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Simplifying Boolean Algebra – using identities

Exercise: Simplifying boolean expressions

Q1) $A + 0$

Answer :

A

Q2) $A.0$

Answer :

0

Q3) $E + 1$

Answer :

1

Q4) $A + A + B + B + C$

Answer :

$A + B + C$

Q5) $(A.B) + (A.B)$

Answer :

$A.B$

Q6) $A.A.B.B.C$

[**Answer :**

$A.B.C$

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Q7) $(A + \overline{A}).B$

Answer :

1. $(A + \overline{A}).B$ applying the identity $A + \overline{A} = 1$
2. $(1).B$ applying the identity $1.B = B$
3. B

Q8) $(A.\overline{B}) + B$

Answer :

$(A.\overline{B}) + B$

$(A + B).(\overline{B} + B)$ `multiplying out`
$(A + B).(1)$
$(A + B)$

Q9) $(A + B).\overline{A}$

Answer :

This takes some 'multiplying' out:

$(A + B).\overline{A}$
$(A.\overline{A}) + (\overline{A}.B)$
$0 + (\overline{A}.B)$
$B.\overline{A}$

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Q10) $B.(A + A.B)$

Answer :

This takes some 'multiplying' out:

$B.(A + (A.B))$ `treat the brackets first and the AND inside the brackets first`
$(B.A) + (B.A.B)$ `multiply it out`
$(B.A) + (A.B)$ `as` $B.A.B = A.B$
$A.B$ `as` $(B.A) = (A.B)$

Q11) $(A + B).(A + A)$

Answer :

$(A + B).(A + A)$

$(A + B).A$ `as` $A = A + A$
$(A + B).(A + 0)$ `as` $A = A + 0$
$A + (B.0)$ `take A out as the common denominator`
A `as` $(B.0) = 0$

Q12) $(A.\overline{B}) + \overline{A}$

Answer :

This takes some 'multiplying' out:

$(A.\overline{B}) + \overline{A}$
$(A + \overline{A}).(\overline{B} + \overline{A})$
$1.(\overline{B} + \overline{A})$
$\overline{B} + \overline{A}$

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Q13) $(A.B) + \overline{A}$

Answer :

This takes some 'multiplying' out:

$(A.B) + \overline{A}$
$(A + \overline{A}).(B + \overline{A})$ multiplied out
$(1).(B + \overline{A})$ as $(A + \overline{A}) = 1$
$B + \overline{A}$ as $1.Q = Q$

Q14) $(A.\overline{B}) + (A.B)$

Answer :

Take the common factor, A from both sides:

$A.(\overline{B} + B)$
As $\overline{B} + B = 1$
Then $A.(\overline{B} + B) = A.1$
As $A.1 = A$
Then $(A.\overline{B}) + (A.B) = A$