

Modular Arithmetic

Monday, February 1, 2021 9:22 AM

1] Defⁿ -

$$a \equiv b \pmod{n} \text{ iff } a \bmod n = b \bmod n$$

2] Thrm: if $a \equiv b \pmod{n}$ then $n \mid (a-b)$

3] Thrm: if $a \equiv b \pmod{n}$

and $c \equiv d \pmod{n}$

then

$$\textcircled{1} \quad a+c \equiv b+d \pmod{n}$$

$$\textcircled{2} \quad a-c \equiv b-d \pmod{n}$$

$$\textcircled{3} \quad a \cdot c \equiv b \cdot d \pmod{n}$$

4] e.g. $(28052 * 3499) \bmod 7$

$$\equiv (28000 + 49 + 3) (3500 - 1)$$

$$\equiv (0 + 0 + 3) (0 - 1)$$

$$\equiv 3 \cdot (-1) \equiv -3 \equiv 4$$

e.g. 897356

$$\equiv 9 \pmod{11}$$

$$2788 \equiv 1 \pmod{3}$$

$$7287 \equiv 0 \pmod{3}$$

$$5462 \equiv 2 \pmod{3}$$

4] Divisibility by 3: add the digits

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$$\begin{aligned}n = 5462 &= 5 \times 10^3 + 4 \times 10^2 + 6 \times 10 + 2 \\ &\equiv 5(1)^3 + 4(1)^2 + 6(1) + 2 \pmod{3} \\ &\equiv 17 \\ &\equiv 2 \pmod{3}\end{aligned}$$