In the debating club 35
A collection of palindromes, mirrors, and antimirrors

** Palindromic semiprimes

1991 = 11*181
17777771 = 11*1616161
155555555551 = 11* 14141414141

Similar

11111111 = 11*1010101
12344321 = 11*1122211
23455432 = 11*2132312
34566543 = 11*3142413
45677654 = 11*4152514
56788765 = 11*5162615
67899876 = 11*6172716

** Palindromic sum of natural numbers

$1+2+3+4+\ldots+n+\ldots+4+3+2+1 = n^2$

** A corresponding antimirror

$\pm 1^2 m...+(n-2)^2-(n-1)^2+n^2-(n-1)^2+(n-2)^2-...\pm 1 = n$

$-1^2+2^2-3^2+4^2-5^2+6^2-5^2+4^2-3^2+2^2-1^2 = 6$

$+1^2-2^2+3^2-4^2+5^2-6^2+7^2-6^2+5^2-4^2+3^2-2^2+1^2 = 7$

** A corresponding decimal number
0.12345678987654321 =
[0;8,9,1,???…]
See
http://mathworld.wolfram.com/ChampernowneConstant.html

** Another one
$12345654321 = 11*1122332211$
$= 121*102030201$
$= 11^2 * 10101^2$
$= 111111^2$
$999999999^2 = 9^2 * 111111111^2 =$
$(1+2+3+4+5+6+7+8+9+8+7+6+5+4+3+2+1)$
$*(12345678987654321)$

** Pascal's triangle

** π approximation

$$1+\cfrac{1}{1+\cfrac{1}{1+\cfrac{1}{3+\cfrac{1}{23}}}} = \underline{1.570}\ 552147... \approx \frac{\pi}{2}$$

$$1+\cfrac{1}{1+\cfrac{1}{1+\cfrac{1}{3+\cfrac{1}{32}}}} = \underline{1.5707964}601... \approx \frac{\pi}{2}$$

** An almost integer

$$\left[(2-1)^2+\frac{(5^2-1)^2}{6^2+1}\right]e-$$

$$\left[(2+1)^2+\frac{(5^2+1)^2}{6^2-1}\right]^{-1}$$

$$= 44.9999999993962...$$

** 1, 2, 3, and 6

6 = 1 + 2 + 3 = 1 * 2 * 3

6^2 = 1^3 + 2^3 + 3^3 = 1^2 * 2^2 * 3^2

(2^6)/2 = 1^1 + 2^2 + 3^3

(6^3)/2 = 1^1 * 2^2 * 3^3

** 12 ⇔21 and 13⇔31

$12^2 = 144 \Leftrightarrow 441 = 21^2$

$1221 = 11 * 111$

$144441 = 11 * 13131$

$13^2 = 169 \Leftrightarrow 961 = 31^2$

$1331 = 11 * 121 = 11^3$

$169961 = 11 * 15451$

** 163 scf curiosities

$$\frac{13}{163} = \cfrac{1}{12 + \cfrac{1}{1 + \cfrac{1}{1 + \cfrac{1}{6}}}}$$

$$\frac{13+12}{163} = \cfrac{1}{6 + \cfrac{1}{1 + \cfrac{1}{1 + \cfrac{1}{12}}}}$$

** We know the following formula pairs:

Compact expression	long-tailed sum expression	with the symmetric coefficient triangle
1 $(x+y)^n =$	$\sum_{i=0}^{n}\binom{n}{i}x^i y^{n-i}$	1 1 1 1 2 1 1 3 3 1 1 4 6 4 1 ⋮
2 $\frac{x^{n+1}-y^{n+1}}{x-y} =$	$\sum_{i=0}^{n} x^i y^{n-i}$	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 ⋮
3 $(x+y)\frac{x^n-y^n}{x-y} =$	$x^n + 2\sum_{i=1}^{n-1} x^i y^{n-i} + y^n$	1 1 1 2 1 1 2 2 1 1 2 2 1 1 ⋮
4 $\frac{x^{m+1}-y^{m+1}}{x-y}\cdot$ $\frac{x^{n+1}-y^{n+1}}{x-y} =$	$\sum_{i=0}^{m+n}(\min(i,m,n)+1)x^i y^{m+n-i}$	m=2 n=0 1 1 1 1 1 2 2 1 2 1 2 3 2 1 3 1 2 3 3 2 1 4 1 2 3 3 3 2 1 ⋮

5		
$\frac{x^{n+1}-(-y)^{n+1}}{x+y}=$	$\sum_{i=0}^{n}(-1)^i x^i y^{n-i}$	1 1 -1 1 -1 1 1 -1 1 -1 1 -1 1 -1 1 ⋮

* Find more, using the proof method "Mathematical induction" as heuristic tool.
* Discuss applications.

** Trigonometric functions

k	-3	-1	0	1	3
$\sin\left(\frac{3+k}{12}\pi\right)=\frac{1}{2}\sqrt{2+m}$	-2	-1	0	1	2
$\tan\left(\frac{3+k}{12}\pi\right)=3^{\frac{n}{2}}$	$-\infty$	-1	0	1	∞

** To be continued

References

[1] http://en.wikipedia.org/wiki/Palindrome
[2] http://en.wikipedia.org/wiki/Palindromic_number
[3] http://en.wikipedia.org/wiki/Palindromic_prime
[4] http://mathworld.wolfram.com/PalindromicNumber.html
[5] http://mathworld.wolfram.com/PalindromicPrime.html
[6] http://users.skynet.be/worldofnumbers/
[7] http://www.mathematische-basteleien.de/palindrom.htm

Do you know applications of “palindrome etc.” in natural sciences and engineering?

See

[1] http://en.wikipedia.org/wiki/Palindromic_sequence
[2] J. Sander. Virengiganten aus dem Permafrost. Spektrum der Wissenschaft Nov. 2014, S. 18-20
[3] http://en.wikipedia.org/wiki/Symmetry