On the mathematical connections between some Ramanujan formulas concerning p(n) and τ(n), several equations concerning Mock Modularity in M-Theory duality, various parameters concerning Particle Physics, ϕ and ζ(2).

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Abstract

In this paper we describe and analyze new mathematical connections between some Ramanujan formulas concerning p(n) and τ(n), several equations concerning Mock Modularity in M-Theory duality, various parameters concerning Particle Physics, ϕ and ζ(2).

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https://blog.vedicmathsindia.org/srinivasa-ramanujan/

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(15.8) $\dfrac{(1-x^{\varpi^2})(1-x^{2\varpi^2})(1-x^{3\varpi^2})\cdots}{(1-x)(1-x^2)(1-x^3)\cdots} =$

$x^{\frac{\varpi^2-1}{24}}$

$$x\frac{dJ}{dx} + (Q^3-R^2)\sum k_{\ell,m} Q^\ell R^m + \varpi J$$

where the remark about the summation in (15.6) applies here also. From this we can always deduce in every particular case that

(15.9) $$\left\{\sum_1^\infty p\left(n\varpi + \varpi\left[\tfrac{\varpi}{24}\right] - \tfrac{\varpi^2-1}{24}\right)x^n + \left[\tfrac{\varpi}{24}\right]\right\}$$

$$= (R^3-R^2)^{\nu + \left[\frac{\varpi}{24}\right]} \sum k_{\ell,m} Q^\ell R^m + \varpi J,$$

$$(1-x^\varpi)(1-x^{2\varpi})(1-x^{3\varpi})\cdots$$

where $k_{\ell,m}$ is a constant integer and the summation extends over all positive integral values of ℓ and m (including zero) such that

$$4\ell + 6m = \varpi - 13$$

and $[t]$ denotes as usual the greatest integer in t.

Even though all these results are very difficult to prove in general they can be easily proved when $\varpi = 23$.

i) Modulus 17, ~~and~~ 19 and 23

16. In these cases we can easily prove that

(16.1) $$\{p(5)x + p(22)x^2 + p(39)x^3 + p(56)x^4 + \cdots\}$$

$$(1-x^{17})(1-x^{34})(1-x^{51})\cdots$$

$$= 7\sum_1^\infty \tau_2(n)x^n + 17J,$$

~~I have stated in my previous paper that~~

where $\sum_1^\infty \tau_2(n)x^n = Q\,x\{(1-x)(1-x^2)(1-x^3)\cdots\}^{24}$;

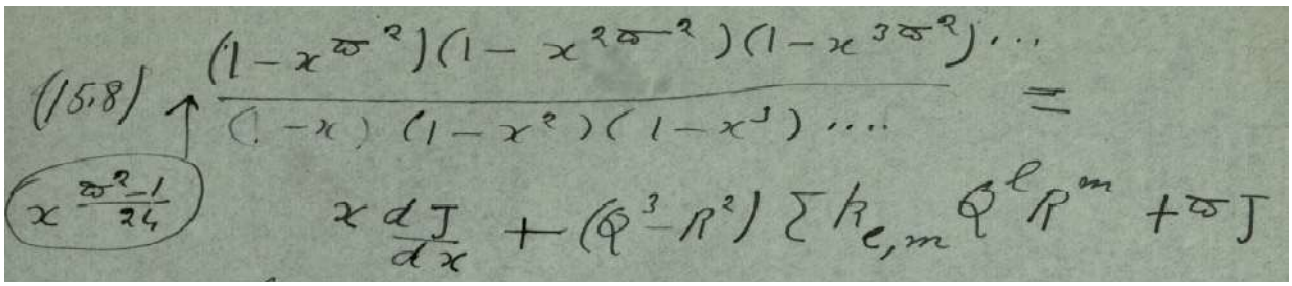
For:

11J = (-312.388 * 9.83114i – 1) = 3071.13

P = -1/2*((((-312.388^3-3*(9.83114i)^2-3071.13))) =
= 1.52437792798269866 × 10^7 = 15243779.279

Q = -312.388; R = 9.83114i

From:





We obtain:

(((1-x^((23^2-1)/24)) (1-x^(2(23^2-1)/24)) (1-x^(3(23^2-1)/24)))) / (((1-x)(1-x^2)(1-x^3)))

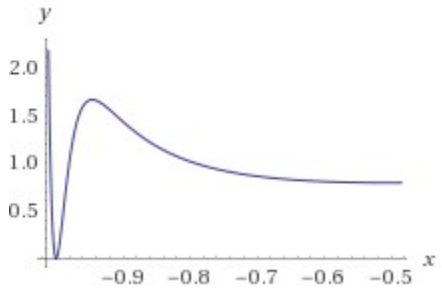
Input:

$$\frac{\left(1-x^{1/24\left(23^2-1\right)}\right)\left(1-x^{2\left(1/24\left(23^2-1\right)\right)}\right)\left(1-x^{3\left(1/24\left(23^2-1\right)\right)}\right)}{(1-x)\left(1-x^2\right)\left(1-x^3\right)}$$

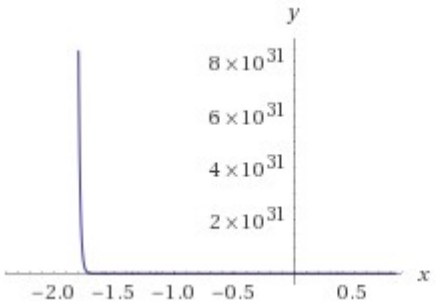
Result:

$$\frac{\left(1-x^{22}\right)\left(1-x^{44}\right)\left(1-x^{66}\right)}{(1-x)\left(1-x^2\right)\left(1-x^3\right)}$$

Plots:



(x from −1 to −0.5)



(x from −2.3 to 0.8)

Alternate forms:

$$(x+1)^2\left(x^{10}-x^9+x^8-x^7+x^6-x^5+x^4-x^3+x^2-x+1\right)^3$$
$$\left(x^{10}+x^9+x^8+x^7+x^6+x^5+x^4+x^3+x^2+x+1\right)^3$$
$$\left(x^{20}-x^{19}+x^{17}-x^{16}+x^{14}-x^{13}+x^{11}-x^{10}+x^9-x^7+x^6-x^4+x^3-x+1\right)$$
$$\left(x^{22}+1\right)\left(x^{22}-x^{11}+1\right)$$

$$\frac{\left(x^{22}-1\right)^3\left(x^{66}+2x^{44}+2x^{22}+1\right)}{(x-1)\left(x^2-1\right)\left(x^3-1\right)}$$

$$-\frac{\left(1-x^{22}\right)\left(1-x^{44}\right)\left(1-x^{66}\right)}{(x-1)\left(x^2-1\right)\left(x^3-1\right)}$$

Expanded form:

$$\frac{1}{(1-x)\left(1-x^2\right)\left(1-x^3\right)}-\frac{x^{132}}{(1-x)\left(1-x^2\right)\left(1-x^3\right)}+\frac{x^{110}}{(1-x)\left(1-x^2\right)\left(1-x^3\right)}+$$
$$\frac{x^{88}}{(1-x)\left(1-x^2\right)\left(1-x^3\right)}-\frac{x^{44}}{(1-x)\left(1-x^2\right)\left(1-x^3\right)}-\frac{x^{22}}{(1-x)\left(1-x^2\right)\left(1-x^3\right)}$$

Quotient and remainder:

$$-x^{132}+x^{110}+x^{88}-x^{44}-x^{22}+1 =$$

$$\begin{aligned}&\left(x^{126}+x^{125}+2x^{124}+3x^{123}+4x^{122}+5x^{121}+7x^{120}+8x^{119}+10x^{118}+12x^{117}+\right.\\&\quad 14x^{116}+16x^{115}+19x^{114}+21x^{113}+24x^{112}+27x^{111}+30x^{110}+33x^{109}+\\&\quad 37x^{108}+40x^{107}+44x^{106}+48x^{105}+51x^{104}+55x^{103}+59x^{102}+62x^{101}+\\&\quad 66x^{100}+70x^{99}+73x^{98}+77x^{97}+81x^{96}+84x^{95}+88x^{94}+92x^{93}+\\&\quad 95x^{92}+99x^{91}+103x^{90}+106x^{89}+110x^{88}+114x^{87}+117x^{86}+121x^{85}+\\&\quad 125x^{84}+128x^{83}+131x^{82}+135x^{81}+137x^{80}+140x^{79}+143x^{78}+\\&\quad 145x^{77}+147x^{76}+150x^{75}+151x^{74}+153x^{73}+155x^{72}+156x^{71}+\\&\quad 157x^{70}+159x^{69}+159x^{68}+160x^{67}+161x^{66}+161x^{65}+161x^{64}+\\&\quad 162x^{63}+161x^{62}+161x^{61}+161x^{60}+160x^{59}+159x^{58}+159x^{57}+\\&\quad 157x^{56}+156x^{55}+155x^{54}+153x^{53}+151x^{52}+150x^{51}+147x^{50}+\\&\quad 145x^{49}+143x^{48}+140x^{47}+137x^{46}+135x^{45}+131x^{44}+128x^{43}+\\&\quad 125x^{42}+121x^{41}+117x^{40}+114x^{39}+110x^{38}+106x^{37}+103x^{36}+\\&\quad 99x^{35}+95x^{34}+92x^{33}+88x^{32}+84x^{31}+81x^{30}+77x^{29}+73x^{28}+\\&\quad 70x^{27}+66x^{26}+62x^{25}+59x^{24}+55x^{23}+51x^{22}+48x^{21}+44x^{20}+\\&\quad 40x^{19}+37x^{18}+33x^{17}+30x^{16}+27x^{15}+24x^{14}+21x^{13}+19x^{12}+\\&\quad \left.16x^{11}+14x^{10}+12x^{9}+10x^{8}+8x^{7}+7x^{6}+5x^{5}+4x^{4}+3x^{3}+2x^{2}+x+1\right)\\&\times\left(-x^{6}+x^{5}+x^{4}-x^{2}-x+1\right)+0\end{aligned}$$

