x^2-2\pi zx}}{\cosh(\pi x)}dx$$

unifies the mock theta functions, partial (or false) theta functions, and some of Zagier's quantum modular forms. As an application, we exploit the connections between q-hypergeometric series and mock and partial theta functions to obtain finite evaluations of the Mordell integral for rational choices of τ and z.

The Mordell integral is

$$h(z;\tau):=\int_{\mathbb{R}}\frac{e^{\pi i\tau w^2-2\pi zw}}{\cosh(\pi w)}dw=2\int_0^{\infty}e^{\pi i\tau w^2}\frac{\cosh(2\pi zw)}{\cosh(\pi w)}dw.$$

1.1 Zagier's quantum modular forms

In a 1997 Max Planck lecture Zagier credits Kontsevich with introducing the function

$$F(q) := \sum_{n=0}^{\infty} (q;q)_n = 1 + (1-q) + (1-q)\left(1-q^2\right) + (1-q)\left(1-q^2\right)\left(1-q^3\right) + \ldots, \quad (1.4)$$

where $(x;q)_n := \prod_{j=0}^{n-1}\left(1-xq^j\right)$. This function, called "Kontsevich's strange function", exists only when q is a root of unity. With $\zeta_k := e^{2\pi i/k}$, Kontsevich conjectured the following elegant asymptotic expansion

$$F(\zeta_k) \sim e^{-\frac{\pi i}{12}\left(k-3+\frac{1}{k}\right)} k^{\frac{3}{2}} + \sum_{n=0}^{\infty} \frac{b_n}{n!}\left(-\frac{2\pi i}{k}\right)^n \text{ as } k \to \infty \quad (1.5)$$

for some constants b_n. Zagier [38] proved this asymptotic, with explicit b_n. Moreover, he proved that this function satisfies the "identity"

$$F(q) = -\frac{1}{2}\sum_{n=1}^{\infty} n\left(\frac{12}{n}\right) q^{\frac{n^2-1}{24}}. \quad (1.6)$$

Neither side of this identity makes sense simultaneously. Indeed, the right hand side converges in the unit disk $|q| < 1$, but nowhere on the unit circle. The identity means that $F(q)$ at roots of unity agrees with the radial limit of the right hand side.

From

$$F(q) = -\frac{1}{2}\sum_{n=1}^{\infty} n\left(\frac{12}{n}\right) q^{\frac{n^2-1}{24}}.$$

we obtain for q = 0.26:

-1/2 * -sum n(12/n) 0.26^((n^2-1)/24)), n=1 to infinity

Input interpretation:

$$-\frac{1}{2} \times (-1) \sum_{n=1}^{\infty} n \times \frac{12}{n} \times 0.26^{1/24\left(n^2-1\right)}$$

Result:

20.5669

20.5669 result practically equal to the black hole entropy 20.5520

For q = 0.165, we obtain:

-1/2 * -sum n(12/n) (0.144+0.021)^((n^2-1)/24)), n=1 to infinity

Input interpretation:

$$-\frac{1}{2}\times(-1)\sum_{n=1}^{\infty} n\times\frac{12}{n}\,(0.144+0.021)^{1/24\,(n^2-1)}$$

Result:

17.6856

17.6856 result very near to the black hole entropy 17.7715

For q = 0.377, we obtain:

-1/2 * -sum n(12/n) 0.377^((n^2-1)/24)), n=1 to infinity

Input interpretation:

$$-\frac{1}{2}\times(-1)\sum_{n=1}^{\infty} n\times\frac{12}{n}\times 0.377^{1/24\,(n^2-1)}$$

Result:

24.3443

24.3443 result very near to the black hole entropy 24.4233

From this result, we obtain also:

[-144/2* -1/2 sum n(12/n) 0.377^((n^2-1)/24)), n=1 to infinity]^1/15

Input interpretation:

$$\sqrt[15]{\frac{1}{2}\left(-\frac{144}{2}\right)\times(-1)\sum_{n=1}^{\infty} n\times\frac{12}{n}\times 0.377^{1/24\,(n^2-1)}}$$

Result:

1.64531

$1.64531 \approx \zeta(2) = \frac{\pi^2}{6} = 1.644934\ldots$

And:

-27/10^3+[-144/2* -1/2 sum n(12/n) 0.377^((n^2-1)/24)), n=1 to infinity]^1/15

Input interpretation:

$$-\frac{27}{10^3}+\sqrt[15]{\frac{1}{2}\left(-\frac{144}{2}\right)\times(-1)\sum_{n=1}^{\infty} n\times\frac{12}{n}\times 0.377^{1/24\left(n^2-1\right)}}$$

Result:

1.61831

1.61831

This result is a very good approximation to the value of the golden ratio 1,618033988749...

For the following value 20.5669, considered as entropy, we obtain:

Mass = 4.225598e-8 kg

Radius = 6.274385e-35 m

Temperature = 2.904212e+30 K

From the Ramanujan-Nardelli mock formula, we obtain:

sqrt[[[[1/(((((((4*1.962364415e+19)/(5*0.0864055^2)))*1/(4.225598e-8)* sqrt[[-((((2.904212e+30 * 4*Pi*(6.274385e-35)^3-(6.274385e-35)^2))))) / ((6.67*10^-11))]]]]]

Input interpretation:

$$\sqrt{\left(1\middle/\left(\frac{4\times 1.962364415\times 10^{19}}{5\times 0.0864055^2}\times\frac{1}{4.225598\times 10^{-8}}\sqrt{-\frac{2.904212\times 10^{30}\times 4\pi\left(6.274385\times 10^{-35}\right)^3-\left(6.274385\times 10^{-35}\right)^2}{6.67\times 10^{-11}}}\right)\right)}$$

Result:

1.618249321850445590329777464278919068613001919750462477867...

1.61824932…

Now, we have that:

To establish the claim we use Theorem 1.4 with

$$\int_0^\infty \frac{e^{-\pi i \frac{k}{2} x^2}}{\cosh(\pi x)} dx = \sqrt{\frac{2}{k}} e^{-\frac{\pi i}{4}} \int_0^\infty \frac{e^{\frac{2\pi i}{k} x^2}}{\cosh(\pi x)} dx = \sqrt{\frac{2}{k}} e^{-\frac{\pi i}{4}} \sum_{n=0}^\infty \frac{1}{n!}\left(\frac{2\pi i}{k}\right)^n \int_0^\infty \frac{x^{2n}}{\cosh(\pi x)} dx.$$

The first equation follows from (1) of [34] or Proposition 1.2 (5) of [42]. The second result follows from Taylor expanding the exponential in the integral and using $\int_0^\infty \frac{x^{2n}}{\cosh(\pi x)} dx = \frac{(-1)^n E_{2n}}{2^{2n+1}}$ (see, for instance, [13]). □

For k = 1 and n = 2 in the integral, we obtain:

sqrt(2)*exp(-Pi*i/4) * sum (1/n!) (2Pi*i)^n, n= 0 to infinity * integrate ((x^4/(cosh(Pi*x))

Indefinite integral:

$$\sqrt{2}\exp\left(-\frac{\pi i}{4}\right)\sum_{n=0}^\infty \frac{(2\pi i)^n}{n!} \int \frac{x^4}{\cosh(\pi x)} dx =$$

$$\frac{1}{40\sqrt{2}\pi^5} \sqrt[4]{-1} \Big(-320\pi^3 x^3 \operatorname{Li}_2(-i e^{\pi x}) - 80\pi^3 (4x^3 + 3x + i) \operatorname{Li}_2(-i e^{-\pi x}) -$$
$$960\pi^2 x^2 \operatorname{Li}_3(-i e^{-\pi x}) + 960\pi^2 x^2 \operatorname{Li}_3(-i e^{\pi x}) - 240\pi^3 x \operatorname{Li}_2(i e^{\pi x}) -$$
$$1920\pi x \operatorname{Li}_4(-i e^{-\pi x}) - 1920\pi x \operatorname{Li}_4(-i e^{\pi x}) - 80 i \pi^3 \operatorname{Li}_2(i e^{\pi x}) -$$
$$240\pi^2 \operatorname{Li}_3(-i e^{-\pi x}) + 240\pi^2 \operatorname{Li}_3(i e^{\pi x}) - 1920 \operatorname{Li}_5(-i e^{-\pi x}) +$$
$$1920 \operatorname{Li}_5(-i e^{\pi x}) + 16\pi^5 x^5 + 80\pi^4 x^4 \log(1 + i e^{-\pi x}) -$$
$$80\pi^4 x^4 \log(1 + i e^{\pi x}) + 40\pi^5 x^3 + 40 i \pi^5 x^2 + 120\pi^4 x^2 \log(1 + i e^{-\pi x}) -$$
$$120\pi^4 x^2 \log(1 - i e^{\pi x}) - 15\pi^5 x + 80 i \pi^4 x \log(1 + i e^{-\pi x}) -$$
$$80 i \pi^4 x \log(1 - i e^{\pi x}) - 15\pi^4 \log(1 + i e^{-\pi x}) + 10\pi^4 \log(1 - i e^{\pi x}) +$$
$$5\pi^4 \log(1 + i e^{\pi x}) - 5\pi^4 \log\left(\tan\left(\frac{1}{4}(\pi + 2 i \pi x)\right)\right) + 10 i \pi^5\Big) + \text{constant}$$

(assuming a complex-valued logarithm)

$n!$ is the factorial function

$\cosh(x)$ is the hyperbolic cosine function

$\log(x)$ is the natural logarithm

$\operatorname{Li}_n(x)$ is the polylogarithm function

i is the imaginary unit

Series expansion of the integral at x = 0:

$$\left(\frac{1}{24} + \frac{i}{24}\right)\left(\frac{72(\operatorname{Li}_3(i) - \operatorname{Li}_3(-i))}{\pi^3} + 4i + \frac{3(\log(1-i) - \log(1+i))}{\pi}\right) + O(x^4)$$

(Taylor series)

Now for n = 2 in the integral:

sqrt(2)*exp(-Pi*i/4) * sum (1/n!) (2Pi*i)^n, n= 0 to infinity * integrate ((2^4/(cosh(Pi*2))x

Indefinite integral:

$$\sqrt{2}\exp\left(-\frac{\pi i}{4}\right)\left(\sum_{n=0}^{\infty}\frac{(2\pi i)^n}{n!}\right)\int\frac{2^4 x}{\cosh(\pi 2)}\,dx = 8\sqrt{2}\,e^{-(i\pi)/4}\,x^2\,\text{sech}(2\pi) + \text{constant}$$

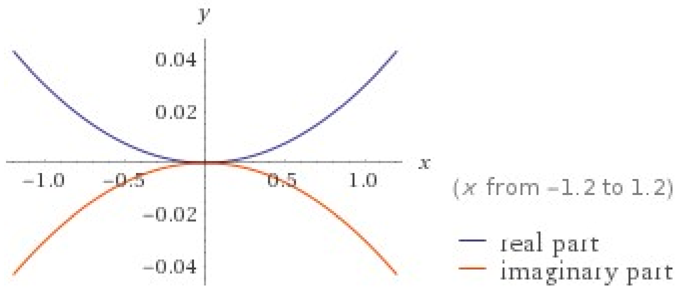
$n!$ is the factorial function

$\cosh(x)$ is the hyperbolic cosine function

$\text{sech}(x)$ is the hyperbolic secant function

i is the imaginary unit

Plot:



Alternate forms:

- $$\frac{8\sqrt{2}\,x^2}{e^{(i\pi)/4}\sinh^2(\pi) + e^{(i\pi)/4}\cosh^2(\pi)}$$
- $$-\frac{8(-1)^{3/4}\sqrt{2}\,x^2}{(\cosh(\pi) - i\sinh(\pi))(\cosh(\pi) + i\sinh(\pi))}$$
- $$-8(-1)^{3/4}\sqrt{2}\,x^2\,\text{sech}(2\pi)$$

$\sinh(x)$ is the hyperbolic sine function

Alternate form assuming x is real:

$$\frac{(16 - 16 i)x^2\cosh(2\pi)}{1 + \cosh(4\pi)}$$

Thence, for x = 2 and i^2, we obtain:

8 sqrt(2) e^(-(i^2* π)/4) 2^2 sech(2 π)

Input:

$$8\sqrt{2}\,e^{-1/4(i^2\pi)} \times 2^2\,\text{sech}(2\pi)$$

$\text{sech}(x)$ is the hyperbolic secant function

i is the imaginary unit

Exact result:

$32\sqrt{2}\ e^{\pi/4}\ \text{sech}(2\pi)$

Decimal approximation:

0.3707104580937325429513899485885383096879945212676569553 36...

