How to find Modulo and Multiplicative Inverse?

1. $-17 \bmod 23$?

2. Multiplicative Inverse of -13 upon modulo 23 ?

Solution:

1. $-17 \bmod 23$?

Step: 1 Understand the operation

Modulo gives the reminder after division.
If we write:

$$-17 \equiv x \bmod 23$$

we want to find a number x such that:

$$-17 \equiv x \bmod 23 \quad \text{and} \quad 0 \leq x < 23$$

Step: 2 Add 23 until you get a positive result

$$-17 + 23 = 6$$

$$\therefore -17 \bmod 23 = 6 \quad \underline{\text{(Ans:)}}$$

2. Multiplicative Inverse of -13 upon modulo 23?

Ans:

$$-13 \bmod 23 = 10$$

find x such that $10x \equiv 1 \bmod 3$

Extended Euclidean Algorithm:

$$23 = 2 \cdot 10 + 3$$
$$10 = 3 \cdot 3 + 1$$
$$3 = 3 \cdot 1 + 0$$

Back substitution:

$$1 = 10 - 3 \cdot 3$$
$$3 = 23 - 2 \cdot 10$$
$$1 = 10 - 3(23 - 2 \cdot 10)$$
$$= 10 - 3 \cdot 23 + 6 \cdot 10$$
$$= 7 \cdot 10 - 3 \cdot 23$$

$$\therefore \ 10^{-1} \bmod 23 = 7$$

Therefore, multiplicative inverse of -13 upon modulo 23 is 7 (Ans:)