Lorentz FitzGerald Contraction.
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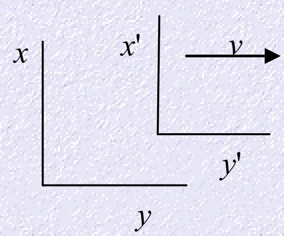
Introduction.

In this article we will show that an object with length *l* meter, which travels with a velocity *v* m/sec to the right, will shorten in length, measured from a frame at rest.

Moving frame and frame at rest.



The second frame is moving to the right with a velocity *v* m/sec.

According to the Lorentz transformation formulae the relation between the position, in the frame at rest and moving frame, is:

$$x' = \frac{x - v.t}{\sqrt{1 - \frac{v^2}{c^2}}}$$

Thus the object is moving with velocity v m/sec to the right. The length of the object is the distance between both ends. Now we consider the locations of the ends, one in x_a' and the other in x_b'. The length of the object is then $x_a' - x_b' = l$. The measurement, in the frame at rest, is done by determining the position of the ends of the object in the frame at rest which are at x_a and x_b. The measurement is simultaneously done, so at the same time *t.* (Otherwise the object would be at a different location.)
Thus

$$x_a' - x_b' = \frac{x_a - v.t}{\sqrt{1-\frac{v^2}{c^2}}} - \frac{x_b - v.t}{\sqrt{1-\frac{v^2}{c^2}}} \quad \text{is} \quad x_a' - x_b' = \frac{x_a - x_b}{\sqrt{1-\frac{v^2}{c^2}}}$$

In the moving frame the length of the object is $l = x_a' - x_b'$ In the frame at rest the length of the moving object is:

$$x_a - x_b = (x_a' - x_b')\sqrt{1 - \frac{v^2}{c^2}} = l.\sqrt{1 - \frac{v^2}{c^2}}$$

As the factor $\sqrt{1-\frac{v^2}{c^2}}$ is between one and zero, the length of the moving object is shorter, measured in the frame at rest.