0 1 . 1 **Figure 1** shows a logic gate symbol.
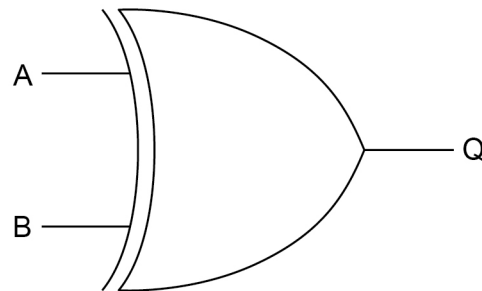
Write the name of the logic gate underneath the figure.

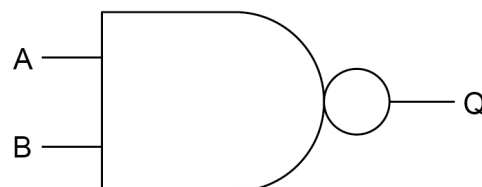**[1 mark]**

Figure 1

Answer:_____

0 1 . 2 **Figure 2** shows a logic gate symbol.

Figure 2

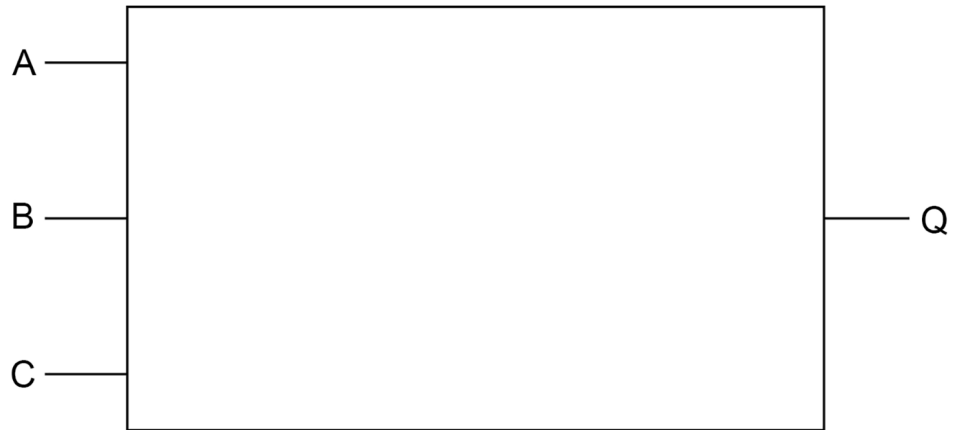Complete the truth table below for the logic gate shown in **Figure 2.**

[1 mark]

A	B	Q
0	0	
0	1	
1	0	
1	1	

0 1 . 3 Represent the Boolean equation $\overline{A} + \overline{B} \cdot C$ as a logic circuit by drawing a diagram of it in the space below.

[3 marks]

A —

B — Q

C —

0 2 . 1   State the name of the logic gate represented by the truth table shown in **Figure 1**.

[1 mark]

Figure 1

A	B	Q
0	0	1
0	1	0
1	0	0
1	1	0

Answer: _____

0 2 . 2   A factory has a machine for filling bottles on a conveyor belt.

- Q represents the signal to move the conveyor belt on. When Q is set to true the belt will move on.
- A is a sensor which outputs true if a bottle is present.
- B is a sensor which outputs true if a bottle is full.
- C is a sensor which outputs true if a bottle is correctly positioned.
- D is a sensor which outputs true if the next section has a bottle in it.

The conveyor belt is able to move if both of these conditions are true:

- a bottle is full and correctly positioned or there is no bottle present
- there is no bottle in the next section.

In the box below, draw a logic circuit for the machine.

[3 marks]

A —

B —

C —

D —

Q

0 2 . 3 De Morgan's laws can be applied to enable a combination of logic gates to be replaced by a single gate that produces the same output.

What single gate could replace the combination of gates in the expression $\overline{\overline{A} \cdot \overline{B}}$?

