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kms 대한수학회
Korean Mathematical Society

Mathematical Calendar 2015

designed by **Poo-Sung Park**

January

S	M	T	W	Th	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

February

S	M	T	W	Th	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28

March

S	M	T	W	Th	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

April

S	M	T	W	Th	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

May

S	M	T	W	Th	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24/31	25	26	27	28	29	30

June

S	M	T	W	Th	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

July

S	M	T	W	Th	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

August

S	M	T	W	Th	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23/30	24/31	25	26	27	28	29

September

S	M	T	W	Th	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

October

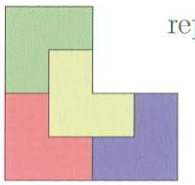
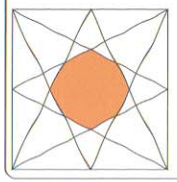
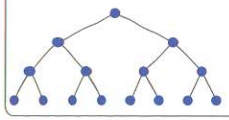
S	M	T	W	Th	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

November

S	M	T	W	Th	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

December

S	M	T	W	Th	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

SUN	MON	TUE	WED	THU	FRI	SAT
				1 $\lim_{x\to 0}\dfrac{e^x-1}{x}$	**2** $(S_n : A_n)$	**3** $1!+2!$
 **4** rep-tiles	**5** p: prime ≥ 5 $\Rightarrow p^5 \mid \binom{p^2}{p}-\binom{p}{1}$	 **6** $\frac{1}{6}$	**7** pandigital expression $98532 \div 14076$	**8** 2^3	 **9** odd # of faces, each face has the same # of edges	**10** $1+2+3+4$
11 $\dfrac{1}{F_{11}}=\dfrac{1}{89}$ $=0.01123595\cdots$ $=\sum_{k=0}^{\infty}\dfrac{F_k}{10^{k+1}}$	**12** $\dfrac{4}{1-\frac{2}{3}}$	**13** pandigital expression $103428 \div 7956$	**14** $\dfrac{1}{4+1}\binom{2\cdot 4}{4}$ is the 4th Catalan number.	**15** 	**16** $(-1+2+3)\times 4$	**17** $\frac{1}{4}+2=(1\frac{1}{2})^2$ $\frac{1}{4}+2\cdot 3=(2\frac{1}{2})^2$ $\frac{1}{4}+2\cdot 3\cdot 5=(5\frac{1}{2})^2$ $\frac{1}{4}+2\cdot 3\cdot 5\cdot 7=(14\frac{1}{2})^2$ $\frac{1}{4}+2\cdot 3\cdot 5\cdot 7\cdot 11\cdot 13\cdot 17=(714\frac{1}{2})^2$
18 Sum of three primes: $2+3+13$ $=2+5+11$	**19** $\approx \dfrac{\pi^4+e^4}{8}$	**20** 22_9	**21** $1+(2+3)\times 4$	**22** 2×11 $2=1+1$ All prime factors have the same digit sum.	**23** $e^{2\pi}-2\pi \approx 23^2+\dfrac{1}{\sqrt{23}}$	**24** $4!$
25 $25=5^2$ 1st Friedman #	**26** pandigital expression $\dfrac{65}{10}\times\dfrac{948}{237}$	**27** $\lfloor 10e \rfloor$	**28** $\approx 8e+\dfrac{17}{e}$	**29** $\approx \dfrac{170}{\pi+e}$	**30** pandigital expression $\dfrac{174690}{5823}=\dfrac{174960}{5832}$	**31** $1+2+2^2+2^3+2^4$ $=1+5+5^2$

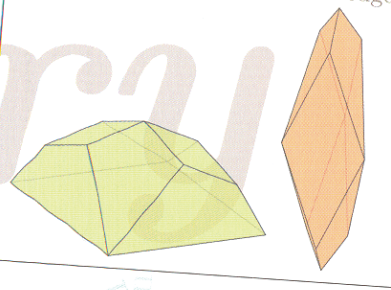
kms **2015.1.**

Th F S S M T W Th F S S M T W Th F

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

January 2015

These polyherons have odd number of faces that each has the same number of edges.



Friedman number

$25 = 5^2$
$121 = 11^2$
$125 = 5^{1+2}$
$126 = 6 \times 21$
$127 = -1 + 2^7$
$128 = 2^{8-1}$
$153 = 5 \times 31$
$216 = 6^{2+1}$
$289 = (8+9)^2$

$$e^{2\pi} - 2\pi = 529.20847\cdots$$
$$23^2 + \frac{1}{\sqrt{23}} = 529.20851\cdots$$

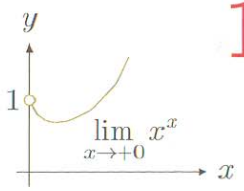
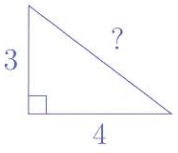
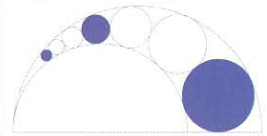
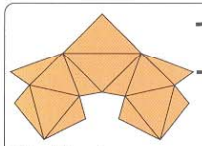
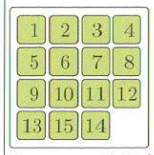
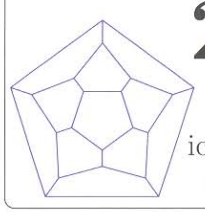
$$\frac{\pi^4 + e^4}{8} = 19.000905\ldots$$

$$8e + \frac{17}{e} = 28.000205\cdots$$

17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

S S M T W Th F S S M T W Th F S

kms

SUN	MON	TUE	WED	THU	FRI	SAT
1 	**2** $\cos\frac{\pi}{2^{n+1}} = \frac{1}{2}\underbrace{\sqrt{2+\sqrt{2+\sqrt{2+\cdots}}}}_{n\text{-fold}}$	**3** $F_0 = 2^{2^0}+1$	**4** $4 \nmid 2015$ The year 2015 is not a leap year.	**5** 	**6** $\binom{4}{2}$	**7** $\frac{7}{r_4} = \frac{2}{r_7} + \frac{5}{r_1}$ 
8 $\frac{10^8-8}{8}$ and $\frac{10^{8+8}-8}{8}$ are both prime.	**9** # of derangements of 4 objects $= 4!\left(\frac{1}{2!}-\frac{1}{3!}+\frac{1}{4!}\right)$	**10** $1^1+2^2+3^3+\cdots+9^9+10^{10}$ is prime.	**11** $\frac{1}{1}+\frac{1}{2}+\cdots+\frac{1}{10} < 3 < \frac{1}{1}+\frac{1}{2}+\cdots+\frac{1}{11}$	**12** $\approx \sqrt[3]{9^3+10^3}$	**13** 111_3	**14**  Steffen's flexible polyhedron
15  Impossible!	**16** 2^{2^2}	**17** pandigital expression $\frac{68}{10}\times\frac{735}{294}$	**18** divides the differences between emirp pairs.	**19** $\approx \frac{46}{\sqrt{\pi+e}}$	**20**  icosian game	**21** $1_2 \times 11_2 \times 111_2$
22 $\approx \sqrt{15^2+16^2}$	**23** the length of the perfect binary Golay code	**24** 1 day = 24 hours	**25** $\approx 30e-18\pi$	**26** $\frac{26}{65} = \frac{2}{5}$	**27** In Collatz sequence, $\underbrace{27\to82\to41\to\ldots\to1}_{112\text{ numbers}}$	**28** $(1+2\times3)\times4$

kms **2015.2.**

S	M	T	W	Th	F	S
1	2	3	4	5	6	7
S	M	T	W	Th	F	S
8	9	10	11	12	13	14
S	M					
15	16					

February 2015

An emirp is a prime number which results in a different prime number when read reversely.

