The Distributive Law

I) $A(B+C) = AB + AC$

II) $(A+B)(A+C) = A+BC$

Using the first part of the distributive law, convert the following expressions to their opposite form.

(a) D(E + F + G)
(b) QR + QS + QT
(c) V(W + Y + XZ)
(d) JK(L + MN)
(e) $\bar{H}J + JK\bar{L} + GJM$
(f) L(MNP + QR)
(g) ABC + DAFB
(h) AB(CD + E + FG)

Answers

(a) DE + DF + DG
(b) Q(R + S + T)
(c) VW + VY + VXZ
(d) JKL + JKMN
(e) $J(\bar{H} + K\bar{L} + GM)$
(f) LMNP + LQR
(g) AB(C + DF)
(h) ABCD + ABE + ABFG

Use the second part of the distributive law to convert the following expressions to their opposite form.

(a) K + LM
(b) (R + S) (R + T)
(c) TV + X
(d) (A + C) (C + D)
(e) J + KL$\bar{M}$
(f) (E + F + G) (F + H + J)
(g) A + BCDE
(h) R + (S + T)V
(i) (J + K + L) (M + L + P)
(j) (Q + R + S) (P + Q + R)
(k) $(\bar{A} + B)(B + C + \bar{D})$
(l) (N + P) (Q + R) + M

Answers

(a) (K + L) (K + M)
(b) R + ST
(c) (T + X) (V + X)
(d) C + AD
(e) (J + K) (J + L) (J + $\bar{M}$)
(f) F + (E + G) (H + J)
(g) (A + B) (A + C) (A + D) (A + E)
(h) (R + S + T) (R + V)
(i) L + (J + K) (M + P)
(j) Q + R + SP
(k) $B + \bar{A}(C + \bar{D})$
(l) (M + N + P) (M + Q + R)

Convert the following expressions to their opposite form.

(a) $W + \bar{Z}X\bar{Y}$
(b) RS + STV + PSX
(c) DE(F + G + H)
(d) (M + N + P)(M + N + Q)

Answers

(a) $(W + \bar{Z})(W + X)(W + \bar{Y})$
(b) S(R + TV + PX)
(c) DEF + DEG + DEH
(d) M + N + PQ

None of the expressions listed below can be further simplified in their present form. Convert them, using the distributive law, then simplify.

(a) $AC + A\overline{C}$ (c) $R + S\overline{R}$

(b) $(J + \overline{K})(J + K)$ (d) $\overline{X}(X + Y)$

Note that one of the variables in each of the above expressions is negated; therefore, it is not possible, for example, in the first item to factor out C since one C is complemented or negated. Show your work.

(a) $A(C + \overline{C}) = A \cdot 1 = A$

(b) $J + \overline{K}K = J + 0 = J$

(c) $(R + S)(R + \overline{R}) = (R + S) \cdot 1 = R + S$

(d) $\overline{X}X + \overline{X}Y = 0 + \overline{X}Y = \overline{X}Y$

Convert each of the expressions below to a form without parentheses if it has parentheses and to a form with parentheses if it has none. Use the preceding information.

(a) $(A + B)(C + D)$

↘ Answers

$= AC + AD + BD + BC$

(b) $JK + LM$

$JK + LM$

$(JK + L)(JK + M) = (J + L)(K + L)(J + M)(K + M)$

(c) $E + F + GH$

$E + F + GH$

$(E + F + G)(E + F + H)$

(d) $(\overline{A} + B)(D + G + H)$

$(\overline{A} + B)(D + G + H)$

$(\overline{A} + B)D + (\overline{A} + B)G + (\overline{A} + B)H =$

$D\overline{A} + DB + G\overline{A} + GB + H\overline{A} + HB$

(e) $\overline{R}T + SU\overline{V}$

$\overline{R}T + SU\overline{V}$

$(\overline{R}T + S)(\overline{R}T + U)(\overline{R}T + \overline{V}) = (\overline{R} + S)(T + S)(\overline{R} + U)(T + U)(\overline{R} + \overline{V})(T + \overline{V})$

(f) $JK + L + M$

$JK + L + M$

$(L + M + J)(L + M + K)$

For additional practice, convert each of the following expressions to the opposite form.

(a) WX + YZ
(b) (J + K) (L + MN)
(c) RS + TV + W

Answers

(a) (W + Y) (X + Y) (W + Z) (X + Z)
(b) JL + KL + JMN + KMN
(c) (W + S + T) (W + S + V) (W + R + T) (W + R + V)

(W+TV+R)(W+TV+S) =

Factor the following expressions using the distributive law.

(a) (A + B) (C + D) (A + E)
(b) JKL + GM + HJL
(c) CD + EF + FC + ED
(d) (L + M) (N + P) (J + L) (L + K)
(e) (W + X) (Y + W) (Z + Y) (Z + X)

Answers

(a) (A + BE) (C + D)
(b) JL(K + H) + GM
(c) (C + E) (D + F)
(d) (L + JKM) (N + P)
(e) XY + WZ

(W+XY) (Z+XY) = (WZ+XZ)