(using the principal branch of the logarithm for complex exponentiation)

0.37071045…

Property:

$32\sqrt{2}\ e^{\pi/4}\ \text{sech}(2\pi)$ is a transcendental number

Alternate forms:

$$\frac{32\sqrt{2}\ e^{\pi/4}}{\cosh(2\pi)}$$

$$\frac{64\sqrt{2}\ e^{(9\pi)/4}}{1+e^{4\pi}}$$

•

$$\frac{64\sqrt{2}\ e^{\pi/4}\cosh(2\pi)}{1+\cosh(4\pi)}$$

Alternative representations:

$$8\sqrt{2}\ e^{-1/4\left(i^2\pi\right)}\ 2^2\ \text{sech}(2\pi) = \frac{32\ e^{-\left(\pi i^2\right)/4}\sqrt{2}}{\cosh(2\pi)}$$

•

$$8\sqrt{2}\ e^{-1/4\left(i^2\pi\right)}\ 2^2\ \text{sech}(2\pi) = \frac{32\ e^{-\left(\pi i^2\right)/4}\sqrt{2}}{\cos(-2\,i\,\pi)}$$

•

$$8\sqrt{2}\ e^{-1/4\left(i^2\pi\right)}\ 2^2\ \text{sech}(2\pi) = \frac{32\ e^{-\left(\pi i^2\right)/4}\sqrt{2}}{\cos(2\,i\,\pi)}$$

Series representations:

$$8\sqrt{2}\ e^{-1/4\left(i^2\pi\right)}\ 2^2\ \text{sech}(2\pi) = 64\sqrt{2}\ e^{-(7\pi)/4}\sum_{k=0}^{\infty} e^{(-4+i)k\pi}$$

•

$$8\sqrt{2}\ e^{-1/4\left(i^2\pi\right)}\ 2^2\ \operatorname{sech}(2\pi) = -64\sqrt{2}\ e^{\pi/4}\sum_{k=1}^{\infty}(-1)^k q^{-1+2k} \quad \text{for } q = e^{2\pi}$$

- $$8\sqrt{2}\ e^{-1/4\left(i^2\pi\right)}\ 2^2\ \operatorname{sech}(2\pi) = \frac{128\sqrt{2}\ e^{\pi/4}\sum_{k=0}^{\infty}\frac{(-1)^k(1+2k)}{17+4k+4k^2}}{\pi}$$

More information »

- **Integral representation:**

$$8\sqrt{2}\ e^{-1/4\left(i^2\pi\right)}\ 2^2\ \operatorname{sech}(2\pi) = \frac{64\sqrt{2}\ e^{\pi/4}}{\pi}\int_0^{\infty}\frac{t^{4i}}{1+t^2}\,dt$$

Now, in conclusion, we obtain:

1/sqrt(((((8 sqrt(2) e^(-(i^2* π)/4) 2^2 sech(2 π)))))

Input:

$$\frac{1}{\sqrt{8\sqrt{2}\ e^{-1/4\left(i^2\pi\right)}\times 2^2\ \operatorname{sech}(2\pi)}}$$

sech(x) is the hyperbolic secant function

i is the imaginary unit

Exact result:

$$\frac{e^{-\pi/8}}{4\times 2^{3/4}\sqrt{\operatorname{sech}(2\pi)}}$$

Decimal approximation:

1.642413783106222633829092096996853168042332483317176059351...

(using the principal branch of the logarithm for complex exponentiation)

1.6424137… ≈ ζ(2) = $\frac{\pi^2}{6} = 1.644934$ ...

Alternate forms:

$$\frac{e^{-\pi/8}\sqrt{\cosh(2\pi)}}{4\times 2^{3/4}}$$

$$\frac{e^{-(9\pi)/8}\sqrt{1+e^{4\pi}}}{8\sqrt[4]{2}}$$

- $$\frac{e^{-\pi/8}\sqrt{e^{-2\pi}+e^{2\pi}}}{8\sqrt[4]{2}}$$

cosh(x) is the hyperbolic cosine function

Alternative representations:

$$\frac{1}{\sqrt{8\sqrt{2}\ e^{-1/4(i^2\pi)}\ 2^2\ \text{sech}(2\pi)}} = \frac{1}{\sqrt{\frac{32\ e^{-(\pi i^2)/4}\sqrt{2}}{\cosh(2\pi)}}}$$

- $$\frac{1}{\sqrt{8\sqrt{2}\ e^{-1/4(i^2\pi)}\ 2^2\ \text{sech}(2\pi)}} = \frac{1}{\sqrt{\frac{32\ e^{-(\pi i^2)/4}\sqrt{2}}{\cos(-2\,i\,\pi)}}}$$

- $$\frac{1}{\sqrt{8\sqrt{2}\ e^{-1/4(i^2\pi)}\ 2^2\ \text{sech}(2\pi)}} = \frac{1}{\sqrt{\frac{32\ e^{-(\pi i^2)/4}\sqrt{2}}{\cos(2\,i\,\pi)}}}$$

Series representations:

$$\frac{1}{\sqrt{8\sqrt{2}\ e^{-1/4(i^2\pi)}\ 2^2\ \text{sech}(2\pi)}} = \frac{e^{(7\pi)/8}}{8\sqrt[4]{2}\sqrt{\sum_{k=0}^{\infty} e^{(-4+i)k\pi}}}$$

- $$\frac{1}{\sqrt{8\sqrt{2}\ e^{-1/4(i^2\pi)}\ 2^2\ \text{sech}(2\pi)}} = \frac{e^{-\pi/8}\sqrt{\pi}}{8\times 2^{3/4}\sqrt{\sum_{k=0}^{\infty}\frac{(-1)^k(1+2k)}{17+4k+4k^2}}}$$

•

$$\frac{1}{\sqrt{8\sqrt{2}\ e^{-1/4\,(i^2\,\pi)}\ 2^2\ \text{sech}(2\,\pi)}} = -\frac{e^{-\pi/8}\sqrt{-\sum_{k=1}^{\infty}(-1)^k\,q^{-1+2\,k}}}{8\sqrt[4]{2}\ \sum_{k=1}^{\infty}(-1)^k\,q^{-1+2\,k}} \quad \text{for } q = e^{2\,\pi}$$

Integral representation:

$$\frac{1}{\sqrt{8\sqrt{2}\ e^{-1/4\,(i^2\,\pi)}\ 2^2\ \text{sech}(2\,\pi)}} = \frac{e^{-\pi/8}\sqrt{\pi}}{8\sqrt[4]{2}\ \sqrt{\int_0^{\infty}\frac{t^{4\,i}}{1+t^2}\,dt}}$$

And:

-(8+2) * ln(((((8 sqrt(2) e^(-(i^2* π)/4) 2^2 sech(2 π)))))

Input:

$$-(8+2)\log\left(8\sqrt{2}\ e^{-1/4\,(i^2\,\pi)}\times 2^2\ \text{sech}(2\,\pi)\right)$$

sech(x) is the hyperbolic secant function

log(x) is the natural logarithm

i is the imaginary unit

Exact result:

$$-10\log\left(32\sqrt{2}\ e^{\pi/4}\ \text{sech}(2\,\pi)\right)$$

Decimal approximation:

9.923339574787691008755378866198952579570524555126047156610...

(using the principal branch of the logarithm for complex exponentiation)

9.92333… result practically equal to the black hole entropy 9.9340

Alternate forms:

$$-\frac{5}{2}\left(\pi+\log(4)+4\log(32\ \text{sech}(2\,\pi))\right)$$

•

$$-\frac{45\pi}{2} - 65\log(2) + 10\log(1+e^{4\pi})$$

$$-10\left(\frac{\pi}{4} + \frac{\log(2)}{2} + \log(32) + \log(\operatorname{sech}(2\pi))\right)$$

Alternative representations:

$$-(8+2)\log\left(8\sqrt{2}\,e^{-1/4\,(i^2\pi)}\,2^2\operatorname{sech}(2\pi)\right) = -10\log_e\left(32\,e^{-(\pi i^2)/4}\operatorname{sech}(2\pi)\sqrt{2}\right)$$

- $$-(8+2)\log\left(8\sqrt{2}\,e^{-1/4\,(i^2\pi)}\,2^2\operatorname{sech}(2\pi)\right) = -10\log\left(\frac{32\,e^{-(\pi i^2)/4}\sqrt{2}}{\cos(-2i\pi)}\right)$$

- $$-(8+2)\log\left(8\sqrt{2}\,e^{-1/4\,(i^2\pi)}\,2^2\operatorname{sech}(2\pi)\right) = -10\log(a)\log_a\left(32\,e^{-(\pi i^2)/4}\operatorname{sech}(2\pi)\sqrt{2}\right)$$

$\log_b(x)$ is the base- b logarithm

Series representation:

$$-(8+2)\log\left(8\sqrt{2}\,e^{-1/4\,(i^2\pi)}\,2^2\operatorname{sech}(2\pi)\right) = 10\sum_{k=1}^{\infty}\frac{(-1)^k\left(-1+32\sqrt{2}\,e^{\pi/4}\operatorname{sech}(2\pi)\right)^k}{k}$$

Integral representations:

$$-(8+2)\log\left(8\sqrt{2}\,e^{-1/4\,(i^2\pi)}\,2^2\operatorname{sech}(2\pi)\right) = -10\int_1^{32\sqrt{2}\,e^{\pi/4}\operatorname{sech}(2\pi)}\frac{1}{t}\,dt$$

- $$-(8+2)\log\left(8\sqrt{2}\,e^{-1/4\,(i^2\pi)}\,2^2\operatorname{sech}(2\pi)\right) = -10\log\left(\frac{64\sqrt{2}\,e^{\pi/4}}{\pi}\int_0^{\infty}\frac{t^{4i}}{1+t^2}\,dt\right)$$

For x = 13, we obtain:

8 sqrt(2) e^(-(i^2* π)/4) 13^2 sech(2 π)

Input:

$$8\sqrt{2}\,e^{-1/4\,(i^2\pi)}\times 13^2\operatorname{sech}(2\pi)$$

sech(x) is the hyperbolic secant function

i is the imaginary unit

Exact result:

$$1352\sqrt{2}\ e^{\pi/4}\ \text{sech}(2\pi)$$

Decimal approximation:

15.66251685446019993969622532786574358431776852355850636295...

(using the principal branch of the logarithm for complex exponentiation)

15.6625168… result practically equal to the black hole entropy 15.6730, directly obtained from the integral result for x = 13

Property:

$1352\sqrt{2}\ e^{\pi/4}\ \text{sech}(2\pi)$ is a transcendental number

Alternate forms:

$$\frac{1352\sqrt{2}\ e^{\pi/4}}{\cosh(2\pi)}$$

$$\frac{2704\sqrt{2}\ e^{(9\pi)/4}}{1+e^{4\pi}}$$

$$\frac{2704\sqrt{2}\ e^{\pi/4}\cosh(2\pi)}{1+\cosh(4\pi)}$$

cosh(x) is the hyperbolic cosine function

Alternative representations:

$$8\sqrt{2}\ e^{-1/4\,(i^2\pi)}\ 13^2\ \text{sech}(2\pi) = \frac{8\times 13^2\ e^{-(\pi i^2)/4}\sqrt{2}}{\cosh(2\pi)}$$

- $$8\sqrt{2}\ e^{-1/4\,(i^2\pi)}\ 13^2\ \text{sech}(2\pi) = \frac{8\times 13^2\ e^{-(\pi i^2)/4}\sqrt{2}}{\cos(-2\,i\,\pi)}$$

- $$8\sqrt{2}\ e^{-1/4\,(i^2\pi)}\ 13^2\ \text{sech}(2\pi) = \frac{8\times 13^2\ e^{-(\pi i^2)/4}\sqrt{2}}{\cos(2\,i\,\pi)}$$

Series representations:

$$8\sqrt{2}\, e^{-1/4\,(i^2\,\pi)}\, 13^2\,\operatorname{sech}(2\pi) = 2704\sqrt{2}\, e^{-(7\pi)/4}\sum_{k=0}^{\infty} e^{(-4+i)k\pi}$$

- $$8\sqrt{2}\, e^{-1/4\,(i^2\,\pi)}\, 13^2\,\operatorname{sech}(2\pi) = -2704\sqrt{2}\, e^{\pi/4}\sum_{k=1}^{\infty}(-1)^k q^{-1+2k} \quad \text{for } q = e^{2\pi}$$

- $$8\sqrt{2}\, e^{-1/4\,(i^2\,\pi)}\, 13^2\,\operatorname{sech}(2\pi) = \frac{5408\sqrt{2}\, e^{\pi/4}\sum_{k=0}^{\infty}\frac{(-1)^k(1+2k)}{17+4k+4k^2}}{\pi}$$

Integral representation:

$$8\sqrt{2}\, e^{-1/4\,(i^2\,\pi)}\, 13^2\,\operatorname{sech}(2\pi) = \frac{2704\sqrt{2}\, e^{\pi/4}}{\pi}\int_0^{\infty}\frac{t^{4i}}{1+t^2}\,dt$$

For the result 15.6625168 considered as entropy, we obtain:

Mass = 3.687521e-8

Radius = 5.475421e-35

Temperature = 3.327990e+30

From the Ramanujan-Nardelli mock formula, we obtain:

sqrt[[[[1/(((((((((4*1.962364415e+19)/(5*0.0864055^2)))*1/(3.687521e-8)* sqrt[[-((((3.327990e+30 * 4*Pi*(5.475421e-35)^3-(5.475421e-35)^2))))) / ((6.67*10^-11))]]]]]

Input interpretation:

$$\sqrt{\left(1\middle/\left(\frac{4\times 1.962364415\times 10^{19}}{5\times 0.0864055^2}\times\frac{1}{3.687521\times 10^{-8}}\sqrt{-\frac{3.327990\times 10^{30}\times 4\pi\,(5.475421\times 10^{-35})^3-(5.475421\times 10^{-35})^2}{6.67\times 10^{-11}}}\right)\right)}$$

Result:

1.618249266803150984475808847466374872323364709332183940569...

