Quiz 3
CMPSC 360

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Question 1:

$\forall x (P(x) \land Q(x)) \rightarrow R(x)$

Question 2:

$\neg \forall x \exists y (P(x,y) \rightarrow Q(x,y)) \equiv \exists x \forall y (\neg P(x,y) \lor Q(x,y))$
$\exists x \neg \exists y (P(x,y) \rightarrow Q(x,y))$
$\exists x \forall y \neg (P(x,y) \rightarrow Q(x,y))$
$\exists x \forall y \neg (\neg P(x,y) \lor Q(x,y))$
$\exists x \forall y (\neg \neg P(x,y) \land \neg Q(x,y))$
$\exists x \forall y (P(x,y) \land \neg Q(x,y))$
The statement is false

Question 3:

Domain: $\mathbb{R}$, $P(x,y)$ is $x^2 = 2y$
$\exists x \forall y P(x,y)$ is false because there is no case where all of y works

Question 4:

$p \rightarrow q$
$\underline{p \land q}$
$\therefore \neg q$
This is not valid. $((p \rightarrow q) \land (p \land q)) \rightarrow \neg q$
When p is true and q

Question 5:

1. $p = $ I eat spicy food today, $q = $ My stomach will give me trouble

   $p \rightarrow q$
   $\underline{\neg q}$
   $\therefore \neg p$
   This statement uses the modus tollens inference rule.

2. $p = $ Penn State will hold a graduation ceremony this Fall
   $q = $ all ceremonies will be canceled due to Covid-19

   $\underline{p}$
   $\therefore p \lor q$

This statement uses the additive inference rule.

3. $p = $ I am a front end developer, $q = $ I am good at CSS

$$\frac{p \wedge q}{\therefore p}$$

This statement uses the simplification rule.