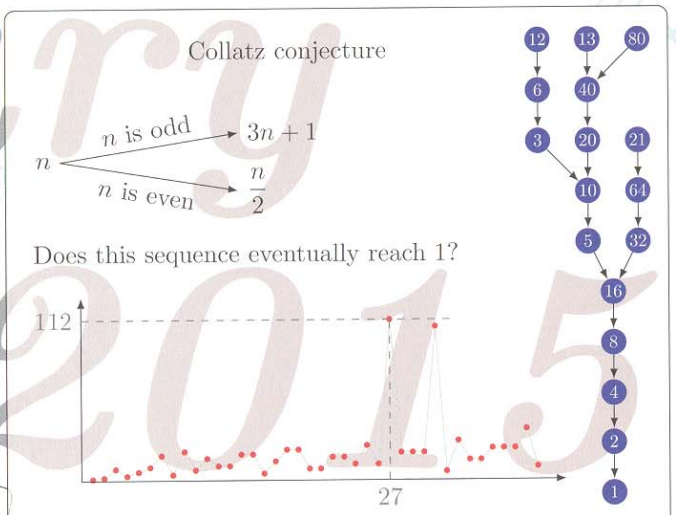
$$18 \mid 31 - 13$$
$$18 \mid 71 - 17$$
$$18 \mid 73 - 37$$
$$18 \mid 97 - 79$$
$$18 \mid 701 - 107$$
$$\dots$$

$$30e - 18\pi = 24.99978\dots$$

Collatz conjecture

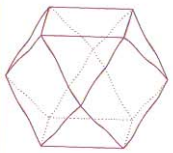
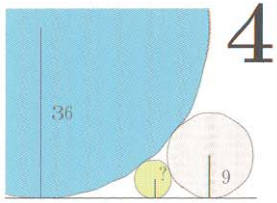
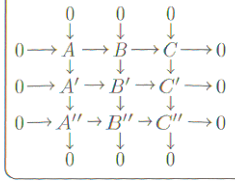
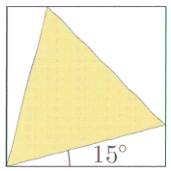
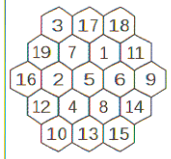
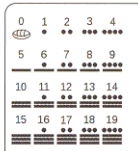
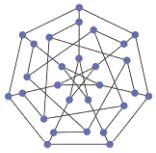
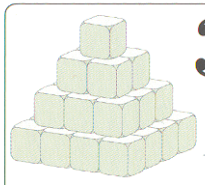
$$n \to \begin{cases} n \text{ is odd} \to 3n+1 \\ n \text{ is even} \to \frac{n}{2} \end{cases}$$

Does this sequence eventually reach 1?



T	W	Th	F	S	S	M	T	W	Th	F	S
17	18	19	20	21	22	23	24	25	26	27	28

kms

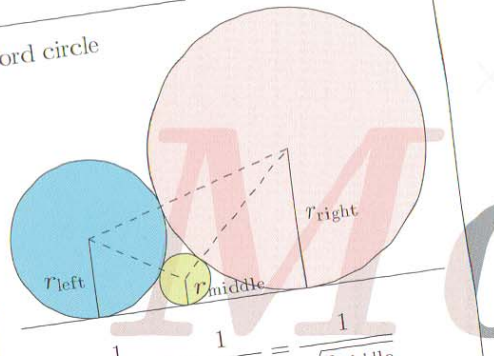
SUN	MON	TUE	WED	THU	FRI	SAT
1 $\lim_{n\to\infty} \sqrt[n]{n}$	**2**  $V-E+F$	**3**  Penrose's △	**4** 	**5** $\pi \approx \log_5\left(\begin{matrix}1+1+5\\+5^2+5^3\end{matrix}\right)$	**6** ♯ Euler squares of order 6	**7** $\coth\left(\log\sqrt{\operatorname{csch}(\log 2)}\right)$
8 1 Byte = 8 bits	**9** Nine lemma: 	**10** $\approx \sqrt{2\pi}^{\sqrt{2\pi}}$	**11** $11\vert\overbrace{100\ldots001}^{2n}$	**12** $\approx \sqrt{3^4+4^3}$	**13** 13^2 $=12^2+5^2$ $=12^2+4^2+3^2$ $=10^2+8^2+2^2+1^2$	**14** $\pi \approx 3.14$
15  largest equilateral △	**16** $\sqrt{10} \approx 3.16$	**17** $\sqrt{8^2+15^2}$	**18** ♯ of infinite famillies of finite simple groups	**19**  magic hexagon	**20**  Mayan base-20 numeral system	**21** $2^{21}-21$ is prime.
22 22 ⎫ 22 ⎭ two twos 22 ⎫ 22 ⎭ two twos ⋮	**23** 3^3-2^2	**24** Every divisor − 1 is prime except 1 & 2.	**25** 256 and 625 are both squares.	**26** 26^3 $=17576$ $=(1+7+5+7+6)^3$	**27** 27^3 $=19683$ $=(1+9+6+8+3)^3$	**28**  Coxeter's graph
29 $2^{29}=536870912$ all distinct digits	**30**  $1^2+2^2+3^2+4^2$	**31** $\sqrt{3+5+7+11+13+17+\cdots+87+89}$	1	2	3	4
5	6	7				

kms **2015.3.**

March 2015

S	M	T	W	Th	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Ford circle



$$\frac{1}{\sqrt{r_{\text{left}}}} + \frac{1}{\sqrt{r_{\text{right}}}} = \frac{1}{\sqrt{r_{\text{middle}}}}$$

