10 Boolean Logic

SrWL Learning · Complete Classroom Teaching Version · 2026–2028 target

Build logic circuits and truth tables

55 editable slides / Explanation · Visual · Practice · Teacher Check

By the end of this chapter

- Logic gates.
- Truth tables.
- Boolean expressions.
- Combining circuits.

Learning goals are organised into bite-sized lessons.

Our learning route

10 mini-lessons · each includes one guided check

- 01 Basic logic gates: A
- 02 Basic logic gates: B
- 03 Other logic gates: A
- 04 Other logic gates: B
- 05 Truth tables: A
- 06 Truth tables: B
- 07 Boolean expressions: A
- 08 Boolean expressions: B
- 09 Real-world logic systems: A
- 10 Real-world logic systems: B

01 Basic logic gates · Foundations

One clear idea to explain before moving to practice

AND outputs 1 only when all inputs are 1.

TEACHER EXPLANATION

Discuss why this principle matters in real computer systems.

Basic logic gates — key points

- AND outputs 1 only when all inputs are 1.
- OR outputs 1 when at least one input is 1.

Worked context: AND(1,0)=0; OR(1,0)=1; NOT(1)=0.

Basic logic gates — connect the ideas

Follow the concept from left to right

01

AND outputs 1 only when all inputs are 1.

→

02

OR outputs 1 when at least one input is 1.

Apply the principles to this example: AND(1,0)=0; OR(1,0)=1; NOT(1)=0.

Try it · Basic logic gates

Think (30 s) · Pair discussion (1 min) · Share

Explain the meaning of this idea and give a relevant example:

OR outputs 1 when at least one input is 1.

YOUR TASK

Use accurate technical vocabulary. Add a second point or a specific example where possible.

Teacher check · Basic logic gates

Model response · Correct misconceptions

OR outputs 1 when at least one input is 1.

EXAM TIP / EXTENSION

Use this worked context to add detail: AND(1,0)=0; OR(1,0)=1; NOT(1)=0.

02 Basic logic gates · Applications

One clear idea to explain before moving to practice

NOT inverts a single input.

TEACHER EXPLANATION

Discuss why this principle matters in real computer systems.

Basic logic gates — key points

- NOT inverts a single input.
- Logic gates operate on binary values 0 and 1.

Worked context: AND(1,0)=0; OR(1,0)=1; NOT(1)=0.

Basic logic gates — connect the ideas

Follow the concept from left to right

01

NOT inverts a single input.

→

02

Logic gates operate on binary values 0 and 1.

Apply the principles to this example: AND(1,0)=0; OR(1,0)=1; NOT(1)=0.

Try it · Basic logic gates

Think (30 s) · Pair discussion (1 min) · Share

Describe when this principle applies:

Logic gates operate on binary values 0 and 1.

YOUR TASK

Use accurate technical vocabulary. Add a second point or a specific example where possible.

Teacher check · Basic logic gates

Model response · Correct misconceptions

Logic gates operate on binary values 0 and 1.

EXAM TIP / EXTENSION

Use this worked context to add detail: AND(1,0)=0; OR(1,0)=1; NOT(1)=0.

03 Other logic gates · Foundations

One clear idea to explain before moving to practice

NAND is the inverse of AND.

TEACHER EXPLANATION

Discuss why this principle matters in real computer systems.

Other logic gates — key points

- NAND is the inverse of AND.
- NOR is the inverse of OR.

Worked context: XOR(0,1)=1; XOR(1,1)=0.

Other logic gates — connect the ideas

Follow the concept from left to right

01

NAND is the inverse of AND.

→

02

NOR is the inverse of OR.

Apply the principles to this example: XOR(0,1)=1; XOR(1,1)=0.

Try it · Other logic gates

Think (30 s) · Pair discussion (1 min) · Share

Identify the key technical terms and describe their roles: NOR is the inverse of OR.

YOUR TASK

Use accurate technical vocabulary. Add a second point or a specific example where possible.

Teacher check · Other logic gates

Model response · Correct misconceptions

NOR is the inverse of OR.

EXAM TIP / EXTENSION

Use this worked context to add detail: XOR(0,1)=1; XOR(1,1)=0.