1.6182492…

-(34-3)/(10^3) +(((8 sqrt(2) e^(-(i^2* π)/4) 13^2 sech(2 π)))))^1/(11/2)

Input:

$$-\frac{34-3}{10^3}+\sqrt[\frac{11}{2}]{8\sqrt{2}\, e^{-1/4\left(i^2\pi\right)}\times 13^2\operatorname{sech}(2\pi)}$$

sech(x) is the hyperbolic secant function

i is the imaginary unit

Exact result:

$$2^{7/11}\times 13^{4/11}\, e^{\pi/22}\operatorname{sech}^{2/11}(2\pi)-\frac{31}{1000}$$

Decimal approximation:

1.618102138220003688477282191961811155372890138924155120028...

(using the principal branch of the logarithm for complex exponentiation)

1.6181021…

This result is a very good approximation to the value of the golden ratio 1,618033988749...

Alternate forms:

$$-\frac{31}{1000}+\frac{2^{7/11}\times 13^{4/11}\, e^{\pi/22}}{\cosh^{2/11}(2\pi)}$$

$$\frac{1000\times 2^{7/11}\times 13^{4/11}\, e^{\pi/22}\operatorname{sech}^{2/11}(2\pi)-31}{1000}$$

- $$\frac{2^{9/11}\times 13^{4/11}\, e^{\pi/22}}{\left(e^{-2\pi}+e^{2\pi}\right)^{2/11}}-\frac{31}{1000}$$

cosh(x) is the hyperbolic cosine function

Alternative representations:

$$-\frac{34-3}{10^3}+\sqrt[\frac{11}{2}]{8\sqrt{2}\,e^{-1/4(i^2\pi)}\,13^2\,\operatorname{sech}(2\pi)}=-\frac{31}{10^3}+\sqrt[\frac{11}{2}]{\frac{8\times 13^2\,e^{-(\pi i^2)/4}\sqrt{2}}{\cosh(2\pi)}}$$

-

$$-\frac{34-3}{10^3}+\sqrt[\frac{11}{2}]{8\sqrt{2}\,e^{-1/4(i^2\pi)}\,13^2\,\operatorname{sech}(2\pi)}=-\frac{31}{10^3}+\sqrt[\frac{11}{2}]{\frac{8\times 13^2\,e^{-(\pi i^2)/4}\sqrt{2}}{\cos(-2i\pi)}}$$

-

$$-\frac{34-3}{10^3}+\sqrt[\frac{11}{2}]{8\sqrt{2}\,e^{-1/4(i^2\pi)}\,13^2\,\operatorname{sech}(2\pi)}=-\frac{31}{10^3}+\sqrt[\frac{11}{2}]{\frac{8\times 13^2\,e^{-(\pi i^2)/4}\sqrt{2}}{\cos(2i\pi)}}$$

Series representations:

$$-\frac{34-3}{10^3}+\sqrt[\frac{11}{2}]{8\sqrt{2}\,e^{-1/4(i^2\pi)}\,13^2\,\operatorname{sech}(2\pi)}=$$
$$-\frac{31}{1000}+2^{9/11}\times 13^{4/11}\,e^{-(7\pi)/22}\left(\sum_{k=0}^{\infty}e^{(-4+i)k\pi}\right)^{2/11}$$

-

$$-\frac{34-3}{10^3}+\sqrt[\frac{11}{2}]{8\sqrt{2}\,e^{-1/4(i^2\pi)}\,13^2\,\operatorname{sech}(2\pi)}=$$
$$-\frac{31}{1000}+2^{9/11}\times 13^{4/11}\,e^{\pi/22}\left(-\sum_{k=1}^{\infty}(-1)^k\,q^{-1+2k}\right)^{2/11}\quad\text{for } q=e^{2\pi}$$

-

$$-\frac{34-3}{10^3}+\sqrt[\frac{11}{2}]{8\sqrt{2}\,e^{-1/4(i^2\pi)}\,13^2\,\operatorname{sech}(2\pi)}=$$
$$-\frac{31}{1000}+\frac{2\times 13^{4/11}\,e^{\pi/22}\left(\sum_{k=0}^{\infty}\frac{(-1)^k(1+2k)}{17+4k+4k^2}\right)^{2/11}}{\pi^{2/11}}$$

Integral representation:

$$-\frac{34-3}{10^3}+\sqrt[\frac{11}{2}]{8\sqrt{2}\ e^{-1/4\left(i^2\pi\right)}\ 13^2\ \text{sech}(2\pi)} =$$

$$-\frac{31}{1000}+\frac{2^{9/11}\times 13^{4/11}\ e^{\pi/22}\left(\int_0^\infty \frac{t^{4i}}{1+t^2}\,dt\right)^{2/11}}{\pi^{2/11}}$$

-5+10^3(((8 sqrt(2) e^(-(i^2* π)/4) 13^2 sech(2 π)))))^1/5

Input:

$$-5+10^3\sqrt[5]{8\sqrt{2}\ e^{-1/4\left(i^2\pi\right)}\times 13^2\ \text{sech}(2\pi)}$$

sech(x) is the hyperbolic secant function

i is the imaginary unit

Exact result:

$$1000\times 2^{7/10}\times 13^{2/5}\ e^{\pi/20}\sqrt[5]{\text{sech}(2\pi)}-5$$

Decimal approximation:

1728.693457470946712924664685224022059998779661184635766934...

(using the principal branch of the logarithm for complex exponentiation)

1728.6934…

This result is very near to the mass of candidate glueball $f_0(1710)$ meson. Furthermore, 1728 occurs in the algebraic formula for the j-invariant of an elliptic curve. As a consequence, it is sometimes called a Zagier as a pun on the Gross–Zagier theorem. The number 1728 is one less than the Hardy–Ramanujan number 1729

Alternate forms:

$$-5+\frac{1000\times 2^{7/10}\times 13^{2/5}\ e^{\pi/20}}{\sqrt[5]{\cosh(2\pi)}}$$

$$5\left(200\times 2^{7/10}\times 13^{2/5}\ e^{\pi/20}\sqrt[5]{\text{sech}(2\pi)}-1\right)$$

•

$$\frac{1000\times 2^{9/10}\times 13^{2/5}\, e^{\pi/20}}{\sqrt[5]{e^{-2\pi}+e^{2\pi}}}-5$$

$\cosh(x)$ is the hyperbolic cosine function

Alternative representations:

$$-5+10^3\sqrt[5]{8\sqrt{2}\, e^{-1/4\left(i^2\pi\right)}\, 13^2\, \text{sech}(2\pi)} = -5+10^3\sqrt[5]{\frac{8\times 13^2\, e^{-\left(\pi i^2\right)/4}\sqrt{2}}{\cosh(2\pi)}}$$

-

$$-5+10^3\sqrt[5]{8\sqrt{2}\, e^{-1/4\left(i^2\pi\right)}\, 13^2\, \text{sech}(2\pi)} = -5+10^3\sqrt[5]{\frac{8\times 13^2\, e^{-\left(\pi i^2\right)/4}\sqrt{2}}{\cos(-2i\pi)}}$$

-

$$-5+10^3\sqrt[5]{8\sqrt{2}\, e^{-1/4\left(i^2\pi\right)}\, 13^2\, \text{sech}(2\pi)} = -5+10^3\sqrt[5]{\frac{8\times 13^2\, e^{-\left(\pi i^2\right)/4}\sqrt{2}}{\cos(2i\pi)}}$$

Series representations:

$$-5+10^3\sqrt[5]{8\sqrt{2}\, e^{-1/4\left(i^2\pi\right)}\, 13^2\, \text{sech}(2\pi)} = -5+1000\times 2^{9/10}\times 13^{2/5}\, e^{-(7\pi)/20}\sqrt[5]{\sum_{k=0}^{\infty} e^{(-4+i)k\pi}}$$

-

$$-5+10^3\sqrt[5]{8\sqrt{2}\, e^{-1/4\left(i^2\pi\right)}\, 13^2\, \text{sech}(2\pi)} = -5+1000\times 2^{9/10}\times 13^{2/5}\, e^{\pi/20}\sqrt[5]{-\sum_{k=1}^{\infty}(-1)^k q^{-1+2k}} \quad \text{for } q=e^{2\pi}$$

-

$$-5+10^3\sqrt[5]{8\sqrt{2}\, e^{-1/4\left(i^2\pi\right)}\, 13^2\, \text{sech}(2\pi)} = -5+\frac{2000\sqrt[10]{2}\, 13^{2/5}\, e^{\pi/20}\sqrt[5]{\sum_{k=0}^{\infty}\frac{(-1)^k(1+2k)}{17+4k+4k^2}}}{\sqrt[5]{\pi}}$$

Integral representation:

$$-5+10^3 \sqrt[5]{8\sqrt{2}\, e^{-1/4 (i^2 \pi)}\, 13^2 \operatorname{sech}(2\pi)} = -5 + \frac{1000 \times 2^{9/10} \times 13^{2/5}\, e^{\pi/20} \sqrt[5]{\int_0^\infty \frac{t^{4i}}{1+t^2}\, dt}}{\sqrt[5]{\pi}}$$

(34+13)+10^3(((8 sqrt(2) e^(-(i^2* π)/4) 13^2 sech(2 π)))))^1/5

Input:

$$(34+13)+10^3 \sqrt[5]{8\sqrt{2}\, e^{-1/4 (i^2 \pi)} \times 13^2 \operatorname{sech}(2\pi)}$$

sech(x) is the hyperbolic secant function

i is the imaginary unit

Exact result:

$$47 + 1000 \times 2^{7/10} \times 13^{2/5}\, e^{\pi/20} \sqrt[5]{\operatorname{sech}(2\pi)}$$

Decimal approximation:

1780.693457470946712924664685224022059998779661184635766934...

(using the principal branch of the logarithm for complex exponentiation)

1780.6934… result in the range of the hypothetical mass of Gluino (gluino = 1785.16 GeV).

Alternate forms:

$$47 + \frac{1000 \times 2^{7/10} \times 13^{2/5}\, e^{\pi/20}}{\sqrt[5]{\cosh(2\pi)}}$$

$$47 + \frac{1000 \times 2^{9/10} \times 13^{2/5}\, e^{\pi/20}}{\sqrt[5]{e^{-2\pi} + e^{2\pi}}}$$

•

$$47 + 1000 \times 2^{9/10} \times 13^{2/5}\, e^{\pi/20} \sqrt[5]{\frac{\cosh(2\pi)}{1+\cosh(4\pi)}}$$

cosh(x) is the hyperbolic cosine function

Alternative representations:

$$(34+13) + 10^3 \sqrt[5]{8\sqrt{2}\, e^{-1/4\left(i^2\pi\right)}\, 13^2 \operatorname{sech}(2\pi)} = 47 + 10^3 \sqrt[5]{\frac{8 \times 13^2\, e^{-\left(\pi i^2\right)/4} \sqrt{2}}{\cosh(2\pi)}}$$

-

$$(34+13) + 10^3 \sqrt[5]{8\sqrt{2}\, e^{-1/4\left(i^2\pi\right)}\, 13^2 \operatorname{sech}(2\pi)} = 47 + 10^3 \sqrt[5]{\frac{8 \times 13^2\, e^{-\left(\pi i^2\right)/4} \sqrt{2}}{\cos(-2 i \pi)}}$$

-

$$(34+13) + 10^3 \sqrt[5]{8\sqrt{2}\, e^{-1/4\left(i^2\pi\right)}\, 13^2 \operatorname{sech}(2\pi)} = 47 + 10^3 \sqrt[5]{\frac{8 \times 13^2\, e^{-\left(\pi i^2\right)/4} \sqrt{2}}{\cos(2 i \pi)}}$$

Series representations:

$$(34+13) + 10^3 \sqrt[5]{8\sqrt{2}\, e^{-1/4\left(i^2\pi\right)}\, 13^2 \operatorname{sech}(2\pi)} = 47 + 1000 \times 2^{9/10} \times 13^{2/5}\, e^{-(7\pi)/20} \sqrt[5]{\sum_{k=0}^{\infty} e^{(-4+i)k\pi}}$$

-

$$(34+13) + 10^3 \sqrt[5]{8\sqrt{2}\, e^{-1/4\left(i^2\pi\right)}\, 13^2 \operatorname{sech}(2\pi)} = 47 + 1000 \times 2^{9/10} \times 13^{2/5}\, e^{\pi/20} \sqrt[5]{-\sum_{k=1}^{\infty} (-1)^k q^{-1+2k}} \quad \text{for } q = e^{2\pi}$$

-

$$(34+13) + 10^3 \sqrt[5]{8\sqrt{2}\, e^{-1/4\left(i^2\pi\right)}\, 13^2 \operatorname{sech}(2\pi)} = 47 + \frac{2000 \sqrt[10]{2}\, 13^{2/5}\, e^{\pi/20} \sqrt[5]{\sum_{k=0}^{\infty} \frac{(-1)^k (1+2k)}{17+4k+4k^2}}}{\sqrt[5]{\pi}}$$

Integral representation:

$$(34+13)+10^3 \sqrt[5]{8\sqrt{2}\, e^{-1/4 (i^2 \pi)}\, 13^2 \operatorname{sech}(2\pi)} = 47 + \frac{1000 \times 2^{9/10} \times 13^{2/5} e^{\pi/20} \sqrt[5]{\int_0^\infty \frac{t^{4i}}{1+t^2}\, dt}}{\sqrt[5]{\pi}}$$

(((((((((-5+10^3[(((((((8 sqrt(2) e^(-(i^2* π)/4) 13^2 sech(2 π)))))))))]^1/5))))))))))^1/15

Input:

$$\sqrt[15]{-5+10^3 \sqrt[5]{8\sqrt{2}\, e^{-1/4 (i^2 \pi)} \times 13^2 \operatorname{sech}(2\pi)}}$$

sech(x) is the hyperbolic secant function

i is the imaginary unit

Exact result:

$$\sqrt[15]{1000 \times 2^{7/10} \times 13^{2/5} e^{\pi/20} \sqrt[5]{\operatorname{sech}(2\pi)} - 5}$$

Decimal approximation:

1.643795797826281244060780172517256678599052387546336431985...