Series expansion at x = 0:

$$1+x+2x^2+3x^3+4x^4+O\left(x^5\right)$$

(Taylor series)

Series expansion at x = ∞:

$$\begin{aligned}&x^{126}+x^{125}+2x^{124}+3x^{123}+4x^{122}+5x^{121}+7x^{120}+8x^{119}+10x^{118}+12x^{117}+\\&\quad 14x^{116}+16x^{115}+19x^{114}+21x^{113}+24x^{112}+27x^{111}+30x^{110}+33x^{109}+\\&\quad 37x^{108}+40x^{107}+44x^{106}+48x^{105}+51x^{104}+55x^{103}+59x^{102}+62x^{101}+\\&\quad 66x^{100}+70x^{99}+73x^{98}+77x^{97}+81x^{96}+84x^{95}+88x^{94}+92x^{93}+\\&\quad 95x^{92}+99x^{91}+103x^{90}+106x^{89}+110x^{88}+114x^{87}+117x^{86}+121x^{85}+\\&\quad 125x^{84}+128x^{83}+131x^{82}+135x^{81}+137x^{80}+140x^{79}+143x^{78}+145x^{77}+\\&\quad 147x^{76}+150x^{75}+151x^{74}+153x^{73}+155x^{72}+156x^{71}+157x^{70}+159x^{69}+\\&\quad 159x^{68}+160x^{67}+161x^{66}+161x^{65}+161x^{64}+162x^{63}+161x^{62}+161x^{61}+\\&\quad 161x^{60}+160x^{59}+159x^{58}+159x^{57}+157x^{56}+156x^{55}+155x^{54}+153x^{53}+\\&\quad 151x^{52}+150x^{51}+147x^{50}+145x^{49}+143x^{48}+140x^{47}+137x^{46}+135x^{45}+\\&\quad 131x^{44}+128x^{43}+125x^{42}+121x^{41}+117x^{40}+114x^{39}+110x^{38}+106x^{37}+\\&\quad 103x^{36}+99x^{35}+95x^{34}+92x^{33}+88x^{32}+84x^{31}+81x^{30}+77x^{29}+\\&\quad 73x^{28}+70x^{27}+66x^{26}+62x^{25}+59x^{24}+55x^{23}+51x^{22}+48x^{21}+44x^{20}+\\&\quad 40x^{19}+37x^{18}+33x^{17}+30x^{16}+27x^{15}+24x^{14}+21x^{13}+19x^{12}+16x^{11}+\\&\quad 14x^{10}+12x^{9}+10x^{8}+8x^{7}+7x^{6}+5x^{5}+4x^{4}+3x^{3}+2x^{2}+x+1+O\left(\left(\frac{1}{x}\right)^1\right)\end{aligned}$$

(Taylor series)

Derivative:

$$\frac{d}{dx}\left(\frac{\left(1-x^{1/24\left(23^2-1\right)}\right)\left(1-x^{2/24\left(23^2-1\right)}\right)\left(1-x^{3/24\left(23^2-1\right)}\right)}{(1-x)\left(1-x^2\right)\left(1-x^3\right)}\right)=$$
$$\left(126\,x^{137}-127\,x^{136}-128\,x^{135}+130\,x^{133}+131\,x^{132}-132\,x^{131}-104\,x^{115}+\right.$$
$$105\,x^{114}+106\,x^{113}-108\,x^{111}-109\,x^{110}+110\,x^{109}-82\,x^{93}+$$
$$83\,x^{92}+84\,x^{91}-86\,x^{89}-87\,x^{88}+88\,x^{87}+38\,x^{49}-39\,x^{48}-40\,x^{47}+$$
$$42\,x^{45}+43\,x^{44}-44\,x^{43}+16\,x^{27}-17\,x^{26}-18\,x^{25}+20\,x^{23}+21\,x^{22}-$$
$$\left.22\,x^{21}+6\,x^5-5\,x^4-4\,x^3+2\,x+1\right)\Big/\left(\left(x^2-1\right)^2\left(x^3-1\right)^2(1-x)^2\right)$$

Indefinite integral:

$$\int\frac{\left(1-x^{22}\right)\left(1-x^{44}\right)\left(1-x^{66}\right)}{(1-x)\left(1-x^2\right)\left(1-x^3\right)}\,dx=$$
$$\frac{x^{127}}{127}+\frac{x^{126}}{126}+\frac{2\,x^{125}}{125}+\frac{3\,x^{124}}{124}+\frac{4\,x^{123}}{123}+\frac{5\,x^{122}}{122}+\frac{7\,x^{121}}{121}+\frac{x^{120}}{15}+\frac{10\,x^{119}}{119}+$$
$$\frac{6\,x^{118}}{59}+\frac{14\,x^{117}}{117}+\frac{4\,x^{116}}{29}+\frac{19\,x^{115}}{115}+\frac{7\,x^{114}}{38}+\frac{24\,x^{113}}{113}+\frac{27\,x^{112}}{112}+\frac{10\,x^{111}}{37}+$$
$$\frac{3\,x^{110}}{10}+\frac{37\,x^{109}}{109}+\frac{10\,x^{108}}{27}+\frac{44\,x^{107}}{107}+\frac{24\,x^{106}}{53}+\frac{17\,x^{105}}{35}+\frac{55\,x^{104}}{104}+$$
$$\frac{59\,x^{103}}{103}+\frac{31\,x^{102}}{51}+\frac{66\,x^{101}}{101}+\frac{7\,x^{100}}{10}+\frac{73\,x^{99}}{99}+\frac{11\,x^{98}}{14}+\frac{81\,x^{97}}{97}+\frac{7\,x^{96}}{8}+$$
$$\frac{88\,x^{95}}{95}+\frac{46\,x^{94}}{47}+\frac{95\,x^{93}}{93}+\frac{99\,x^{92}}{92}+\frac{103\,x^{91}}{91}+\frac{53\,x^{90}}{45}+\frac{110\,x^{89}}{89}+\frac{57\,x^{88}}{44}+$$
$$\frac{39\,x^{87}}{29}+\frac{121\,x^{86}}{86}+\frac{25\,x^{85}}{17}+\frac{32\,x^{84}}{21}+\frac{131\,x^{83}}{83}+\frac{135\,x^{82}}{82}+\frac{137\,x^{81}}{81}+\frac{7\,x^{80}}{4}+$$
$$\frac{143\,x^{79}}{79}+\frac{145\,x^{78}}{78}+\frac{21\,x^{77}}{11}+\frac{75\,x^{76}}{38}+\frac{151\,x^{75}}{75}+\frac{153\,x^{74}}{74}+\frac{155\,x^{73}}{73}+$$
$$\frac{13\,x^{72}}{6}+\frac{157\,x^{71}}{71}+\frac{159\,x^{70}}{70}+\frac{53\,x^{69}}{23}+\frac{40\,x^{68}}{17}+\frac{161\,x^{67}}{67}+\frac{161\,x^{66}}{66}+$$
$$\frac{161\,x^{65}}{65}+\frac{81\,x^{64}}{32}+\frac{23\,x^{63}}{9}+\frac{161\,x^{62}}{62}+\frac{161\,x^{61}}{61}+\frac{8\,x^{60}}{3}+\frac{159\,x^{59}}{59}+\frac{159\,x^{58}}{58}+$$
$$\frac{157\,x^{57}}{57}+\frac{39\,x^{56}}{14}+\frac{31\,x^{55}}{11}+\frac{17\,x^{54}}{6}+\frac{151\,x^{53}}{53}+\frac{75\,x^{52}}{26}+\frac{49\,x^{51}}{17}+\frac{29\,x^{50}}{10}+$$
$$\frac{143\,x^{49}}{49}+\frac{35\,x^{48}}{12}+\frac{137\,x^{47}}{47}+\frac{135\,x^{46}}{46}+\frac{131\,x^{45}}{45}+\frac{32\,x^{44}}{11}+\frac{125\,x^{43}}{43}+$$
$$\frac{121\,x^{42}}{42}+\frac{117\,x^{41}}{41}+\frac{57\,x^{40}}{20}+\frac{110\,x^{39}}{39}+\frac{53\,x^{38}}{19}+\frac{103\,x^{37}}{37}+\frac{11\,x^{36}}{4}+\frac{19\,x^{35}}{7}+$$
$$\frac{46\,x^{34}}{17}+\frac{8\,x^{33}}{3}+\frac{21\,x^{32}}{8}+\frac{81\,x^{31}}{31}+\frac{77\,x^{30}}{30}+\frac{73\,x^{29}}{29}+\frac{5\,x^{28}}{2}+\frac{22\,x^{27}}{9}+$$
$$\frac{31\,x^{26}}{13}+\frac{59\,x^{25}}{25}+\frac{55\,x^{24}}{24}+\frac{51\,x^{23}}{23}+\frac{24\,x^{22}}{11}+\frac{44\,x^{21}}{21}+2\,x^{20}+\frac{37\,x^{19}}{19}+$$
$$\frac{11\,x^{18}}{6}+\frac{30\,x^{17}}{17}+\frac{27\,x^{16}}{16}+\frac{8\,x^{15}}{5}+\frac{3\,x^{14}}{2}+\frac{19\,x^{13}}{13}+\frac{4\,x^{12}}{3}+\frac{14\,x^{11}}{11}+$$
$$\frac{6\,x^{10}}{5}+\frac{10\,x^9}{9}+x^8+x^7+\frac{5\,x^6}{6}+\frac{4\,x^5}{5}+\frac{3\,x^4}{4}+\frac{2\,x^3}{3}+\frac{x^2}{2}+x+\text{constant}$$

for x = 2, we obtain:

$$\frac{(1-x^{22})(1-x^{44})(1-x^{66})}{(1-x)(1-x^2)(1-x^3)}$$

((1 - 2^22) (1 - 2^44) (1 - 2^66))/((1 - 2) (1 - 2^2) (1 - 2^3))