Nine lemma

$$\begin{array}{ccccccc}
 & & 0 & 0 & 0 & & \\
 & & \downarrow & \downarrow & \downarrow & & \\
0 & \to & A & \to B & \to C & \to & 0 \\
 & & \downarrow & \downarrow & \downarrow & & \\
0 & \to & A' & \to B' & \to C' & \to & 0 \\
 & & \downarrow & \downarrow & \downarrow & & \\
0 & \to & A'' & \to B'' & \to C'' & \to & 0 \\
 & & \downarrow & \downarrow & \downarrow & & \\
 & & 0 & 0 & 0 & &
\end{array}$$

exact exact exact

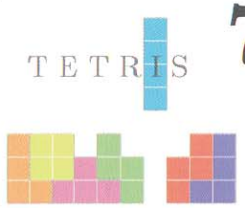
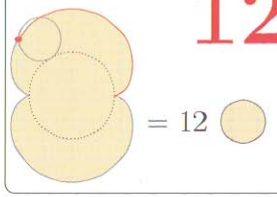
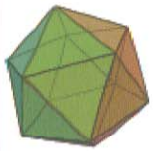
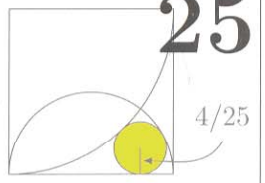
$0 \to A \to B \to C \to 0$: exact
$\iff 0 \to A'' \to B'' \to C'' \to 0$: exact

$$\sqrt{3^4 + 4^3} = \sqrt{145} = 12.041\cdots$$

$$\sqrt{2\pi}^{\sqrt{2\pi}} = 10.008525802\cdots$$

T	W	Th	F	S	S	M	T	W	Th	F	S	S	M	T

kms

SUN	MON	TUE	WED	THU	FRI	SAT
29	30		**1** $-e^{\pi i}$	**2** $1+1$	**3** $\lfloor \pi \rfloor$	**4** $\dfrac{\pi}{\arctan 1}$
5 5th Fibonacci number	**6** 3!	**7** 	**8** 888888883 is the smallest prime having only eight 8s.	**9** $\overbrace{111111111}^{9} \div 9 = 12345679$	**10** 6 weeks $= 10!$ seconds	**11** $11 + 1.1 = 11 \times 1.1$
12  $= 12$	**13** TWO + eleven = TWelve + One	**14** $\lfloor 10\sqrt{2} \rfloor$	**15** $15^4 = 4^4+6^4+8^4+9^4+14^4$	**16** The largest order of $E_{\text{torsion}}(\mathbb{Q})$	**17** $\approx \sqrt[3]{13^3+14^3}$	**18** $18 \times 81 + 1$ is prime.
19 $19 \mid \overbrace{1\ldots19}^{19}, \overbrace{19\ldots9}^{19}$	**20**  icosahedron	**21** $\approx 8e - \dfrac{2}{e}$	**22** $2^{2^2}+2^2+2$	**23** $\approx \dfrac{227}{\pi^2}$	**24** divides $n(n+1)(n+2)(n+3)$	**25** 
26 26: not palindromic 26^2: palindromic	**27** x^3+px+q $\rightsquigarrow \Delta = -4p^3-27q^2$	**28** $28^4 = 614656 = \begin{pmatrix} 6+1+4 \\ +6+5+6 \end{pmatrix}^4$	**29** $\approx 5e(\pi-1)$	**30** $\approx (\pi+6)(6-e)$	1	2
3	4	5				

kms **2015.4.**

W Th F S S M T W Th F S S M T W Th

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

April 2015

Mazur's theorem

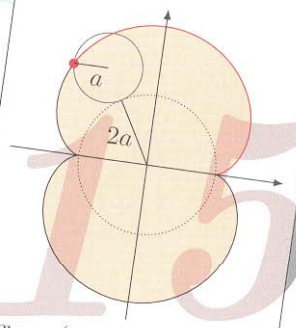
The torsion subgroup of $E(\mathbb{Q})$ is one of the following groups:

(i) $\mathbb{Z}/N\mathbb{Z}$ with $1 \leq N \leq 10$ or $N = 12$

(ii) $\mathbb{Z}/2\mathbb{Z} \times \mathbb{Z}/2N\mathbb{Z}$ with $1 \leq N \leq 4$

$(\pi + 6)(6 - e) = 30.00013\cdots$

Nephroid



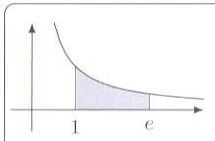
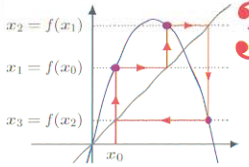
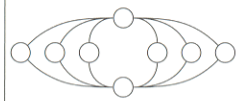
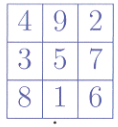
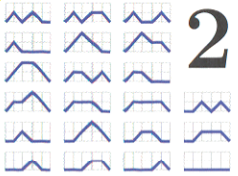
$$x = a(3\cos t - \cos 3t)$$
$$y = a(3\sin t - \sin 3t)$$
$$A = 4\int_0^{\frac{\pi}{2}} y\,dx = 12\pi a^2$$

$8e - \frac{2}{e} = 21.010\cdots$

17 18 19 20 21 22 23 24 25 26 27 28 29 30

F S S M T W Th F S S M T W Th

kms

SUN	MON	TUE	WED	THU	FRI	SAT
					 **1** $\int_1^e \frac{1}{x}\,dx$	**2** How many twin primes p and $p+2$?
 **3** Period 3 implies chaos.	 **4** 4 gal?	**5** $2^{2^5}+1$ $= 641 \times 6700417$	**6** $1+2+3$ $=1\times 2\times 3$	**7** Four 4s: $4+4-4\div 4$	 **8** Quaternion group Q_8	**9** $\pi \approx 9/5+\sqrt{9/5}$
10 $\left(1+\frac{3}{2}\right)\times 4$	**11** uǝʌǝlǝ = eleven	**12** 12th prime is 37. 21st prime is 73.	**13** $2+3+5+7+11+13$ is the 13th prime.	**14** $\approx 9\tan 1$	**15**  magic sum = 15	**16** $16 = 13 \times 7$
17 There are 17 plane symmetry groups.	**18** $9\times 2 = 18 = {}_{?}6$	**19** 章法 Metonic cycle	**20** $\binom{6}{3}$	**21**  5th Motzkin #	**22** 22! is 22 digits long.	**23** $\overbrace{11111\ldots11111}^{23}$ is the third repunit prime.
24 24! $\approx$ Avogadro's #	**25** $\pi(100)=25$ $\pi(25)=9$ $\pi(9)=4$	**26** $\approx \sqrt{14^2+15^2+16^2}$	**27** $27!+1$ is prime.	**28** 28^5 $= 17210368$ $=\begin{pmatrix}1+7+2+1\\+0+3+6+8\end{pmatrix}^5$	**29** $2\times 5+3\times 3+5\times 2$	**30** 33_9
31 $\approx \frac{e^\pi-\log 3}{\log 2}-\frac{4}{5}$						

