Tutorial 1

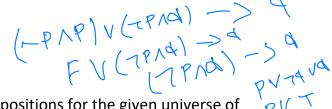
Spring 2022

Answer the following questions:

1. Show that the following conditional statements $(\neg p \land (p \lor q)) \rightarrow q$ is a tautology by using:

a) Truth tables.

b) Applying a chain of logical equivalences.



2. Determine the truth value of the following propositions for the given universe of discourse.

	Universe of discourse	Truth value
∃x (x+1>2x)	\mathbb{Z}	+
∀x (x+1>2x)	\mathbb{Z}	F
$\exists x (x^2 = 2)$	\mathbb{R}	T
$\exists x \exists y (x + y = x - y)$	\mathbb{Z}	, +
$\forall x \exists y (x + y = x - y)$	\mathbb{Z}	+
$\forall y \exists x (x + y = x - y)$	\mathbb{Z}	#
$\forall x \exists y (x - 2y = 0)$	\mathbb{R}	<u></u>
$\forall x (x<10) \rightarrow \forall y (y< x) \rightarrow y<9$	\mathbb{Z}	T
$\forall x (x<10) \rightarrow \forall y (y< x) \rightarrow y<9$	\mathbb{R}	F

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3. For the following statements, write "True" or "False":

a. $\forall x (P(x) \land Q(x)) \equiv \forall x P(x) \land \forall x Q(x) \rightarrow$

b. $\forall x (P(x) \lor Q(x)) \equiv \forall x P(x) \lor \forall x Q(x)$

c. $\exists x (P(x) \land Q(x)) \equiv \exists x P(x) \land \exists x Q(x) \models$

d. $\exists x (P(x) \lor Q(x)) \equiv \exists x P(x) \lor \exists x Q(x) \uparrow$

4. Let L(x,y)="x likes y". Express the following statements using predicates and quantifiers:

a. Everyone likes Khaled. $\forall x \mid (x \mid k \mid haled) \rightarrow 0$

b. There is someone who Fahad doesn't like. $\exists y$, $\exists \lambda \in A$

d. There is someone whom everyone likes. $\exists y \forall x \mid (x, y) \rightarrow b$

e. There is someone whom no one likes.

3 x 4x 7 (x, r) -> e