Nested Logic Practice

1. Translate the following into a sentence with logic symbols and quantifiers.
   "Everyone has exactly one best friend."

2. Let the domain be all integers between -2 and 2.
   Negate the statement: "$\forall x \, \exists y \, (x + y = 0)$

3. Determine the truth value of number 2 above.

Logic Arguments

Let p and q be propositions for the entirety of this worksheet (front & back).

1. Consider the following arguments using textbook notation: ¬, ∧, and ∨. For each:

   (a) determine if the arguments are valid, and

   (b) set p and q to English or math propositions, that better exhibit the validity.

$$\begin{array}{c} p \\ p \rightarrow q \\ \hline \therefore q \end{array} \qquad\qquad \begin{array}{c} p \rightarrow q \\ q \\ \hline \therefore p \end{array} \qquad\qquad \begin{array}{c} \neg q \\ p \rightarrow q \\ \hline \therefore \neg p \end{array}$$

$$\begin{array}{c} p \vee q \\ \neg p \\ \hline \therefore q \end{array} \qquad\qquad \begin{array}{c} p \vee q \\ q \\ \hline \therefore p \end{array} \qquad\qquad \begin{array}{c} p \rightarrow q \\ \neg p \\ \hline \therefore \neg q \end{array}$$

2. Is the following joke funny or not? Rene Descartes is drinking at the local pub. After quite a few glasses of wine (he is French after all) the bartender asked him if he would like another. Descartes said "I think not". Descartes disappeared.