Exercise 1: construct the truth table of proposition $(p \vee \sim q) \rightarrow (\sim q \leftrightarrow r)$

Exercise 2: complete the following truth table

p	q	$\sim q$	$p \wedge q$	$p \rightarrow (p \wedge q)$	$\sim[p \rightarrow (p \wedge q)]$	$\sim q \vee \sim[p \rightarrow (p \wedge q)]$

Exercise 3: show that $p \vee (q \wedge r)$ and $(p \vee q) \wedge (p \vee r)$ are logically equivalent.

p	q	r	$q \wedge r$	$p \vee (q \wedge r)$	$p \vee q$	$p \vee r$	$(p \vee q) \wedge (p \vee r)$

Exercise 4: Decide whether the proposition is tautology or contradiction or contingency $p \wedge \sim [q \rightarrow (p \vee r)]$

p	q	r	$p \vee r$	$q \rightarrow (p \vee r)$	$\sim [q \rightarrow (p \vee r)]$	$p \wedge \sim [q \rightarrow (p \vee r)]$

Exercise 5: Without using truth tables, show that $p \to \left[(p \wedge q) \vee \sim q \right]$ is a tautology.

Exercise 6: Without using truth tables, show that

$$(p \to q) \vee (p \to r) \equiv p \to (q \vee r)$$

Exercise 7: Using logic low, show that $(p \wedge \sim r) \to q \equiv (p \wedge \sim q) \to r$

Exercise 8: Without using truth tables, show that the proposition $\sim (x \to \sim y)$ and $x \wedge [x \to (y \vee \sim x)]$

Exercise 9: State the convers, the invers, and the contrapositive for proposition:

" If a and b are odd number then $(a+b)$ is even number"

The converse is:

The inverse is:

The contrapositive is:

Exercise 10: Determine the truth value of each of these statements and justify your answer.

i. $\forall x \in \mathbb{R},\ x^2 - 4x + 4 \geq 0$

ii. $\exists x \in \{1,2,3,4\},\ 2^x < x!$

iii. $\forall x \in \mathbb{R},\ x^2 - 5x + 6 \geq 0$

iv. $\exists x \in \mathbb{R},\ x^4 < x^2$