One of the *proof methods* we learned in §3.2 was *proof using logically equivalent statements*. Often we have used this method to give a proof of a conditional statement $P \Rightarrow Q$ by proving the logically equivalent contrapositve $\sim Q \Rightarrow \sim P$. This ER uses different logical equivalence from the (linked) handout §2.2 Logically Equivalent Statements.

▶. **Theorem 5**. For all integers a, b, and d with $d \neq 0$, if d divides a or d divides b, then d divides the product ab.

1. Symbolically write Theorem 5. Hint: below is a start.

$$\left(\forall\,(a,b,d) \in \mathbb{Z} \times \mathbb{Z} \times \mathbb{Z}^{\neq 0}\right)\ [\ (d \mid a\ \vee\ d \mid b)\ \Longrightarrow\ \underline{\qquad ? \qquad}\ ] \tag{1}$$

2. Symbolically write an equivalent statement to the statement in (1) by using one of the *Important Locial Equivalencies* from the (linked) handout §2.2 Logically Equivalent Statements.

Hint: don't forget quantifiers, so answer should take the below form.

$$\left(\forall\,(a,b,d) \in \mathbb{Z} \times \mathbb{Z} \times \mathbb{Z}^{\neq 0}\right)\ [\ \underline{\qquad\qquad\qquad ? \qquad\qquad\qquad}\ ] \tag{2}$$

3. Prove Theorem 5.

Hint: to prove Thm. 5, we can prove either (1) or the equivalent (2). Which way looks easier to prove?

. . . .