(using the principal branch of the logarithm for complex exponentiation)

$1.6437957\ldots \approx \zeta(2) = \frac{\pi^2}{6} = 1.644934\ldots$

Alternate forms:

$$\sqrt[15]{-5+\frac{1000 \times 2^{7/10} \times 13^{2/5} e^{\pi/20}}{\sqrt[5]{\cosh(2\pi)}}}$$

$$\sqrt[15]{5\left(200 \times 2^{7/10} \times 13^{2/5} e^{\pi/20} \sqrt[5]{\operatorname{sech}(2\pi)} - 1\right)}$$

•

$$\sqrt[15]{\frac{1000\times 2^{9/10}\times 13^{2/5}\, e^{\pi/20}}{\sqrt[5]{e^{-2\pi}+e^{2\pi}}}-5}$$

cosh(x) is the hyperbolic cosine function

All 15th roots of 1000 2^(7/10) 13^(2/5) e^(π/20) sech(2 π)^(1/5) - 5:

$e^0 \sqrt[15]{1000\times 2^{7/10}\times 13^{2/5}\, e^{\pi/20}\sqrt[5]{\operatorname{sech}(2\pi)}-5} \approx 1.64380$ (real, principal root)

- $e^{(2 i\pi)/15} \sqrt[15]{1000\times 2^{7/10}\times 13^{2/5}\, e^{\pi/20}\sqrt[5]{\operatorname{sech}(2\pi)}-5} \approx 1.5017+0.6686\, i$

- $e^{(4 i\pi)/15} \sqrt[15]{1000\times 2^{7/10}\times 13^{2/5}\, e^{\pi/20}\sqrt[5]{\operatorname{sech}(2\pi)}-5} \approx 1.0999+1.2216\, i$

- $e^{(2 i\pi)/5} \sqrt[15]{1000\times 2^{7/10}\times 13^{2/5}\, e^{\pi/20}\sqrt[5]{\operatorname{sech}(2\pi)}-5} \approx 0.5080+1.5633\, i$

- $e^{(8 i\pi)/15} \sqrt[15]{1000\times 2^{7/10}\times 13^{2/5}\, e^{\pi/20}\sqrt[5]{\operatorname{sech}(2\pi)}-5} \approx -0.17182+1.63479\, i$

Alternative representations:

$$\sqrt[15]{-5+10^3\sqrt[5]{8\sqrt{2}\, e^{-1/4(i^2\pi)}\, 13^2\operatorname{sech}(2\pi)}} = \sqrt[15]{-5+10^3\sqrt[5]{\frac{8\times 13^2\, e^{-(\pi i^2)/4}\sqrt{2}}{\cosh(2\pi)}}}$$

- $$\sqrt[15]{-5+10^3\sqrt[5]{8\sqrt{2}\, e^{-1/4(i^2\pi)}\, 13^2\operatorname{sech}(2\pi)}} = \sqrt[15]{-5+10^3\sqrt[5]{\frac{8\times 13^2\, e^{-(\pi i^2)/4}\sqrt{2}}{\cos(-2 i\pi)}}}$$

- $$\sqrt[15]{-5+10^3\sqrt[5]{8\sqrt{2}\, e^{-1/4(i^2\pi)}\, 13^2\operatorname{sech}(2\pi)}} = \sqrt[15]{-5+10^3\sqrt[5]{\frac{8\times 13^2\, e^{-(\pi i^2)/4}\sqrt{2}}{\cos(2 i\pi)}}}$$

Series representations:

$$\sqrt[15]{-5+10^3\sqrt[5]{8\sqrt{2}\,e^{-1/4(i^2\pi)}\,13^2\,\text{sech}(2\pi)}} =$$
$$\sqrt[15]{-5+1000\times 2^{9/10}\times 13^{2/5}\,e^{-(7\pi)/20}\sqrt[5]{\sum_{k=0}^{\infty}(-1)^k e^{-4k\pi}}}$$

- $$\sqrt[15]{-5+10^3\sqrt[5]{8\sqrt{2}\,e^{-1/4(i^2\pi)}\,13^2\,\text{sech}(2\pi)}} =$$
$$\sqrt[15]{-5+1000\times 2^{9/10}\times 13^{2/5}\,e^{\pi/20}\sqrt[5]{-\sum_{k=1}^{\infty}(-1)^k q^{-1+2k}}} \quad \text{for } q=e^{2\pi}$$

- $$\sqrt[15]{-5+10^3\sqrt[5]{8\sqrt{2}\,e^{-1/4(i^2\pi)}\,13^2\,\text{sech}(2\pi)}} =$$
$$\sqrt[15]{-5+\frac{2000\sqrt[10]{2}\,13^{2/5}\,e^{\pi/20}\sqrt[5]{\sum_{k=0}^{\infty}\frac{(-1)^k(1+2k)}{17+4k+4k^2}}}{\sqrt[5]{\pi}}}$$

Integral representation:

$$\sqrt[15]{-5+10^3\sqrt[5]{8\sqrt{2}\,e^{-1/4(i^2\pi)}\,13^2\,\text{sech}(2\pi)}} =$$
$$\sqrt[15]{-5+\frac{1000\times 2^{9/10}\times 13^{2/5}\,e^{\pi/20}\sqrt[5]{\int_0^{\infty}\frac{t^{4i}}{1+t^2}\,dt}}{\sqrt[5]{\pi}}}$$

-(16^2)/(10^4) +(((((((((-5+10^3[(((((((8 sqrt(2) e^(-(i^2* π)/4) 13^2 sech(2 π)))))))))]^1/5))))))))))^1/15

Input:

$$-\frac{16^2}{10^4}+\sqrt[15]{-5+10^3\sqrt[5]{8\sqrt{2}\,e^{-1/4(i^2\pi)}\times 13^2\,\text{sech}(2\pi)}}$$

sech(x) is the hyperbolic secant function

i is the imaginary unit

Exact result:

$$\sqrt[15]{1000\times 2^{7/10}\times 13^{2/5}\, e^{\pi/20}\, \sqrt[5]{\operatorname{sech}(2\pi)} - 5} - \frac{16}{625}$$

Decimal approximation:

1.618195797826281244060780172517256678599052387546336431985...

(using the principal branch of the logarithm for complex exponentiation)

1.6181957…

This result is a very good approximation to the value of the golden ratio 1,618033988749...

Alternate forms:

$$-\frac{16}{625} + \sqrt[15]{-5 + \frac{1000\times 2^{7/10}\times 13^{2/5}\, e^{\pi/20}}{\sqrt[5]{\cosh(2\pi)}}}$$

$$\sqrt[15]{\frac{1000\times 2^{9/10}\times 13^{2/5}\, e^{\pi/20}}{\sqrt[5]{e^{-2\pi}+e^{2\pi}}} - 5} - \frac{16}{625}$$

- $$\frac{1}{625}\left(625\sqrt[15]{5\left(200\times 2^{7/10}\times 13^{2/5}\, e^{\pi/20}\,\sqrt[5]{\operatorname{sech}(2\pi)} - 1\right)} - 16\right)$$

$\cosh(x)$ is the hyperbolic cosine function

Alternative representations:

$$-\frac{16^2}{10^4} + \sqrt[15]{-5 + 10^3\sqrt[5]{8\sqrt{2}\, e^{-1/4(i^2\pi)}\, 13^2 \operatorname{sech}(2\pi)}} = -\frac{16^2}{10^4} + \sqrt[15]{-5 + 10^3\sqrt[5]{\frac{8\times 13^2\, e^{-(\pi i^2)/4}\sqrt{2}}{\cosh(2\pi)}}}$$

-

$$-\frac{16^2}{10^4}+\sqrt[15]{-5+10^3\sqrt[5]{8\sqrt{2}\,e^{-1/4\left(i^2\pi\right)}\,13^2\,\operatorname{sech}(2\pi)}} = -\frac{16^2}{10^4}+\sqrt[15]{-5+10^3\sqrt[5]{\frac{8\times 13^2\,e^{-\left(\pi i^2\right)/4}\sqrt{2}}{\cos(-2i\pi)}}}$$

- $$-\frac{16^2}{10^4}+\sqrt[15]{-5+10^3\sqrt[5]{8\sqrt{2}\,e^{-1/4\left(i^2\pi\right)}\,13^2\,\operatorname{sech}(2\pi)}} = -\frac{16^2}{10^4}+\sqrt[15]{-5+10^3\sqrt[5]{\frac{8\times 13^2\,e^{-\left(\pi i^2\right)/4}\sqrt{2}}{\cos(2i\pi)}}}$$

Series representations:

$$-\frac{16^2}{10^4}+\sqrt[15]{-5+10^3\sqrt[5]{8\sqrt{2}\,e^{-1/4\left(i^2\pi\right)}\,13^2\,\operatorname{sech}(2\pi)}} = -\frac{16}{625}+\sqrt[15]{-5+1000\times 2^{9/10}\times 13^{2/5}\,e^{-(7\pi)/20}\sqrt[5]{\sum_{k=0}^{\infty}(-1)^k\,e^{-4k\pi}}}$$

- $$-\frac{16^2}{10^4}+\sqrt[15]{-5+10^3\sqrt[5]{8\sqrt{2}\,e^{-1/4\left(i^2\pi\right)}\,13^2\,\operatorname{sech}(2\pi)}} = -\frac{16}{625}+\sqrt[15]{-5+1000\times 2^{9/10}\times 13^{2/5}\,e^{\pi/20}\sqrt[5]{-\sum_{k=1}^{\infty}(-1)^k\,q^{-1+2k}}}\quad \text{for } q=e^{2\pi}$$

- $$-\frac{16^2}{10^4}+\sqrt[15]{-5+10^3\sqrt[5]{8\sqrt{2}\,e^{-1/4\left(i^2\pi\right)}\,13^2\,\operatorname{sech}(2\pi)}} = -\frac{16}{625}+\sqrt[15]{-5+1000\times 2^{7/10}\times 13^{2/5}\,e^{\pi/20}\sqrt[5]{\pi}\sqrt[5]{\sum_{k=0}^{\infty}\frac{(-1)^k\,(1+2k)}{4\pi^2+\left(\frac{1}{2}+k\right)^2\pi^2}}}$$

Integral representation:

$$-\frac{16^2}{10^4}+\sqrt[15]{-5+10^3\sqrt[5]{8\sqrt{2}\,e^{-1/4(i^2\pi)}\,13^2\,\text{sech}(2\pi)}} =$$

$$-\frac{16}{625}+\sqrt[15]{-5+\frac{1000\times 2^{9/10}\times 13^{2/5}\,e^{\pi/20}\sqrt[5]{\int_0^\infty \frac{t^{4i}}{1+t^2}\,dt}}{\sqrt[5]{\pi}}}$$

Now, we have that:

The most significant applications of mock theta functions to the theory of partitions come from the study of Dyson's rank (see the works of Bringmann and Ono [4,5]). An integer partition of n is a sequence $\lambda_1 \geq \lambda_2 \geq \cdots \geq \lambda_\ell > 0$ such that $\lambda_1+\lambda_2+\cdots+\lambda_\ell = n$. The numbers λ_j are the parts of the partition. Dyson's rank [10] of a partition is the largest part minus the number of parts. For example, $5 \geq 4 \geq 4 \geq 3 \geq 3 \geq 2 \geq 1 \geq 1 \geq 1 \geq 1$ is a partition of 25 with rank $5 - 10 = -5$. Let $N(m, n)$ denote the number of integer partitions of n with rank m. Define

$$R(u;\tau) := 1+\sum_{n=1}^{\infty}\sum_{m=-\infty}^{\infty} N(m,n)w^m q^n = \sum_{n=0}^{\infty}\frac{q^{n^2}}{(wq;q)_n(w^{-1}q;q)_n}, \tag{1.2}$$

where $w = e^{2\pi iu}$, $q = e^{2\pi i\tau}$ with $\tau \in \mathbb{H} = \{x+iy : x, y \in \mathbb{R}, y > 0\}$, $(a;q)_n := \prod_{j=0}^{n-1}(1-aq^j)$ for positive integers n, and $(a;q)_0 := 1$. Zwegers's thesis [42] shows that when $z \in \mathbb{Q}+\tau\mathbb{Q}$, the function $R(z;\tau)$ may be viewed as a mock theta function (see [39]).

The next theorem shows that the partial theta function

$$\psi(u;\tau) := \sum_{n=0}^{\infty}\left(\frac{12}{n}\right)e^{-\pi inu}q^{-\frac{n^2}{24}} \tag{1.3}$$

defined for $\tau \in \mathbb{H}^-$, has a modular transformation property that mirrors that for $R(u;\tau)$. Here, $\left(\frac{\cdot}{\cdot}\right)$ is the Kronecker symbol. The function is a "partial theta function" because it is the sum over half of the integer lattice.

