(4) $\Delta t = \gamma \Delta t_0$

$16.0\mu s = \gamma \cdot 2.2\mu s$

$\gamma = \frac{16}{2.2} = 7.27$

$\gamma = \frac{1}{\sqrt{1-\beta^2}} \Rightarrow 1-\beta^2 = \frac{1}{\gamma^2}$

$\beta^2 = 1 - \frac{1}{\gamma^2}$

$\beta = \sqrt{1-\frac{1}{\gamma^2}}$

$\beta = \sqrt{1-\frac{1}{(7.27)^2}} = 0.9905$

$v = \beta \cdot c = 2.97 \cdot 10^8 \ m/s$

(6) (a) $L = \frac{L_0}{\gamma}$, $\frac{L}{L_0} = \frac{1}{2} = \frac{1}{\gamma}$

$\gamma = 2$, $\beta = \sqrt{1-\frac{1}{\gamma^2}}$,

$\beta = \sqrt{\frac{3}{4}} = 0.866$

$v = \beta c = 2.60 \cdot 10^8 \ m/s$

(b) By a factor of $\gamma = 2$

(12) $\gamma = \frac{1}{\sqrt{1-\beta^2}} \Rightarrow \beta = \sqrt{1-\frac{1}{\gamma^2}}$

	γ	β
(a)	1.01	0.14
(b)	10.0	0.995
(c)	100	0.99995
(d)	1000	0.9999995

(16) S': $\beta = 0.60$

$\gamma = \frac{1}{\sqrt{1-\beta^2}} = 1.25$

Event 1: $x = 0, t = 0$ in S

Gotta be

S' $x' = 0, t' = 0$

Event 2:

$x = 3.0\,km$

$t = 4.0\,\mu s$

$x' = \gamma(x - \beta c t) = 1.25(3 - 0.6 \cdot 3 \cdot 10^5 \cdot 4 \cdot 10^{-6})$

$\boxed{x' = 2.85\,km}$

$t' = \gamma\left(t - \beta\frac{x}{c}\right) = 1.25\left(4.0 \cdot 10^{-6} - 0.6 \cdot \frac{3}{3 \cdot 10^5}\right)$

$\boxed{t' = -2.5\,\mu s}$