

Rosen, Discrete Mathematics and Its Applications, 7th edition
 Extra Examples
 Section 12.1—Boolean Functions



— Page references correspond to locations of Extra Examples icons in the textbook.

p.816, icon at Example 10

#1. Prove the idempotent law $x = x \cdot x$ using the other identities of Boolean algebra listed in Table 5 of Section 11.1 the textbook.

Solution:

$x = x \cdot 1$	identity law
$= x \cdot (x + \bar{x})$	unit property
$= x \cdot x + x \cdot \bar{x}$	distributive law
$= x \cdot x + 0$	zero property
$= x \cdot x.$	identity law

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#2. Prove the domination law $x \cdot 0 = 0$ using the other identities of Boolean algebra listed in Table 5 in Section 11.1 of the textbook.

Solution:

$x \cdot 0 = x \cdot (x \cdot \bar{x})$	zero property
$= (x \cdot x) \cdot \bar{x}$	associative law
$= x \cdot \bar{x}$	idempotent law
$= 0.$	zero property

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#3. Using the properties of Boolean algebra, prove that

$$yz + x(\overline{xz}) + y(\bar{z} + 1) + \bar{z}x$$

can be simplified to give $y + \bar{z}x$.

Solution:

$yz + x(\overline{xz}) + y(\bar{z} + 1) + \bar{z}x$	De Morgan's law
$= yz + x(\bar{x} + \bar{z}) + y(\bar{z} + 1) + \bar{z}x$	distributive law; identity law
$= yz + x\bar{x} + x\bar{z} + y\bar{z} + y + \bar{z}x$	zero property
$= yz + 0 + x\bar{z} + y\bar{z} + y + \bar{z}x$	identity law
$= yz + x\bar{z} + y\bar{z} + y + \bar{z}x$	commutative law
$= y + yz + y\bar{z} + x\bar{z} + \bar{z}x$	distributive law
$= y + y(z + \bar{z}) + x\bar{z} + \bar{z}x$	unit property
$= y + y1 + x\bar{z} + \bar{z}x$	identity law
$= y + y + x\bar{z} + \bar{z}x$	

$$\begin{aligned} &= y + x\bar{z} + \bar{z}x \\ &= y + \bar{z}x + \bar{z}x \\ &= y + \bar{z}x. \end{aligned}$$

idempotent law
commutative law
idempotent law