Theorem 1.1. *Define* $\widetilde{R}(u;\tau) = \frac{iq^{\frac{1}{24}}}{2\sin(\pi u)}R(u;\tau)$. *For* $\tau \in \mathbb{H} = \{x+iy : x, y \in \mathbb{R}, y > 0\}$ *and* $u \in \mathbb{C}\setminus(\mathbb{Z}+\tau\mathbb{Z})$

$$\widetilde{R}(u;\tau) - \frac{e^{\frac{3\pi iu^2}{\tau}}}{\sqrt{i\tau}}\widetilde{R}\left(\frac{u}{\tau};-\frac{1}{\tau}\right) = \frac{1}{2}q^{-\frac{1}{6}}\sum_{\pm}\pm e^{-2\pi iu}h(3u\pm\tau;3\tau).$$

On the other hand, for $\tau \in \left(0,\frac{1}{2}\right)$ *and* $u \in \mathbb{H}^- = \{x+iy : x, y \in \mathbb{R}, y < 0\}$ *and* $Re(u) < \frac{1}{6}$

$$\psi(u;\tau) - \frac{e^{\frac{3\pi iu^2}{\tau}}}{\sqrt{i\tau}}\psi\left(\frac{u}{\tau};-\frac{1}{\tau}\right) = \frac{1}{2}q^{-\frac{1}{6}}\sum_{\pm}\pm e^{+2\pi iu}h(3u\pm\tau;3\tau).$$

In this section the Mordell integral is represented in terms of the partial theta function. The result is used to deduce the second part of Theorem 1.1. The following result, slightly reworded, appears in Ramanujan's article [34]. In particular, see (19) and (20) on page 62 of [34].

Theorem 2.1. *If* τ *is a positive real number and* $z \in \mathbb{H}^- = \{x+iy : x, y \in \mathbb{R}, y < 0\}$ *with* $|Re(z)| < \frac{1}{2}$, *we have*

$$\frac{1}{2}h(z;\tau) = \eta\,(z;\tau) + e^{\frac{\pi i z^2}{\tau}}\sqrt{\frac{i}{\tau}}\,\eta\left(\frac{z}{\tau};-\frac{1}{\tau}\right)$$

where

$$\eta(z;\tau) := \sum_{n=0}^{\infty}\left(\frac{-4}{n}\right)e^{-\pi inz}e^{-\pi i\tau\frac{n^2}{4}}.$$

of second part of Theorem 1.1.

We consider

$$\frac{1}{2}\sum_{\pm}\pm e^{\mp 2\pi iu}h(3u\pm\tau;3\tau) = \sum_{\pm}\pm e^{\mp 2\pi iu}\eta(3u\ \pm\ \tau;3\tau) + \frac{\sqrt{i}e^{\frac{3\pi iu^2}{\tau}}q^{\frac{1}{6}}}{\sqrt{3\tau}}\sum_{\pm}\pm\eta\left(\frac{u}{\tau}\pm\frac{1}{3};-\frac{1}{3\tau}\right).$$

First, we have

$$
\begin{aligned}
&\sum_{\pm} \pm e^{\mp 2\pi iu} \eta(3u \pm \tau; 3\tau) \\
&= e^{-2\pi iu} \sum_{n=0}^{\infty} \left(\frac{-4}{n}\right) e^{-3\pi inu - \pi in\tau - \frac{3\pi in^2\tau}{4}} - e^{2\pi iu} \sum_{n=0}^{\infty} \left(\frac{-4}{n}\right) e^{-3\pi inu + \pi in\tau - \frac{3\pi in^2\tau}{4}} \\
&= \sum_{n=0}^{\infty} \left(\frac{-4}{n}\right) e^{-\pi i(3n+2) - \frac{\pi i\tau}{12}((3n)^2+12n)} - \sum_{n=0}^{\infty} \left(\frac{-4}{n}\right) e^{-\pi i(3n-2) - \frac{\pi i\tau}{12}((3n)^2-12n)} \\
&= -q^{\frac{1}{6}} \sum_{n=0}^{\infty} \chi(n) e^{-\pi iun} q^{-\frac{n^2}{24}} \\
&= -q^{\frac{1}{6}} \psi(u;\tau)
\end{aligned}
$$

where

$$
\chi(n) := \begin{cases} -1 & n \equiv 2 \pmod 3 \text{ and } \frac{n-2}{3} \equiv 1 \pmod 4 \\ -1 & n \equiv 1 \pmod 3 \text{ and } \frac{n+2}{3} \equiv 3 \pmod 4 \\ 1 & n \equiv 2 \pmod 3 \text{ and } \frac{n-2}{3} \equiv 3 \pmod 4 \\ 1 & n \equiv 1 \pmod 3 \text{ and } \frac{n+2}{3} \equiv 1 \pmod 4 \\ 0 & \text{else} \end{cases}.
$$

The final line follows from $\chi(n) = \left(\frac{12}{n}\right)$.

On the other hand

$$
\begin{aligned}
\sum_{\pm} \eta\left(\frac{u}{\tau} \pm \frac{1}{3}; -\frac{1}{3\tau}\right) &= \sum_{n=0}^{\infty} \left(\frac{-4}{n}\right) e^{-\pi in\frac{u}{\tau} + \frac{\pi in^2}{12\tau}} \sum_{\pm} \pm e^{\mp\frac{\pi in}{3}} \\
&= -2i \sum_{n=0}^{\infty} \left(\frac{-4}{n}\right) \sin\left(\frac{\pi n}{3}\right) e^{-\pi in\frac{u}{\tau}} q_1^{-\frac{n^2}{24}} \\
&= -\sqrt{3}i \sum_{n=0}^{\infty} \left(\frac{12}{n}\right) e^{-\pi in\frac{u}{\tau}} q_1^{-\frac{n^2}{24}} \\
&= -i\sqrt{3}\psi\left(\frac{u}{\tau}; -\frac{1}{\tau}\right).
\end{aligned}
$$

since $\left(-\frac{4}{n}\right) \sin\left(\frac{\pi n}{3}\right) = \frac{\sqrt{3}}{2}\left(\frac{12}{n}\right)$. Hence

$$
\frac{1}{2}\sum_{\pm} \pm e^{\mp 2\pi iu} h(3u \pm \tau; 3\tau) = -q^{\frac{1}{6}} \left(\psi(u;\tau) - \frac{e^{\frac{3\pi iu^2}{\tau}}}{\sqrt{i\tau}} \psi\left(\frac{u}{\tau}; -\frac{1}{\tau}\right)\right).
$$

Rewriting the sum of Mordell integrals gives the second claim of the theorem. □

From:

$$= -2i \sum_{n=0}^{\infty} \left(\frac{-4}{n}\right) \sin\left(\frac{\pi n}{3}\right) e^{-\pi i n \frac{u}{\tau}} q_1^{-\frac{n^2}{24}}$$

since $\left(-\frac{4}{n}\right) \sin\left(\frac{\pi n}{3}\right) = \frac{\sqrt{3}}{2} \left(\frac{12}{n}\right)$

For n = 2, iuτ = 1; iτ = 1 and q = $e^{2\pi}$, we obtain:

-2*i*(((((((sqrt(3))/2)))*6)))) * e^(-2Pi) * (((e^(2Pi)))^(-1/6)

Input:

$$-2\, i \left(\frac{\sqrt{3}}{2} \times 6\right) e^{-2\pi} \left(e^{2\pi}\right)^{-1/6}$$

i is the imaginary unit

Exact result:

$$-6\, i \sqrt{3}\, e^{-(7\pi)/3}$$

Decimal approximation:

$$-0.006810312681563406580392519624140080684811497915045397\ldots\, i$$

- **Property:**

$-6\, i \sqrt{3}\, e^{-(7\pi)/3}$ is a transcendental number

- **Polar coordinates:**

$r \approx 0.00681031$ (radius), $\theta = -90°$ (angle)

0.00681031

Series representations:

$$\frac{1}{2}\left(-2 \times 6\, i \left(e^{-2\pi} \left(e^{2\pi}\right)^{-1/6}\right)\right)\sqrt{3} = -6\, e^{-4\pi} \left(e^{2\pi}\right)^{5/6} i \sqrt{2} \sum_{k=0}^{\infty} 2^{-k} \binom{\frac{1}{2}}{k}$$

- $$\frac{1}{2}\left(-2 \times 6\, i \left(e^{-2\pi} \left(e^{2\pi}\right)^{-1/6}\right)\right)\sqrt{3} = -6\, e^{-4\pi} \left(e^{2\pi}\right)^{5/6} i \sqrt{2} \sum_{k=0}^{\infty} \frac{\left(-\frac{1}{2}\right)^k \left(-\frac{1}{2}\right)_k}{k!}$$

- $$\frac{1}{2}\left(-2 \times 6\, i \left(e^{-2\pi} \left(e^{2\pi}\right)^{-1/6}\right)\right)\sqrt{3} = -\frac{3\, e^{-4\pi} \left(e^{2\pi}\right)^{5/6} i \sum_{j=0}^{\infty} \operatorname{Res}_{s=-\frac{1}{2}+j} 2^{-s}\, \Gamma\left(-\frac{1}{2} - s\right) \Gamma(s)}{\sqrt{\pi}}$$

1/ ((((((((((-2*i*(((((((sqrt(3))/2)))*6)))) * e^(-2Pi) * (((e^(2Pi)))^(-1/6)))))))))

Input:

$$\frac{1}{\left(-2\, i \left(\frac{\sqrt{3}}{2} \times 6\right)\right) e^{-2\pi} \left(e^{2\pi}\right)^{-1/6}}$$

i is the imaginary unit

Exact result:

$$\frac{i\, e^{(7\pi)/3}}{6\sqrt{3}}$$

Decimal approximation:

- More digits

146.8361361303069301268067978130044126238625344455468149241... i

-

Property:

$\frac{i\, e^{(7\pi)/3}}{6\sqrt{3}}$ is a transcendental number

-

Polar coordinates:

$r \approx 146.836$ (radius), $\theta = 90°$ (angle)

146.836

Series representations:

$$\frac{1}{\frac{1}{2}\left(e^{-2\pi}\left(e^{2\pi}\right)^{-1/6}\right)(-2)\left(i\left(\sqrt{3}\ 6\right)\right)} = -\frac{\left(e^{2\pi}\right)^{7/6}}{6\, i\sqrt{2}\sum_{k=0}^{\infty} 2^{-k}\binom{\frac{1}{2}}{k}}$$

-

$$\frac{1}{\frac{1}{2}\left(e^{-2\pi}\left(e^{2\pi}\right)^{-1/6}\right)(-2)\left(i\left(\sqrt{3}\ 6\right)\right)} = -\frac{\left(e^{2\pi}\right)^{7/6}}{6\, i\sqrt{2}\sum_{k=0}^{\infty}\frac{\left(-\frac{1}{2}\right)^k\left(-\frac{1}{2}\right)_k}{k!}}$$

-

$$\frac{1}{\frac{1}{2}\left(e^{-2\pi}\left(e^{2\pi}\right)^{-1/6}\right)(-2)\left(i\left(\sqrt{3}\ 6\right)\right)} = -\frac{\left(e^{2\pi}\right)^{7/6}\sqrt{\pi}}{3\, i\sum_{j=0}^{\infty}\operatorname{Res}_{s=-\frac{1}{2}+j}\, 2^{-s}\,\Gamma\left(-\frac{1}{2}-s\right)\Gamma(s)}$$

$\binom{n}{m}$ is the binomial coefficient

$n!$ is the factorial function

$(a)_n$ is the Pochhammer symbol (rising factorial)

$\Gamma(x)$ is the gamma function

$\underset{z=z_0}{\text{Res}} f$ is a complex residue

12/ (((((((((-2*i*(((((((sqrt(3))/2)))*6)))) * e^(-2Pi) * (((e^(2Pi)))^(-1/6))))))))

Input:

$$\frac{12}{\left(-2\,i\left(\frac{\sqrt{3}}{2}\times 6\right)\right)e^{-2\pi}\left(e^{2\pi}\right)^{-1/6}}$$

i is the imaginary unit

Exact result:

$$\frac{2\,i\,e^{(7\pi)/3}}{\sqrt{3}}$$

Decimal approximation:

1762.033633563683161521681573756052951486350413346561779089... i

1762.03… result in the range of the mass of candidate "glueball" $f_0(1710)$ ("glueball" =1760 ± 15 MeV).

