

Name _____

Class _____

Date _____

By the end of this worksheet I can...

- ☐ complete truth tables for AND, OR and NOT and combinations of gates
- ☐ turn a written problem into a logic circuit
- ☐ write a Boolean expression from a circuit or truth table
- ☐ use NAND and NOR equivalents to reduce the number of chips

I DO**Worked example** Read how a full-mark answer is built

A machine guard system: the motor runs (Z) only when the guard is closed (A) AND the start button is pressed (B), OR when the maintenance key (C) is on.

1 Draw the logic diagram. (3 marks)**Points that earn marks** from the marking instructions: one ✓ per point

- ✓ AND gate with inputs A and B
- ✓ OR gate with the AND output and C
- ✓ Output Z from the OR gate

WE DO**Guided practice** Use the starters and word bank to help you

A circuit has inputs A and B into an OR gate whose output goes through a NOT gate to Z.

2 Complete the truth table for Z. (2 marks)**Sentence starters**

One ... is ..., which means ...
Another ... is ..., so ...

Word bank

Tip: 2 marks = 2 separate, developed points.

YOU DO

On your own No notes. Check your answers afterwards.

3 Quick check: tick one box for each.

- a) How many rows does a 4-input truth table have?
☐ 8 ☐ 16 ☐ 12 ☐ 4
- b) How many rows does a 3-input truth table have?
☐ 8 ☐ 6 ☐ 3 ☐ 9
- c) $A=1$, $B=0$ into an AND gate gives...
☐ Both ☐ 1 ☐ 0 ☐ Neither
- d) $Z = (A \cdot B) + C$. When $A = 1$, $B = 0$, $C = 0$, Z is...
☐ 2 ☐ 1 ☐ Undefined ☐ 0

4 Key terms: write the letter of the matching description next to each term.

1. Writing a Boolean expression	_____	A Output 1 only when all inputs are 1.
2. Boolean from a truth table	_____	B Gate by gate from the inputs, with brackets for the order.
3. AND gate	_____	C 8
4. OR gate	_____	D AND term for each row where $Z = 1$; OR the terms together.
5. NOT gate	_____	E Output is the opposite of the input.
6. Rows in a 3-input truth table	_____	F Output 1 when any input is 1.

A smoke effect turns on ($Z = 1$) when the stage door is closed ($A = 1$) and either the switch (B) or the timer (C) is on.

5 Write the Boolean equation for Z. (2 marks)

A circuit: $Z = (A \text{ AND NOT } B) \text{ OR } C$.

6 Write the Boolean expression and draw the NAND equivalent with the fewest gates. (3 marks)

Check and reflect

Mark your answers with the answer sheet. Go back to the checklist on the site and re-rate each "I can" statement above. Which one still needs work?
