Physics 234: Exercise 2

1. Complete the 8-bit, unsigned addition given below. Show all the steps in both hexadecimal (left) and binary (right).

	A	F
+	7	2

$\Longleftrightarrow$

+								

   Is there an overflow?

2. Suppose we want to find an iterative algorithm for raising the number a to a rational power—i.e., for computing $a^{p/q}$ with p and q integer. Convince yourself that the sequence defined by

$$x_0 := 1$$
$$x_{n+1} := \Big(1 - \frac{1}{q}\Big)x_n + \frac{a^p}{q}x_n^{1-q}$$

   has $a^{p/q}$ as its limit. I suggest you proceed in this way: suppose that x_n is a good guess to the answer; construct a better guess $x_{n+1} = x_n + \delta x \approx a^{p/q}$; solve for δx to lowest order in a series expansion.

3. Find the value of b such that the functions

$$t(x) = x - \frac{1}{3}x^3 + \frac{2}{15}x^5$$
$$\text{and} \quad r(x) = \frac{15x + x^3}{15 + bx^2}$$

   agree to sixth order. Plot the functions $t(x)$, $r(x)$, and $\tanh x$ in the range $0 \le x \le 2$. Also, plot the differences $t(x) - \tanh x$ and $r(x) - \tanh x$ with the log scale on the y-axis. How do they compare? What do $t(x)$ and $r(x)$ represent?