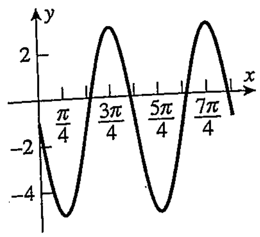
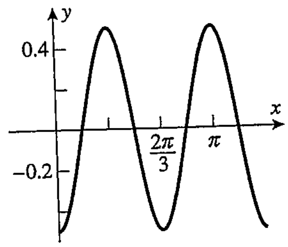
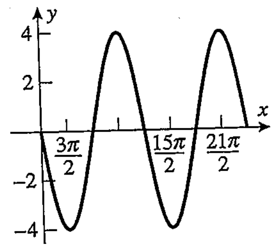
34. (a) $4, \pi$



(b) $1/2, 2\pi/3$



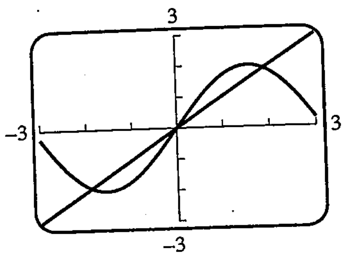
(c) $4, 6\pi$



35. (a) $x = A\sin(\omega t + \theta) = A[\sin\omega t\cos\theta + \sin\theta\cos\omega t)$, so let $A\cos\theta = A_1, A\sin\theta = A_2$, then $A_1^2 + A_2^2 = A^2(\cos^2\theta + \sin^2\theta) = A^2$, and $A_2/A_1 = A\sin\theta/A\cos\theta = \tan\theta$.

(b) $A^2 = 2 + 6, A = 2\sqrt{2}; \tan\theta = \sqrt{6}/\sqrt{2} = \sqrt{3}, \theta = \pi/3$, and $x = 2\sqrt{2}\sin(2\pi t + \pi/3)$.

36. three; $x = 0$, $x = \pm 1.8955$



EXERCISE SET 1.5

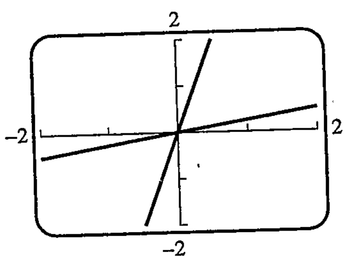
1. (a) $f(g(x)) = 4(x/4) = x$, $g(f(x)) = (4x)/4 = x$, f and g are inverse functions

(b) $f(g(x)) = 3(3x - 1) + 1 = 9x - 2 \neq x$ so f and g are not inverse functions

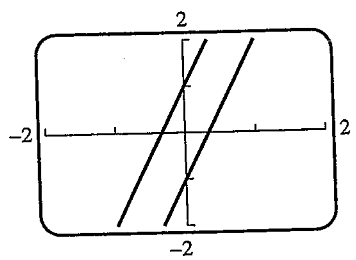
(c) $f(g(x)) = \sqrt[3]{(x^3 + 2) - 2} = x$, $g(f(x)) = (x - 2) + 2 = x$, f and g are inverse functions

(d) $f(g(x)) = (x^{1/4})^4 = x$, $g(f(x)) = (x^4)^{1/4} = |x| \neq x$, f and g are not inverse functions

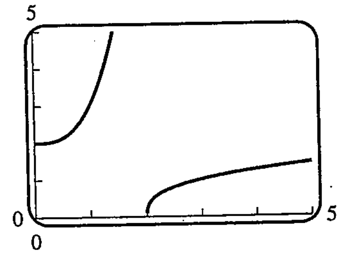
2. (a) They are inverse functions.



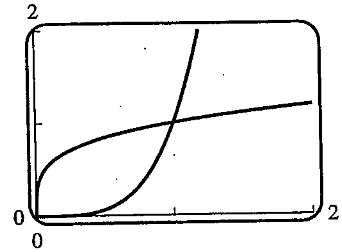
(b) The graphs are not reflections of each other about the line $y = x$.



(c) They are inverse functions provided the domain of g is restricted to $[0, +\infty)$

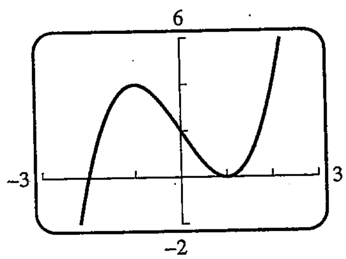


(d) They are inverse functions provided the domain of $f(x)$ is restricted to $[0, +\infty)$

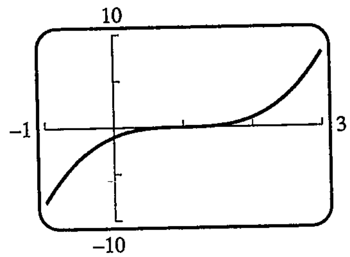


3. (a) yes (b) yes (c) no (d) yes (e) no (f) no

4. (a) no, the horizontal line test fails



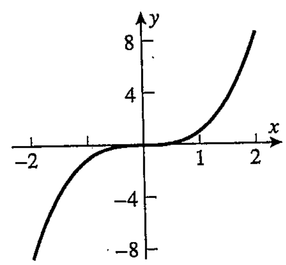
(b) yes, by the horizontal line test



5. (a) yes; all outputs (the elements of row two) are distinct
(b) no; $f(1) = f(6)$

6. (a) Since the point $(0, 0)$ lies on the graph, no other point on the line $x = 0$ can lie on the graph, by the vertical line test. Thus the hour hand cannot point straight up or straight down. Thus noon, midnight, 6AM and 6PM are impossible. To show other times are possible, suppose (a, b) lies on the graph with $a \neq 0$. Then the function $y = Ax^{1/3}$ passes through $(0, 0)$ and (a, b) provided $A = b/a^{1/3}$.
(b) same as **(a)**
(c) Then the minute hand cannot point to 6 or 12, so in addition to **(a)**, times of the form 1:00, 1:30, 2:00, 2:30, , 12:30 are also impossible.

