MODULE Q BOOLEAN LOGIC · Q6

# Logic expressions: writing them and drawing them

Original practice questions · 21 marks · ~25 minutes · OCR J277 spec 2.4.1

Name _____ Date _____

**Instructions.** Answer all questions in the spaces provided. The marks for each part are shown in brackets [ ]. The total for this worksheet is **21 marks**. Logic expressions use AND, OR and NOT. Draw logic diagrams in pencil with the standard gate symbols. All scenarios are made up.

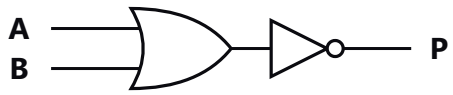
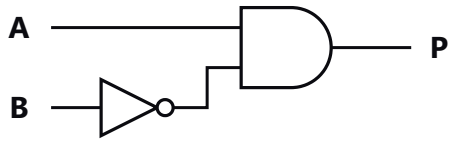
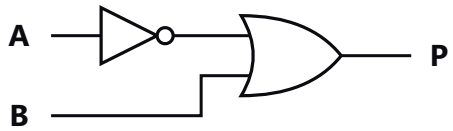
## 1

**Total: 3 marks**

Here are four logic expressions.

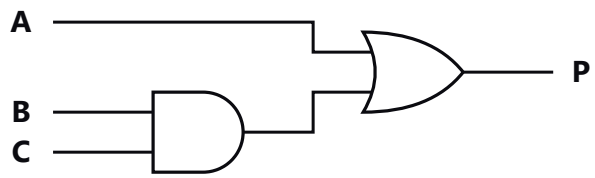
| Number | Logic expression |
|---|---|
| 1 | `P = A AND (NOT B)` |
| 2 | `P = (NOT A) OR B` |
| 3 | `P = NOT (A OR B)` |
| 4 | `P = A OR (NOT B)` |

**(a)** Write the number of the matching logic expression next to each circuit. One expression is not used. **[3]**

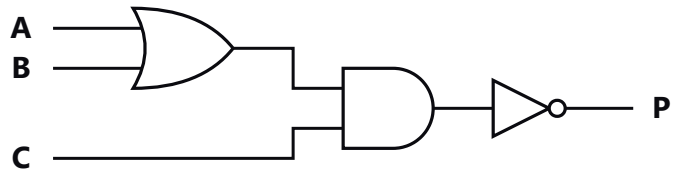
| | Circuit | Expression number |
|---|---|---|
| (i) |  | |
| (ii) |  | |
| (iii) |  | |

**2** **Total: 5 marks**

A control unit in a car park barrier contains the logic circuits below.




**(a)** Write the logic expression for this circuit. Start with `P =` **[2]**




**(b)** Write the logic expression for this circuit. Use brackets to show which part the NOT applies to. **[3]**

**3** **Total: 3 marks**

A lighting panel uses this logic expression:

```
P = (A AND (NOT B)) OR C
```

**(a)** Draw the logic diagram for this expression. Use the correct symbol for each gate. **[3]**



**4** **Total: 6 marks**

Two logic expressions use the same inputs and the same gates, but the NOT is in a different place.

```
P = NOT (A AND B)
Q = (NOT A) AND B
```

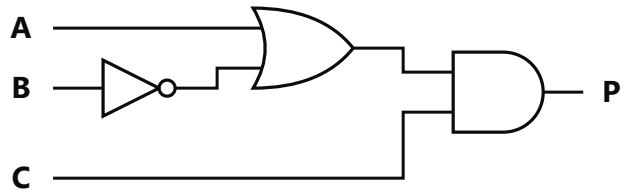
**(a)** Complete the truth table for **both** expressions. **[4]**

| A | B | P | Q |
|---|---|---|---|
| 0 | 0 | | |
| 0 | 1 | | |
| 1 | 0 | | |
| 1 | 1 | | |

**(b)** Explain why P and Q do not always give the same output. Refer to **one** row of your truth table in your answer. **[2]**

**5** **Total: 4 marks**

A technician looks at this circuit from a greenhouse heater controller.




The technician writes this logic expression for the circuit:

```
P = A OR NOT (B AND C)
```

**(a)** Describe **two** mistakes in the technician's expression. **[2]**

**(b)** Write the correct logic expression for the circuit. **[2]**

**Total for this worksheet: 21 marks**