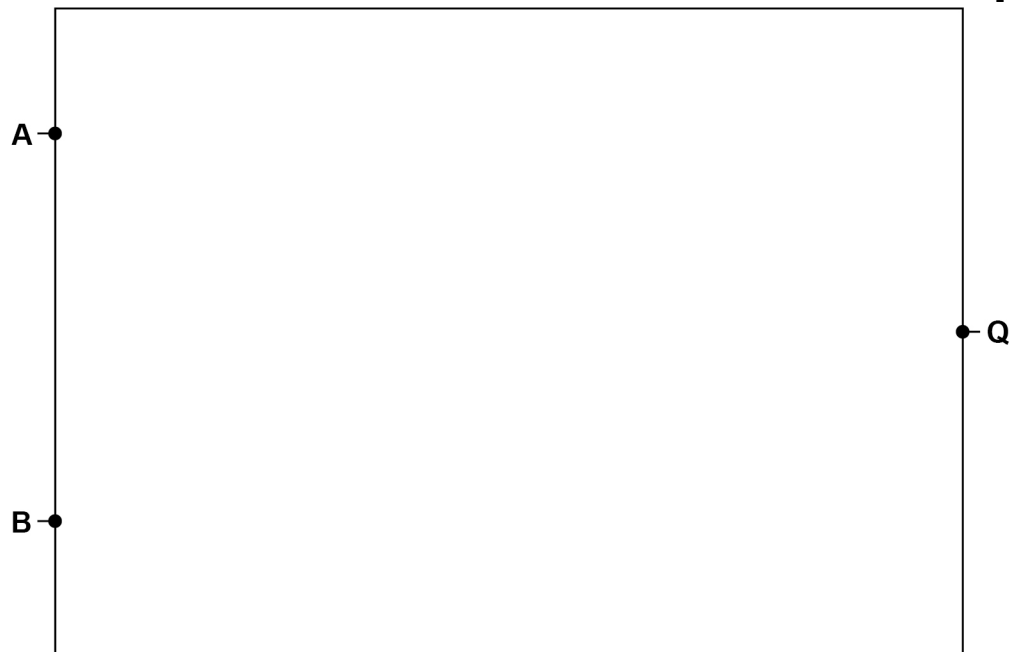**[1 mark**

0 3 . 1 Complete the truth table for A NAND B.

[1 mark]

A	B	A NAND B
0	0	
0	1	
1	0	
1	1	

0 3 . 2   A XOR B can be implemented as a logic circuit without using an XOR gate.

Using **only** AND, OR and NOT gates draw a circuit that will produce an output **Q** which is logically equivalent to **A XOR B**.
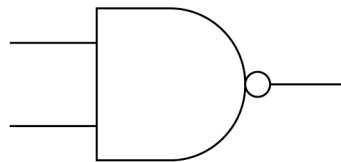
[3 marks]

0 4 . 1 State which logic gate has the truth table shown in **Figure 4**.

[1 mark]

