

3.5 Boolean Expressions

Name: _____ Class: _____ Date: _____

Total: 13 marks

KEY WORDS boolean expression • logical operators
• relational operators • list • string

Objective

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

You must be able to:

- explain how a **Boolean expression** evaluates to true or false
- build one with **relational operators** (equal to, greater than, less than)
- combine conditions with the **logical operators** AND, OR, NOT
- predict the result of a compound Boolean expression

1 Key knowledge and worked examples

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

■ Boolean expression

Always evaluates to **true** or **false**.

■ Operators

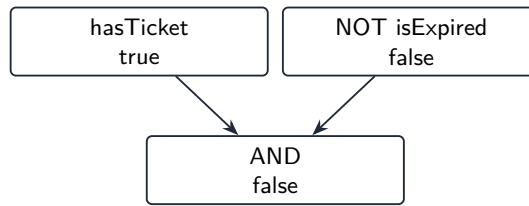
- **Relational:** =, >, < (and $\geq$, $\leq$).
- **Logical:** **AND** (both true), **OR** (either true), **NOT** (the opposite).

■ Compound expressions

Evaluate each part, then combine: $(5 > 3) \text{ AND } (2 > 4) = \text{true AND false} = \text{false}$.

■ Worked application: Separate AND from inclusive OR

A fictional access rule uses `hasTicket` AND NOT `isExpired`. If a visitor has a ticket but it has expired, the first condition is true and NOT `isExpired` is false, so access is false. By contrast, `hasTicket` OR `hasInvitation` is true when both are true as well as when only one is true: OR is inclusive. Work out each simple condition before combining it, and check all possible input combinations with a truth table. Replacing AND with OR could admit a visitor without a valid ticket; the operator represents a policy choice, not a formatting preference.



2 Practice

2.1 State what a Boolean expression evaluates to. [1]

2.2 Evaluate $(7 > 2)$ AND $(4 > 9)$. [2]

2.3 State what the NOT operator does. [1]

3 Exam-style questions

3.1 A Boolean expression evaluates to [1]

- ☐ **A** a number
B a string
C true or false
D a list

3.2 The expression $(3 > 1)$ OR $(5 < 2)$ is [1]

- ☐ **A** true
B false
C undefined
D 3

3.3 Given $a = 5$ and $b = 8$:

(a) evaluate $a < b$. [1]

(b) evaluate $(a < b)$ AND $(b < 10)$. [1]

(c) evaluate NOT $(a < b)$. [1]

3.4 A rule is `(score >= 60) AND NOT absent`. For score 60 and `absent = true`, evaluate both components and the final result. Then state the result if `absent = false` while score stays 60. [4]