Input:

$$\frac{(1-2^{22})(1-2^{44})(1-2^{66})}{(1-2)(1-2^2)(1-2^3)}$$

Result:

259 262 693 936 213 871 271 298 345 657 508 311 235

Scientific notation:

$2.592626939362138712712983456575083112 35 \times 10^{38}$

$2.592626\ldots*10^{38}$

[((1 - 2^22) (1 - 2^44) (1 - 2^66))/((1 - 2) (1 - 2^2) (1 - 2^3))] / 23^3

Input:

$$\frac{\frac{(1-2^{22})(1-2^{44})(1-2^{66})}{(1-2)(1-2^2)(1-2^3)}}{23^3}$$

Result:

21 308 678 715 888 376 039 393 305 305 951 205

Scientific notation:

$2.130867871588837603939330530595120 5 \times 10^{34}$

$2.1308678\ldots*10^{34}$

Prime factorization:

$3^3 \times 5 \times 67 \times 89^3 \times 397 \times 683^3 \times 2113 \times 20857 \times 599479$

3^3×5×67×89^3×397×683^3×2113×20857×599479

2*2130867871588837603939330530595120 5 /
(3^3×5×89^3×397×683^3×2113×20857×599479)

Input:

$$2\times\frac{21\,308\,678\,715\,888\,376\,039\,393\,305\,305\,951\,205}{3^3\times5\times89^3\times397\times683^3\times2113\times20\,857\times599\,479}$$

Result:

134

134 result practically equal to the rest mass of Pion meson 134.9766 MeV

2*2130867871588837603939330530595120 5 /
(3^3×5×89^3×397×683^3×2113×20857×599479) - 3^2

Input:

$$2\times\frac{21\,308\,678\,715\,888\,376\,039\,393\,305\,305\,951\,205}{3^3\times5\times89^3\times397\times683^3\times2113\times20\,857\times599\,479}-3^2$$

Result:

125

125 result very near to the Higgs boson mass 125.18 GeV

64*2130867871588837603939330530595120 5 /
(5×67×89^3×397×683^3×2113×20857×599479)+1

Input:

$$64\times\frac{21\,308\,678\,715\,888\,376\,039\,393\,305\,305\,951\,205}{5\times67\times89^3\times397\times683^3\times2113\times20\,857\times599\,479}+1$$

Result:

1729

1729

This result is very near to the mass of candidate glueball **f_0(1710) scalar meson.** Furthermore, 1728 occurs in the algebraic formula for the j-invariant of an elliptic

curve. The number 1728 is one less than the Hardy–Ramanujan number 1729 (taxicab number)

(((64*213086787158883760393933053059512 05 /
(5×67×89^3×397×683^3×2113×20857×599479)+1)))^1/15

Input:

$$\sqrt[15]{64 \times \frac{21\,308\,678\,715\,888\,376\,039\,393\,305\,305\,951\,205}{5 \times 67 \times 89^3 \times 397 \times 683^3 \times 2113 \times 20\,857 \times 599\,479} + 1}$$

Result:

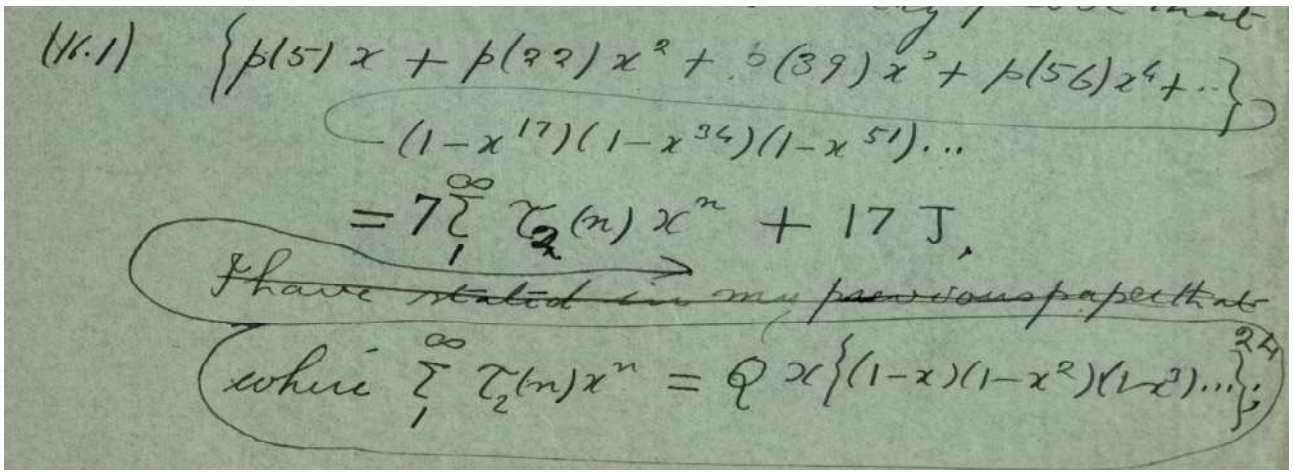
$$\sqrt[15]{1729}$$

Decimal approximation:

1.643815228748728130580088031324769514329283143699940172645...

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

Now, we have that:



For x = 2, we obtain:

(((p(5) * 2 + p(22) * 2^2 + p(39) * 2^3 + p(56) * 2^4))) * (1-2^17)(1-2^34)(1-2^51)

(((7 * 2 + 1002 * 2^2 + 31185 * 2^3 + 526823 * 2^4))) * (1-2^17)(1-2^34)(1-2^51)

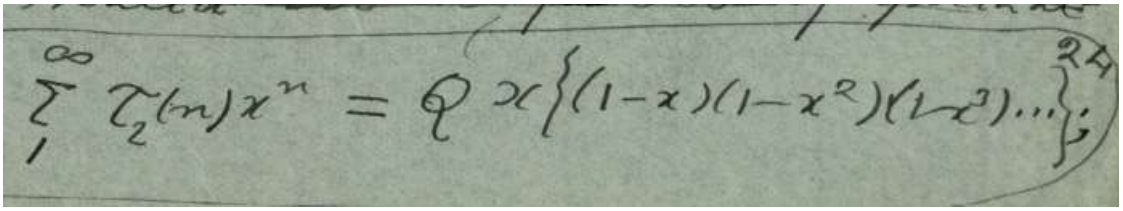
Input:

$$(7\times 2+1002\times 2^2+31\,185\times 2^3+526\,823\times 2^4)(1-2^{17})(1-2^{34})(1-2^{51})$$

Result:

$$-44\,026\,031\,451\,245\,612\,260\,985\,593\,878\,885\,663\,570$$

$$-4.402603145124561226098559387888566357\times 10^{37}$$



For:

Q = -312.388; x = 2, 11J = 3071.13

we obtain:

-312.388*2((1-2)(1-2^2)(1-2^3))^24

Input interpretation:

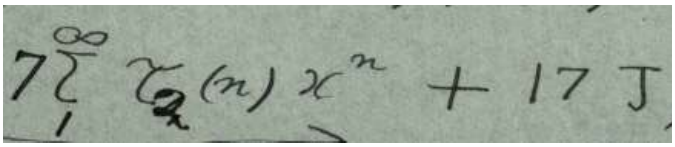
$$-312.388\times 2\,((1-2)(1-2^2)(1-2^3))^{24}$$

Result:

$$-3.380550374935885602272388641640973965 6\times 10^{34}$$

$$-3.38055037\ldots *10^{34}$$

From



7*(((-312.388*2((1-2)(1-2^2)(1-2^3))^24)))+17*279.1936

Input interpretation:

$7\left(-312.388\times 2\left((1-2)\left(1-2^2\right)\left(1-2^3\right)\right)^{24}\right)+17\times 279.1936$

Result:

$-2.366385262455119921590672049148634313008\times 10^{35}$

$-2.36638526\ldots *10^{35}$

and:

((((7*(((-312.388*2((1-2)(1-2^2)(1-2^3))^24)))*186.048+17*279.1936))))

Input interpretation:

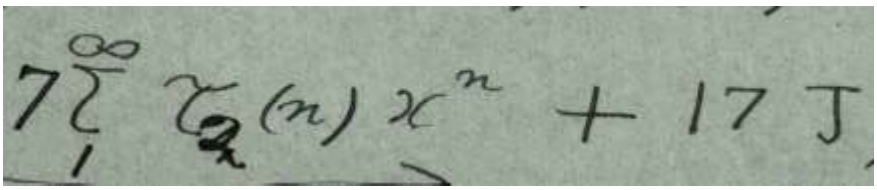
$7\left(-312.388\times 2\left((1-2)\left(1-2^2\right)\left(1-2^3\right)\right)^{24}\right)\times 186.048+17\times 279.1936$

Result:

$-4.402612453092501511721013534000138995834 5216\times 10^{37}$

$-4.402612453092501511721013534000051166666512384\times 10^{37}$

Thence:



Is equal to: -4.402612453092501511721013534000051166666512384 × 10^37

and:

1/(7*186.048)(-4.40261245309250151172101353400005116666512384 × 10^37-17*279.1936)

Input interpretation:

$$\frac{1}{7\times 186.048}\left(-4.40261245309250151172101353400005116666512384\times 10^{37}+17\times(-279.1936)\right)$$

Result:

