MA 190 ALGEBRA & CALCULUS

CONTEXTS

ALGEBRA TOPICS : - Elementary Number Theory (internet communications)

- Matrix Theory (geometry + communications)

- Eigenvalues & Eigenvectors (breeding rabbits / google searches)

ELEMENTARY NUMBER THEORY

$[9 \div 12 = 9 \mod 12]$ (= : same as)

Monday, 73 days time? Thursday.

examples →

↳ $1 + 73 \equiv 4 \mod 7$

$10 \cdot 5 \equiv 2 \mod 12$

$7 \cdot 8 \equiv 2 \mod 9$

$2 \cdot 5 \equiv 5 \mod 8$

$\frac{1}{4}$: a number that when multiplied by 4 is equal to one. → $(\frac{1}{4}) \cdot 4 = 1$

Alternative notation: 4^{-1}

↳ "multiplicative inverse" of 4

What is $3^{-1} \mod 10$?

[x^{-1} : has property that when multiplied by x is equal to one]

$x = 3^{-1}$

$3x \equiv 1 \mod 10$

number $\cdot 3 \equiv 1 \mod 10$

$7 \cdot 3 = 21 \equiv 1 \mod 10$

$x = 7$

$[3^{-1} \equiv 7 \mod 10]$

MA 190

Applications

Any book is identified by an ISBN → international standard book number

String of 10 digits

(Famous 5 on a treasure island) e.g. 0340029232

0340029232 = identification + safety check digit

↳ chosen so that $(1 \cdot \text{first digit}) + (2 \cdot \text{2nd digit}) + [\ldots] + (9 \cdot 9^{\text{th}} \text{ digit}) + (10 \cdot \text{2nd})$

$\equiv 0 \mod 11$