Property:

$\frac{2\,i\,e^{(7\pi)/3}}{\sqrt{3}}$ is a transcendental number

-

Polar coordinates:

$r \approx 1762.03$ (radius), $\theta = 90°$ (angle)

Series representations:

$$\frac{12}{\frac{1}{2}\left(e^{-2\pi}\left(e^{2\pi}\right)^{-1/6}\right)(-2)\left(i\left(\sqrt{3}\ 6\right)\right)} = -\frac{2\left(e^{2\pi}\right)^{7/6}}{i\sqrt{2}\sum_{k=0}^{\infty} 2^{-k}\binom{\frac{1}{2}}{k}}$$

- $$\frac{12}{\frac{1}{2}\left(e^{-2\pi}\left(e^{2\pi}\right)^{-1/6}\right)(-2)\left(i\left(\sqrt{3}\ 6\right)\right)} = -\frac{2\left(e^{2\pi}\right)^{7/6}}{i\sqrt{2}\sum_{k=0}^{\infty} \frac{\left(-\frac{1}{2}\right)^k\left(-\frac{1}{2}\right)_k}{k!}}$$

- $$\frac{12}{\frac{1}{2}\left(e^{-2\pi}\left(e^{2\pi}\right)^{-1/6}\right)(-2)\left(i\left(\sqrt{3}\ 6\right)\right)} = -\frac{4\left(e^{2\pi}\right)^{7/6}\sqrt{\pi}}{i\sum_{j=0}^{\infty} \operatorname{Res}_{s=-\frac{1}{2}+j} 2^{-s}\,\Gamma\left(-\frac{1}{2}-s\right)\Gamma(s)}$$

$\binom{n}{m}$ is the binomial coefficient

$n!$ is the factorial function

$(a)_n$ is the Pochhammer symbol (rising factorial)

$\Gamma(x)$ is the gamma function

$\operatorname{Res}_{z=z_0} f$ is a complex residue

((((((12/ (((((((((((-2*i*(((((((sqrt(3))/2)))*6)))) * e^(-2Pi) * (((e^(2Pi)))^(-1/6))))))))))))))))^1/15

Input:

$$\sqrt[15]{\frac{12}{\left(-2\,i\left(\frac{\sqrt{3}}{2}\times 6\right)\right)e^{-2\pi}\left(e^{2\pi}\right)^{-1/6}}}$$

i is the imaginary unit

Exact result:

$$\sqrt[30]{-\frac{1}{3}}\ \sqrt[15]{2}\ e^{(7\pi)/45}$$

Decimal approximation:

1.636874168831032192478094743436895203749785792771760 4417... +
0.172042407741125421602267244318703243171306335281949 21453... i

- **Property:**

$\sqrt[30]{-\frac{1}{3}}\ \sqrt[15]{2}\ e^{(7\pi)/45}$ is a transcendental number

- **Polar coordinates:**

$r \approx 1.64589$ (radius), $\theta = 6°$ (angle)

$1.64589 \approx \zeta(2) = \frac{\pi^2}{6} = 1.644934 \ldots$

Alternate forms:

$e^{(7\pi)/45}$ root of $3x^{30} + 4$ near $x = 1.0041 + 0.105536\, i$

- $\frac{\sqrt[15]{2}\ e^{(7\pi)/45} \cos\left(\frac{\pi}{30}\right)}{\sqrt[30]{3}} + \frac{i\, \sqrt[15]{2}\ e^{(7\pi)/45} \sin\left(\frac{\pi}{30}\right)}{\sqrt[30]{3}}$

All 15th roots of (2 i e^((7 π)/3))/sqrt(3):

$\frac{\sqrt[15]{2}\ e^{(7\pi)/45}\ e^{(i\pi)/30}}{\sqrt[30]{3}} \approx 1.63687 + 0.17204\, i$ (principal root)

- $\frac{\sqrt[15]{2}\ e^{(7\pi)/45}\ e^{(i\pi)/6}}{\sqrt[30]{3}} \approx 1.42538 + 0.82295\, i$

- $\frac{\sqrt[15]{2}\ e^{(7\pi)/45}\ e^{(3i\pi)/10}}{\sqrt[30]{3}} \approx 0.9674 + 1.3316\, i$

- $\frac{\sqrt[15]{2}\ e^{(7\pi)/45}\ e^{(13i\pi)/30}}{\sqrt[30]{3}} \approx 0.3422 + 1.6099\, i$

- $\frac{\sqrt[15]{2}\ e^{(7\pi)/45}\ e^{(17i\pi)/30}}{\sqrt[30]{3}} \approx -0.3422 + 1.6099\, i$

- **Series representations:**

$$\sqrt[15]{\frac{12}{\frac{1}{2}\left(e^{-2\pi}\left(e^{2\pi}\right)^{-1/6}\right)(-2)\left(i\left(\sqrt{3}\ 6\right)\right)}} = \sqrt[30]{-\frac{1}{3}}\ \sqrt[15]{2}\ e^{28/45 \sum_{k=0}^{\infty}(-1)^k/(1+2k)}$$

-

$$\sqrt[15]{\frac{12}{\frac{1}{2}\left(e^{-2\pi}\left(e^{2\pi}\right)^{-1/6}\right)(-2)\left(i\left(\sqrt{3}\ 6\right)\right)}} = \sqrt[30]{-\frac{1}{3}}\ \sqrt[15]{2}\left(\sum_{k=0}^{\infty}\frac{1}{k!}\right)^{(7\pi)/45}$$

-

$$\sqrt[15]{\frac{12}{\frac{1}{2}\left(e^{-2\pi}\left(e^{2\pi}\right)^{-1/6}\right)(-2)\left(i\left(\sqrt{3}\ 6\right)\right)}} = \sqrt[30]{-\frac{1}{3}}\ \sqrt[15]{2}\left(\frac{1}{\sum_{k=0}^{\infty}\frac{(-1)^k}{k!}}\right)^{(7\pi)/45}$$

$n!$ is the factorial function

Integral representations:

$$\sqrt[15]{\frac{12}{\frac{1}{2}\left(e^{-2\pi}\left(e^{2\pi}\right)^{-1/6}\right)(-2)\left(i\left(\sqrt{3}\ 6\right)\right)}} = \sqrt[30]{-\frac{1}{3}}\ \sqrt[15]{2}\ e^{28/45 \int_0^1 \sqrt{1-t^2}\,dt}$$

-

$$\sqrt[15]{\frac{12}{\frac{1}{2}\left(e^{-2\pi}\left(e^{2\pi}\right)^{-1/6}\right)(-2)\left(i\left(\sqrt{3}\ 6\right)\right)}} = \sqrt[30]{-\frac{1}{3}}\ \sqrt[15]{2}\ e^{14/45 \int_0^1 1/\sqrt{1-t^2}\,dt}$$

-

$$\sqrt[15]{\frac{12}{\frac{1}{2}\left(e^{-2\pi}\left(e^{2\pi}\right)^{-1/6}\right)(-2)\left(i\left(\sqrt{3}\ 6\right)\right)}} = \sqrt[30]{-\frac{1}{3}}\ \sqrt[15]{2}\ e^{14/45 \int_0^{\infty} 1/(1+t^2)\,dt}$$

-

0.61803398+(((((((1/ (((((((((-2*i*(((((((sqrt(3))/2)))*6)))) * e^(-2Pi) * (((e^(2Pi)))^(-1/6)))))))))))))))))^1/2

Input interpretation:

$$0.61803398 + \sqrt{\frac{1}{\left(-2\,i\left(\frac{\sqrt{3}}{2}\times 6\right)\right)e^{-2\pi}\left(e^{2\pi}\right)^{-1/6}}}$$

i is the imaginary unit

Result:

9.18646838... +
8.56843440... i

Polar coordinates:

$r = 12.5622$ (radius), $\theta = 43.0064°$ (angle)

12.5622 result practically equal to the black hole entropy 12.5664

Series representations:

$$0.618034 + \sqrt{\frac{1}{\frac{1}{2}\left(e^{-2\pi}\left(e^{2\pi}\right)^{-1/6}\right)(-2)\left(i\left(\sqrt{3}\ 6\right)\right)}} = 0.618034 + 0.408248\sqrt{-\frac{\left(e^{2\pi}\right)^{7/6}}{i\sqrt{2}\sum_{k=0}^{\infty} 2^{-k}\binom{\frac{1}{2}}{k}}}$$

•

$$0.618034 + \sqrt{\frac{1}{\frac{1}{2}\left(e^{-2\pi}\left(e^{2\pi}\right)^{-1/6}\right)(-2)\left(i\left(\sqrt{3}\ 6\right)\right)}} = 0.618034 + 0.408248\sqrt{-\frac{\left(e^{2\pi}\right)^{7/6}}{i\sqrt{2}\sum_{k=0}^{\infty} \frac{\left(-\frac{1}{2}\right)^k\left(-\frac{1}{2}\right)_k}{k!}}}$$

•

$$0.618034 + \sqrt{\frac{1}{\frac{1}{2}\left(e^{-2\pi}\left(e^{2\pi}\right)^{-1/6}\right)(-2)\left(i\left(\sqrt{3}\ 6\right)\right)}} = 0.618034 + 0.57735\sqrt{-\frac{\left(e^{2\pi}\right)^{7/6}\sqrt{\pi}}{i\sum_{j=0}^{\infty} \operatorname{Res}_{s=-\frac{1}{2}+j} 2^{-s}\,\Gamma\left(-\frac{1}{2}-s\right)\Gamma(s)}}$$

$\binom{n}{m}$ is the binomial coefficient

$n!$ is the factorial function

$(a)_n$ is the Pochhammer symbol (rising factorial)

$\Gamma(x)$ is the gamma function

$\operatorname{Res}_{z=z_0} f$ is a complex residue

SOME NEW EXPLICIT VALUES FOR RAMANUJAN'S CLASS INVARIANTS

M. S. MAHADEVA NAIKA

We have that:

In this section, we establish several new explicit evaluations of the class invariant G_n for odd values of n using the Ramanujan's modular equations of different degrees.

Theorem 3.1. *We have*

$$G_{95} = \left(\frac{\sqrt{5}+1}{2}\right)^{1/2}\left(\frac{1+\sqrt{2\sqrt{5}-1}}{\sqrt{2}}\right)^{1/2} \left(\sqrt{\frac{218+105\sqrt{5}+\sqrt{102475+45850\sqrt{5}}}{8}}+\sqrt{\frac{210+105\sqrt{5}+\sqrt{102475+45850\sqrt{5}}}{8}}\right)^{1/6} \tag{3.1}$$

$$G_{19/5} = \left(\frac{\sqrt{5}+1}{2}\right)^{1/2}\left(\frac{1+\sqrt{2\sqrt{5}-1}}{\sqrt{2}}\right)^{1/2} \left(\sqrt{\frac{218+105\sqrt{5}+\sqrt{102475+45850\sqrt{5}}}{8}}-\sqrt{\frac{210+105\sqrt{5}+\sqrt{102475-45850\sqrt{5}}}{8}}\right)^{1/6}. \tag{3.2}$$

(sqrt((((((1/8*(210+105sqrt(5)+((sqrt(102475+45580sqrt(5)))))

Input:

$$\sqrt{\frac{1}{8}\left(210+105\sqrt{5}+\sqrt{102475+45580\sqrt{5}}\right)}$$

Result:

$$\frac{1}{2}\sqrt{\frac{1}{2}\left(210+105\sqrt{5}+\sqrt{102475+45580\sqrt{5}}\right)}$$

Decimal approximation:

10.588246822981351841584765315077332328975838761530860918 14...

10.58824682298135184158476531507733232897583876153086091814+((((((sqrt((((((1/8*(218+105sqrt(5)+((sqrt(102475+45580sqrt(5)))))

Input interpretation:

$$10.5882468229813518415847653150773323289758387615308609181 4+\sqrt{\frac{1}{8}\left(218+105\sqrt{5}+\sqrt{102475+45580\sqrt{5}}\right)}$$

Result:

21.223610981503366959806447801790759946825586558032925681 04...

(21.22361098150336695980644780179075994682558655803292568104)^1/6

Input interpretation:

$$\sqrt[6]{21.22361098150336695980644780179075994682558655803292568104}$$

Result:

1.663935724552899421892612967615746549023249644080225899876...

1.663935… is very near to the 14th root of the following Ramanujan's class invariant $Q=\left(G_{505}/G_{101/5}\right)^3$ = 1164,2696 i.e. 1,65578...

(((sqrt(5)+1))/2)))^0.5 * ((((1+sqrt(2sqrt(5)-1))/(sqrt(2))))^0.5
(21.22361098150336695980644780179075994682558655803292568104)^1/6

Input interpretation:

$$\sqrt{\frac{1}{2}\left(\sqrt{5}+1\right)}\left(\sqrt{\frac{1+\sqrt{2\sqrt{5}-1}}{\sqrt{2}}}\sqrt[6]{21.22361098150336695980644780179075994682558655803292568104}\right)$$

Result:

3.011697596713666179769133877213060156296516322549462225073...

3.0116975…

1+1/((((((((((1/2*(((((((sqrt(5)+1))/2)))^0.5 * ((((1+sqrt(2sqrt(5)-1))/(sqrt(2))))^0.5
(21.2236109815033669)^1/6))))))))))))))

Input interpretation:

$$1+\frac{1}{\frac{1}{2}\left(\sqrt{\frac{1}{2}\left(\sqrt{5}+1\right)}\left(\sqrt{\frac{1+\sqrt{2\sqrt{5}-1}}{\sqrt{2}}}\sqrt[6]{21.2236109815033669}\right)\right)}$$

Result:

1.664077297196896422...

1.6640772… is very near to the 14th root of the following Ramanujan's class invariant $Q = \left(G_{505}/G_{101/5}\right)^3$ = 1164,2696 i.e. 1,65578...

And:

exp((((((((((sqrt(5)+1))/2)))^0.5 * ((((1+sqrt(2sqrt(5)-1))/(sqrt(2))))^0.5 (21.2236109815033669)^1/6)))))))))))))

Input interpretation:

$$\exp\left(\sqrt{\frac{1}{2}\left(\sqrt{5}+1\right)}\left(\sqrt{\frac{1+\sqrt{2\sqrt{5}-1}}{\sqrt{2}}}\sqrt[6]{21.2236109815033669}\right)\right)$$

Result:

20.3218689976970667...

