

Math 2303
Fall 2009
Activity 17

Why does the divisibility by 9 test work?

Let's "prove" it with an example:

(not really a complete proof, but the real proof is the general "letter version" of this example)

Show 9 divides 153 divides by 9 since $1+5+3=9$ divides by 9.

Proof:

$$153 = 1 * 100 + 5 * 10 + 3$$

Place values for base 10

$$= 1 * (99 + 1) + 5 * (9 + 1) + 3$$

Addition facts

$$= 1*99 + 1*1 + 5*9 + 5*1 + 3$$

?

$$= 1*99 + 5*9 + 1*1 + 5*1 + 3$$

?

$$= 1*11*9 + 5*9 + 1*1 + 5*1 + 3$$

Addition fact

$$= (1*11)*9 + 5*9 + 1*1 + 5*1 + 3$$

?

$$= 11*9 + 5*9 + 1 + 5 + 3$$

?

$$= (11+5)*9 + 1 + 5 + 3$$

?

$$1+5 + 3 = 9 \text{ which divides by nine}$$

$$= 16*9 + 9$$

Addition facts

$$= (16 + 1)*9$$

?

153 divides by nine!!