kms **2015.5.**

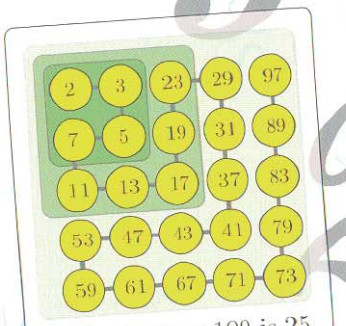
F S S M T W Th F S S M T W Th F S

1 3 5 7 9 11 13 15

2 4 6 8 10 12 14 16

$$\frac{9}{5}+\sqrt{\frac{9}{5}} = 3.14164\ldots$$

May 2015



# of primes < 100 is 25.
# of primes < 25 is 9.
# of primes < 9 is 4.

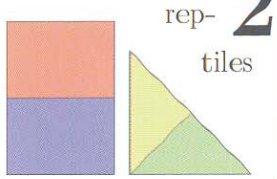
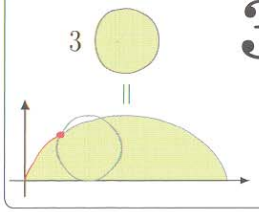
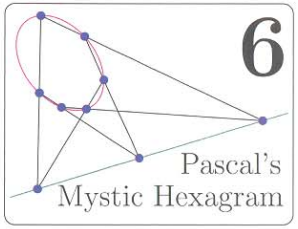
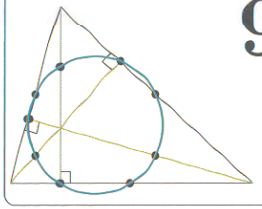
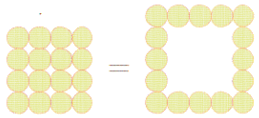
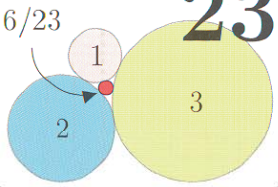
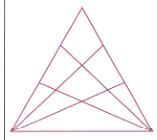
$$\frac{e^{\pi}-\log 3}{\log 2}-\frac{4}{5} = 31.000000003325\ldots$$

17 19 21 23 25 27 29 31

18 20 22 24 26 28 30

S M T W Th F S S M T W Th F S S

kms

SUN	MON	TUE	WED	THU	FRI	SAT
31	**1** $\log e$	**2**  rep-tiles	**3** 	**4** $\sqrt{6+2\sqrt{7+3\sqrt{8+4\sqrt{\cdots}}}}$	**5** $\frac{95}{19} = 5$	**6**  Pascal's Mystic Hexagram
7 77767777 is the smallest prime having only seven 7s.	**8**  figure 8 knot	**9** 	**10** $\frac{\Gamma(\frac{1}{10})\Gamma(\frac{9}{10})}{\Gamma(\frac{3}{10})\Gamma(\frac{7}{10})} = \frac{3+\sqrt{5}}{2}$	**11** $p(11n+6) \equiv 0 \pmod{11}$	**12** pandigital expression $107352 \div 8946$	**13** 78910111213 is prime.
14 $\approx 5\sqrt{2}+4\sqrt{3}$	**15** $\binom{6}{2}$	**16** 	**17** $\exists$ 17 standard-form types of quadratic surfaces.	**18** $3 \times (3+3)$	**19** $19 \mid 181716\ldots321$	**20** $20 + \overbrace{1111\cdots1111}^{20}$ is prime.
21 $\binom{6+1}{2}$ is the 6th  number.	**22** $\lfloor \pi^e \rfloor$	**23** 	**24** $(\mathbb{Z}/24\mathbb{Z})^\times \cong (\mathbb{Z}/2\mathbb{Z})^3$	**25** Shapiro's inequality does not hold for $n \geq 25$.	**26** $\sum_{n=1}^{\infty} \frac{n^3}{2^n}$	**27**  How many $\triangle$s?
28 $\binom{7+1}{2}$ is the 7th  number.	**29** $\sum_{k=0}^{4} \binom{2k}{k}$	**30** $2 \times 3 \times 5$	1	2	3	4
5	6	7				

kms **2015.6.**

M T W Th F S S M T W Th F S S M T

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

June 2015

Ramanujan's problem

$$\begin{aligned}4 &= \sqrt{16}\\ &= \sqrt{6+2\times 5}\\ &= \sqrt{6+2\sqrt{25}}\\ &= \sqrt{6+2\sqrt{7+3\times 6}}\\ &= \sqrt{6+2\sqrt{7+3\sqrt{36}}}\\ &= \sqrt{6+2\sqrt{7+3\sqrt{8+4\times 7}}}\\ &= \dots\end{aligned}$$

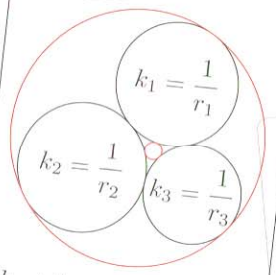
Partition number

$p(11n+6) \equiv 0 \pmod{11}$

$p(n)$	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10
11×0	1	1	2	3	5	7	11	15	22	30	42
11×1	56	77	101	135	176	231	297	385	490	627	792
11×2	1002	1255	1575	1958	2436	3010	3718	4565	5604	6842	8349
11×3	10143	12310	14883	17977	21637	26015	31185	37338	44583	53174	63261
11×4	75175	89134	105558	124754	147273	173525	204226	239943	281589	329931	386155

$5\sqrt{2}+4\sqrt{3}$
$= 13.9992\cdots$

Soddy circles



$$(k_1+k_2+k_3+k_4)^2 = 2(k_1^2+k_2^2+k_3^2+k_4{}^2)$$

Total number of triangles

$$= \binom{4}{2}^2 - \binom{3}{2}^2 = 27$$

Shapiro inequality

$x_1, x_2, \dots, x_n > 0$
and $\begin{cases} n \text{ is even and } \le 12, \text{ or} \\ n \text{ is odd and } \le 23. \end{cases}$
Then,

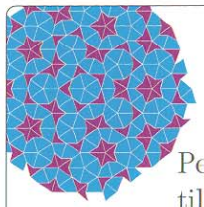
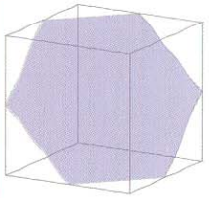
$$\sum_{i=1}^{n} \frac{x_i}{x_{i+1}+x_{i+2}} \ge \frac{n}{2}$$

where $x_{n+1} = x_1, x_{n+2} = x_2$.
$\exists$ counterexaples for
$n = 14, 16, 18, 20, 22, 24, 25, 26, 27, \dots$