$-3.38055037493588560227238864164090652588444444444444\ldots\times 10^{34}$

$-3.3805503749\ldots.*10^{34} = \tau_2(n)$

Indeed:

Input interpretation:

$$7\left(-3.38055037493588560227238864164090652588444444444444\times 10^{34}\right)\times 186.048+17\times(-279.1936)$$

Result:

$-4.40261245309250151172101353400005211592336383999999\ldots\times 10^{37}$

$-4.402612453\ldots*10^{37}$

From:

Duality and Mock Modularity
Atish Dabholkar, Pavel Putrov, Edward Witten - arXiv:2004.14387v1 [hep-th] 29 Apr 2020

We have that:

The partition function of the bosons on the torus reads

$$Z_{\rm bos}(\tau) = \frac{V_D}{(8\pi^2\tau_2)^{D/2}}\,|\eta(\tau)|^{-2D}$$

$$q = \exp(2\pi i\tau).$$

The Dedekind eta function is (from Wikipedia):

For any complex number τ with $\mathrm{Im}(\tau) > 0$, let $q = e^{2\pi i\tau}$, then the eta function is defined by,

$$\eta(\tau) = e^{\frac{\pi i\tau}{12}} \prod_{n=1}^{\infty}(1 - e^{2n\pi i\tau}) = q^{\frac{1}{24}} \prod_{n=1}^{\infty}(1 - q^n).$$

We have that:

(((exp(2Pi))))^1/24 * product(1-((exp(2Pi)))^n), n=1..3

Input interpretation:

$$\sqrt[24]{\exp(2\,\pi)} \prod_{n=1}^{3}(1 - \exp^n(2\,\pi))$$

Result:

$$e^{\pi/12}\left(1 - e^{2\,\pi}\right)\left(1 - e^{4\,\pi}\right)\left(1 - e^{6\,\pi}\right) \approx -3.05774 \times 10^{16}$$

$-3.05774*10^{16} = \eta(\tau)$

Alternate forms:

$$-e^{\pi/12}\left(e^{2\,\pi} - 1\right)\left(e^{4\,\pi} - 1\right)\left(e^{6\,\pi} - 1\right)$$

$$e^{\pi/12} - e^{(25\,\pi)/12} - e^{(49\,\pi)/12} + e^{(97\,\pi)/12} + e^{(121\,\pi)/12} - e^{(145\,\pi)/12}$$

$$-e^{\pi/12}\left(e^{\pi/12} - 1\right)^3\left(1 + e^{\pi/12}\right)^3\left(1 + e^{\pi/6}\right)^3\left(1 - e^{\pi/12} + e^{\pi/6}\right)^3\left(1 + e^{\pi/12} + e^{\pi/6}\right)^3$$
$$\left(1 + e^{\pi/3}\right)^3\left(1 - e^{\pi/6} + e^{\pi/3}\right)^3\left(1 - e^{\pi/4} + e^{\pi/2}\right)\left(1 + e^{\pi/4} + e^{\pi/2}\right)\left(1 + e^{(2\,\pi)/3}\right)$$
$$\left(1 - e^{\pi/3} + e^{(2\,\pi)/3}\right)^3\left(1 - e^{\pi/2} + e^{\pi}\right)\left(1 - e^{(2\,\pi)/3} + e^{(4\,\pi)/3}\right)\left(1 - e^{\pi} + e^{2\,\pi}\right)$$

Now, we put

$Z_{bos}(\tau) =$ $-4.4026031451245612260985593878885663 57\times 10^{37}$

From:

$$Z_{\mathrm{bos}}(\tau) = \frac{V_D}{(8\pi^2\tau_2)^{D/2}}\,|\eta(\tau)|^{-2D}$$

(((x/(8Pi^2*-3.3805503749….*10^{34})^2))) * (-3.05774e+16)^(-8) = -4.402603145e+37

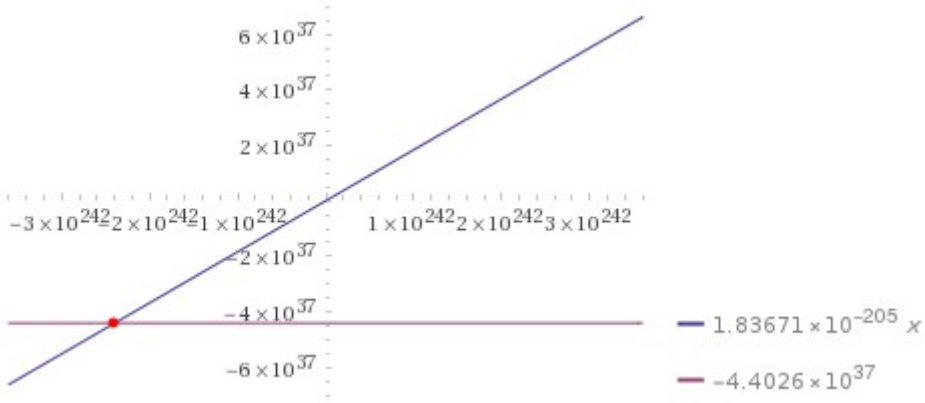
Input interpretation:

$$\frac{x}{\frac{(8\pi^2(-3.3805503749\times10^{34}))^2}{(-3.05774\times10^{16})^8}} = -4.402603145\times10^{37}$$

Result:

$$1.83671\times10^{-205}\,x = -4.4026\times10^{37}$$

Plot:



Alternate form:

$$1.83671\times10^{-205}\,x + 4.4026\times10^{37} = 0$$

Alternate form assuming x is real:

$$1.83671\times10^{-205}\,x + 0 = -4.4026\times10^{37}$$

Solution:

$x =$

$-239\,700\,127\,117\,043\,955\,238\,896\,355\,494\,047\,550\,277\,119\,516\,919\,434\,530\,905 \cdot$
$027\,013\,050\,570\,371\,990\,578\,103\,038\,362\,990\,837\,929\,012\,946\,725\,263\,918\,905 \cdot$
$329\,690\,206\,587\,551\,594\,431\,553\,457\,649\,489\,662\,183\,782\,275\,948\,357\,908\,592 \cdot$
$683\,131\,004\,451\,653\,887\,600\,473\,135\,931\,991\,809\,634\,839\,471\,707\,568\,065\,946 \cdot$
$293\,025\,957\,216\,256$

Integer solution:

$x =$

$-239\,700\,127\,117\,043\,955\,238\,896\,355\,494\,047\,550\,277\,119\,516\,919\,434\,530\,905 \cdot$
$027\,013\,050\,570\,371\,990\,578\,103\,038\,362\,990\,837\,929\,012\,946\,725\,263\,918\,905 \cdot$
$329\,690\,206\,587\,551\,594\,431\,553\,457\,649\,489\,662\,183\,782\,275\,948\,357\,908\,592 \cdot$
$683\,131\,004\,451\,653\,887\,600\,473\,135\,931\,991\,809\,634\,839\,471\,707\,568\,065\,946 \cdot$
$293\,025\,957\,216\,256$

x = -2.3970012711704396*10^{242}

Indeed:

(((-2.3970012711704396*10^242/(8Pi^2*-3.3805503749*10^34)^2))) * (-3.05774e+16)^(-8)

Input interpretation:

$$\frac{-\frac{2.3970012711704396\times 10^{242}}{\left(8\,\pi^2\left(-3.3805503749\times 10^{34}\right)\right)^2}}{\left(-3.05774\times 10^{16}\right)^8}$$

Result:

$-4.40260\ldots \times 10^{37}$

-4.40260…*10^{37}

i.e. -4402603145000001769380266569697694376 7

We perform the differences with the successive number of partitions of n (the partition numbers see OEIS https://oeis.org/A000041/b000041.txt)

443326576189011960058888538820513859 39-
440260314500000176938026656969769437 67

Result:

306 626 168 901 178 312 086 188 185 074 442 172

Scientific notation:

$3.066261689011783120861881850744421 72 \times 10^{35}$

3.066261689…*10^{35}

308578209734051855476222280888835192-
306626168901178312086188185074442172

Result:

1 952 040 832 873 543 390 034 095 814 393 020

Scientific notation:

$1.952040832873543390034095814393302 \times 10^{33}$

195204083287354339003409581439302 0-194346062361786416485576310365090 0

Result:

8 580 209 255 679 225 178 332 710 742 120

Scientific notation:

$8.580209255679225178332710742 12 \times 10^{30}$

858020925567922517833271074212 0-854478855390372946074152671475 0

Result:

35 420 701 775 495 717 591 184 027 370

Scientific notation:

$3.542070177549571759118402737 \times 10^{28}$

354207017754957175911840273 70-342118710317525482787722844 53

Result:
1 208 830 743 743 169 312 411 742 917

Scientific notation:
$1.208830743743169312411742917 \times 10^{27}$

120883074374316931241174291 7-120418607301637502221951699 2

Result:
4 644 670 726 794 290 192 225 925

Scientific notation:
$4.644670726794290192225925 \times 10^{24}$

464467072679429019222592 5-452670612825417378104429 8

Result:
117 964 598 540 116 411 181 627

Scientific notation:
$1.179645985401164111816 27 \times 10^{23}$
117964598540116411181627-114721795630860408658491

Result:
3 242 802 909 256 002 523 136

Scientific notation:
$3.242802909256002523136 \times 10^{21}$

324280290925600252313 6-320364427509620207001 2

Result:
39 158 634 159 800 453 124

Scientific notation:
$3.9158634159800453124 \times 10^{19}$

391586341598004531 24-390201480002372596 65

Result:
138 486 159 563 193 459

Scientific notation:
$1.38486159563193459 \times 10^{17}$

13848615956319345 9-134819180623301520

Result:
3 666 978 939 891 939

Scientific notation:
$3.666978939891939 \times 10^{15}$

3666978939891939-3652430836071053

Result:
14 548 103 820 886

Scientific notation:
$1.4548103820886 \times 10^{13}$

14548103820886-14070545699287

Result:
477 558 121 599

Scientific notation:
$4.77558121599 \times 10^{11}$

477558121599-476715857290

Result:
842 264 309

Scientific notation:

