

Sample question from ACEPhysics activity:

X gate (Also called “Not gate” or U_{Not} gate)

The X gate performs the function of a NOT gate, changing $|0\rangle$ to $|1\rangle$ and vice versa.

The mathematical expression that matches this sentence is $X |0\rangle = |1\rangle$.

Mathematically, the X gate is written in matrix notation as

$$X = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$$

Take a moment to verify (using matrix multiplication) that

$$X |0\rangle = |1\rangle \quad \text{and} \quad X |1\rangle = |0\rangle.$$

I verified these equalities ↓

A. What is $X(a |0\rangle + b |1\rangle)$?

Type your response here

Can you answer this without using matrices?

Link to full demo:

<https://acephysics.net/demo/introduction-to-quantum-gates>