


Fun with 2D Glasses

and a Sprinkling of Special Relativity

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How to make “2D glasses”

- Take two pairs of 3D glasses.
- Cut them each in half.
- Join together halves of the same colour.
- The result is a pair of binocular colour filters, 1 for red, one for cyan.
- I call these “2D glasses” because if you view a 3D picture though them it will look flat.
- The same technique can be used with polarised glasses if you don’t like watching films in 3D! (Cardboard frames required).

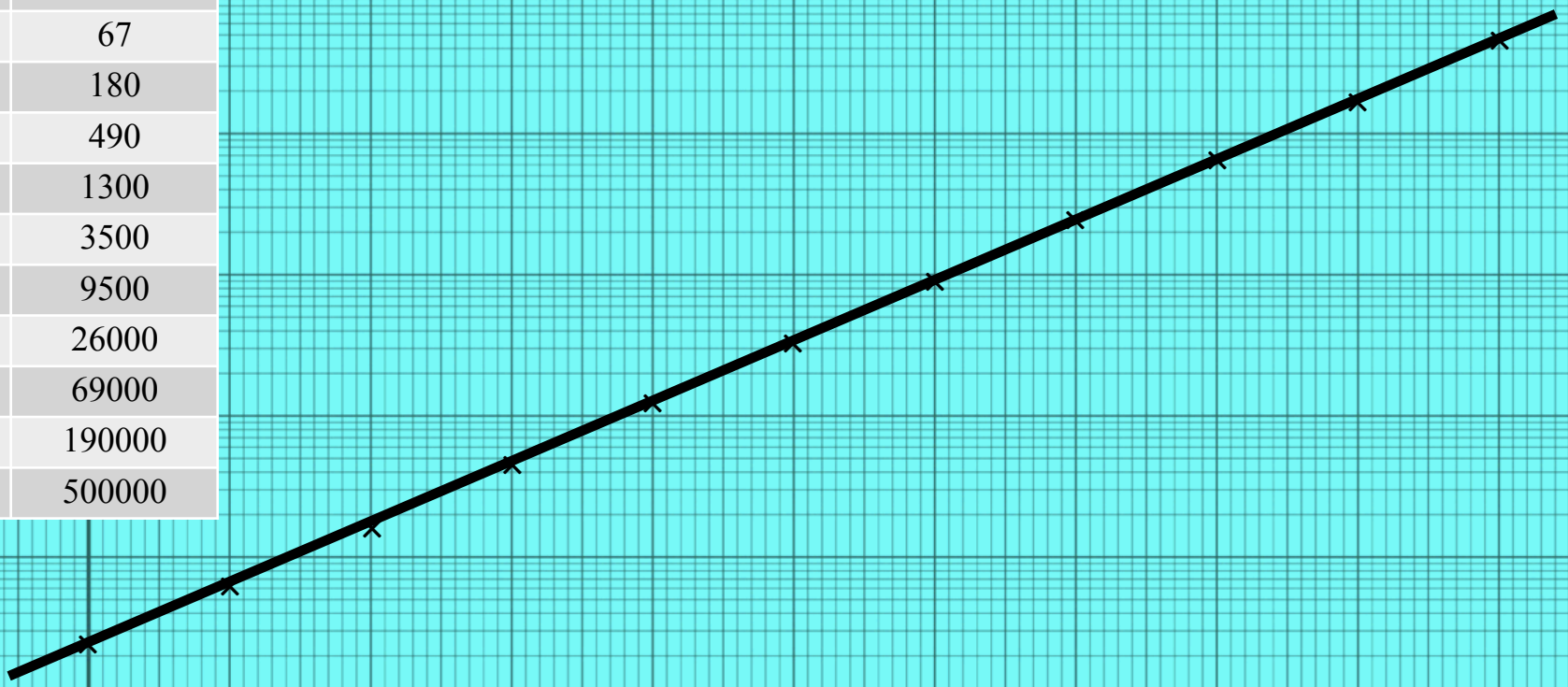
What you can do with them

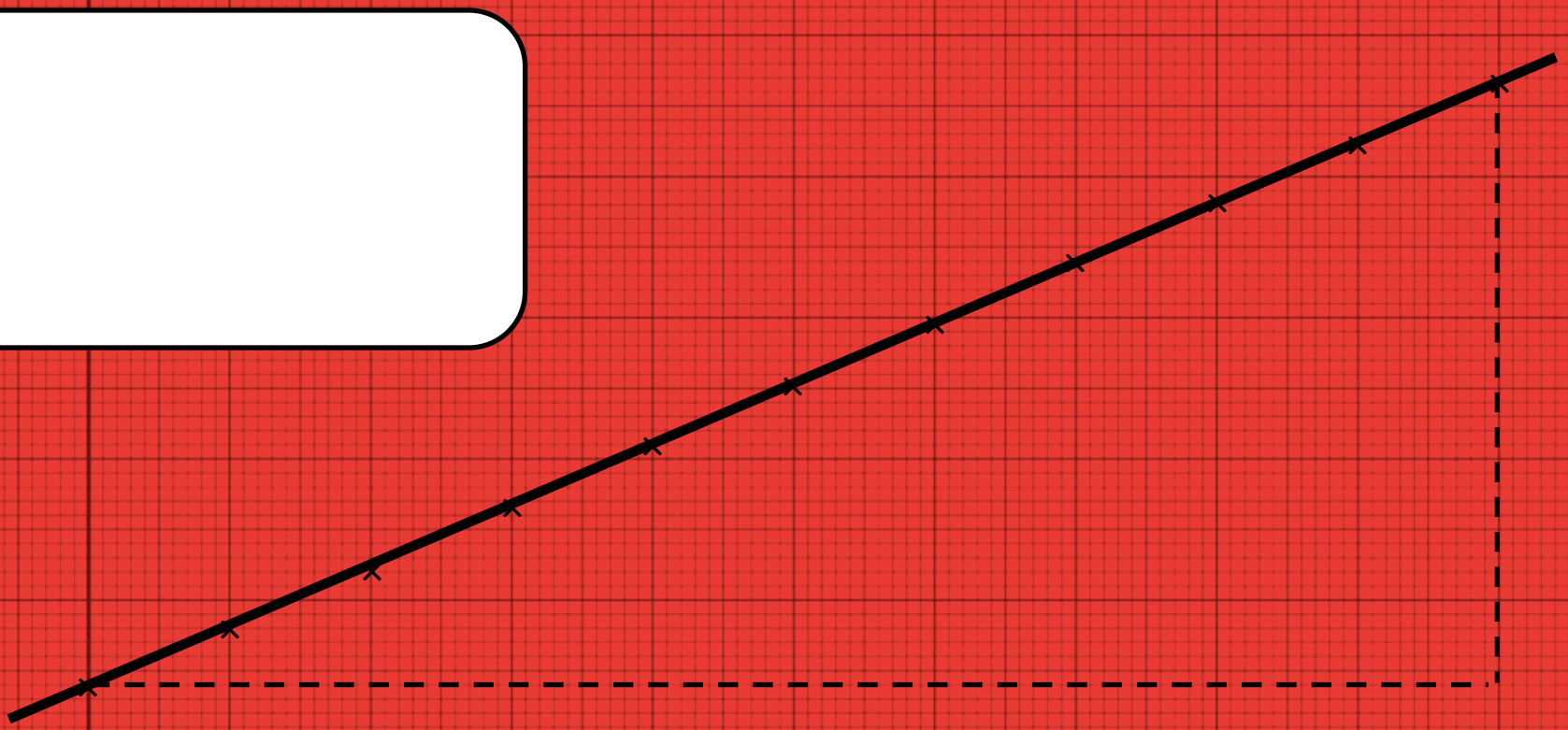
- Many situations can be understood better by viewing them from more than one point of view.
- 2D glasses allow you to overlay two different scales/coordinate systems, but see just one or the other at any one time.
- Any information displayed will be visible from both points of view, allowing easy translation between the two, and assurance of logical consistency.

