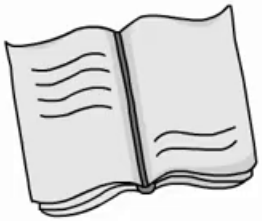
Modular arithmetic

Arabic animated intuition

Modular arithmetic

what's modular arithmetic ?



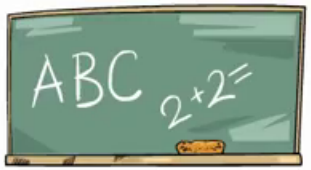
14%3=?

14%3=2

find the smallest non negative number m such that x-m is multiple of y

14-2=12

math behind modular arithmetic



14%3=2

x%y=m

4*3+2=14

q*y+m=x

q=4

y=3

x=14

Modular arithmetic

focus on the given cases x%y examples

x>y 23%6=? 5

x=y 2%2=? 0

x<y 4%5=? 4

0%2=? 0

y=0 1%0=? math error

12%6=? 0

let's notice something
in the coming example

find num%5 for every
num in the given list

0 1 2 3 4 5 6 7 8 9

0 1 2 3 4 0 1 2 3 4

do you see the pattern ?
if i take num%x what is
the range for my ans ?

Modular arithmetic properties

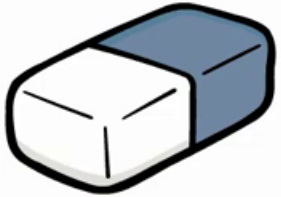
- cyclic

in the previous example num%5

0 1 2 3 4 5 6 7 8 9

0 1 2 3 4 0 1 2 3 4

you can easily see that if we want num%x our mod range from 0 to x-1



- (a+b)%c=((a%c)+(b%c))%c
- (a*b)%c=((a%c)*(b%c))%c

a%c in range 0 to c-1

b%c in range 0 to c-1

in the worst case (2c-2)

how to handel negative numbers ?

-8%3

add 3 to -8 untill we have positive num

-8%3=(-8+(3*3))%3

Modular arithmetic

- $(a-b)\%c=((a\%c)-(b\%c)+c)\%c$

why we add C

cause in the worst case

$a\%c=0$

$b\%c=c-1$

$(a\%c)-(b\%c)=-(c-1)$

so adding a c will make it positive

- $(a/b)\%c=((a\%c)*(b^{-1}\ \%c))\%c$

$3^{-1} = 1/(3^{1})$

$3^{-2} = 1/(3^{2})$