Fun with Digit Sums

Slide Show 17

	16	8	4	2	1	sum
17	1	0	0	0	1	

	16	8	4	2	1	sum
17	1	0	0	0	1	2

$$17 - 2 = 15$$

$$17 - 2 = 15$$

$$\frac{15}{2 - 1} = 15$$

	9	3	1	sum
17	1	2	2	

	9	3	1	sum
17	1	2	2	5

$$17 - 5 = 12$$

$$17 - 5 = 12$$

$$\frac{12}{3 - 1} = 6$$

	5	1	sum
17	3	2	

	5	1	sum
17	3	2	5

$$17 - 5 = 12$$

$$17 - 5 = 12$$

$$\frac{12}{5 - 1} = 3$$

	7	1	sum
17	2	3	

	7	1	sum
17	2	3	5

$$17 - 5 = 12$$

$$17 - 5 = 12$$

$$\frac{12}{7 - 1} = 2$$

	11	1	sum
17	1	6	

	11	1	sum
17	1	6	7

$$17 - 7 = 10$$

$$17 - 7 = 10$$

$$\frac{10}{11 - 1} = 1$$

	13	1	sum
17	1	4	

	13	1	sum
17	1	4	5

$$17 - 5 = 12$$

$$17 - 5 = 12$$

$$\frac{12}{13 - 1} = 1$$

	17	1	sum
17	1	0	

	17	1	sum
17	1	0	1

$$17 - 1 = 16$$

$$17 - 1 = 16$$

$$\frac{16}{17 - 1} = 1$$

2,15 3,6 5,3 7,2 11,1 13,1 17,1

2^{15} 3^{6} 5^{3} 7^{2} 11^{1} 13^{1} 17^{1}

$$2^{15}\ 3^{6}\ 5^{3}\ 7^{2}\ 11^{1}\ 13^{1}\ 17^{1} = \dots$$

$$2^{15}\ 3^{6}\ 5^{3}\ 7^{2}\ 11^{1}\ 13^{1}\ 17^{1} = \ldots$$

355 687 428 096 000

$$2^{15} \; 3^{6} \; 5^{3} \; 7^{2} \; 11^{1} \; 13^{1} \; 17^{1} = \ldots$$

$$355\,687\,428\,096\,000 = 17!$$

Any positive integer

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its digit sum in base p (prime)

all divided by

$p-1$

is

the power of p in the prime factorisation of the factorial of

the number you first thought of.

For the keen

What might a proof look like?

Is there a “digit sums” formula for powers in prime factorisations of integers that *aren’t* factorials?

(Hint: yes.)