Answer each of the following questions in the space provided. The number of marks allocated to each question appears on the right.

1. Use a truth table to determine whether the following statement form is a tautology, a contradiction, or neither.

$$(p \wedge \sim q) \leftrightarrow (\sim p \vee q)$$

(3 marks)

p	q	$\sim p$	$\sim q$	$p \wedge \sim q$	$\sim p \vee q$	$(p \wedge \sim q) \leftrightarrow (\sim p \vee q)$
T	T	F	F	F	T	F
T	F	F	T	T	F	F
F	T	T	F	F	T	F
F	F	T	T	F	T	F

This statement form is a contradiction.

2. (a) Translate the following statement into an informal English sentence.

$$\exists n, k \in \mathbb{Z} \text{ such that } n = 2k + 1.$$

(2 marks)

There exists an odd integer.

(b) Translate the following English sentence into a statement in symbolic form.

Every real number is positive, negative or zero.

(2 marks)

$$\forall x \in \mathbb{R}, (x > 0) \vee (x < 0) \vee (x = 0).$$

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