28. Find the duals of these Boolean expressions.

a) $x + y$ **b)** $\bar{x}\,\bar{y}$

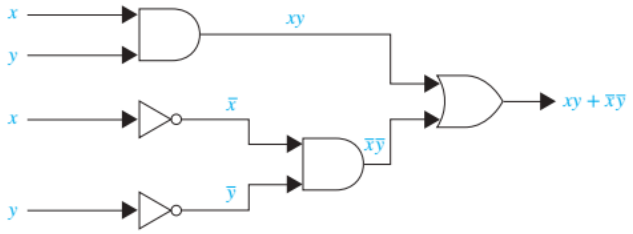
c) $xyz + \bar{x}\,\bar{y}\,\bar{z}$ **d)** $x\bar{z} + x \cdot 0 + \bar{x} \cdot 1$

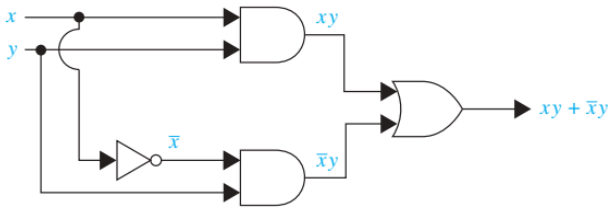
EXAMPLE 11 Find the duals of $x(y + 0)$ and $\bar{x} \cdot 1 + (\bar{y} + z)$.

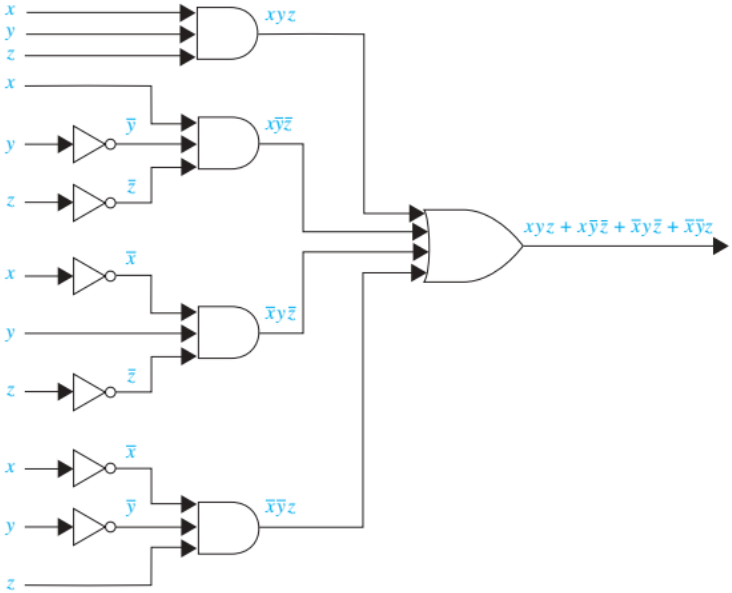
Solution: Interchanging $\cdot$ signs and $+$ signs and interchanging 0s and 1s in these expressions produces their duals. The duals are $x + (y \cdot 1)$ and $(\bar{x} + 0)(\bar{y}z)$, respectively. ◀

TABLE 2

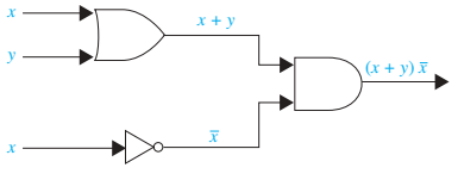
x	y	z	xy	$\bar{z}$	$F(x, y, z) = xy + \bar{z}$
1	1	1	1	0	1
1	1	0	1	1	1
1	0	1	0	0	0
1	0	0	0	1	1
0	1	1	0	0	0
0	1	0	0	1	1
0	0	1	0	0	0
0	0	0	0	1	1







(a)



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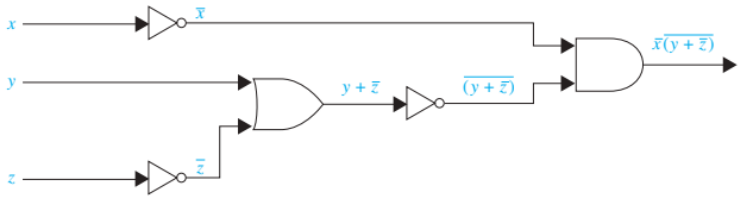

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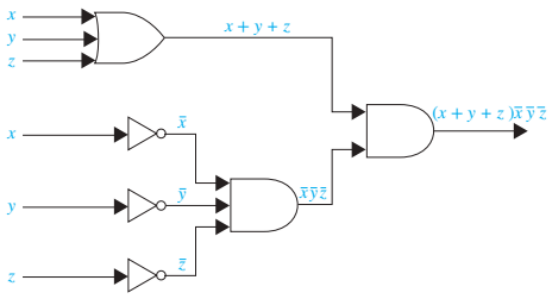
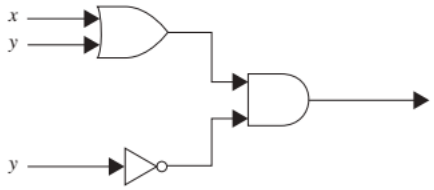


In Exercises 1–5 find the output of the given circuit.

1.



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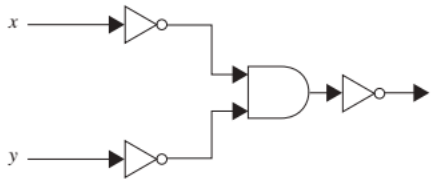

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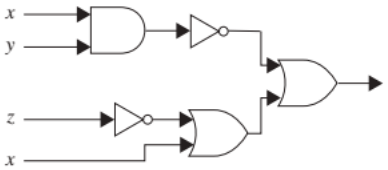

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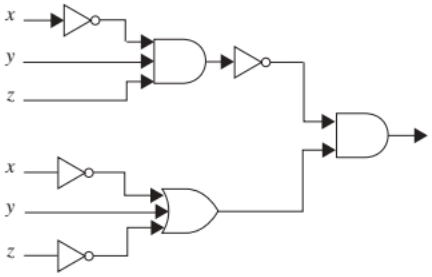

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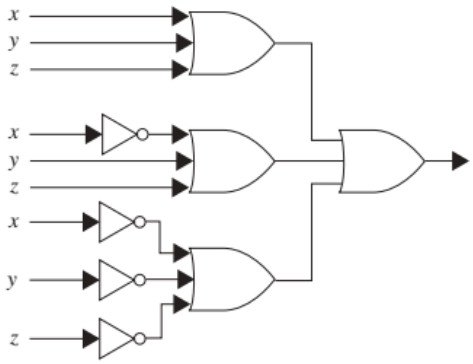
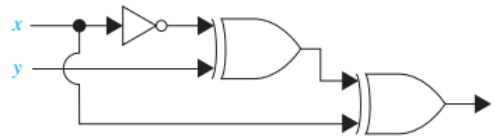


a)



b)