1) The half-life of Brianium is 693 years. (10 points)
   a) If a fossil is 100 years old, what percentage of its Brianium should it have left?
      \[ P(t) = P_0 e^{-\lambda t} \]
      \[ \lambda = \frac{\ln(0.5)}{693} \approx -0.001 \]
      \[ P(t) = 1 e^{-0.001(100)} \]
      \[ P(t) = e^{-1} \approx 0.368 \text{ or } 36.8\% \]
   b) How long would it take for a fossil to decay to the point that it only has 15% of it’s Brianium left?
      \[ 0.15 = 1 e^{-0.001t} \]
      \[ \ln(0.15) = -0.001t \]
      \[ t = -\frac{\ln(0.15)}{0.001} = 1897 \text{ years} \]

2) Determine the following (without a calculator). Make sure to rationalize the denominator where applicable. (1 point)
   a) \[ \sin\left(\frac{x}{6}\right) = \frac{1}{2} \]
   b) \[ \cos\left(\frac{x}{6}\right) = \frac{\sqrt{3}}{2} \]
   c) \[ \tan\left(\frac{x}{6}\right) = \frac{\sin\left(\frac{\pi}{6}\right)}{\cos\left(\frac{\pi}{6}\right)} = \frac{\frac{1}{2}}{\frac{\sqrt{3}}{2}} = \frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3} \]
   d) \[ \csc\left(\frac{x}{6}\right) = \frac{1}{\sin\left(\frac{\pi}{6}\right)} = \frac{1}{\frac{1}{2}} = \frac{2}{1} = 2 \]
   e) \[ \sec\left(\frac{x}{6}\right) = \frac{1}{\cos\left(\frac{\pi}{6}\right)} = \frac{1}{\frac{\sqrt{3}}{2}} = \frac{2}{\sqrt{3}} = \frac{2\sqrt{3}}{3} \]
   f) \[ \cot\left(\frac{x}{6}\right) = \frac{1}{\tan\left(\frac{\pi}{6}\right)} = \frac{1}{\frac{\sqrt{3}}{3}} = \frac{3}{\sqrt{3}} = \frac{3\sqrt{3}}{3} = \sqrt{3} \]