04 Other logic gates · Applications

One clear idea to explain before moving to practice

XOR outputs 1 when its two inputs differ.

TEACHER EXPLANATION

Discuss why this principle matters in real computer systems.

Other logic gates — key points

- XOR outputs 1 when its two inputs differ.
- Recognise gate symbols and their behaviour.

Worked context: XOR(0,1)=1; XOR(1,1)=0.

Other logic gates — connect the ideas

Follow the concept from left to right

01

XOR outputs 1 when its two inputs differ.

→

02

Recognise gate symbols and their behaviour.

Apply the principles to this example: XOR(0,1)=1; XOR(1,1)=0.

Try it · Other logic gates

Think (30 s) · Pair discussion (1 min) · Share

Compare this concept with a related alternative:
Recognise gate symbols and their behaviour.

YOUR TASK

Use accurate technical vocabulary. Add a second point or a specific example where possible.

Teacher check · Other logic gates

Model response · Correct misconceptions

Recognise gate symbols and their behaviour.

EXAM TIP / EXTENSION

Use this worked context to add detail: XOR(0,1)=1; XOR(1,1)=0.

05 Truth tables · Foundations

One clear idea to explain before moving to practice

Two inputs have $2^2 = 4$ combinations.

TEACHER EXPLANATION

Discuss why this principle matters in real computer systems.

Truth tables — key points

- Two inputs have $2^2 = 4$ combinations.
- Three inputs have $2^3 = 8$ combinations.

Worked context: For A AND B, output row order 00,01,10,11 → 0,0,0,1.

Truth tables — connect the ideas

Follow the concept from left to right

01

Two inputs have $2^2 = 4$ combinations.

→

02

Three inputs have $2^3 = 8$ combinations.

Apply the principles to this example: For A AND B, output row order 00,01,10,11 → 0,0,0,1.

Try it · Truth tables

Think (30 s) · Pair discussion (1 min) · Share

Apply this idea to a new computer science scenario:
Three inputs have $2^3 = 8$ combinations.

YOUR TASK

Use accurate technical vocabulary. Add a second point or a specific example where possible.

Teacher check · Truth tables

Model response · Correct misconceptions

Three inputs have $2^3 = 8$ combinations.

EXAM TIP / EXTENSION

Use this worked context to add detail: For A AND B, output row order 00,01,10,11 → 0,0,0,1.

06 Truth tables · Applications

One clear idea to explain before moving to practice

List every input combination systematically.

TEACHER EXPLANATION

Discuss why this principle matters in real computer systems.

Truth tables — key points

- List every input combination systematically.
- Evaluate each stage of a multi-gate circuit.

Worked context: For A AND B, output row order 00,01,10,11 → 0,0,0,1.

Truth tables — connect the ideas

Follow the concept from left to right

01

List every input combination systematically.

→

02

Evaluate each stage of a multi-gate circuit.

Apply the principles to this example: For A AND B, output row order 00,01,10,11 → 0,0,0,1.

Try it · Truth tables

Think (30 s) · Pair discussion (1 min) · Share

Explain the meaning of this idea and give a relevant example:

Evaluate each stage of a multi-gate circuit.

YOUR TASK

Use accurate technical vocabulary. Add a second point or a specific example where possible.

Teacher check · Truth tables

Model response · Correct misconceptions

Evaluate each stage of a multi-gate circuit.

EXAM TIP / EXTENSION

Use this worked context to add detail: For A AND B, output row order 00,01,10,11 → 0,0,0,1.

07 Boolean expressions · Foundations

One clear idea to explain before moving to practice

AND, OR and NOT describe circuit operations.

TEACHER EXPLANATION

Discuss why this principle matters in real computer systems.

Boolean expressions — key points

- AND, OR and NOT describe circuit operations.
- Brackets make order of operations clear.

Worked context: X = (A AND B) OR (NOT C).

Boolean expressions — connect the ideas

Follow the concept from left to right

01

AND, OR and NOT describe circuit operations.

→

02

Brackets make order of operations clear.

Apply the principles to this example: X = (A AND B) OR (NOT C).

