1. Let $f(x) = \frac{1}{x^2}$ and $g(x) = 6\sqrt{4 + x}$. Write down the functions $(f \circ g)(x)$ and $(g \circ f)(x)$, along with their domains.

$$(f \circ g)(x) = \left( \frac{1}{6\sqrt{4 + x}} \right)^2$$

The domain is $\{x : x > -4\} = (-4, +\infty)$; even though the function is squared, the fact that there is a square root in the definition means that $4 + x$ may not be negative.

$$(g \circ f)(x) = 6\sqrt{4 + \frac{1}{x^2}}$$

The domain is $\{x : x \neq 0\} = (-\infty, 0) \cup (0, +\infty)$; $x$ may not be negative or positive without the equation inheriting a square root of a negative number, but still may not be zero.

2. Let $h(x) = e^{7x} - 2e$.

(a) Find (in simplest form) the value of $h\left(\frac{1}{7}\right)$.

$$h\left(\frac{1}{7}\right) = e^7 \cdot \frac{1}{7} - 2e = e^1 - 2e = -e$$

(b) Find the inverse function $h^{-1}(x)$.

Recall the method to find the inverse function is to switch the variables, and then solve for $y$:

$$x = e^{7y} - 2e$$

$$e^{7y} = x + 2e$$

Now you must take the natural logarithm of both sides in order to get the $7y$ out of the exponent:

$$\ln(e^{7y}) = \ln(x + 2e), \text{ which because of the inverse property gives } 7y = \ln(x + 2e)$$

Divide both sides by 7 to get

$$y = \frac{1}{7} \ln(x + 2e), \text{ or, if you prefer, } y = \ln\left(\sqrt[7]{x + 2e}\right)$$

3. Find the following:

I won’t include a long narration of how to find these values, as it would be repeating the long sections that already appear in the textbook, but the answers are below.

(a) $\tan\left(\frac{\pi}{4}\right) = -1$

(b) $\sin^{-1}\left(\frac{1}{2}\right) = \frac{\pi}{6}$

(c) $\cos(\sin^{-1}(0.6)) = 0.8$