

MA180, MA185, MA190 Welcome

MA161, MA133, MA160 NOT Welcome

Algebra & Calculus

Graham Zehi

Algebra

Topics

- Elementary Number Theory
- Matrix Theory
- Eigen values & Eigenvectors

Context

Internet Communications

Geometry & Internet Communications

Breeding rabbits

Elementary number theory

$$5 + 15 = 20 \quad \text{in school}$$

$$9 + 12 = 9 \quad \text{on a clock}$$

$$9 + 12 \equiv 9 \pmod{12}$$

Today is Monday, in 73 days time it will be Thursday.

$$1 + 73 \equiv 4 \pmod{7}$$

More Examples

$$10 \times 5 \equiv 2 \pmod{12}$$

$$7 + 5 \equiv 3 \pmod{9}$$

$$7 + 8 \equiv 2 \pmod{9}$$

$$2 - 5 = 5 \pmod{8}$$

What is $\frac{1}{4}$?

$\frac{1}{4}$ is that number which when multiplied by 4 gives 1.

That is, it's a number with the property

$$\left(\frac{1}{4}\right) \times 4 = 1.$$

Alternative notation

$$4^{-1} = \frac{1}{4}$$

We call $\frac{1}{4}$ the multiplicative inverse of 4.

Back to clocks

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

$$\neq \boxed{3^{-1} \equiv 7 \pmod{10}}$$

Because $7 \times 3 \equiv 1 \pmod{10}$,

Applications

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Five on a treasure island.

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Synopsis [About this title](#)

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"synopsis" ...

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Synopsis

A political maniac with a scheme to shadow and kill prominent public figures in a takeover plot can only be stopped by using a beautiful woman as bait, and Matt Helm goes along as the woman's "husband" to act as her protection

$$(1 \times 0) + (2 \times 3) + (3 \times 4) + (4 \times 0) \\ + (5 \times 0) + (6 \times 2) + (7 \times 4) \\ + (8 \times 2) + (9 \times 3) + (10 \times 2)$$

$$\equiv 0 + 6 + 1 + 0 + 0 + 1 + 6 \\ + 5 + 5 + 9$$

$$\equiv 0$$

mod 11