Modular Arithmetic

3^{2020}

$3^0 = 1$
$3^1 = 3$
$3^2 = 9$
$3^3 = 7$
$3^4 = 1$
$3^5 = 3$
$3^6 = 9$

3^a

remainder of a divided by 4

$3^{a \bmod 4}$

$a \equiv b \pmod 4$

congruent

Def: 2 integers a, b are congruent modulo m if a mod m = b mod m

$$a \equiv b \pmod m$$

$3713 \bmod 4 = 1$ $\qquad$ $5 \bmod 4 = 1$

$$\begin{array}{r} 928 \text{ R}1 \\ 4\overline{)3713} \\ -36 \\ \hline 11 \\ -8 \\ \hline 33 \\ -32 \\ \hline 1 \end{array}$$

$3713 \equiv 5 \pmod 4$

$$\begin{array}{rl} 3713 = & 928 \cdot 4 + 1 \\ -\quad 5 = & 1 \cdot 4 + 1 \\ \hline 3708 = & 927 \cdot 4 \end{array}$$

divides

$a \equiv b \pmod m \Rightarrow m \mid a-b$

Q: Is $23 \equiv 3 \pmod{10}$?

$23 \bmod 10 = 3$

$3 \bmod 10 = 3$