

$$\Delta V_{Ac} = \sqrt{\frac{2\mu}{a_1(1-e) + a_2(1+e)}} \cdot \frac{a_2(1+e)}{a_1(1-e)} - \sqrt{\frac{2\mu}{a_1(1-e) + a_2(1+e)}} \cdot \frac{a_1(1+e)}{a_1(1-e)}$$

$$+ \sqrt{\frac{2\mu}{a_2(1-e) + a_2(1+e)}} \cdot \frac{a_2(1-e)}{a_2(1+e)} - \sqrt{\frac{2\mu}{a_1(1-e) + a_2(1+e)}} \cdot \frac{a_1(1-e)}{a_2(1+e)}$$

$$\frac{\Delta V_{Ac}}{\sqrt{\mu}} = \left(\frac{1}{\sqrt{a + \frac{\Delta a(1+e)}{2}}} \right) \left(\sqrt{1+e} \sqrt{a+\Delta a} \right) \left(\frac{1}{\sqrt{1-e} \sqrt{a}} \right)$$

$$- \sqrt{\frac{1+e}{1-e}} \sqrt{\frac{1}{a}} + \sqrt{\frac{1-e}{1+e}} \sqrt{\frac{1}{a+\Delta a}}$$

$$- \frac{1}{\sqrt{a + \frac{\Delta a(1+e)}{2}}} \left(\sqrt{1-e} \sqrt{a} \right) \left(\frac{1}{\sqrt{1+e} \sqrt{a+\Delta a}} \right)$$

now letting

$$\sqrt{a+\Delta a} \doteq \sqrt{a} + \frac{\Delta a}{2\sqrt{a}}$$

$$\frac{1}{\sqrt{a+\Delta a}} \doteq \frac{1}{\sqrt{a}} - \frac{\Delta a}{2\sqrt{a}^3}$$

substituting, and letting $\Delta a \rightarrow 0$ gives

$$\frac{\delta(\Delta V_{Ac})}{\delta a} = \frac{1}{2a} \sqrt{\frac{\mu(1+e)(1-e)}{a}}$$