8.42264309×10^{8}

842264309-761002156

Result:

81 262 153

Scientific notation:

8.1262153×10^{7}

81262153-72533807

Result:

8 728 346

8728346-8118264

Result:

610 082

610082-526823

Result:

83 259

83259-75175

Result:

8084

8084-6842

Result:
1242

1242-1002

Result:
240

240-231

Result:
9

9-7

Result:
2

Or:

From

354207017754957175911840273 70; we obtain:

(-357162648590939776876473134 15+354207017754957175911840273 70)

Input:
−35 716 264 859 093 977 687 647 313 415 + 35 420 701 775 495 717 591 184 027 370

Result:
−295 563 083 598 260 096 463 286 045

From which:

Input:

$$295\,563\,083\,598\,260\,096\,463\,286\,045 - 293\,604\,071\,362\,025\,285\,843\,562\,670 - 1\,959\,847\,686\,321\,528\,964\,669\,495 + 841\,457\,028\,742\,823\,649\,455 - 5\,945\,790\,114\,707\,874\,597 - 60\,105\,349\,839\,666\,544 - 1\,050\,197\,489\,931\,117 + 3\,646\,072\,432\,125 - 8\,149\,040\,695 - 384\,276\,336$$

Result:

$-19\,653\,829$

Input:

$$-19\,653\,829 + 20\,506\,255 - 831\,820 - 21\,637 + 1002 + 22 + 7$$

Result:

0

From the division of the two values, we obtain:

[1/(44332657618901196005888853882051385939/4402603145000001769380266569697694376 7)]^1/8

Input:

$$\sqrt[8]{\frac{1}{\frac{44\,332\,657\,618\,901\,196\,005\,888\,853\,882\,051\,385\,939}{44\,026\,031\,450\,000\,017\,693\,802\,665\,696\,976\,943\,767}}}$$

Result:

$$\sqrt[8]{\frac{44\,026\,031\,450\,000\,017\,693\,802\,665\,696\,976\,943\,767}{44\,332\,657\,618\,901\,196\,005\,888\,853\,882\,051\,385\,939}}$$

Decimal approximation:

0.99913281186052163980656671763453160382205282936989884246 6...

0.99913281186….. result very near to the value of the following Rogers-Ramanujan continued fraction:

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

= 0.9991104684

We have that:

3.1 Mock Modularity of $\mathbb{CP}^2$ Partition Function

Since $H^2(\mathbb{CP}^2, \mathbb{Z}_2) \cong \mathbb{Z}_2$, an $SO(3)$ bundle $E \to \mathbb{C}^2$ has two possible values of $v = w_2(E)$: $v = 0$ with $v^2 = 0$ and $v \neq 0$ with $v^2 = -1$ modulo 4. Accordingly, there are two partition functions, which we denote by $Z_0(\tau)$ and $Z_1(\tau)$. It was shown in [1] using the work of Klyachko and Yoshioka [2, 3] that the partition functions can be expressed in terms of the Hurwitz-Kronecker class numbers denoted by $H(N)$ for $N \in \mathbb{Z}$. These class numbers are defined for $N > 0$ as the number of $PSL(2, \mathbb{Z})$-equivalence classes of integral binary quadratic forms of discriminant $-N$, weighted by the reciprocal of the number of their automorphisms (if $-N$ is the discriminant of an imaginary quadratic field K other than $\mathbb{Q}(i)$ or $\mathbb{Q}(\sqrt{-3})$, this is just the class number of K), and for other values of N by $H(0) = -1/12$ and $H(N) = 0$ for $N < 0$. These numbers vanish unless N is 0 or -1 modulo 4.

From:

$$\frac{\partial Z_v}{\partial \bar{\tau}} = \frac{3}{16\pi i \tau_2^{3/2} \eta(\tau)^3} \sum_{n \in \mathbb{Z}} \bar{q}^{(n+v/2)^2} \qquad (4.38)$$

For: $-3.05774*10^{16} = \eta(\tau)$; $-3.3805503749....*10^{34} = \tau_2(n)$; $n = 2$; $v = i$, where the value of $\tau_2(n)$ is the same as the previous Ramanujan expression analyzed

(((3*(exp(2Pi))^(2+i/2)^2)))/((((16Pi*i*(-3.3805503749e+34)^1.5*(-3.05774e+16)^3)))

Input interpretation:

$$\frac{3\exp^{\left(2+\frac{i}{2}\right)^2}(2\pi)}{16\pi i(-3.3805503749\times 10^{34})^{1.5}(-3.05774\times 10^{16})^3}$$

Result:

$-5.74105\ldots\times 10^{-93}$

(using the principal branch of the logarithm for complex exponentiation)

$-5.74105\ldots*10^{-93}$

Now, we have:

$$\langle \bar{G}\rangle_{\mathcal{Y}} = -i\left(\int_{\mathcal{Y}} h\right)\cdot e^{3\pi i/4}\,\overline{\eta(\tau)^3}\cdot\frac{1}{8\pi^2\tau_2\eta(\tau)^2\overline{\eta(\tau)^2}}\cdot\frac{\widehat{\chi_v^{u(1)}}_2(\tau)}{2\pi\sqrt{2}}$$
$$= \frac{-3i\cdot e^{3\pi i/4}}{4\pi\sqrt{2}\tau_2\eta(\tau)^2}\cdot\sum_{n\in\mathbb{Z}}\bar{q}^{(n+v/2)^2}. \qquad (4.37)$$

With the previous data, we obtain:

$-3.05774*10^{16} = \eta(\tau)$; $-3.3805503749\ldots.*10^{34} = \tau_2(n)$;

(((-3*i*exp((3Pi*i)/4)))) * (((exp(2Pi))^((2+i/2)^2))) / (((4Pi*sqrt2 * (-3.3805503749e+34)*(-3.05774e+16)^2)))

Input interpretation:

$$\left(-3\,i\exp\left(\frac{1}{4}(3\pi i)\right)\right)\times\frac{\exp^{\left(2+\frac{i}{2}\right)^2}(2\pi)}{4\pi\sqrt{2}\,(-3.3805503749\times 10^{34})(-3.05774\times 10^{16})^2}$$

i is the imaginary unit

Result:

$-6.45529\ldots\times 10^{-59} - 6.45529\ldots\times 10^{-59}\,i$

(using the principal branch of the logarithm for complex exponentiation)

Polar coordinates:

$r = 9.12915 \times 10^{-59}$ (radius), $\theta = -135°$ (angle)

$9.12915*10^{-59}$

Dividing the two results, we obtain:

-5.74104923946866357041689910304701250077892825 5 × 10^-93 / [(((-3*i*exp((3Pi*i)/4)))) * (((exp(2Pi))^((2+i/2)^2))) / (((4Pi*sqrt2 * (-3.3805503749e+34)*(-3.05774e+16)^2)))]

Input interpretation:

$$-\frac{5.74104923946866357041689910304701250077892825 \times 10^{-93}}{\left(-3\, i \exp\left(\frac{1}{4}(3\pi i)\right)\right) \times \frac{\exp^{\left(2+\frac{i}{2}\right)^2}(2\pi)}{4\pi\sqrt{2}\,(-3.3805503749 \times 10^{34})(-3.05774 \times 10^{16})^2}}$$

i is the imaginary unit

Result:

$4.44678... \times 10^{-35}$ −

$4.44678... \times 10^{-35}\, i$

(using the principal branch of the logarithm for complex exponentiation)

Polar coordinates:

$r = 6.2887 \times 10^{-35}$ (radius), $\theta = -45°$ (angle)

$6.2887*10^{-35}$

From which:

(((sqrt(55/(3 e π)) log(π))))*((((-5.74105e-93)/(-6.45529 × 10^-59 -6.45529 × 10^-59 i))))

Input interpretation:

$$\left(\sqrt{\frac{55}{3\,e\,\pi}}\,\log(\pi)\right)\left(-\frac{5.74105 \times 10^{-93}}{-6.45529 \times 10^{-59} - 6.45529 \times 10^{-59}\, i}\right)$$

$\log(x)$ is the natural logarithm

i is the imaginary unit

Result:

$7.45843... \times 10^{-35} -$
$7.45843... \times 10^{-35}\, i$

Polar coordinates:

$r = 1.05478 \times 10^{-34}$ (radius), $\theta = -45°$ (angle)

$1.05478*10^{-34}$ result practically equal to the value of the reduced Planck constant $1.054571817...\times10^{-34}$ J·s

Now, we have:

$$\frac{\partial Z_{\mathcal{X}}}{\partial \bar{\tau}} = \langle -2\pi i \bar{T}(z_0)\rangle_{\mathcal{X}} = \langle -\pi\{Q, \bar{G}(z_0)\}\rangle_{\mathcal{X}} = \frac{-e^{\pi i/4}}{\sqrt{8\tau_2}\eta(\tau)}\langle \bar{G}(z_0)\rangle_{\mathcal{Y}} \qquad (4.32)$$

From the previous data

$-3.05774*10^{16} = \eta(\tau)$; $-3.3805503749....*10^{34} = \tau_2(n)$;

we obtain:

-exp((Pi*i)/4) * (((-3*i*exp((3Pi*i)/4)))) * [((((exp(2Pi))^((2+i/2)^2))) / (((4Pi*sqrt2 * (-3.3805503749e+34)*(-3.05774e+16)^2)))] * [(((((1/(((sqrt(8*-3.3805503749e+34)*-3.05774e+16)))))))]

