11. **a)** False **b)** False **c)** False **d)** True **e)** False **f)** False
g) True **13.** **a)** True **b)** True **c)** False **d)** True **e)** True

g) True **13.** **a)** True **b)** True **c)** False **d)** True **e)** True
f) False

19. Suppose that $x \in A$. Because $A \subseteq B$, this implies that $x \in B$. Because $B \subseteq C$, we see that $x \in C$. Because $x \in A$ implies that $x \in C$, it follows that $A \subseteq C$. **21.** **a)** 1

$x \in A$ implies that $x \in C$, it follows that $A \subseteq C$. **21.** **a)** 1
b) 1 **c)** 2 **d)** 3 **23.** **a)** $\{\emptyset, \{a\}\}$ **b)** $\{\emptyset, \{a\}, \{b\}, \{a, b\}\}$

b) 1 **c)** 2 **d)** 3 **23.** **a)** $\{\emptyset, \{a\}\}$ **b)** $\{\emptyset, \{a\}, \{b\}, \{a, b\}\}$
c) $\{\emptyset, \{\emptyset\}, \{\{\emptyset\}\}, \{\emptyset, \{\emptyset\}\}\}$ **25.** **a)** 8 **b)** 16 **c)** 2 **27.** For

implies $a \in B$, as desired. **29.** **a)** $\{(a, y), (b, y), (c, y), (d, y), (a, z), (b, z), (c, z), (d, z)\}$ **b)** $\{(y, a), (y, b), (y, c), (y, d), (z, a), (z, b), (z, c), (z, d)\}$ **31.** The set of triples (a, b, c), where a

33. $\emptyset \times A = \{(x, y) \mid x \in \emptyset \text{ and } y \in A\} = \emptyset = \{(x, y) \mid x \in A \text{ and } y \in \emptyset\} = A \times \emptyset$ **35.** **a)** $\{(0, 0), (0, 1), (0, 3),$

$x \in A \text{ and } y \in \emptyset\} = A \times \emptyset$ **35.** **a)** $\{(0, 0), (0, 1), (0, 3),$
$(1, 0), (1, 1), (1, 3), (3, 0), (3, 1), (3, 3)\}$ **b)** $\{(1, 1), (1, 2), (1, a), (1, b), (2, 1), (2, 2), (2, a), (2, b), (a, 1), (a, 2), (a, a), (a, b), (b, 1), (b, 2), (b, a), (b, b)\}$ **37.** mn **39.** m^n **41.** The ele-

$(b, 1), (b, 2), (b, a), (b, b)\}$ **37.** mn **39.** m^n **41.** The ele-

$(b, 1), (b, 2), (b, a), (b, b)\}$ **37.** mn **39.** m^n **41.** The ele-
ments of $A \times B \times C$ consist of 3-tuples (a, b, c), where $a \in A$, $b \in B$, and $c \in C$, whereas the elements of $(A \times B) \times C$ look like $((a, b), c)$—ordered pairs, the first coordinate of which is again an ordered pair. **43.** This is not true. The simplest