Figure 4

A	B	Q
0	0	1
0	1	0
1	0	0
1	1	0

Answer

0 4 . 2 State the logic gate that is represented by the symbol shown in **Figure 5**.
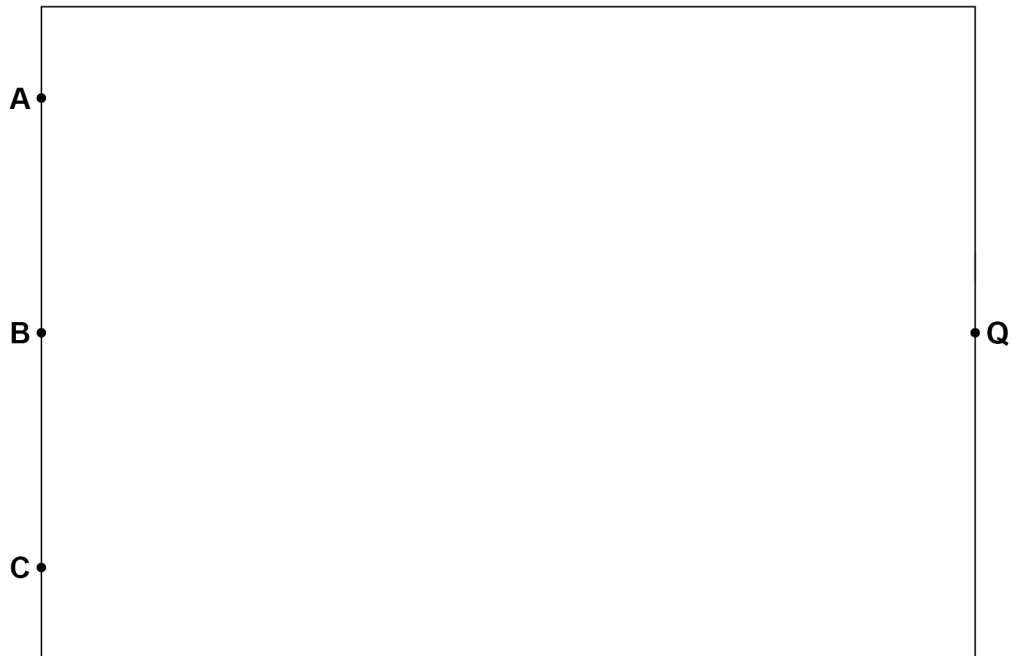
[1 mark]

Figure 5

Answer

0 4 . 3 Draw the logic circuit for the following Boolean expression.

$$Q = \overline{A \cdot B} + C$$

[2 marks]

A •

B •   • Q

C •

0 4 . 4 Complete the truth table below.

A	**B**	**B̄**	$\left(A + \overline{B}\right)$	$\left(A + \overline{B}\right) \cdot B$
0	0			
0	1			
1	0			
1	1			

Using the final column, give a simplified Boolean expression for

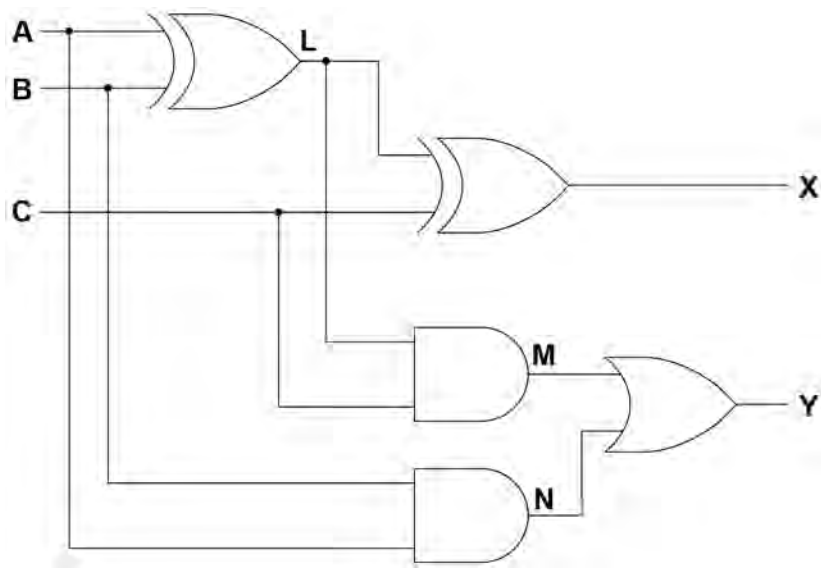$$\left(A + \overline{B}\right) \cdot B$$

[3 marks]

Answer _____

0 5 . 1   **Figure 3** shows a circuit diagram.

Figure 3

Complete the truth table below for the circuit shown in **Figure 3**.

