

2.6 Comparing Boolean Expressions

Name: _____ Class: _____ Date: _____

Total: 8 marks

KEY WORDS equivalent 等价 • de morgan's laws 德摩根定律 • boolean expression 布尔表达式

Objective

Build the skills to answer exam questions on **comparing Boolean expressions**.

You must be able to:

- determine whether two Boolean expressions are **equivalent** 等价
- apply **De Morgan's Laws** 德摩根定律 to rewrite $!(a \ \&\& \ b)$ and $!(a \ || \ b)$
- simplify a compound Boolean expression

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ Equivalent expressions

Two Boolean expressions are **equivalent** if they always give the **same** result for every input.

■ De Morgan's Laws

$$!(a \ \&\& \ b) = !a \ || \ !b, \quad !(a \ || \ b) = !a \ \&\& \ !b.$$

■ Simplifying

$!(x > 5)$ is simply $x \leq 5$.

2 Practice

2.1 State what it means for two Boolean expressions to be equivalent. [1]

2.2 Rewrite $!(a \ \&\& \ b)$ using De Morgan's Law. [1]

2.3 Rewrite `!(x > 5)` as a simpler comparison.

[1]

3 Exam-style questions

3.1 `!(a || b)` is equivalent to

[1]

A	B
C	D

A `!a || !b`

B `!a && !b`

C `a && b`

D `a || b`

3.2 Two Boolean expressions are equivalent if they

[1]

A	B
C	D

A look the same

B always give the same result

C are both `true`

D both use `&&`

3.3 Simplify or rewrite the following.

(a) Rewrite `!(p && q)`.

[1]

(b) Rewrite `!(x >= 10)` as a comparison.

[1]

(c) State whether `!(true)` equals `false`.

[1]