17 18 19 20 21 22 23 24 25 26 27 28 29 30

W Th F S S M T W Th F S S M T

kms

SUN	MON	TUE	WED	THU	FRI	SAT
28	29	30	**1** $0.999999\cdots$	**2** $\sqrt{2+\sqrt{2+\sqrt{2+\cdots}}}$	**3** 2333 is the smallest prime having only three 3s.	**4** $4+4\times(4-4)$
5  Penrose tiling	**6** 	**7** $1/7 = 0.142857\ldots$ $5/7 = 0.7142857\ldots$ $4/7 = 0.57142857\ldots$ $6/7 = 0.857142857\ldots$ $2/7 = 0.2857142857\ldots$ $3/7 = 0.42857142857\ldots$	**8** $\text{ɐıƃɥʇ} = \text{eight}$	**9** $2^3+1^3=9$ is an exception to Zsigmondy's theorem.	**10** 1010_2	**11** $\sqrt{121} = \sqrt[3]{1331}$
12 12th Fibonacci number is 12^2.	**13** $\approx 6e-\frac{9}{e}$	**14** $r_1=\frac{1}{1^2+14}$ $r_2=\frac{1}{3^2+14}$ $r_3=\frac{1}{5^2+14}$ $\vdots$ $\frac{1}{2}$ $\frac{1}{2}$	**15** $1+2+3+4+5$	**16** 1 lb = 16 oz	**17** sum of 1-digit primes $2+3+5+7$	**18** $18\,|\,10\cdots08$
19 $e \approx 19/7$	**20** $\approx 37\cos 1$	**21** circumference $\approx$ 10 2	**22** $22/7 \approx \pi$	**23** $1!$ $+2!+2!$ $+3!+3!+3!$	**24** $24+4\times2$ $=2^4+4^2$	**25** pandigital expression $\frac{68}{13}\times\frac{975}{204}$
26 square cube	**27** $2+3+4+5+6+7$	**28** $\exists$ 28 exotic 7-spheres	**29** $29\,|\,\overbrace{2\ldots29}^{29},\overbrace{29\ldots9}^{29}$	**30** $\sum_{r=0}^{3} r\binom{3}{r}^2$	**31** $\sqrt{14^2} = \sqrt{961}$	1
2	3	4				

kms **2015.7.**

July 2015

W	Th	F	S	S	M	T	W	Th	F	S	S	M	T	W	Th
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

F	S	S	M	T	W	Th	F	S	S	M	T	W	Th	F
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

Zsigmondy Theorem

Form 1:

If $a > b \geq 1$, $(a,b) = 1$,
then $a^n - b^n$ has a primitive prime factor
with exceptions:

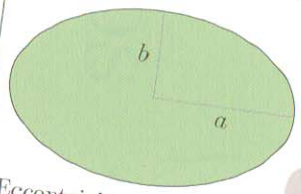
(1) $2^6 - 1^6$

(2) $n = 2$ & $a + b = 4, 8, 16, \ldots$

Form 2:

If $a > b \geq 1$, then $a^n + b^n$ has
a primitive prime factor
with the exception $2^3 + 1^3 = 9$.

$$p \nmid a^1 - b^1$$
$$\ldots$$
$$p \nmid a^{n-1} - b^{n-1}$$
$$p \mid a^n - b^n$$



Eccentricity:

$$e = \frac{\sqrt{a^2 - b^2}}{a}$$

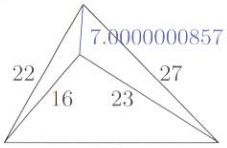
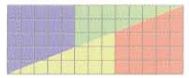
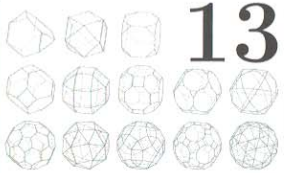
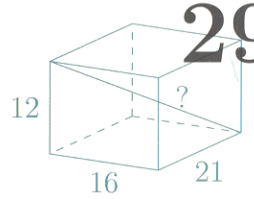
Circumference:

$$C = 4aE(e)$$
$$= 4a \int_0^{\frac{\pi}{2}} \sqrt{1 - e^2 \sin^2\theta}\, d\theta$$

$a = 5, b = 1 \Rightarrow C \approx 21.01004$

$x^3 - y^2 = 2$ has
a unique positive
integer solution
$3^3 - 5^2 = 2$.

kms

SUN	MON	TUE	WED	THU	FRI	SAT
						1 $\tan\frac{\pi}{4}$
2 The unique even prime number.	**3** ΕΥΡΗΚΑ! num = △+△+△	**4** 44449 is the smallest prime having only four 4s.	**5** There are only 5 Platonic polyhedra.	**6** $\approx \log(\pi^4+\pi^5)$	**7**  Ed Pegg Jr.'s △	**8**  $8^2 = 5\times 13$ = 
9 123456789 $\times\,(2,4,5,7,8)$ are pandigital.	**10** 	**11** $\sqrt{37+41+43}$	**12** 1 ft = 12 in	**13**  Archimedean solids	**14** pandigital expression $\frac{57}{12}\times\frac{896}{304}$	**15** Ramanujan's error: $x^2+2y^2+5z^2+5w^2$ represents all positive integers except 15.
16 $2^4 = 4^2$	**17** $F_2 = 2^{2^2}+1$	**18** $\approx \sqrt[46]{1!+2!+\cdots+46!}$	**19** XIX	**20** $(1\times 2+3)\times 4$	**21** 111_4	**22** $\approx \frac{19^2}{\pi^4-3^4}$
23 23! is 23 digits long.	**24** 24! is 24 digits long.	**25** $25^n = \cdots 25$	**26** 2×13	**27** 33_8	**28** $2+3+5+7+11$	**29** 
30 $\approx 11e$	**31** pandigital expression $\frac{93}{24}\times\frac{856}{107}$					

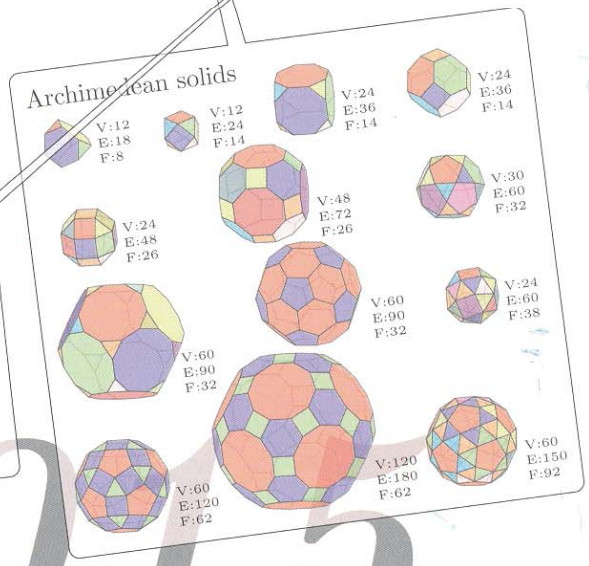
kms **2015.8.**

S S M T W Th F S S M T W Th F S S

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

August 2015

Ramanujan classified
$\langle a, b, c, d\rangle := ax^2 + by^2 + cz^2 + dw^2$
which represents all positive integers.
But, he missed $\langle 1, 2, 5, 5\rangle$ cannot represent 15.
It represents all positive integers except only 15.



$$\frac{19^2}{\pi^4 - 3^4} = 21.9999998325\ldots$$

This was from
Ramanujan's approximation:

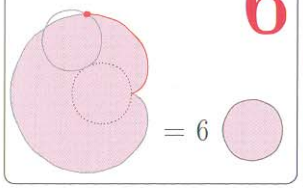
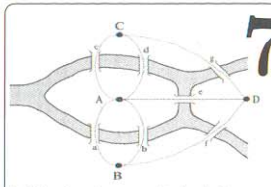
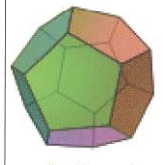
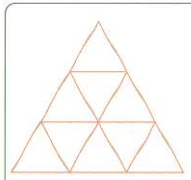
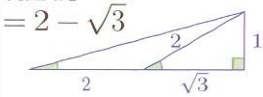
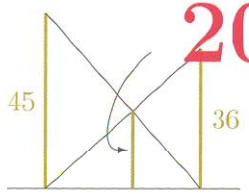
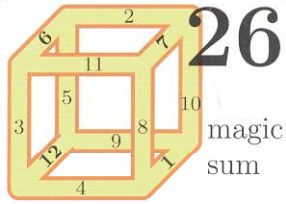
$$\pi \approx \sqrt[4]{3^4 + 2^4 + \frac{1}{2 + \left(\frac{2}{3}\right)^2}}$$

$$\sqrt[46]{1! + 2! + 3! + \cdots + 46!} = 18.00683\ldots$$

17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

M T W Th F S S M T W Th F S S M

kms

SUN	MON	TUE	WED	THU	FRI	SAT
30	31	**1** $\cos^2\theta + \sin^2\theta$	**2** The smallest prime number.	**3** Friedman's counterexample to FLT $70^3 = 3\,4\,3\,0\,0\,0$ $+212^3 = 9\,5\,2\,8\,1\,2\,8$ $462^3 = 9\,8\,611\,2\,8$	**4** A glider of period 4 in Conway's game of life	**5** Five lemma: $A \to B \to C \to D \to E$ $\downarrow\ \downarrow\ \downarrow\ \downarrow\ \downarrow$ $A' \to B' \to C' \to D' \to E'$
6  $= 6$	**7**  Königsberg 7 bridges	**8** The smallest composite Fibonacci number	**9** xıs	**10** $\#\left\{\begin{matrix}0,1,2,3,4,\\5,6,7,8,9\end{matrix}\right\}$	**11** $\sin 11 \approx -1$	**12**  dodecahedron
13  How many △s?	**14** $\approx 1 + \pi + \pi^2$	**15** $\tan 15^\circ = 2 - \sqrt{3}$  	**16** $\pi \approx \left(\frac{16}{9}\right)^2$ Egyptian approximation	**17** $\approx \sqrt{92\pi}$	**18** $\approx 4\pi + 2e$	**19** $2\left(1-\frac{1}{3^2}\right)\left(1-\frac{1}{7^2}\right)\left(1-\frac{1}{11^2}\right)\left(1-\frac{1}{19^2}\right)$ $= \left(1+\frac{1}{7}\right)^2\left(1+\frac{1}{11}\right)^2\left(1+\frac{1}{19}\right)^2$
20  	**21** 10101_2	**22** 2nd Smith number $22 = 2 \times 11$ $2 + 2 = 2 + (1 + 1)$	**23** $\approx 10 \log 10$	**24** $2 \times 3 \times 4$	**25** $\sum_{r=0}^{2} r\binom{5}{r}$	**26**  magic sum
27 $3\sqrt{81} = 3\,)\overline{81}$	**28** the second perfect number	**29** $3^{29} - 2^{29}$ is prime.	**30** $1\,\text{ft} \approx 30\,\text{cm}$	1	2	3
4	5	6				

kms **2015.9.**

September 2015

T	W	Th	F	S	S	M	T	W	Th	F	S	S	M	T	W
1		3		5		7		9		11		13		15	
	2		4		6		8		10		12		14		16

Th	F	S	S	M	T	W	Th	F	S	S	M	T	W
17		19		21		23		25		27		29	
	18		20		22		24		26		28		30

Five lemma

$$\begin{array}{ccccccccc} A & \to & B & \to & C & \to & D & \to & E \\ \downarrow & & \downarrow & & \downarrow & & \downarrow & & \downarrow \\ A' & \to & B' & \to & C' & \to & D' & \to & E' \end{array}$$

exact exact

epi. iso. iso. mono.

$\Rightarrow C \to C'$: isomorphism

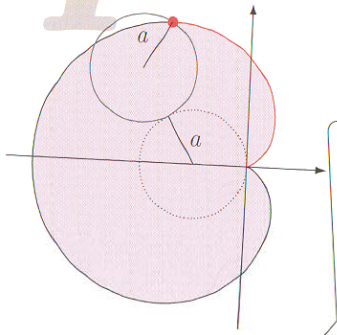
$$\sin 11 = \sin\left(\frac{22}{7} \times \frac{7}{2}\right) \approx \sin\left(\pi \times \frac{7}{2}\right) = \sin\left(2\pi + \frac{3}{2}\pi\right) = \sin\frac{3}{2}\pi = -1$$

$1 + \pi + \pi^2 = 14.0111\cdots$

$4\pi + 2e = 18.00293\cdots$

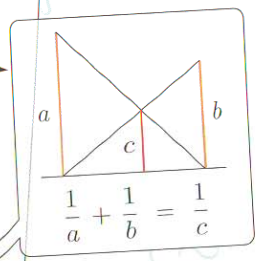
$\sqrt{92\pi} = 17.00078\cdots$

Cardioid

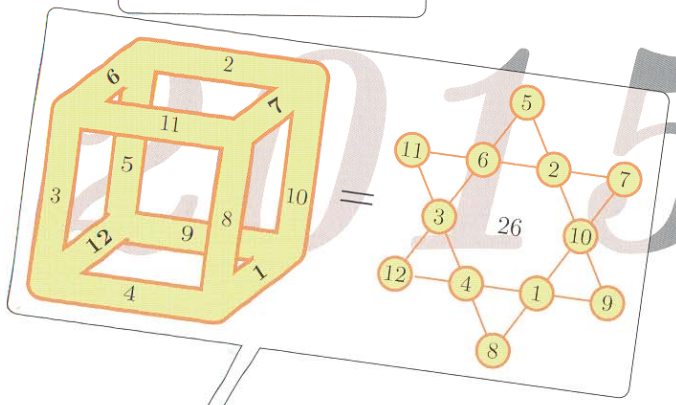


$r = 2a(1 - \cos\theta)$

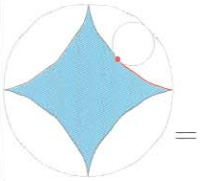
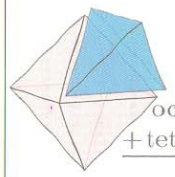
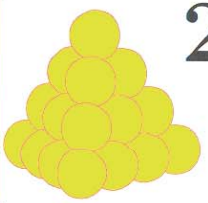
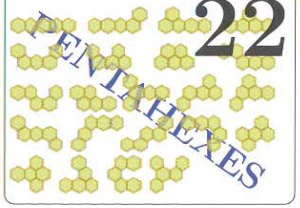
$A = \int_0^{2\pi} \frac{1}{2} r^2 d\theta = 6\pi a^2$