Input interpretation:

$$-\exp\left(\frac{\pi i}{4}\right)\left(-3\, i \exp\left(\frac{1}{4}(3\pi i)\right)\right) \times \frac{\exp^{\left(2+\frac{i}{2}\right)^2}(2\pi)}{4\pi\sqrt{2}\,(-3.3805503749\times10^{34})(-3.05774\times10^{16})^2} \times \frac{1}{\sqrt{8\,(-3.3805503749\times10^{34})}\,(-3.05774\times10^{16})}$$

i is the imaginary unit

Result:

$-5.74105... \times 10^{-93}$

(using the principal branch of the logarithm for complex exponentiation)

$-5.74105...*10^{-93}$ as above

From the previous expression, we obtain:

-8ln[(((3*(exp(2Pi))^(2+i/2)^2)))/((((16Pi*i*(-3.3805503749e+34)^1.5*(-3.05774e+16)^3))))]+29

Input interpretation:

$$-8 \log\left(\frac{3 \exp^{\left(2+\frac{i}{2}\right)^2}(2\pi)}{16\pi i\left(-3.3805503749\times 10^{34}\right)^{1.5}\left(-3.05774\times 10^{16}\right)^3}\right)+29$$

$\log(x)$ is the natural logarithm

i is the imaginary unit

Result:

1728.14... −
25.1327... i

(using the principal branch of the logarithm for complex exponentiation)

Polar coordinates:

$r = 1728.32$ (radius), $\theta = 0.833206°$ (angle)
1728.32

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

(((-8ln[(((3*(exp(2Pi))^(2+i/2)^2)))/((((16Pi*i*(-3.3805503749e+34)^1.5*(-3.05774e+16)^3))))]+29)))^1/15

Input interpretation:

$$\sqrt[15]{-8 \log\left(\frac{3 \exp^{\left(2+\frac{i}{2}\right)^2}(2\pi)}{16\pi i\left(-3.3805503749\times 10^{34}\right)^{1.5}\left(-3.05774\times 10^{16}\right)^3}\right)+29}$$

$\log(x)$ is the natural logarithm

i is the imaginary unit

Result:

1.643772... −
0.001593603... i

(using the principal branch of the logarithm for complex exponentiation)

Polar coordinates:

$r = 1.64377$ (radius), $\theta = 0.0555471°$ (angle)

$1.64377 \approx \zeta(2) = \frac{\pi^2}{6} = 1.644934 \ldots$

-1/2ln[(((3*(exp(2Pi))^(2+i/2)^2)))/((((16Pi*i*(-3.3805503749e+34)^1.5*(-3.05774e+16)^3))))]+29

Input interpretation:

$$-\frac{1}{2}\log\left(\frac{3\exp^{\left(2+\frac{i}{2}\right)^2}(2\pi)}{16\pi i\left(-3.3805503749\times10^{34}\right)^{1.5}\left(-3.05774\times10^{16}\right)^3}\right)+29$$

$\log(x)$ is the natural logarithm

i is the imaginary unit

Result:

135.196... –
1.57080... i

(using the principal branch of the logarithm for complex exponentiation)

Polar coordinates:

$r = 135.206$ (radius), $\theta = 0.665668°$ (angle)

135.206 result practically equal to the rest mass of Pion meson 134.9766 MeV

-1/2ln[(((3*(exp(2Pi))^(2+i/2)^2)))/((((16Pi*i*(-3.3805503749e+34)^1.5*(-3.05774e+16)^3))))]+19

Input interpretation:

$$-\frac{1}{2}\log\left(\frac{3\exp^{\left(2+\frac{i}{2}\right)^2}(2\pi)}{16\pi i\left(-3.3805503749\times10^{34}\right)^{1.5}\left(-3.05774\times10^{16}\right)^3}\right)+19$$

$\log(x)$ is the natural logarithm

i is the imaginary unit

Result:

125.196... –
1.57080... i

(using the principal branch of the logarithm for complex exponentiation)

Polar coordinates:

$r = 125.206$ (radius), $\theta = 0.718833°$ (angle)

125.206 result very near to the Higgs boson mass 125.18 GeV

Now, we have:

$$\omega - \frac{e_1}{R} + \frac{R\,e_2}{2}, \qquad h^- - \frac{e_1}{R} - \frac{R\,e_2}{2}, \tag{5.9}$$

where $R^2/2$ is the ratio of the areas of two $\mathbb{CP}^1$'s. In this case the effective two-dimensional theory is closely related to a (0,1) sigma model with $S^1 \times \mathbb{R}^3$ target, where R is the radius of S^1. The difference comes from rescaling of the lattice of winding numbers and momenta along S^1 by the overall $\sqrt{2}$ factor. The formula (5.3) then reads

$$\frac{\partial Z_v}{\partial \bar{\tau}} = \frac{(c_1(X)\cdot[\omega])}{16\pi i\,\tau_2^{3/2}\eta(\tau)^{3+b_2^-}} \sum_{\substack{n\in H^2(X,\mathbb{Z})\\ n=v \mod 2}} \bar{q}^{(n^+\cdot n^+)/4} q^{-(n^-\cdot n^-)/4}, \tag{5.3}$$

$$n^+ := (n\cdot\omega)\,\omega, \qquad n^- := \sum_{i=1}^{b_2^-} (n\cdot h_i^-)\,h_i^-,$$

$n^+ = (2*3/2)*3/2 = 9/2$ $\qquad$ $n^- = (2*1/2)*1/2 = 1/2$

For:

$$b_2^+ = b_2^- = 1.$$

$$e_1 \cdot e_2 = 1.$$

$$c_1(X) = 2e_1 + 2e_2.$$

$\omega = 1+1/2 = 3/2$; $h^- = 1-1/2 = 1/2$

$-3.05774*10^{16} = \eta(\tau)$; $\quad -3.3805503749....*10^{34} = \tau_2(n)$; $\quad n = 2$; $\quad v = i$

From

$$\frac{\partial Z_v}{\partial \bar{\tau}} = \frac{(c_1(X)\cdot[\omega])}{16\pi i\,\tau_2^{3/2}\eta(\tau)^{3+b_2^-}} \sum_{\substack{n\in H^2(X,\mathbb{Z})\\ n=v \mod 2}} \bar{q}^{(n^+\cdot n^+)/4} q^{-(n^-\cdot n^-)/4}, \tag{5.3}$$

(4*3/2) / ((((16Pi*i*(-3.3805503749e+34)^1.5*(-3.05774e+16)^4)))) * (exp(2Pi))^(81/16) * (exp(2Pi))^-(1/16)

Input interpretation:

$$\frac{4\times\frac{3}{2}}{16\,\pi\,i\,(-3.3805503749\times 10^{34})^{1.5}\,(-3.05774\times 10^{16})^4}\,\exp^{\frac{81}{16}}(2\,\pi)\,\exp^{-\frac{1}{16}}(2\,\pi)$$

i is the imaginary unit

Result:

$9.67301\ldots\times 10^{-106}$

9.67301…*10^-106

That is:

6 / ((((16Pi*i*(-3.3805503749e+34)^1.5*(-3.05774e+16)^4)))) * (535.491655)^(81/16) * (535.491655)^-(1/16)

Input interpretation:

$$\frac{6}{16\,\pi\,i\,(-3.3805503749\times 10^{34})^{1.5}\,(-3.05774\times 10^{16})^4}\times\frac{}{535.491655^{81/16}\times 535.491655^{-1/16}}$$

i is the imaginary unit

Result:

$9.67301\ldots\times 10^{-106}$

9.67301…*10^-106

Dividing with the previous expression, we obtain:

(((((3*(exp(2Pi))^(2+i/2)^2)))1/((((16Pi*i*(-3.3805503749e+34)^1.5*(-3.05774e+16)^3)))))) 1/ 9.67301 × 10^-106

Input interpretation:

$$\left(\left(3\exp^{\left(2+\frac{i}{2}\right)^2}(2\pi)\right)\times\frac{1}{16\pi i\left(-3.3805503749\times10^{34}\right)^{1.5}\left(-3.05774\times10^{16}\right)^3}\right)\times\frac{1}{\frac{9.67301}{10^{106}}}$$

i is the imaginary unit

Result:

$-5.93512\ldots\times10^{12}$

(using the principal branch of the logarithm for complex exponentiation)

$-5.93512\ldots*10^{12}$

From which:

[-(((((3*(exp(2Pi))^(2+i/2)^2)))1/((((16Pi*i*(-3.3805503749e+34)^1.5*(-3.05774e+16)^3)))))) 1/ 9.67301 × 10^-106]^1/4+144+24

Input interpretation:

$$\sqrt[4]{-\left(\left(3\exp^{\left(2+\frac{i}{2}\right)^2}(2\pi)\right)\times\frac{1}{16\pi i\left(-3.3805503749\times10^{34}\right)^{1.5}\left(-3.05774\times10^{16}\right)^3}\right)\times\frac{1}{\frac{9.67301}{10^{106}}}}+144+24$$

i is the imaginary unit

Result:

1728.84...

(using the principal branch of the logarithm for complex exponentiation)

$1728.84\ldots\approx1729$

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

and:

[-(((((3*(exp(2Pi))^(2+i/2)^2)))1/((((16Pi*i*(-3.3805503749e+34)^1.5*(-3.05774e+16)^3)))))) 1/ 9.67301 × 10^-106]^1/6

Input interpretation:

$$\sqrt[6]{-\left(\left(3\exp^{\left(2+\frac{i}{2}\right)^2}(2\pi)\right)\times\frac{1}{16\pi i\left(-3.3805503749\times10^{34}\right)^{1.5}\left(-3.05774\times10^{16}\right)^3}\right)\times\frac{1}{\frac{9.67301}{10^{106}}}}$$

i is the imaginary unit

Result:

134.557...

