1. **a)** $f(0)$ is not defined. **b)** $f(x)$ is not defined for $x < 0$. **c)** $f(x)$ is not well defined because there are two distinct values assigned to each x. **3.** **a)** Not a function **b)** A function **c)** Not a

tions in parts (a) and (d) **15.** **a)** Onto **b)** Not onto **c)** Onto **d)** Not onto **e)** Onto **17.** **a)** Depends on whether teach-

23. **a)** Yes **b)** No **c)** Yes **d)** No **25.** Suppose that f is strictly

29. The function is not one-to-one, so it is not invertible. On the restricted domain, the function is the identity function on the nonnegative real numbers, $f(x) = x$, so it is its own inverse. **31.** **a)** $f(S) = \{0, 1, 3\}$ **b)** $f(S) = \{0, 1, 3, 5, 8\}$

c) $f(S) = \{0, 8, 16, 40\}$ **d)** $f(S) = \{1, 12, 33, 65\}$ **33.** **a)** Let x and y be distinct elements of A. Because g is one-to-one, $g(x)$ and $g(y)$ are distinct elements of B. Because f is one-to-one, $f(g(x)) = (f \circ g)(x)$ and $f(g(y)) = (f \circ g)(y)$ are distinct elements of C. Hence, $f \circ g$ is one-to-one. **b)** Let $y \in C$. Because f is onto, $y = f(b)$ for some $b \in B$. Now because g is onto, $b = g(x)$ for some $x \in A$. Hence, $y = f(b) = f(g(x)) = (f \circ g)(x)$. It follows that $f \circ g$ is onto. **35.** Let $A = \{a\}$, $B = \{b_1, b_2\}$,

follows that $f \circ g$ is onto. **35.** Let $A = \{a\}$, $B = \{b_1, b_2\}$,
$C = \{c\}$, $g(a) = b_1$, and $f(b_1) = f(b_2) = c$. **37.** No. For

$(fg)(x) = x^3 + 2x^2 + x + 2$ **41.** f is one-to-one because $f(x_1) = f(x_2) \to ax_1 + b = ax_2 + b \to ax_1 = ax_2 \to x_1 = x_2$. f is onto because $f((y - b)/a) = y$. $f^{-1}(y) = (y - b)/a$.