$\frac{1}{a} + \frac{1}{b} = \frac{1}{c}$



kms

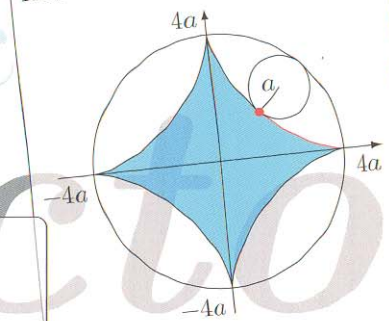
SUN	MON	TUE	WED	THU	FRI	SAT
27	28	29	30	**1** 0!	**2** 223 is the smallest prime having only two 2s.	**3** $M_2 = 2^2 - 1$
4 $\det A_3$ $= \det \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$	**5** $\sec^2(\arctan 2)$	**6**  $= 6$ 	**7**  octahedron + tetrahedron 7 faces	**8** $\approx \frac{987654321}{123456789}$	**9** 10999999999 is the smallest prime having only nine 9s.	**10** $\sharp$ projective plane of order 10
11 $\frac{1}{1} + \frac{1}{11} + \frac{1}{111} + \cdots$ $\approx 11/10$	**12**  12 pentominoes	**13** $13 \mid \overbrace{1 \ldots 13}^{13}, \overbrace{13 \ldots 3}^{13}$	**14** 14+ (3,5,17,257,65537) are all prime.	**15** $15 \mid (1+5)!$	**16**  strobogrammatic prime	**17**  17-gon is constructible.
18 $\approx \frac{133}{e^2}$	**19** $4! - 3! + 2! - 1!$	**20** 	**21** pandigital expression $\frac{56}{23} \times \frac{897}{104}$	**22** 	**23** $23 \mid \overbrace{2 \ldots 23}^{23}, \overbrace{23 \ldots 3}^{23}$	**24** Four 4s: $4 + 4 + 4 \times 4$
25 $\sqrt{7^2 + 24^2}$	**26** $\frac{\Gamma(\frac{1}{26})\Gamma(\frac{3}{26})\Gamma(\frac{9}{26}) \times \Gamma(\frac{17}{26})\Gamma(\frac{23}{26})\Gamma(\frac{25}{26})}{\Gamma(\frac{5}{26})\Gamma(\frac{7}{26})\Gamma(\frac{11}{26}) \times \Gamma(\frac{15}{26})\Gamma(\frac{19}{26})\Gamma(\frac{21}{26})}$ $= \frac{11+3\sqrt{13}}{2}$	**27** $x, y, z \le 1$ $x + y + z = 1$ $\frac{1}{1+x^2} + \frac{1}{1+y^2} + \frac{1}{1+z^2}$ $\le 27/10$	**28** $\approx 8\pi + \frac{9}{\pi}$	**29** # of topologies on 3 elements	**30** $3! + 4!$	**31** $2^5 - 1$ 
1	2	3				

kms **2015.10.**

October 2015

Th	F	S	S	M	T	W	Th	F	S	S	M	T	W	Th	F
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
S	S	M	T	W	Th	F	S	S	M	T	W	Th	F	S	

Astroid



$$x^{\frac{2}{3}} + y^{\frac{2}{3}} = (4a)^{\frac{2}{3}}$$

$$x = 4a\cos^3\theta, y = 4a\sin^3\theta$$

$$A = 4\int_0^{\frac{\pi}{2}} x dy = 6\pi a^2$$

$$\frac{133}{e^2} = 17.99959267\cdots$$

$$e^2 = [7; 2, 1, 1, 3, 18, 5, 1, 1, 6, 30, 8, \cdots]$$

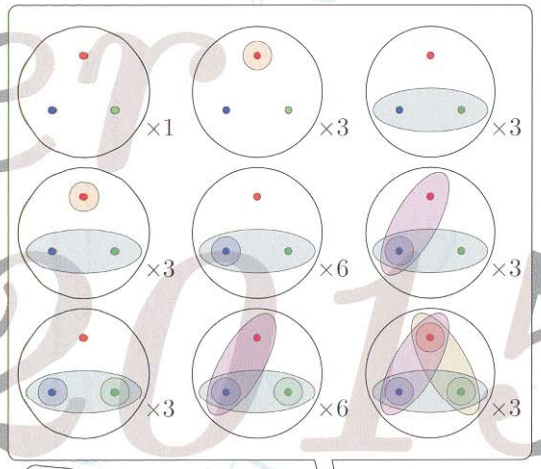
$$= 7 + \cfrac{1}{2 + \cfrac{1}{1 + \cfrac{1}{1 + \cfrac{1}{3 + \cfrac{1}{18 + \cfrac{1}{5 + \cdots}}}}}}$$

$$[7;2] = \frac{15}{2}$$

$$[7;2,1] = \frac{22}{3}$$

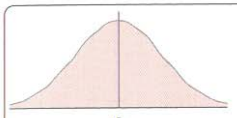
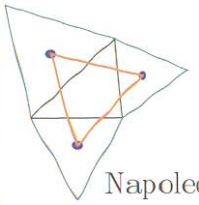
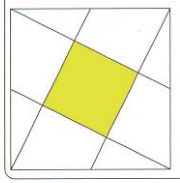
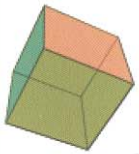
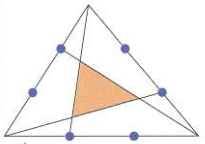
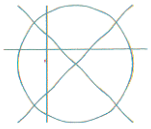
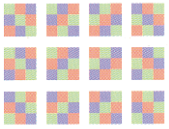
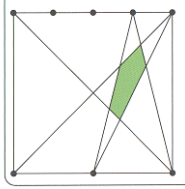
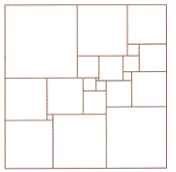
$$[7;2,1,1] = \frac{37}{5}$$

