6. (10 points) Einstein's special theory of relativity states that an object's length contracts as its velocity increases according to the formula

$$L(v) = L_0 \sqrt{1 - \left(\frac{v}{c}\right)^2}$$

where L_0 is the length of the object at rest, v is the velocity of the object, and c is the speed of light. (Recall from physics that $v < c$ necessarily)

(a) Approximate $L(v)$ by its second degree Taylor polynomial near $v = 0$.

(b) What is the approximate error in your approximation from part (a) in terms of v when v is small compared to c?

(c) By what percentage will the length of the object contract when it is travelling at a velocity of 99% of the speed of light?