multiplicative Inverse: $-13 \bmod 23$

We are looking for x such that:

$$(-13) \cdot x \equiv 1 \pmod{23}$$

Since, $-13 \equiv 10 \pmod{23}$

this is equivalent to find:

$$10x \equiv 1 \pmod{23}$$

Using extended euclidean algorithm:-

$23 = 2 \times 10 + 3$

$10 = 3 \times 3 + 1$

$3 = 3 \times 1 + 0$

Back substitute:

$$1 = 10 - 3 \times 3$$
$$= 10 - 3 \times (23 - 2 \times 10)$$
$$= 7 \times 10 - 3 \times 23$$

$\therefore$ modular inverse of $10 \bmod 23$ ($-13 \bmod 23$) is

(Ans.)

-17 mod 23

To compute -17 mod 23, we want the least non-negative residue, a number 'r' such that

$$-17 \equiv r \pmod{23} \; ; \; 0 \leq r < 23$$

we can do this by adding 23 until we get a positive result:

$-17 \bmod 23 = 6$

So, $-17 \bmod 23 = 6$ (Ans.)