We present a new method for computing exact values of the Dedekind eta function and the closely related Weber function. Specifically, by working with ratios of Dedekind eta functions, we’re able to compute \( \eta(2\tau) \), \( \eta(-2/\tau) \), and \( \eta(\tau + 2) \) from \( \eta(\tau) \). This allows us to compute \( f(\tau) \) for dyadic complex numbers in the upper half-plane. We also extend this method to compute values of the Weber function for a wide class of imaginary quadratic surds, such as

\[
\frac{\eta(\frac{2+\sqrt{-15}}{4})}{\eta(\frac{2+\sqrt{-15}}{4})} = \frac{12\sqrt{-33+19\sqrt{5}-i(9\sqrt{15}-15\sqrt{3})}}{3\sqrt{2}}
\]

Finally, we find an asymptotic formula for the behavior of \( \eta \) close to the real line, as well as a few other special values using PSLQ and other empirical methods. (Received September 22, 2015)