

Logic Homework Exercises #1 - Solutions

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Name _____

Instructions. In exercises 1 - 4, let p be the statement: “The sun will shine,” and let q be the statement: “Spot will wag his tail.” Write each statement in symbolic form.

1. $\underbrace{\text{The sun will shine}}_p \text{ or } \underbrace{\text{spot will wag his tail}}_q$

Answer: $p \vee q$

2. $\underbrace{\text{The sun will shine}}_p \text{ and } \underbrace{\text{spot will not wag his tail}}_{\neg q}$

Answer: $p \wedge (\neg q)$

3. $\underbrace{\text{Spot will wag his tail}}_q \text{ but } \underbrace{\text{the sun will not shine}}_{\neg p}$

Answer: $q \wedge (\neg p)$

4. $\underbrace{\text{The sun will not shine}}_{\neg p} \text{ or } \underbrace{\text{Spot will not wag his tail}}_{\neg q}$

Answer: $(\neg p) \vee (\neg q)$

In exercises 5 - 8, let p be the statement: “Dick and Jane caught some fish,” and let q be the statement: “They will tell a whopper of a fish story.” Write each statement in words.

5. $\underbrace{\text{Dick and Jane caught some fish}}_p \text{ or } \underbrace{\text{They will tell a whopper of a fish story}}_q$

6. $\underbrace{\text{Dick and Jane caught some fish}}_p \text{ and } \underbrace{\text{they will tell a whopper of a fish story}}_q$

7. $\underbrace{\text{Dick and Jane caught some fish}}_p \text{ and } \underbrace{\text{they will not tell a whopper of a fish story}}_{\neg q}$

8. $\neg p \vee \neg q$ $\underbrace{\text{Dick and Jane did not catch any fish}}_{\neg p} \text{ or } \underbrace{\text{they will not tell a whopper of a fish story}}_{\neg q}$

In exercises 9 - 13, construct a truth table for the given statement.

9. $p \wedge \neg q$

p	q	$\neg q$	$(p \wedge \neg q)$
T	T	F	F
T	F	T	T
F	T	F	F
F	F	T	F

10. $(p \vee q) \wedge (p \wedge \neg q)$

p	q	$\neg q$	$p \vee q$	$p \wedge \neg q$	$(p \vee q) \wedge (p \wedge \neg q)$
T	T	F	T	F	F
T	F	T	T	T	T
F	T	F	T	F	F
F	F	T	F	F	F

11. $(p \wedge \neg q) \vee (\neg p \wedge q)$

p	q	$\neg p$	$\neg q$	$p \wedge \neg q$	$\neg p \wedge q$	$(p \wedge \neg q) \vee (\neg p \wedge q)$
T	T	F	F	F	F	F
T	F	F	T	T	F	T
F	T	T	F	F	T	T
F	F	T	T	F	F	F

12. $(p \wedge \neg q) \vee (\neg r \wedge q)$

p	q	r	$\neg q$	$\neg r$	$p \wedge \neg q$	$\neg r \wedge q$	$(p \wedge \neg q) \vee (\neg r \wedge q)$
T	T	T	F	F	F	F	F
T	T	F	F	T	F	T	T
T	F	T	T	F	T	F	T
T	F	F	T	T	T	F	T
F	T	T	F	F	F	F	F
F	T	F	F	T	F	T	T
F	F	T	T	F	F	F	F
F	F	F	T	T	F	F	F

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

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

14. (Ross & Wright, Discrete Math 2nd Ed.) Determine whether the following propositions are True or False:

(a) If $2 + 2 = 4$, then $2 + 4 = 8$.

Answer: **False**. (This is of the form: $T \rightarrow F$)

(b) If $2 + 2 = 5$, then $2 + 4 = 8$.

Answer: **True**. (This is of the form: $F \rightarrow F$)

(c) If $2 + 2 = 4$, then $2 + 4 = 6$.

Answer: **True**. (This is of the form: $T \rightarrow T$)

(d) If $2 + 2 = 5$, then $2 + 4 = 6$.

Answer: **True**. (This is of the form: $F \rightarrow T$)

(e) If the earth is flat, then Julius Caesar was the first president of the United States.

Answer: **True**. (This is of the form: $F \rightarrow F$)

(f) If the earth is flat, then George Washington was the first president of the United States.

Answer: **True**. (This is of the form: $F \rightarrow T$)

(g) If George Washington was the first president of the United States, then the earth is flat.

Answer: **False**. (This is of the form: $T \rightarrow F$)

(h) If George Washington was the first president of the United States, then $2 + 2 = 4$.

Answer: **True**. (This is of the form: $T \rightarrow T$)