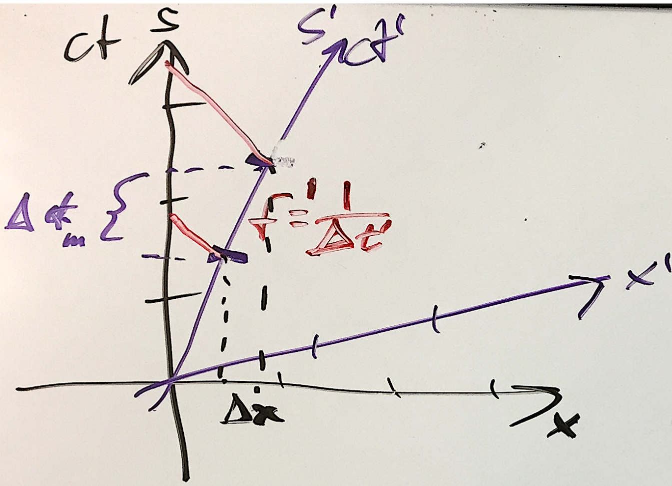


$$\lambda \cdot f = c$$

$$\Delta ct = \gamma \cdot \left(\Delta ct' + \cancel{\frac{v}{c}\Delta x'}\right)$$

$$+ \Delta x$$

$$\Delta x = \frac{v}{c} \cdot \Delta ct$$

$$\Delta ct = \gamma(\Delta ct') + \frac{v}{c}\gamma \Delta ct'$$

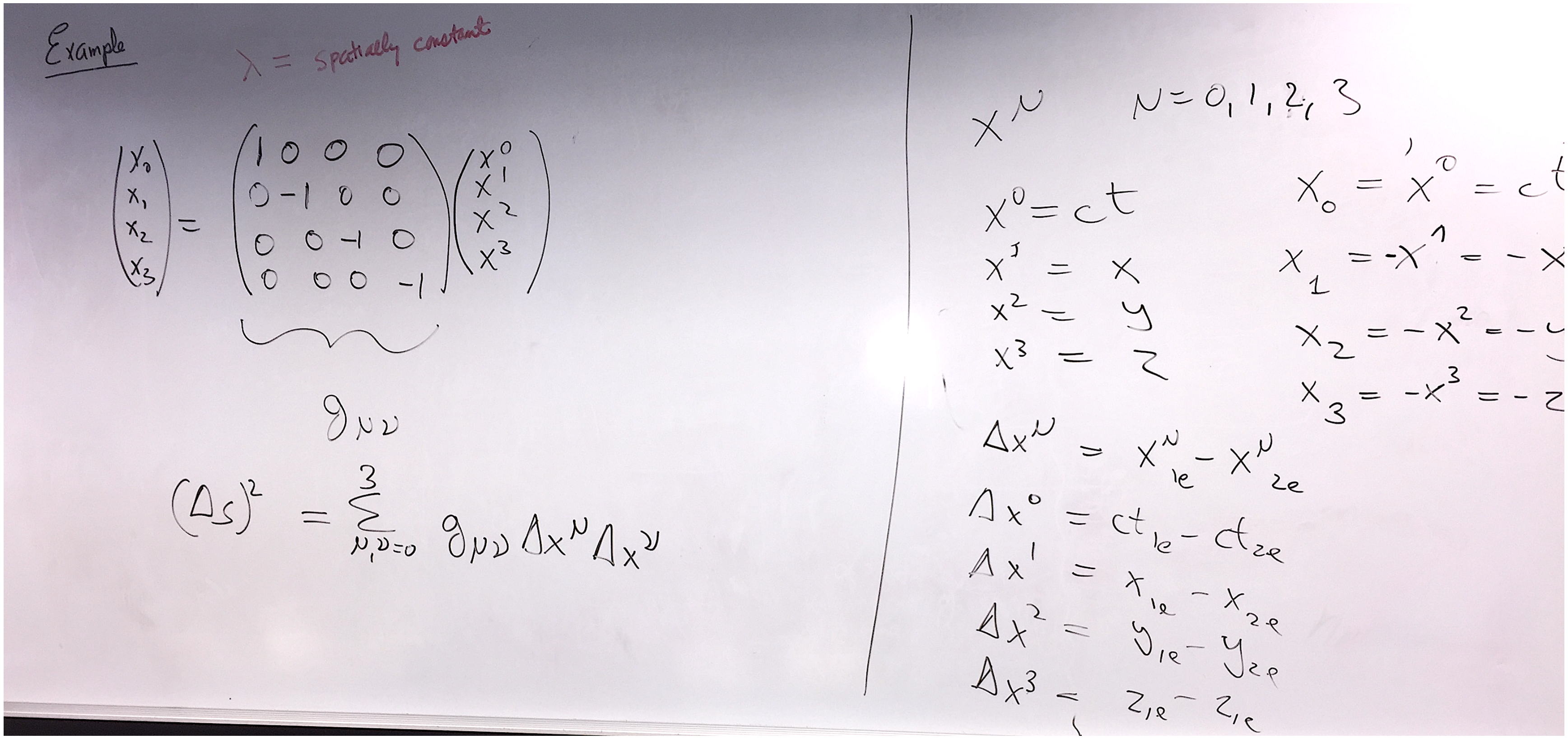
$$= \left(1 + \frac{v}{c}\right)\gamma \Delta ct'$$