20.32186... result near to the black hole entropy 20.5520

8((((((((((sqrt(5)+1))/2)))^0.5 * ((((1+sqrt(2sqrt(5)-1))/(sqrt(2))))^0.5 (21.2236109815033669)^1/6)))))))))))))

Input interpretation:

$$8\left(\sqrt{\frac{1}{2}\left(\sqrt{5}+1\right)}\left(\sqrt{\frac{1+\sqrt{2\sqrt{5}-1}}{\sqrt{2}}}\sqrt[6]{21.2236109815033669}\right)\right)$$

Result:

24.09358077370932943...

24.09358... result very near to the black hole entropy 24.2477

From 20.32186 as entropy, we obtain:

Mass = 4.200350e-8 (equivalent to 2.356224×10^19 GeV, practically near to the mean value 1.962 * 10^{19} of DM particle that has a Planck scale mass: m ≈ 10^{19} GeV (Planck mass = 1,2209 × 10^{19} GeV/c^2 = 21,76 μg Wikipedia) and is very nearly to the result of the following Ramanujan mock theta function: **χ(q) = 1.962364415**)

Radius = 6.236896e-35

Temperature = 2.921669e+30

From the Ramanujan-Nardelli mock formula, we obtain:

sqrt[[[[1/(((((((4*1.962364415e+19)/(5*0.0864055^2)))*1/(4.200350e-8)* sqrt[[-((((2.921669e+30* 4*Pi*(6.236896e-35)^3-(6.236896e-35)^2))))) / ((6.67*10^-11))]]]]]

Input interpretation:

$$\sqrt{1\Bigg/\left(\frac{4\times1.962364415\times10^{19}}{5\times0.0864055^2}\times\frac{1}{4.200350\times10^{-8}}\sqrt{-\frac{2.921669\times10^{30}\times4\pi\,(6.236896\times10^{-35})^3-(6.236896\times10^{-35})^2}{6.67\times10^{-11}}}\right)}$$

Result:

1.618249253491065545007799946812616150878153219107481818267...

1.6182492…

And, for 1.897512108 as Ramanujan mock theta function, we obtain:

sqrt[[[[1/(((((((4*1.897512108e+19)/(5*0.0864055^2)))*1/(4.200350e-8)* sqrt[[-((((2.921669e+30* 4*Pi*(6.236896e-35)^3-(6.236896e-35)^2))))) / ((6.67*10^-11))]]]]]

Input interpretation:

$$\sqrt{\left(1/\left(\frac{4\times 1.897512108\times 10^{19}}{5\times 0.0864055^2}\times\frac{1}{4.200350\times 10^{-8}}\sqrt{-\frac{2.921669\times 10^{30}\times 4\pi\,(6.236896\times 10^{-35})^3-(6.236896\times 10^{-35})^2}{6.67\times 10^{-11}}}\right)\right)}$$

Result:

1.6456708155223073750146110548516235245430680155385300145 93...

1.64567… ≈ ζ(2) = $\frac{\pi^2}{6} = 1.644934$ ...

From:

(4.17)

$$N=\sqrt{\frac{140451+81090\sqrt{3}-69\sqrt{8286609+4784310\sqrt{3}}}{2}}+\sqrt{\frac{140449+81090\sqrt{3}-69\sqrt{8286609+4784310\sqrt{3}}}{2}}.$$

We obtain:

1.000003559960413460146484711972 3

We note that, from the inverse of result, we obtain:

ln(((1/((colog(1/1.00000355996041346)))))

Input interpretation:

$$\log\left(-\frac{1}{\log\left(\frac{1}{1.00000355996041346}\right)}\right)$$

log(x) is the natural logarithm

Result:

12.545762912954...

12.54576… result very near to the black hole entropy 12.5663

Alternative representations:

$$\log\left(-\frac{1}{\log\left(\frac{1}{1.000003559960413460000}\right)}\right)=\log_e\left(-\frac{1}{\log\left(\frac{1}{1.000003559960413460000}\right)}\right)$$

$$\log\left(-\frac{1}{\log\left(\frac{1}{1.0000035599604134600000}\right)}\right) = \log(a)\log_a\left(-\frac{1}{\log\left(\frac{1}{1.0000035599604134600000}\right)}\right)$$

$$\log\left(-\frac{1}{\log\left(\frac{1}{1.0000035599604134600000}\right)}\right) = -\text{Li}_1\left(1 - -\frac{1}{\log\left(\frac{1}{1.0000035599604134600000}\right)}\right)$$

$\log_b(x)$ is the base- b logarithm

$\text{Li}_n(x)$ is the polylogarithm function

Series representations:

$$\log\left(-\frac{1}{\log\left(\frac{1}{1.0000035599604134600000}\right)}\right) = \log\left(-1 - \frac{1}{\log(0.99999644005225598130291)}\right) - \sum_{k=1}^{\infty} \frac{(-1)^k \left(-1 - \frac{1}{\log(0.99999644005225598130291)}\right)^{-k}}{k}$$

$$\log\left(-\frac{1}{\log\left(\frac{1}{1.0000035599604134600000}\right)}\right) = 2 i \pi \left\lfloor \frac{\arg\left(-x - \frac{1}{\log(0.99999644005225598130291)}\right)}{2\pi} \right\rfloor + \log(x) - \sum_{k=1}^{\infty} \frac{(-1)^k x^{-k} \left(-x - \frac{1}{\log(0.99999644005225598130291)}\right)^k}{k} \quad \text{for } x < 0$$

$$\log\left(-\frac{1}{\log\left(\frac{1}{1.0000035599604134600000}\right)}\right) = \left\lfloor \frac{\arg\left(-\frac{1}{\log(0.99999644005225598130291)} - z_0\right)}{2\pi} \right\rfloor \log\left(\frac{1}{z_0}\right) + \log(z_0) + \left\lfloor \frac{\arg\left(-\frac{1}{\log(0.99999644005225598130291)} - z_0\right)}{2\pi} \right\rfloor \log(z_0) - \sum_{k=1}^{\infty} \frac{(-1)^k \left(-\frac{1}{\log(0.99999644005225598130291)} - z_0\right)^k z_0^{-k}}{k}$$

$\arg(z)$ is the complex argument

$\lfloor x \rfloor$ is the floor function

i is the imaginary unit

Integral representations:

$$\log\left(-\frac{1}{\log\left(\frac{1}{1.0000035599604134600000}\right)}\right) = \int_1^{-\frac{1}{\log(0.99999644005225981 30291)}} \frac{1}{t}\, dt$$

$$\log\left(-\frac{1}{\log\left(\frac{1}{1.0000035599604134600000}\right)}\right) = \frac{1}{2 i \pi} \int_{-i \infty+\gamma}^{i \infty+\gamma} \frac{\Gamma(-s)^2\, \Gamma(1+s) \left(-1 - \frac{1}{\log(0.99999644005225981 30291)}\right)^{-s}}{\Gamma(1-s)}\, ds \quad \text{for } -1 < \gamma < 0$$

$\Gamma(x)$ is the gamma function

Now, we have that:

Theorem 4.1. *We have*

$$(4.1) \qquad g_{57} = 2^{-1/8} \left(\frac{3\sqrt{19}-13}{\sqrt{2}}\right)^{1/12} (2+\sqrt{3})^{1/4} \left(\sqrt{\frac{170+39\sqrt{19}}{2}} + \sqrt{\frac{168+39\sqrt{19}}{2}}\right)^{1/4} \left(\sqrt{\frac{339+78\sqrt{19}-45\sqrt{113+26\sqrt{19}}}{2}} + \sqrt{\frac{337+78\sqrt{19}-45\sqrt{113+26\sqrt{19}}}{2}}\right)^{1/4}$$

(0,91700404320467123174354159479414 * 0,78437161389013532079588337771744*1,3899106635241477179115488119922 * 2,2589318177595206222038904975762*1,0003685316911066866003881134365) =

= 2.2591400259551219341077739935978

1+((ln(2.2591400259551219341077739935978)))^2

Input interpretation:

$1 + \log^2(2.2591400259551219341077739935978)$

$\log(x)$ is the natural logarithm

Result:

1.6641992810973847054689759980764...

1.664199… is very near to the 14th root of the following Ramanujan's class invariant $Q = \left(G_{505}/G_{101/5}\right)^3$ = 1164,2696 i.e. 1,65578...

Alternative representations:

$$1+\log^2(2.25914002595512193410777399359780000) = 1+\log_e^2(2.25914002595512193410777399359780000)$$

$$1+\log^2(2.25914002595512193410777399359780000) = 1+(\log(a)\log_a(2.25914002595512193410777399359780000))^2$$

$$1+\log^2(2.25914002595512193410777399359780000) = 1+(-\text{Li}_1(-1.25914002595512193410777399359780000))^2$$

$\log_b(x)$ is the base- b logarithm

$\text{Li}_n(x)$ is the polylogarithm function

Series representations:

$$1+\log^2(2.25914002595512193410777399359780000) = 1+\left(\log(1.25914002595512193410777399359780000) - \sum_{k=1}^{\infty}\frac{(-1)^k e^{-0.230428968885796648722259902564393857k}}{k}\right)^2$$

$$1+\log^2(2.25914002595512193410777399359780000) = 1+\left(2i\pi\left\lfloor\frac{\arg(2.25914002595512193410777399359780000-x)}{2\pi}\right\rfloor+\log(x) - \sum_{k=1}^{\infty}\frac{(-1)^k(2.25914002595512193410777399359780000-x)^k x^{-k}}{k}\right)^2 \quad \text{for } x<0$$

$$1+\log^2(2.25914002595512193410777399359780000) = 1+\left(\log(z_0)+\left\lfloor \frac{\arg(2.25914002595512193410777399359780000-z_0)}{2\pi} \right\rfloor \left(\log\left(\frac{1}{z_0}\right)+\log(z_0)\right) - \sum_{k=1}^{\infty} \frac{(-1)^k (2.25914002595512193410777399359780000-z_0)^k z_0^{-k}}{k}\right)^2$$

$\arg(z)$ is the complex argument

$\lfloor x \rfloor$ is the floor function

i is the imaginary unit

Integral representations:

$$1+\log^2(2.25914002595512193410777399359780000) = 1+\left(\int_1^{2.25914002595512193410777399359780000} \frac{1}{t}\,dt\right)^2$$

$$1+\log^2(2.25914002595512193410777399359780000) = 1+\frac{\left(\int_{-i\infty+\gamma}^{i\infty+\gamma} \frac{e^{-0.230428968857966487222599025643938 57 s}\,\Gamma(-s)^2\,\Gamma(1+s)}{\Gamma(1-s)}\,ds\right)^2}{4 i^2 \pi^2} \quad \text{for } -1<\gamma<0$$

$\Gamma(x)$ is the gamma function

8 * (2.25914002595512193410777399359780000)

Input interpretation:

$8 \times 2.259140025955121934107773993597 8$

Result:

18.07312020764097547286219487824

18.07312… result very near to the black hole entropy 18.0524

With an entropy equal to the result 18.07312 that we have obtained from the ln of the value of expression, by the Hawking radiation calculator, we have the following black hole parameters:

Mass = 3.961141e-8 (equivalent to 2.222038×10^19 GeV, practically near to the mean value 1.962 * 10^{19} of DM particle that has a Planck scale mass: m ≈ 10^{19} GeV (Planck mass = 1,2209 × 10^{19} GeV/c^2 = 21,76 μg Wikipedia) and is very nearly to the result of the following Ramanujan mock theta function: **χ(q) = 1.962364415**)

Radius = 5.881706e-35

Temperature = 3.098105e+30

From the Ramanujan-Nardelli mock formula, we obtain:

sqrt[[[[1/(((((((4*1.962364415e+19)/(5*0.0864055^2)))*1/(3.961141e-8)* sqrt[[-((((3.098105e+30* 4*Pi*(5.881706e-35)^3-(5.881706e-35)^2))))) / ((6.67*10^-11))]]]]]

Input interpretation:

$$\sqrt{1/\left(\frac{4\times 1.962364415\times 10^{19}}{5\times 0.0864055^2}\times\frac{1}{3.961141\times 10^{-8}}\sqrt{-\frac{3.098105\times 10^{30}\times 4\pi(5.881706\times 10^{-35})^3-(5.881706\times 10^{-35})^2}{6.67\times 10^{-11}}}\right)}$$

Result:

1.618249274997892019504587237680764169194850285735542064077...

1.6182492…

We have that:

Theorem 4.2. *We have*

$$(4.11)\qquad g_{177}=2^{-1/8}\left(\frac{3\sqrt{59}+23}{\sqrt{2}}\right)^{1/6}\left(\frac{\sqrt{3}-1}{\sqrt{2}}\right)^{3/4}\left(\sqrt{\frac{70226+40545\sqrt{3}}{2}}+\sqrt{\frac{70224+40545\sqrt{3}}{2}}\right)^{1/4}$$

$$\left(\sqrt{\frac{140451+81090\sqrt{3}-69\sqrt{8286609+4784310\sqrt{3}}}{2}}+\sqrt{\frac{140449+81090\sqrt{3}-69\sqrt{8286609+4784310\sqrt{3}}}{2}}\right)^{1/4}$$

0.91700404320467123174354159479414 * 1.7869351424559208571495550416157

0.6102666956689520186491088604345 7 * 4.7981006496823336466985311022 99 *

1.000000889988915243927792766590 6 =

Input interpretation:

0.61026669566895201864910886043457×
1.7869351424559208571495550416157×
0.61026669566895201864910886043457×
4.7981006496823336466985311022 99×1.0000008899889152439277927665906

Result:

4.79810171724750063997268285253939349268463236563300 0040389...

