

Determine if each statement is true or false. If it is true, prove it. If it is false, give a disproof.

1. There is an integer  $n$  such that  $n^2 \equiv -1 \pmod{13}$ .
2. For all  $a, b, c \in \mathbb{Z}$ , if  $a|bc$ , then  $a|b$  or  $a|c$ .
3. There are integers  $a$  and  $b$  such that  $12a + 15b = 2$ .
4. There are integers  $a$  and  $b$  such that  $11a + 15b = 1$ .
5. If  $X \subseteq A \cup B$ , then  $X \subseteq A$  or  $X \subseteq B$ .

**Challenge.** There is an integer  $n$  such that  $n^2 \equiv -1 \pmod{3}$ .