(using the principal branch of the logarithm for complex exponentiation)

134.557… result practically equal to the rest mass of Pion meson 134.9766 MeV

[-(((((3*(exp(2Pi))^(2+i/2)^2)))1/((((16Pi*i*(-3.3805503749e+34)^1.5*(-3.05774e+16)^3)))))) 1/ 9.67301 × 10^-106]^1/6-7-2

Input interpretation:

$$\sqrt[6]{-\left(\left(3\exp^{\left(2+\frac{i}{2}\right)^2}(2\pi)\right)\times\frac{1}{16\pi i\left(-3.3805503749\times10^{34}\right)^{1.5}\left(-3.05774\times10^{16}\right)^3}\right)\times\frac{1}{\frac{9.67301}{10^{106}}}}-7-2$$

i is the imaginary unit

Result:

125.557...

(using the principal branch of the logarithm for complex exponentiation)

125.557… result very near to the Higgs boson mass 125.18 GeV

Or, inverting the division:

9.67301 × 10^-106*1/(((((3*(exp(2Pi))^(2+i/2)^2)))1/((((16Pi*i*(-3.3805503749e+34)^1.5*(-3.05774e+16)^3))))))

Input interpretation:

$$\frac{9.67301}{10^{106}} \times \frac{1}{\left(3 \exp^{\left(2+\frac{i}{2}\right)^2}(2\,\pi)\right) \times \frac{1}{16\,\pi\,i\,(-3.3805503749 \times 10^{34})^{1.5}\,(-3.05774 \times 10^{16})^3}}$$

i is the imaginary unit

Result:

$-1.68489... \times 10^{-13}$

(using the principal branch of the logarithm for complex exponentiation)

-1.68489…*10^{-13}

From which:

-(64*2*10^3+64*16)*9.67301 × 10^-106*1/(((((3*(exp(2Pi))^(2+i/2)^2)))1/((((16Pi*i*(-3.3805503749e+34)^1.5*(-3.05774e+16)^3))))))

Input interpretation:

$$-(64 \times 2 \times 10^3 + 64 \times 16)\left(\frac{9.67301}{10^{106}} \times \frac{1}{\left(3 \exp^{\left(2+\frac{i}{2}\right)^2}(2\,\pi)\right) \times \frac{1}{16\,\pi\,i\,(-3.3805503749 \times 10^{34})^{1.5}\,(-3.05774 \times 10^{16})^3}}\right)$$

i is the imaginary unit

Result:

$2.17391... \times 10^{-8}$

(using the principal branch of the logarithm for complex exponentiation)

2.17391…*10^{-8} result practically equal to the value of Planck mass
2.176435×10^{-8} kg

Now, we have that:

$$\frac{\partial Z_v}{\partial \bar{\tau}} = \frac{(R+2/R)}{16\pi i \tau_2^{3/2}\eta(\tau)^4} \sum_{\substack{n\in\mathbb{Z}^2 \\ n=v \mod 2}} \bar{q}^{(n_1/R+Rn_2/2)^2/4} q^{(n_1/R-Rn_2/2)^2/4}, \qquad (5.10)$$

For :

$n^+ = (2*3/2)*3/2 = 9/2$; $n^- = (2*1/2)*1/2 = 1/2$; $n_1 = 9/2$; $n_2 = 1/2$;

$R = 1$; $-3.05774*10^{16} = \eta(\tau)$; $-3.3805503749....*10^{34} = \tau_2(n)$; $n = 2$;

We obtain:

3 / ((((16Pi*i*(-3.3805503749e+34)^1.5 * (-3.05774e+16)^4)))) *
(((exp(2Pi)^((9/2+(1/2)/2)/4) * exp(2Pi)^((9/2-(1/2)/2)/4))))

Input interpretation:

$$\frac{3}{16\,\pi\,i\,(-3.3805503749\times 10^{34})^{1.5}\,(-3.05774\times 10^{16})^4}\left(\exp^{\frac{1}{4}\left(\frac{9}{2}+\frac{1}{2}\right)}_{(2\,\pi)}\exp^{\frac{1}{4}\left(\frac{9}{2}-\frac{1}{2}\right)}_{(2\,\pi)}\right)$$

i is the imaginary unit

Result:

$1.51517... \times 10^{-113}$

$1.51517...*10^{-113}$

From which, we obtain:

(8*3^4+5)^3 * 3 / ((((16Pi*i*(-3.3805503749e+34)^1.5 * (-3.05774e+16)^4)))) *
(((exp(2Pi)^((9/2+(1/2)/2)/4) * exp(2Pi)^((9/2-(1/2)/2)/4))))

Input interpretation:

$$(8\times 3^4+5)^3 \times \frac{3}{16\,\pi\,i\,(-3.3805503749\times 10^{34})^{1.5}\,(-3.05774\times 10^{16})^4}\left(\exp^{\frac{1}{4}\left(\frac{9}{2}+\frac{1}{2}\right)}_{(2\,\pi)}\exp^{\frac{1}{4}\left(\frac{9}{2}-\frac{1}{2}\right)}_{(2\,\pi)}\right)$$

i is the imaginary unit

Result:

$4.21892... \times 10^{-105}$

4.21892…*10^-105 result practically equal to the value of the Planck volume

4.2217×10^{-105} m^3

With the previous result, we obtain also:

9.6730091246379339190682 × 10^-106 / ((((3 / ((((16Pi*i*(-3.3805503749e+34)^1.5 * (-3.05774e+16)^4)))) * (((exp(2Pi)^((9/2+(1/2)/2)/4) * exp(2Pi)^((9/2-(1/2)/2)/4))))))))

Input interpretation:

$$\frac{\frac{9.6730091246379339190682}{10^{106}}}{\frac{3}{16\pi\, i\left(-3.3805503749\times 10^{34}\right)^{1.5}\left(-3.05774\times 10^{16}\right)^4}\left(\exp^{\frac{1}{4}\left(\frac{9}{2}+\frac{1}{2}{2}\right)}(2\pi)\exp^{\frac{1}{4}\left(\frac{9}{2}-\frac{\frac{1}{2}}{2}\right)}(2\pi)\right)}$$

i is the imaginary unit

Result:

$6.384103831484274349106268579995065748739780713656947 55... \times 10^7$

6.38410383…*10^7

((47+3)/(3Pi^4))[((9.67300912e-106 /((((3/((((16Pi*i*(-3.38055037e+34)^1.5 * (-3.05774e+16)^4))))*(((exp(2Pi)^((9/2+(1/2)/2)/4) * exp(2Pi)^((9/2-(1/2)/2)/4))))))))))]^1/8

Input interpretation:

$$\frac{47+3}{3\pi^4}\sqrt[8]{\frac{\frac{9.67300912}{10^{106}}}{\frac{3}{16\pi\, i\left(-3.38055037\times 10^{34}\right)^{1.5}\left(-3.05774\times 10^{16}\right)^4}\left(\exp^{\frac{1}{4}\left(\frac{9}{2}+\frac{1}{2}{2}\right)}(2\pi)\exp^{\frac{1}{4}\left(\frac{9}{2}-\frac{\frac{1}{2}}{2}\right)}(2\pi)\right)}}$$

i is the imaginary unit

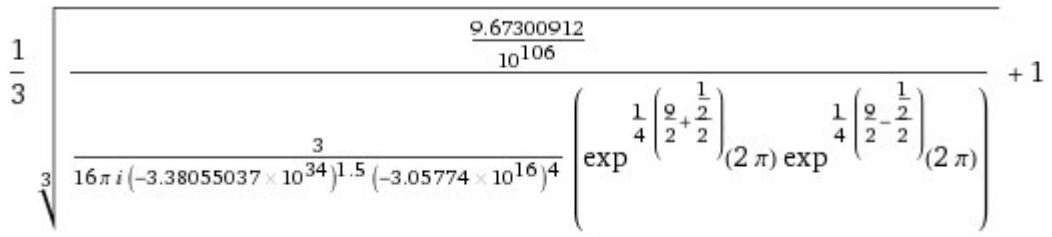
Result:

1.617658154823676182547119862770264245233071534804844725 40...

1.617658154….. result that is a very good approximation to the value of the golden ratio 1.618033988749...

1/3[((9.67300912e-106 /((((3/((((16Pi*i*(-3.38055037e+34)^1.5 * (-3.05774e+16)^4))))*(((exp(2Pi)^((9/2+(1/2)/2)/4) * exp(2Pi)^((9/2-(1/2)/2)/4))))))))))]^1/3+1

Input interpretation:



i is the imaginary unit

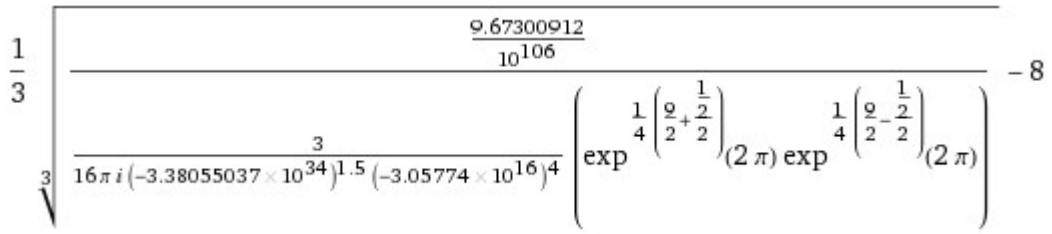
Result:

134.223...

134.223… result practically equal to the rest mass of Pion meson 134.9766 MeV

1/3[((9.67300912e-106 /((((3/((((16Pi*i*(-3.38055037e+34)^1.5 * (-3.05774e+16)^4))))*(((exp(2Pi)^((9/2+(1/2)/2)/4) * exp(2Pi)^((9/2-(1/2)/2)/4))))))))))]^1/3-8

Input interpretation:



i is the imaginary unit

Result:

125.223...