4.79810171724750063997268285253939349268463236563300 0040389

(4.79810171724750063997268285253939349268463236563300 0040389)^5 – 812

Input interpretation:

$4.798101717247500639972682852539393492684632365633000040389^5 - 812$

Result:

1731.00522631406879260297763660362965855717471240551 5442944...

1731.0052…

This result is very near to the mass of candidate glueball $f_0(1710)$ meson.

(4.79810171724750063997268285253939349268463236563300 0040389)* sqrt(26)

Input interpretation:

$4.798101717247500639972682852539393492684632365633000040389 \sqrt{26}$

Result:

24.4656142844480563246173875328199579710590453997827 5887912...

24.46561428… result practically equal to black hole entropy 24.4233

From this entropy 24.46561428, we obtain:

Mass = 4.608736e-8

Radius = 6.843288e-35

Temperature = 2.662776e+30

From the Ramanujan-Nardelli mock formula, we obtain:

sqrt[[[[1/((((((((4*1.962364415e+19)/(5*0.0864055^2)))*1/(4.608736e-8)* sqrt[[-((((2.662776e+30* 4*Pi*(6.843288e-35)^3-(6.843288e-35)^2))))) / ((6.67*10^-11))]]]]]

Input interpretation:

$$\sqrt{\left(1\Bigg/\left(\frac{4\times1.962364415\times10^{19}}{5\times0.0864055^2}\times\frac{1}{4.608736\times10^{-8}}\sqrt{-\frac{2.662776\times10^{30}\times4\pi\,(6.843288\times10^{-35})^3-(6.843288\times10^{-35})^2}{6.67\times10^{-11}}}\right)\right)}$$

Result:

1.618249320144158002340722774115529964322392175785035433397...

1.6182493…

Appendix A

Mathematical connection between 728, $\zeta(2) = \pi^2/6$ and $\phi = 1.61803398...$

We have the following interesting expression that link 728, $\zeta(2)$ and ϕ:
zeta (2) - ((((sqrt728)/(10^3))))

Input:

$$\zeta(2)-\frac{\sqrt{728}}{10^3}$$

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

Exact result:

$$\frac{\pi^2}{6}-\frac{\sqrt{\frac{91}{2}}}{250}$$

Decimal approximation:

1.617952591721762353541314555423034099274039165006363415026...

1.6179525…

This result is a very good approximation to the value of the golden ratio 1,618033988749...

Property:

$-\frac{\sqrt{\frac{91}{2}}}{250} + \frac{\pi^2}{6}$ is a transcendental number

Alternate forms:

$$\frac{250\,\pi^2 - 3\sqrt{182}}{1500}$$

- $$\frac{1}{750}\left(125\,\pi^2 - 3\sqrt{\frac{91}{2}}\right)$$

Alternative representations:

$$\zeta(2) - \frac{\sqrt{728}}{10^3} = -\frac{\sqrt{728}}{10^3} + \zeta(2, 1)$$

- $$\zeta(2) - \frac{\sqrt{728}}{10^3} = S_{1,1}(1) - \frac{\sqrt{728}}{10^3}$$

- $$\zeta(2) - \frac{\sqrt{728}}{10^3} = -\frac{\text{Li}_2(-1)}{\frac{1}{2}} - \frac{\sqrt{728}}{10^3}$$

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

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

$\text{Li}_n(x)$ is the polylogarithm function

Series representations:

$$\zeta(2) - \frac{\sqrt{728}}{10^3} = \frac{1000 \sum_{k=1}^{\infty} \frac{1}{k^2} - \sqrt{727} \sum_{k=0}^{\infty} 727^{-k} \binom{\frac{1}{2}}{k}}{1000}$$

•

$$\zeta(2) - \frac{\sqrt{728}}{10^3} = \frac{1000 \sum_{k=1}^{\infty} \frac{1}{k^2} - \exp\left(i \pi \left\lfloor \frac{\arg(728-x)}{2\pi} \right\rfloor\right) \sqrt{x} \sum_{k=0}^{\infty} \frac{(-1)^k (728-x)^k x^{-k} \left(-\frac{1}{2}\right)_k}{k!}}{1000}$$

for ($x \in \mathbb{R}$ and $x < 0$)

•

$$\zeta(2) - \frac{\sqrt{728}}{10^3} =$$
$$\frac{1000 \exp\left(\sum_{k=1}^{\infty} \sum_{j=1}^{\infty} \frac{(p_k)^{-2j}}{j}\right) - \exp\left(i \pi \left\lfloor \frac{\arg(728-x)}{2\pi} \right\rfloor\right) \sqrt{x} \sum_{k=0}^{\infty} \frac{(-1)^k (728-x)^k x^{-k} \left(-\frac{1}{2}\right)_k}{k!}}{1000}$$

for ($x \in \mathbb{R}$ and $x < 0$)

$\binom{n}{m}$ is the binomial coefficient

$\arg(z)$ is the complex argument

$\lfloor x \rfloor$ is the floor function

$n!$ is the factorial function

$(a)_n$ is the Pochhammer symbol (rising factorial)

i is the imaginary unit

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

p_n is the n^{th} prime number

Integral representations:

$$\zeta(2) - \frac{\sqrt{728}}{10^3} = \frac{1}{\Gamma(2)} \int_0^{\infty} \frac{t}{-1 + e^t} \, dt - \frac{\sqrt{728}}{1000}$$

•

$$\zeta(2) - \frac{\sqrt{728}}{10^3} = \frac{2}{3\,\Gamma(2)} \int_0^{\infty} t \operatorname{csch}(t) \, dt - \frac{\sqrt{728}}{1000}$$

•

$$\zeta(2) - \frac{\sqrt{728}}{10^3} = \frac{2}{\Gamma(3)} \int_0^\infty t^2 \operatorname{csch}^2(t)\, dt - \frac{\sqrt{728}}{1000}$$

$\Gamma(x)$ is the gamma function

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

Entropies from π

8Pi

Input:

8π

Decimal approximation:

25.132741228718345907701147066236023073577355195000846567 79...

25.1327… equal to the black hole entropy 25.1327

Conversion from radians to degrees:

1440°

Property:

8π is a transcendental number

Application example of Ramanujan-Nardelli mock formula on the particle Delta baryon rest mass, considered as a quantum black hole

Now, from the Delta baryon rest mass 1232, we obtain:

[[[[[(1232)]]]]]^1/14

Input:

$\sqrt[14]{1232}$

Result:

$2^{2/7} \sqrt[14]{77}$

Decimal approximation:

1.6624856591496145091617330520044670657153904400937069083333...

1.6624856… is very near to the 14th root of the following Ramanujan's class invariant $Q = (G_{505}/G_{101/5})^3$ = 1164,2696 i.e. 1,65578...

From the formula of ζ(2) = $\pi^2/6$ = 1.64493, we obtain about 2π. Indeed:

2(((((((6*(((((((([[[[[(1232)]]]]]^1/14))))))))))^1/2

Input:

$$2\sqrt{6\sqrt[14]{1232}}$$

Result:

$$2\times 2^{9/14}\sqrt{3}\sqrt[28]{77}$$

Decimal approximation:

6.316617434956049973673897320907890669067683682030624571693...

6.3166174…

From the ratio with 2π, we obtain:

6.316617434956049973673897320907890669067683682030624571693/(2Pi)

Input interpretation:

$$\frac{6.316617434956049973673897320907890669067683682030624571693}{2\pi}$$

Result:

1.005320888393704021174092136477898180118967136778065504853...

1.0053208… this is the radius

Alternative representations:

$$\frac{6.3166174349560499736738973209078906690676836820306245716930000}{2\pi} = -\frac{6.3166174349560499736738973209078906690676836820306245716930000}{2\,i\log(-1)}$$

$$\frac{6.3166174349560499736738973209078906690676836820306245716930000}{2\pi} = \frac{6.3166174349560499736738973209078906690676836820306245716930000}{2\cos^{-1}(-1)}$$

$\log(x)$ is the natural logarithm

i is the imaginary unit

$\cos^{-1}(x)$ is the inverse cosine function

Series representations:

$$\frac{6.316617434956049973673897320907890669067683682030624571693 0000}{2\pi} = \frac{0.7895771793695062467092371651134863336334604602538280714616 2500}{\sum_{k=0}^{\infty} \frac{(-1)^k}{1+2k}}$$

$$\frac{6.3166174349560499736738973209078906690676836820306245716930000}{2\pi} = 1.5791543587390124934184743302269726672669209205076561429232500 \Big/ \left(-1.0000000000000000000000000000000000000000000000000000000000000 + \sum_{k=1}^{\infty} \frac{2^k}{\binom{2k}{k}}\right)$$

$$\frac{6.3166174349560499736738973209078906690676836820306245716930000}{2\pi} = \frac{3.1583087174780249868369486604539453345338418410153122858465000}{\sum_{k=0}^{\infty} \frac{2^{-k}(-6+50k)}{\binom{3k}{k}}}$$

$\binom{n}{m}$ is the binomial coefficient

Integral representations:

$$\frac{6.3166174349560499736738973209078906690676836820306245716930000}{2\pi} = \frac{1.5791543587390124934184743302269726672669209205076561429232500}{\int_0^{\infty} \frac{1}{1+t^2}\, dt}$$

$$\frac{6.316617434956049973673897320907890669067683682030624571693000 0}{2\pi} = \frac{0.789577179369506246709237165113486333633460460253828071461625 00}{\int_0^1 \sqrt{1-t^2}\, dt}$$

$$\frac{6.316617434956049973673897320907890669067683682030624571693000 0}{2\pi} = \frac{1.579154358739012493418474330226972667266920920507656142923250 0}{\int_0^\infty \frac{\sin(t)}{t}\, dt}$$

From the above calculated radius 1.005321, inserting this value in the Hawking black hole radiation calculator, we obtain:

Mass = 6.770515e+26

Radius = 1.005321

Temperature = 0.0001812570

From the Ramanujan-Nardelli mock formula, we obtain:

sqrt[[[[1/((((((((4*1.962364415e+19)/(5*0.0864055^2)))*1/(6.770515e+26)* sqrt[[-((((0.0001812570* 4*Pi*(1.005321)^3-(1.005321)^2))))) / ((6.67*10^-11))]]]]]

Input interpretation:

$$\sqrt{\frac{1}{\frac{4\times 1.962364415\times 10^{19}}{5\times 0.0864055^2}\times \frac{1}{6.770515\times 10^{26}}\sqrt{-\frac{0.0001812570\times 4\pi\times 1.005321^3-1.005321^2}{6.67\times 10^{-11}}}}}$$

Result:

1.618249201774669727129593653709932216503767446288407609302...

1.6182492… that is a very good approximation to the value of golden ratio

From:

Received: September 7, 2007 - Accepted: October 28, 2007 - Published: November 9, 2007

Three-dimensional AdS gravity and extremal CFTs at c = 8m

Spyros D. Avramis, Alex Kehagias and Constantina Mattheopouloub

Department of Engineering Sciences, University of Patras,
26110 Patras, Greece - Physics Department, National Technical University of Athens,
15780 Zografou Campus, Athens, Greece
E-mail: avramis@mail.cern.ch, kehagias@central.ntua.gr,
conmat@central.ntua.gr

Table 1

m	L_0	d	S	S_{BH}	m	L_0	d	S	S_{BH}
	1	196883	12.1904	12.5664		1	42987519	17.5764	17.7715
3	2	21296876	16.8741	17.7715	6	2	40448921875	24.4233	25.1327
	3	842609326	20.5520	21.7656		3	8463511703277	29.7668	30.7812
	2/3	139503	11.8458	11.8477		2/3	7402775	15.8174	15.6730
4	5/3	69193488	18.0524	18.7328	7	5/3	33934039437	24.2477	24.7812
	8/3	6928824200	22.6589	23.6954		8/3	16953652012291	30.4615	31.3460
	1/3	20619	9.9340	9.3664		1/3	278511	12.5372	11.8477
5	4/3	86645620	18.2773	18.7328	8	4/3	13996384631	23.3621	23.6954
	7/3	24157197490	23.9078	24.7812		7/3	19400406113385	30.5963	31.3460

Table 1: Degeneracies, microscopic entropies and semiclassical entropies for the first few values of m and L_0.

Conclusion

In this paper, in addition to the connections obtained between Ramanujan mock theta functions, class invariants and black hole entropy values, in turn connected with golden ratio and ζ (2), we highlight the following results:

(supersymmetric condition ⟶ ∞)

(supersymmetric condition ⟶ 0)

From our point of view, these results could indicate that Ramanujan had already guessed, albeit in a non-detailed manner, the supersymmetry that is hidden in zero (zero point energy) and in infinity (absolute = supersymmetric infinite-dimensional toroidal space = absence of entropy).

From:
https://www.cittanuova.it/ramanujanhardy-e-il-piacere-di-scoprire/

“Indeed Ramanujan elaborated a theory of reality around Zero (representing the Absolute Reality) and the Infinite (the multiple manifestations of that reality): their mathematical product represented all the numbers, each of which corresponded to individual acts of creation. In short, even if his english friends didn't understand him very much, for him "the numbers and their mathematical relationships let us understand how everything was in harmony in the universe" ”

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