[3 marks]

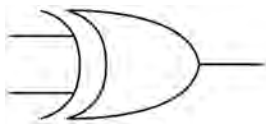| A	B	C	L	M	N	X	Y
0	0	0		0		0	
0	0	1		0		1	
0	1	0		0		1	
0	1	1		1		0	
1	0	0		0		1	
1	0	1		1		0	
1	1	0		0		0	
1	1	1		0		1	

0 5 . 2 Using **Figure 3**, write a Boolean expression for output **Y** in terms of inputs **A**, **B** and **C**.

[2 marks]

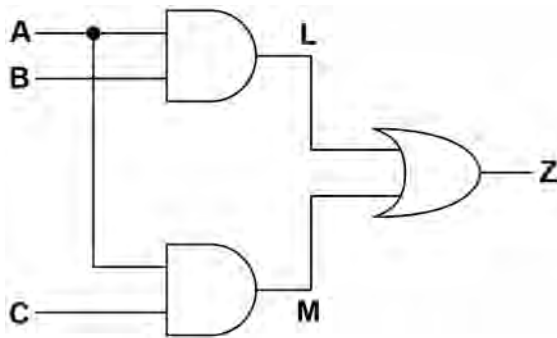**Y** = _____

0 6 . 1 **Figure 2** shows the symbol for a logic gate.

Figure 2

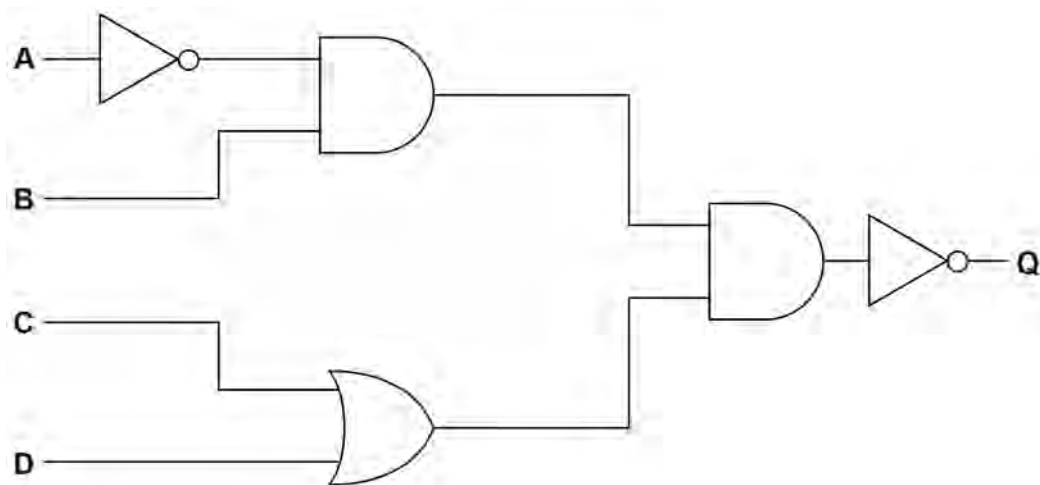State the name of the logic gate shown in **Figure 2**.

[1 mark]

---

0 6 . 2 **Figure 3** shows a logic circuit.

Figure 3

Complete the truth table for the logic circuit in **Figure 3**.

[2 marks]

A	B	C	L	M	Z
0	0	0			
0	0	1			
0	1	0			
0	1	1			
1	0	0			
1	0	1			
1	1	0			
1	1	1			

0 6 . 3 **Figure 4** shows a logic circuit.

Figure 4

Write a Boolean expression for **Q**.

[3 marks]

_____

_____

_____

0 6 . 4 Using the rules of Boolean algebra, simplify the following expression.

$$\overline{W} \cdot X \cdot Z + W \cdot Z + X \cdot Y \cdot \overline{Z} + \overline{W} \cdot X \cdot Y \cdot 1$$

You **must** show your working.

[4 marks]

Final answer