$$\frac{c}{f} = \gamma\left(1 + \frac{v}{c}\right)\frac{c}{f'}$$

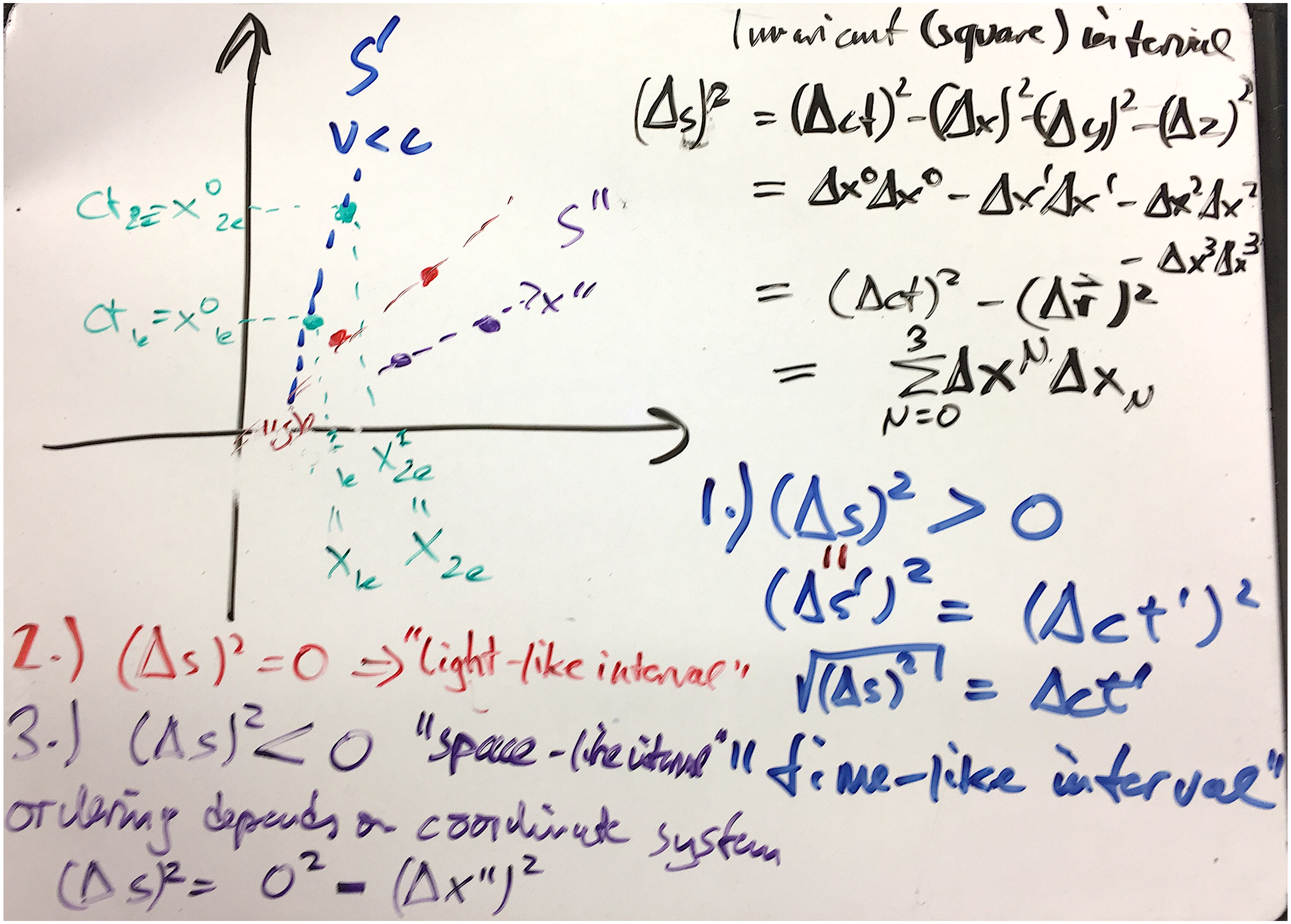
$$\lambda = \frac{1 + \frac{v}{c}}{\sqrt{1 - v^2/c^2}}\lambda' > \lambda'$$

$$= (1+z)\lambda'$$

Doppler Shift



Formal rules for "scalar product" in 4-dimensional space-time. Metric *g*.



Invariant intervals