Answers of the (even) homework problems from Chapter 1

1.1.26. The domain is $[0, 4]$.  
1.1.32. The graph of $H(t)$ is the same as the graph of the function $f(t) = t + 2$ (a straight line) except for a hole at the point $(2, 4)$.  
1.1.40. The domain is $\mathbb{R}$. Solved in class.  
1.2.2. The answers are as follows.  
(a) rational function  
(b) algebraic function  
(c) exponential function  
(d) power function  
(e) polynomial function  
(f) trigonometric function  
1.2.4. Solved in class:  
(a) it is a line (choice G)  
(b) exponential function (choice f)  
(c) odd polynomial (or power) function (choice F)  
(d) root function (choice g)  
1.3.12. Start with the graph of $y = x^2$, shift 2 units to the right, and then shift 1 unit downward (solved in class).  
1.3.16. Start with the graph of $y = \frac{1}{x}$ and shift 4 units to the right.  
1.3.20. Start with the graph of $y = \sqrt{x}$, shift 1 unit to the right, and then shift 1 unit upward.  
1.3.24. Solved in class. Use that $y = |2x - x^2| = |x^2 - 2x + 1 - 1| = |(x - 1)^2 - 1|$.  
1.3.32. The domain of $f + g$ is $(-\infty, 1] \cap [-1, \infty) = [-1, 1]$.  
The domain of $f - g$ is $(-\infty, 1] \cap [-1, \infty) = [-1, 1]$.  
The domain of $fg$ is $(-\infty, 1] \cap [-1, \infty) = [-1, 1]$.  
The domain of $\frac{f}{g}$ is $[-1, 1)$ (we must exclude $x = 1$).  
1.3.36. The domain of $f$ is $\mathbb{R}$ and the domain of $g$ is $\{x \mid x \neq 0\}$. Then the domain of $f \circ g$ is $\{x \mid x \neq 0\}$; the domain of $g \circ f$ is $\{x \mid x \neq 1\}$; the domain of $f \circ f$ is $\mathbb{R}$; and the domain of $g \circ g$ is $\{x \mid x \neq 0\}$.  
1.3.40. The domain of $f$ is $\{x \mid x \geq -\frac{3}{2}\} = [-\frac{3}{2}, \infty)$ and the domain of $g$ is $\mathbb{R}$. Then the domain of $f \circ g$ is $\mathbb{R}$; the domain of $g \circ f$ is $\{x \mid x \geq -\frac{3}{2}\} = [-\frac{3}{2}, \infty)$; the domain of $f \circ f$ is $[-\frac{3}{2}, \infty)$; and the domain of $g \circ g$ is $\mathbb{R}$.  
1.5.4. The graph of $y = e^{-x}$ is a reflection of the graph of $y = e^x$ about the $y$-axis, and the graph of $y = 8^{-x}$ is a reflection of that of $y = 8^x$ about the $y$-axis. The graph of $8^x$ is above that of $e^x$ for $x > 0$, etc.
1.5.6. Solved in class. See the solution of 1.5.4.

1.5.8. We start with the graph of $y = 4^x$ and then shift 3 units to the right.

1.5.12. We start with the graph of $y = e^x$, reflect it about the $y$-axis, and then about the $x$-axis. Now shift the last graph 1 unit upward, stretch it by a factor of 5, and then shift it 2 units upward.

1.5.16. Solved in class. However, look at part (b)!

(a) The domain of $g(t)$ is $\mathbb{R}$.

(b) The domain of $g(t)$ is $(-\infty, 0]$ (in class we found the domain of the function $\sqrt{2^t - 1}$ not of $\sqrt{1 - 2^t}$).

1.6.10. It is not $1 - 1$. For example $f(1) = 4 = f(3)$.

1.6.12. The function is $1 - 1$.

1.6.26. The inverse function of $f$ is

$$f^{-1}(x) = \sqrt{x - \frac{3}{2}}.$$ 

The domain of $f^{-1}$ is $\mathbb{R}$.

1.6.28. The inverse function of $f$ is

$$f^{-1}(x) = \ln\left(\frac{x - 1}{x + 1}\right).$$

The domain of $f^{-1}$ is $\{x \mid |x > 1]\} = (-\infty, -1) \cup (1, \infty)$.

1.6.36. (a) $\frac{13}{7}$; (b) $\sqrt{2}$.

1.6.38. (a) 15; (b) 8.

1.6.40. The answer is $\ln(\frac{1 + x}{3})$.

1.6.52(a). The answer is $x = e^x$.

1.6.66. (a) $\frac{\pi}{4}$; (b) $\frac{\pi}{2}$.

1.6.68. (a) We let $\theta = \tan^{-1}2 = \arctan(2)$, so $\tan(\theta) = 2$. We then find $\sec(\arctan 2) = \sec(\theta) = \sqrt{5}$.

(b) Let $\theta = \sin^{-1}\frac{5}{13}$ so $\sin \theta = \frac{5}{13}$. Then

$$\cos\left(2\sin^{-1}\frac{5}{13}\right) = \cos 2\theta = 1 - 2\sin^2 \theta = \frac{119}{169}.$$ 

1.6.72. Let $y = \cos^{-1}x$. Then $\cos y = x$ and thus $\sin y = \sqrt{1 - x^2}$ since $0 \leq y \leq \pi$. So

$$\sin(2\cos^{-1}x) = \sin 2y = 2\sin y \cos y = 2x\sqrt{1 - x^2}.$$