Name: _____

- All answers should be fully justified.
- Complete this quiz without any aids, including the text or your peers.

(1) Prove that $p \to (q \wedge r) \equiv (p \to q) \wedge (p \to r)$ using the table of common logical equivalences.

(2) Prove that $(p \wedge q) \to r \not\equiv (p \to r) \wedge (q \to r)$.

(3) Determine whether each of the following statements are true or false in each of the given domains. Give brief justifications.

Domain	$\exists x\ \forall y\ x \leq y$	$\forall y\ \exists x\ x \leq y$
$\mathbb{N}$		
$\mathbb{Z}$		

(4) Complete the proof below that the following argument is valid.

$$\forall x\ (P(x) \rightarrow Q(x))\quad (a)$$
$$\exists x\ \neg Q(x) \qquad\qquad (b)$$
$$\overline{\therefore\quad \exists x\ \neg P(x)}$$

1. $\exists x\ \neg Q(x)$	Hypothesis (b)
2. (c is a particular element)$\wedge \neg Q(c)$	
3. $\neg Q(c)$	
4. $\forall x\ (P(x) \rightarrow Q(x))$	
5. c is a particular element	
6. $P(c) \rightarrow Q(c)$	
7.	Modus Tollens using statement numbers ...
8. $\exists x\ \neg P(x)$	