Exercise walk-through

Comparing Boolean Expressions ▪ 2.6

eXercise

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

Method — Equivalent expressions

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

Method — De Morgan's Laws

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

Method — Simplifying

`!(x > 5)` is simply `x <= 5`.

Practice 2.1 ▪ 1 mark

State what it means for two Boolean expressions to be equivalent.

Solution 2.1

Method: Equivalent expressions

Worked steps

they give the same result for every possible input B1.

Practice 2.2 ▪ 1 mark

Rewrite `!(a && b)` using De Morgan's Law.

Solution 2.2

Worked steps

`!a || !b` B1.

Practice 2.3 ▪ 1 mark

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

Solution 2.3

Worked steps

`x <= 5` B1.

Exam-style 3.1 ▪ 1 mark

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

A `!a || !b`

B `!a && !b`

C `a && b`

D `a || b`

Solution 3.1

A `!a || !b`

B `!a && !b` ✓

C `a && b`

D `a || b`

Worked steps

B.

Exam-style 3.2 ▪ 1 mark

Two Boolean expressions are equivalent if they

A look the same

B always give the same result

C are both `true`

D both use `&&`

Solution 3.2

Method: Equivalent expressions

A look the same

B always give the same result ✓

C are both `true`

D both use `&&`

Worked steps

B.

Exam-style 3.3 ▪ 1 mark

Simplify or rewrite the following.
(a) Rewrite `!(p && q)`.
(b) Rewrite `!(x >= 10)` as a comparison.
(c) State whether `!(true)` equals `false`.

Solution 3.3

Worked steps

(a) `!p || !q` B1. (b) `x < 10` B1. (c) yes B1.