$$[7;2,1,1,3] = \frac{133}{18}$$



$$8\pi + \frac{9}{\pi} = 27.9975302\ldots$$

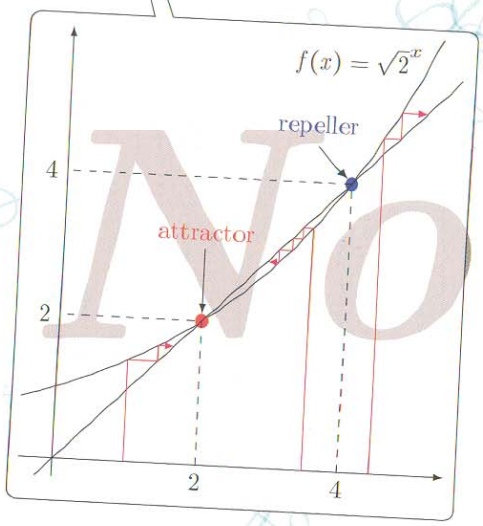
kms

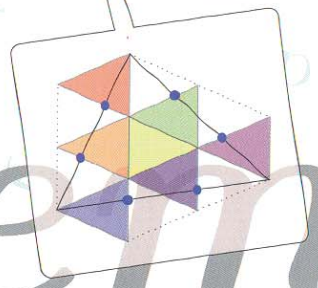
SUN	MON	TUE	WED	THU	FRI	SAT
1  $\int_{-\infty}^{\infty} \frac{1}{\sqrt{2\pi}} e^{-\frac{x^2}{2}}\, dx$	**2** $\sqrt{2}^{\sqrt{2}^{\sqrt{2}^{\sqrt{2}}}} \cdots$	**3**  Napoleon △	**4** $a+bi+cj+dk \in \mathbb{H}$ Quaternion	**5**  $\frac{1}{5}$	**6**  hexahedron	**7**  $\frac{1}{7}$ area
8 $\lim_{x \to 8} \frac{1}{\frac{\lvert 8-x \rvert}{8-x}} = \infty$	**9** 9^9 is 9 digits long.	**10** $10! = 1!3!5!7!$	**11**  11 regions	**12**  # of Latin squares of order 3	**13** $\sqrt{7+8+9+\cdots+18+19}$	**14** # of known pentagonal tilings
15 $2^{15}+15$ is prime.	**16** $\approx 19 \sin 1$	**17** 17000000000000071 is a 17-digit palindromic prime.	**18** EIGHTEEN =EIGH⅃EEИ	**19** $\overbrace{11111\ldots11111}^{19}$ is the second repunit prime.	**20**  $\frac{1}{20}$	**21**  smallest # of squares
22 Each of $\varphi(n)=22$, $\varphi(n)=\varphi(22)$, $\varphi(\varphi(n))=22$, $\varphi(\varphi(n))=\varphi(22)$ has only 2 solutions.	**23** $-1+2\times3\times4$	**24** $3^3-2^2+1^1$	**25** $1+2\times3\times4$	**26** # of sporadic simple groups	**27** $1!+2!+4!$	**28** $\frac{28!+1}{28+1}$ is a $28+1$ digits prime.
29 29 and 29_{29} are both prime.	**30** $-\frac{1}{B_4}=-\frac{1}{B_8}$	1	2	3	4	5
6	7	8				

kms **2015.11.**

S M T W Th F S S M T W Th F S S M

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16





November 2015

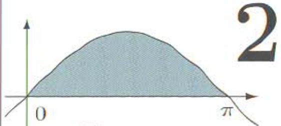
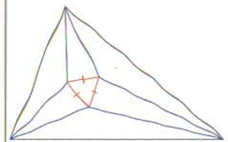
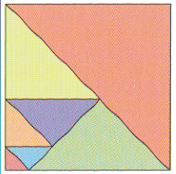
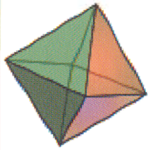
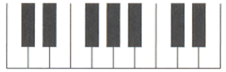
Bernoulli number

$$\frac{x}{e^x - 1} = \sum_{n=0}^{\infty} \frac{B_n x^n}{n!} = 1 - \frac{1}{2}\frac{x}{1!} + \frac{1}{6}\frac{x^2}{2!} - \frac{1}{30}\frac{x^4}{4!} + \frac{1}{42}\frac{x^6}{6!} - \frac{1}{30}\frac{x^8}{8!} + \frac{5}{66}\frac{x^{10}}{10!} - \frac{691}{2730}\frac{x^{12}}{12!} + \frac{7}{6}\frac{x^{14}}{14!} + \cdots$$

17 18 19 20 21 22 23 24 25 26 27 28 29 30

T W Th F S S M T W Th F S S M

kms

SUN	MON	TUE	WED	THU	FRI	SAT
29	30	**1** $\lim_{x\to 0}\frac{\sin x}{x}$	**2**  $\int_0^\pi \sin x\, dx$	**3**  Morley's △	**4** $1-2+3-4+\cdots = \frac{1}{4}$	**5** S_5 is not solvable.
6 Four 4s: $4+(4+4)\div 4$	**7**  different isosceles right △s	**8**  octahedron	**9** $\approx 2\pi + e$	**10** $\approx \frac{\pi^{3^2}}{e^{2^3}}$	**11** THREE THREE TWO TWO + ONE ELEVEN doubly true alphametic	**12** $2^{\frac{1}{12}}$ 
13 $1+2+3+\cdots+12+13 = 1^2+2^2+3^2+\cdots+6^2$	**14** $\nexists n : \varphi(n) = 14$	**15** # of set partitions of $\{1,2,3,4\}$	**16** pandigital expression $150768 \div 9423$	**17** No odd Fibonacci number is divisible by 17.	**18** $18^2 - 10 \approx 100\pi$	**19** $19\overbrace{22222\ldots22222}^{19}19$ is prime.
20 Four 4s: $4\times(4+4\div 4)$	**21** $\sqrt{12^2} = \sqrt{144}$ (printed mirrored)	**22** $\approx \sqrt[3]{17^3+18^3}$	**23** $\pi^{23} \approx 43^7$	**24** $70^2 = 1^2+2^2+3^2+\cdots+24^2$	**25** Ramsey # $R(4,5)$	**26** 222_3
27 Lander & Parkin $27^5+84^5+110^5+133^5 = 144^5$	**28** pandigital expression $129780 \div 4635$	**29** $2^2+3^2+4^2$	**30** 3^3+3	**31** 2^2+3^3	1	2
3	4	5				

kms

2015.12.

T W Th F S S M T W Th F S S M T W

1 3 5 7 9 11 13 15

2 4 6 8 10 12 14 16

$$\frac{\pi^9}{e^8} = 9.9998\ldots$$

December 2015

$$\pi^{23} = 271923706893.61\cdots$$
$$43^7 = 271818611107$$
$$\frac{\pi^{23}}{43^7} = 1.0003\cdots$$

Cannonball problem

The Diophantine equation

$$\sum_{n=1}^{N} n^2 = M^2$$

has a unique solution

$N = 24$ and $M = 70$

when $N > 1$.

17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

Th F S S M T W Th F S S M T W Th

kms

January 2016

S	M	T	W	Th	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24/31	25	26	27	28	29	30

February 2016

S	M	T	W	Th	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29					

March 2016

S	M	T	W	Th	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

April 2016

S	M	T	W	Th	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

May 2016

S	M	T	W	Th	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

June 2016

S	M	T	W	Th	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

July 2016

S	M	T	W	Th	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24/31	25	26	27	28	29	30

August 2016

S	M	T	W	Th	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

September 2016

S	M	T	W	Th	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

October 2016

S	M	T	W	Th	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23/30	24/31	25	26	27	28	29

November 2016

S	M	T	W	Th	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

December 2016

S	M	T	W	Th	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31