7. (a) f has an inverse because the graph passes the horizontal line test. To compute $f^{-1}(2)$ start at 2 on the y-axis and go to the curve and then down, so $f^{-1}(2) = 8$; similarly, $f^{-1}(-1) = -1$ and $f^{-1}(0) = 0$.
(b) domain of f^{-1} is $[-2, 2]$, range is $[-8, 8]$
(c)



8. (a) the horizontal line test fails
(b) $-3 < x \leq -1$; $-1 \leq x \leq 2$; and $2 \leq x < 4$.

9. $y = f^{-1}(x)$, $x = f(y) = 7y - 6$, $y = \dfrac{1}{7}(x + 6) = f^{-1}(x)$

Exercise Set 1.5

10. $y = f^{-1}(x)$, $x = f(y) = \dfrac{y+1}{y-1}$, $xy - x = y + 1$, $(x-1)y = x + 1$, $y = \dfrac{x+1}{x-1} = f^{-1}(x)$

11. $y = f^{-1}(x)$, $x = f(y) = 3y^3 - 5$, $y = \sqrt[3]{(x+5)/3} = f^{-1}(x)$

12. $y = f^{-1}(x)$, $x = f(y) = \sqrt[5]{4y+2}$, $y = \dfrac{1}{4}(x^5 - 2) = f^{-1}(x)$

13. $y = f^{-1}(x)$, $x = f(y) = \sqrt[3]{2y-1}$, $y = (x^3+1)/2 = f^{-1}(x)$

14. $y = f^{-1}(x)$, $x = f(y) = \dfrac{5}{y^2+1}$, $y = \sqrt{\dfrac{5-x}{x}} = f^{-1}(x)$

15. $y = f^{-1}(x)$, $x = f(y) = 3/y^2$, $y = -\sqrt{3/x} = f^{-1}(x)$

16. $y = f^{-1}(x)$, $x = f(y) = \begin{cases} 2y, & y \le 0 \\ y^2, & y > 0 \end{cases}$, $y = f^{-1}(x) = \begin{cases} x/2, & x \le 0 \\ \sqrt{x}, & x > 0 \end{cases}$

17. $y = f^{-1}(x), x = f(y) = \begin{cases} 5/2 - y, & y < 2 \\ 1/y, & y \ge 2 \end{cases}$, $y = f^{-1}(x) = \begin{cases} 5/2 - x, & x > 1/2 \\ 1/x, & 0 < x \le 1/2 \end{cases}$

18. $y = p^{-1}(x)$, $x = p(y) = y^3 - 3y^2 + 3y - 1 = (y-1)^3$, $y = x^{1/3} + 1 = p^{-1}(x)$

19. $y = f^{-1}(x)$, $x = f(y) = (y+2)^4$ for $y \ge 0$, $y = f^{-1}(x) = x^{1/4} - 2$ for $x \ge 16$

20. $y = f^{-1}(x)$, $x = f(y) = \sqrt{y+3}$ for $y \ge -3$, $y = f^{-1}(x) = x^2 - 3$ for $x \ge 0$

21. $y = f^{-1}(x)$, $x = f(y) = -\sqrt{3-2y}$ for $y \le 3/2$, $y = f^{-1}(x) = (3 - x^2)/2$ for $x \le 0$

22. $y = f^{-1}(x)$, $x = f(y) = 3y^2 + 5y - 2$ for $y \ge 0$, $3y^2 + 5y - 2 - x = 0$ for $y \ge 0$,
$y = f^{-1}(x) = (-5 + \sqrt{12x+49})/6$ for $x \ge -2$

23. $y = f^{-1}(x)$, $x = f(y) = y - 5y^2$ for $y \ge 1$, $5y^2 - y + x = 0$ for $y \ge 1$,
$y = f^{-1}(x) = (1 + \sqrt{1-20x})/10$ for $x \le -4$

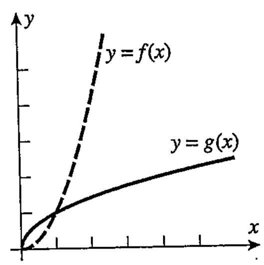
24. (a) $C = \dfrac{5}{9}(F - 32)$
(b) how many degrees Celsius given the Fahrenheit temperature
(c) $C = -273.15°$ C is equivalent to $F = -459.67°$ F, so the domain is $F \ge -459.67$, the range is $C \ge -273.15$

WRONG!!

25. (a) ~~$y = f(x) = (6.214 \times 10^{-4})x$~~ x ... y $\Rightarrow y = f(x) = \dfrac{x}{6.214 \times 10^{-4}}$ (b) ~~$y = f^{-1}(x) = \dfrac{10^4}{6.214}x$~~ $f^{-1}(y) = (6.214 \times 10^{-4})y = x$ miles
(c) ~~how many meters in y miles~~
how many miles in y meters

26. (a) $f(g(x)) = f(\sqrt{x})$
$= (\sqrt{x})^2 = x, x > 1;$
$g(f(x)) = g(x^2)$
$= \sqrt{x^2} = x, x > 1$

(b)



(c) no, because $f(g(x)) = x$ for every x in the domain of g is not satisfied (the domain of g is $x \ge 0$)