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| Name | Reads as | Logic Gate | OCR Notation | Alternative Notation | Examples | Truth table | Notes |
| Conjunction | AND | and |  | AND  e.g. A AND B | Both operators in a submarine need to turn their launch keys at the same time for a missile to fire. | |  |  |  | | --- | --- | --- | | A | B | Output | | 0 | 0 | **0** | | 0 | 1 | **0** | | 1 | 0 | **0** | | 1 | 1 | **1** | | C:\Users\Molcavian\AppData\Local\Microsoft\Windows\INetCacheContent.Word\nand.wmfAdding a circle to the end of an AND gate turns it into a NAND gate (Not AND). It simply reverses the output from the gate. |
| Disjunction | OR | or |  | OR e.g A OR B  + e.g A+B | The fire alarm will go off if the smoke detector senses the temperature rises to high or if it senses smoke or both. | |  |  |  | | --- | --- | --- | | A | B | Output | | 0 | 0 | **0** | | 0 | 1 | **1** | | 1 | 0 | **1** | | 1 | 1 | **1** | | C:\Users\Molcavian\AppData\Local\Microsoft\Windows\INetCacheContent.Word\nor.wmf Adding a circle to the end of an OR gate turns it into a NOR gate (Not OR). It simply reverses the output from the gate. |
| Exclusive Disjunction | XOR | xor |  | XOR e.g A XOR B  e.g A B | Opposing football teams will get 3 points for a win if one side scores more, but not if they draw. | |  |  |  | | --- | --- | --- | | A | B | Output | | 0 | 0 | **0** | | 0 | 1 | **1** | | 1 | 0 | **1** | | 1 | 1 | **0** | | Adding a circle to the end of an XOR gate turns it into a XNOR gate (Not XOR). It simply reverses the output from the gate. |
| Negation | NOT | not | ¬ | *bar* e.g A  ~ e.g ~A  NOT e.g NOT A | A microwave will stop if the door is not closed.  A house alarm will go off if the door is not closed. | |  |  | | --- | --- | | A | Output | | 1 | **0** | | 0 | **1** | |  |
| Equivalence | If and only if.  Means the same as |  |  |  | The decimal 0.25 is the same as the fraction ¼.  The temperature 25 Celsius is the same as 77 Fahrenheit. |  |  |

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| Rule | What does it mean? | In Boolean Algebra in the OCR exam | Examples in English | Notes |
| De Morgan’s Law | Either logical function **AND** or **OR** may be replaced by the other, given certain changes to the equation. | ¬ (A B) (¬ A) (¬ B)  ***NOT*** *(A* ***OR*** *B) is the same as (****NOT*** *A)* ***AND*** *(NOT B)*  This is the same as:  ¬ (A B) (¬ A) (¬ B)  ***NOT*** *(A* ***AND*** *B) is the same as (****NOT*** *A)* ***OR*** *(****NOT*** *B)* | It cannot be both *winter***AND** *summer* (at any point in time)  Is the same as…  (At any point in time) It is **NOT** *winter* **OR** it is **NOT** *summer* | DeMorgan's Law Venn Diagram 2.svgDeMorgan's Law Venn Diagram 1.svg |
| Distribution | This law allows for the multiplying or factoring out of an expression. | This is the **OR** Distributive law:  A (B C) (A B) (A C)  *A* ***AND*** *(B* ***OR*** *C) is the same as (A* ***AND*** *B)* ***OR*** *(A* ***AND*** *C)*  This is the **AND** Distributive law:  A (B C) (A B) (A C)  *A* ***OR*** *(B* ***AND*** *C) is the same as (A* ***OR*** *B)* ***AND*** *(A* ***OR*** *C)* | You can choose 1 main course and either a start or a desert.  Is the same as…  You can choose 1 main and 1 starter or you can choose 1 main and 1 desert |  |
| Association | This law allows for the removal of brackets from an expression and the regrouping of the variables. | This is the **OR** Association Law:  A (B C) (A B) C A B C  *A* ***OR*** *(B* ***OR*** *C) is the same as (A* ***OR*** *B)* ***OR*** *C is the same as A* ***OR*** *B* ***OR*** *C*  This is the **AND** Association Law:  A (B C) (A B) C A B C  *A* ***AND*** *(B* ***AND*** *C) is the same as (A* ***AND*** *B)* ***AND*** *C is the same as A* ***AND*** *B* ***AND*** *C* | “Craig and his friends James & Tom are coming to the party”  Is the same as..  “James & Tom and their friend Craig are coming to the party”  Is the same as…  “Craig, James and Tom are coming to the party” |  |
| Commutation | The order of application of two separate terms is not important. | A B B A  The order in which two variables are **AND**’ed makes no difference  A B B A  The order in which two variables are **OR**’ed makes no difference | Tom and Jane are going shopping.  Is the same as…  Jane and Tom are going shopping |  |
| Double negation | NOT NOT A  (double negative) = "A" | ¬(¬ A) = A | “It’s not as if I don’t like you” clearly means “I do like you”! |  |
| Absorption | Where the rule applies the second term inside the bracket can always be eliminated and “absorbed” by the term outside the bracket. | X (X Y) X  *X* ***OR*** *(X* ***AND*** *Y) is the same as X*  X (X Y) X  *X* ***AND*** *(X* ***OR*** *Y) is the same as X* | If it will rain, then I will wear my coat.  Therefore, if it will rain then it will rain and I will wear my coat. | To be able to apply the Absorption rule:   1. The operators inside and outside the brackets must be different 2. The term outside the brackets must also be inside the brackets |

**In addition to the 5 laws / rules above which are listed in the OCR specification and the Absorption rule there are also 8 general identities or “rules” which you really should know which will help you gratefully when it comes to simplifying Boolean Expressions.**

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|  | Rule | Explanation |  | Rule | Explanation |
| AND rules | | Remember that with **AND** both terms have to be 1 or **TRUE** for the result to be **TRUE** | **OR** rules | | Remember that with **OR** only 1 term has to be 1 or **TRUE** for the result to be **TRUE** |
| 1 | X 0 = 0 | X **AND** 0 is the same as 0  *Or to put it another way… X* ***AND FALSE*** *has to equal* ***FALSE*** *(See truth table on reverse side for proof)* | **5** | X 0 = X | X **OR** 0 is the same as X  *Or to put it another way… X* ***OR FALSE*** *has to equal* ***TRUE*** *(See truth table on reverse side for proof)* |
| 2 | X 1 = X | X **AND** 1 is the same as X  *Or to put it another way… X* ***AND TRUE*** *has to equal* ***TRUE*** *(See truth table on reverse side for proof)* | **6** | X 1 = X | X **OR** 1 is the same as X  *Or to put it another way… X* ***OR TRUE*** *has to equal* ***TRUE*** *(See truth table on reverse side for proof)* |
| 3 | X X = X | X **AND** X is the same as X  *Or to put it another way… X* ***AND*** *X**has to equal X**(See truth table on reverse side for proof)* | **7** | X X = X | X **OR** X is the same as X  *Or to put it another way… X* ***OR*** *X has to equal X**(See truth table on reverse side for proof)* |
| 4 | X ¬X = 0 | X **AND** **not** X is the same as 0  *Or to put it another way… X* ***AND NOT(****X****)*** *has to equal* ***FALSE*** *(See truth table on reverse side for proof)* | **8** | X ¬X = 1 | X **OR not** X is the same as 1  *Or to put it another way… X* ***OR NOT(****X****)*** *has to equal* ***TRUE*** *(See truth table on reverse side for proof)* |