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Multiplicative inverse of -7 modulo 20:

→ We need to find x such that $-7x \equiv 1 \mod 20$

→ if $ax \equiv 1 \pmod{m}$, then x is the multiplicative inverse of a modulo m.

→ $-7 \equiv 13 \pmod{20}$

We are looking for an integer x such that $13x = 20k + 1$ for some integer k.

We can test values of x:

if $x = 1$, $13(1) = 13 \not\equiv 1 \mod 20$

if $x = 2$, $13(2) = 26 \not\equiv 1 \mod 20$

if $x = 3$, $13(3) = 39 \not\equiv 1 \mod 20$

if $x = 4$, $13(4) = 52 \not\equiv 1 \mod 20$

if $x = 5$, $13(5) = 65 \not\equiv 1 \mod 20$

if $x = 6$, $13(6) = 78 \not\equiv 1 \mod 20$

if $x = 7$, $13(8) = 104 \not\equiv 4 \mod 20$

if $x = 8$, $13(9) = 117 \equiv 17 \mod 20$

if $x = 10$, $13(10) = 130 \equiv 10 \mod 20$

if $x = 11$, $13(11) = 143 \equiv 3 \mod 20$

if $x = 12$, $13(12) = 156 \equiv 16 \mod 20$

if $x = 13$, $13(13) = 169 \equiv 9 \mod 20$

if $x=14$, $13(14) = 182 \equiv 2 \mod 20$

if $x=15$, $13(15) = 195 \equiv 15 \mod 20$

if $x=16$, $13(16) = 208 \equiv 8 \mod 20$

if $x=17$, $13(17) = 221 \equiv 1 \mod 20$

Thus $x=17$ is multiplicative inverse of 13 modulo 20.

$\therefore$ The multiplicative inverse of -7 mode of 20 is 17.

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* $-17 \mod 23$:

$$23)\,-17\,(-1$$
$$\underline{(-)\,23}$$
$$6$$

$\Rightarrow -17 = (-1 \times 23) + 6$

$-17 \mod 23 = 6$ (Ans)

* Multiplication Inverse of $-13 \bmod 23$:

⇒ The multiplicative inverse of a number a made m is a x such that : $ax \equiv 1 \bmod m$.

In oure case, we are looking for a number x such that:

$$-13x \equiv 1 \bmod 23$$

To simplify, we first convert -13 into a pasitive equivalent modulo 23.

$-13 \bmod 23 = -13 + 23 = 10$

so, the equatvalent equation become s:

$$10x \equiv 1 \bmod 23$$

Now, we find the integer x such that $10x \equiv 1 \bmod 23$

if $x = 1$, $10 \times 1 = 10 \not\equiv 1 \bmod 23$

if $x = 2$, $10 \times 2 = 20 \not\equiv 1 \bmod 23$

if $x = 3$, $10 \times 3 = 30 \equiv 7 \bmod 23$

if $x=4$ $10 \times 4 = 40 \equiv 17 \mod 23$

if $x=5$ $10 \times 5 = 50 \equiv 4 \mod 23$

if $x=6$ $10 \times 6 = 60 \equiv 14 \mod 23$

if $x=7$ $10 \times 7 = 70 \equiv 1 \mod 23$

We found it : $10 \cdot 7 = 70 \equiv 1 \mod 23$

Since $-13 \equiv 10 \mod 23$ and $10^{-1} \mod 23 = 7$

We conclude-

The multiplicative inverse of $-13 \mod 23$ is 7 (Ans).