125.223…. result very near to the Higgs boson mass 125.18 GeV

27*1/2[1/3[((9.67300912e-106 /((((3/((((16Pi*i*(-3.38055037e+34)^1.5 * (-3.05774e+16)^4))))*(((exp(2Pi)^((9/2+(1/2)/2)/4) * exp(2Pi)^((9/2-(1/2)/2)/4))))))))))]^1/3-5]-2

Input interpretation:

$$27\times\frac{1}{2}\left(\frac{1}{3}\left(\frac{9.67300912}{10^{106}}\Big/\left(\frac{3}{16\,\pi\,i\,(-3.38055037\times10^{34})^{1.5}\,(-3.05774\times10^{16})^{4}\left(\exp^{\frac{1}{4}\left(\frac{9}{2}+\frac{\frac{1}{2}}{2}\right)}(2\,\pi)\exp^{\frac{1}{4}\left(\frac{9}{2}-\frac{\frac{1}{2}}{2}\right)}(2\,\pi)\right)}\right)\right)\text{^}\,(1/3)-5\right)-2$$

i is the imaginary unit

Result:

1729.01...
1729.01….

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

With regard 27 (From Wikipedia):

"The fundamental group of the complex form, compact real form, or any algebraic version of E_6 is the cyclic group $\boldsymbol{Z}/3\boldsymbol{Z}$, and its outer automorphism group is the cyclic group $\boldsymbol{Z}/2\boldsymbol{Z}$. Its fundamental representation is 27-dimensional (complex), and a basis is given by the 27 lines on a cubic surface. The dual representation, which is inequivalent, is also 27-dimensional. In particle physics, E_6 plays a role in some grand unified theories".

and also:

1/4((colog(((3 / ((((16Pi*i*(-3.3805503749e+34)^1.5 * (-3.05774e+16)^4)))) * (((exp(2Pi)^((9/2+(1/2)/2)/4) * exp(2Pi)^((9/2-(1/2)/2)/4)))))))-4))

Input interpretation:

$$\frac{1}{4}\left(-\log\left(\frac{3}{16\,\pi\,i\,(-3.3805503749\times10^{34})^{1.5}\,(-3.05774\times10^{16})^{4}\left(\exp^{\frac{1}{4}\left(\frac{9}{2}+\frac{\frac{1}{2}}{2}\right)}_{(2\,\pi)}\exp^{\frac{1}{4}\left(\frac{9}{2}-\frac{\frac{1}{2}}{2}\right)}_{(2\,\pi)}\right)}\right)-4\right)$$

$\log(x)$ is the natural logarithm

i is the imaginary unit

Result:

63.9441...

63.9441….≈ 64

Observations

From:
https://www.scientificamerican.com/article/mathematics-ramanujan/?fbclid=IwAR2caRXrn_RpOSvJ1QxWsVLBcJ6KVgd_Af_hrmDYBNyU8mpSjRs1BDeremA

Ramanujan's statement concerned the deceptively simple concept of partitions—the different ways in which a whole number can be subdivided into smaller numbers. Ramanujan's original statement, in fact, stemmed from the observation of patterns, such as the fact that p(9) = 30, p(9 + 5) = 135, p(9 + 10) = 490, p(9 + 15) = 1,575 and so on are all divisible by 5. Note that here the n's come at intervals of five units.

Ramanujan posited that this pattern should go on forever, and that similar patterns exist when 5 is replaced by 7 or 11—there are infinite sequences of p(n) that are all divisible by 7 or 11, or, as mathematicians say, in which the "moduli" are 7 or 11.

Then, in nearly oracular tone Ramanujan went on: "There appear to be corresponding properties," he wrote in his 1919 paper, "in which the moduli are powers of 5, 7 or 11...and no simple properties for any moduli involving primes other than these three." (Primes are whole numbers that are only divisible by themselves or by 1.) Thus, for instance, there should be formulas for an infinity of n's separated by 5^3 = 125 units, saying that the corresponding p(n)'s should all be divisible by 125.
In the past methods developed to understand partitions have later been applied to physics problems such as the theory of the strong nuclear force or the entropy of black holes.

From Wikipedia

In particle physics, Yukawa's interaction or Yukawa coupling, named after Hideki Yukawa, is an interaction between a scalar field ϕ and a Dirac field ψ. The Yukawa interaction can be used to describe the nuclear force between nucleons (which are fermions), mediated by pions (which are pseudoscalar mesons). The Yukawa interaction is also used in the Standard Model to describe the coupling between the Higgs field and massless quark and lepton fields (i.e., the fundamental fermion particles). Through spontaneous symmetry breaking, these fermions acquire a mass proportional to the vacuum expectation value of the Higgs field.

Can be this the motivation that from the development of the Ramanujan's equations we obtain results very near to the dilaton mass calculated as a type of Higgs boson: 125 GeV for T = 0 and to the Higgs boson mass 125.18 GeV and practically equal to the rest mass of Pion meson 139.57 MeV

Note that:

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

Hence

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

so that

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

Hence

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

Thence:

$$64g_{22}^{-24} = 4096e^{-\pi\sqrt{22}} + \cdots$$

And

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

That are connected with 64, 128, 256, 512, 1024 and 4096 = 64^2

(Modular equations and approximations to π - S. Ramanujan - Quarterly Journal of Mathematics, XLV, 1914, 350 – 372)

All the results of the most important connections are signed in blue throughout the drafting of the paper. We highlight as in the development of the various equations we use always the constants π, ϕ, 1/ϕ, the Fibonacci and Lucas numbers, linked to the golden ratio, that play a fundamental role in the development, and therefore, in the final results of the analyzed expressions.

In mathematics, the Fibonacci numbers, commonly denoted F_n, form a sequence, called the Fibonacci sequence, such that each number is the sum of the two preceding ones, starting from 0 and 1. Fibonacci numbers are strongly related to the golden

ratio: Binet's formula expresses the nth Fibonacci number in terms of n and the golden ratio, and implies that the ratio of two consecutive Fibonacci numbers tends to the golden ratio as n increases.
Fibonacci numbers are also closely related to Lucas numbers ,in that the Fibonacci and Lucas numbers form a complementary pair of Lucas sequences

The beginning of the sequence is thus:

0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987, 1597, 2584, 4181, 6765, 10946, 17711, 28657, 46368, 75025, 121393, 196418, 317811, 514229, 832040, 1346269, 2178309, 3524578, 5702887, 9227465, 14930352, 24157817, 39088169, 63245986, 102334155...

The Lucas numbers or Lucas series are an integer sequence named after the mathematician François Édouard Anatole Lucas (1842–91), who studied both that sequence and the closely related Fibonacci numbers. Lucas numbers and Fibonacci numbers form complementary instances of Lucas sequences.

The Lucas sequence has the same recursive relationship as the Fibonacci sequence, where each term is the sum of the two previous terms, but with different starting values. This produces a sequence where the ratios of successive terms approach the golden ratio, and in fact the terms themselves are roundings of integer powers of the golden ratio.[1] The sequence also has a variety of relationships with the Fibonacci numbers, like the fact that adding any two Fibonacci numbers two terms apart in the Fibonacci sequence results in the Lucas number in between.

The sequence of Lucas numbers is:

2, 1, 3, 4, 7, 11, 18, 29, 47, 76, 123, 199, 322, 521, 843, 1364, 2207, 3571, 5778, 9349, 15127, 24476, 39603, 64079, 103682, 167761, 271443, 439204, 710647, 1149851, 1860498, 3010349, 4870847, 7881196, 12752043, 20633239, 33385282, 54018521, 87403803……

All Fibonacci-like integer sequences appear in shifted form as a row of the Wythoff array; the Fibonacci sequence itself is the first row and the Lucas sequence is the second row. Also like all Fibonacci-like integer sequences, the ratio between two consecutive Lucas numbers converges to the golden ratio.

A Lucas prime is a Lucas number that is prime. The first few Lucas primes are:

2, 3, 7, 11, 29, 47, 199, 521, 2207, 3571, 9349, 3010349, 54018521, 370248451, 6643838879, ... (sequence A005479 in the OEIS).

In geometry, a golden spiral is a logarithmic spiral whose growth factor is φ, the golden ratio.[1] That is, a golden spiral gets wider (or further from its origin) by a factor of φ for every quarter turn it makes. Approximate logarithmic spirals can occur in nature, for example the arms of spiral galaxies[3] - golden spirals are one special case of these logarithmic spirals

We observe that 1728 and 1729 are results very near to the mass of candidate glueball **f_0(1710) scalar meson.** Furthermore, 1728 occurs in the algebraic formula for the j-invariant of an elliptic curve. 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 (taxicab number).

Furthermore, we obtain as results of our computations, always values very near to the Higgs boson mass 125.18 GeV and practically equals to the rest mass of Pion meson 139.57 MeV. In conclusion we obtain also many results that are very good approximations to the value of the golden ratio 1.618033988749... and to ζ(2) = $\frac{\pi^2}{6} = 1.644934 \ldots$

We note how the following three values: 137.508 (golden angle), 139.57 (mass of the Pion - meson Pi) and 125.18 (mass of the Higgs boson), are connected to each other. In fact, just add 2 to 137.508 to obtain a result very close to the mass of the Pion and subtract 12 to 137.508 to obtain a result that is also very close to the mass of the Higgs boson. We can therefore hypothesize that it is the golden angle (and the related golden ratio inherent in it) to be a fundamental ingredient both in the structures of the microcosm and in those of the macrocosm.

References

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Duality and Mock Modularity
Atish Dabholkar, Pavel Putrov, Edward Witten - arXiv:2004.14387v1 [hep-th] 29 Apr 2020