Try it · Boolean expressions

Think (30 s) · Pair discussion (1 min) · Share

Describe when this principle applies:

Brackets make order of operations clear.

YOUR TASK

Use accurate technical vocabulary. Add a second point or a specific example where possible.

Teacher check · Boolean expressions

Model response · Correct misconceptions

Brackets make order of operations clear.

EXAM TIP / EXTENSION

Use this worked context to add detail: X = (A AND B) OR (NOT C).

08 Boolean expressions · Applications

One clear idea to explain before moving to practice

Intermediate columns can simplify complex truth tables.

TEACHER EXPLANATION

Discuss why this principle matters in real computer systems.

Boolean expressions — key points

- Intermediate columns can simplify complex truth tables.
- A circuit can be constructed from an expression.

Worked context: X = (A AND B) OR (NOT C).

Boolean expressions — connect the ideas

Follow the concept from left to right

01

Intermediate columns can simplify complex truth tables.

→

02

A circuit can be constructed from an expression.

Apply the principles to this example: X = (A AND B) OR (NOT C).

Try it · Boolean expressions

Think (30 s) · Pair discussion (1 min) · Share

Identify the key technical terms and describe their roles:
A circuit can be constructed from an expression.

YOUR TASK

Use accurate technical vocabulary. Add a second point or a specific example where possible.

Teacher check · Boolean expressions

Model response · Correct misconceptions

A circuit can be constructed from an expression.

EXAM TIP / EXTENSION

Use this worked context to add detail: X = (A AND B) OR (NOT C).

09 Real-world logic systems · Foundations

One clear idea to explain before moving to practice

Multiple conditions can protect an industrial process.

TEACHER EXPLANATION

Discuss why this principle matters in real computer systems.

Real-world logic systems — key points

- Multiple conditions can protect an industrial process.
- Sensor states may be mapped to binary inputs.

Worked context: Example: alarm = door open AND system armed.

Real-world logic systems — connect the ideas

Follow the concept from left to right

01

Multiple conditions can protect an industrial process.

→

02

Sensor states may be mapped to binary inputs.

Apply the principles to this example: Example: alarm = door open AND system armed.

Try it · Real-world logic systems

Think (30 s) · Pair discussion (1 min) · Share

Compare this concept with a related alternative:
Sensor states may be mapped to binary inputs.

YOUR TASK

Use accurate technical vocabulary. Add a second point or a specific example where possible.

Teacher check · Real-world logic systems

Model response · Correct misconceptions

Sensor states may be mapped to binary inputs.

EXAM TIP / EXTENSION

Use this worked context to add detail: Example: alarm = door open AND system armed.

10 Real-world logic systems · Applications

One clear idea to explain before moving to practice

The output can activate an alarm or shut down equipment.

TEACHER EXPLANATION

Discuss why this principle matters in real computer systems.

Real-world logic systems — key points

- The output can activate an alarm or shut down equipment.
- Test all combinations to confirm safe behaviour.

Worked context: Example: alarm = door open AND system armed.

Real-world logic systems — connect the ideas

Follow the concept from left to right

01

The output can activate an alarm or shut down equipment.

→

02

Test all combinations to confirm safe behaviour.

Apply the principles to this example: Example: alarm = door open AND system armed.

Try it · Real-world logic systems

Think (30 s) · Pair discussion (1 min) · Share

Apply this idea to a new computer science scenario:
Test all combinations to confirm safe behaviour.

YOUR TASK

Use accurate technical vocabulary. Add a second point or a specific example where possible.

Teacher check · Real-world logic systems

Model response · Correct misconceptions

Test all combinations to confirm safe behaviour.

EXAM TIP / EXTENSION

Use this worked context to add detail: Example: alarm = door open AND system armed.

Five essential ideas

Recall these without looking at the teaching slides

01 Basic logic gates

02 Other logic gates

03 Truth tables

04 Boolean expressions

05 Real-world logic systems

End-of-chapter challenge

Answer in your notebook, then compare with a partner

What is XOR output when A = 1 and B = 1? Why?

TEACHER MODEL ANSWER

0, because XOR is 1 only when its two inputs differ.