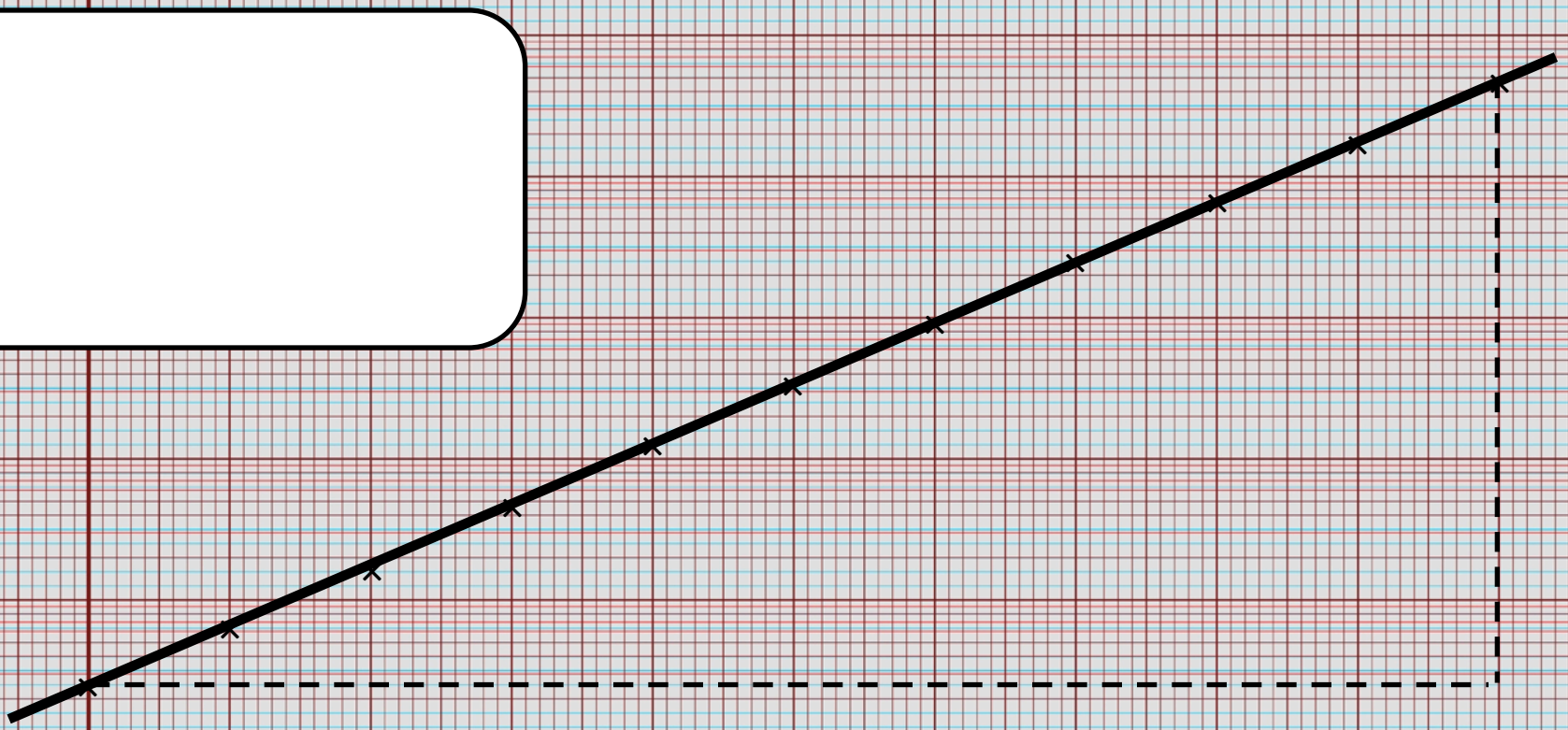
Example I: Exponential Variation

Test whether data fits the exponential form and establish the values of both and .

x	*y*
0	25
1	67
2	180
3	490
4	1300
5	3500
6	9500
7	26000
8	69000
9	190000
10	500000







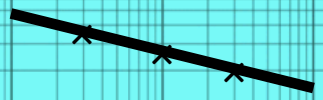
Example II: Power Laws

Test whether data fits the .

length ≈ 7 x 300 km
≈ 2100 km

length ≈ 28 x 100 km
≈ 2800 km

length ≈ 136 x 30 km
≈ 3780 km



This corresponds to a fractional dimension of

$$d =$$

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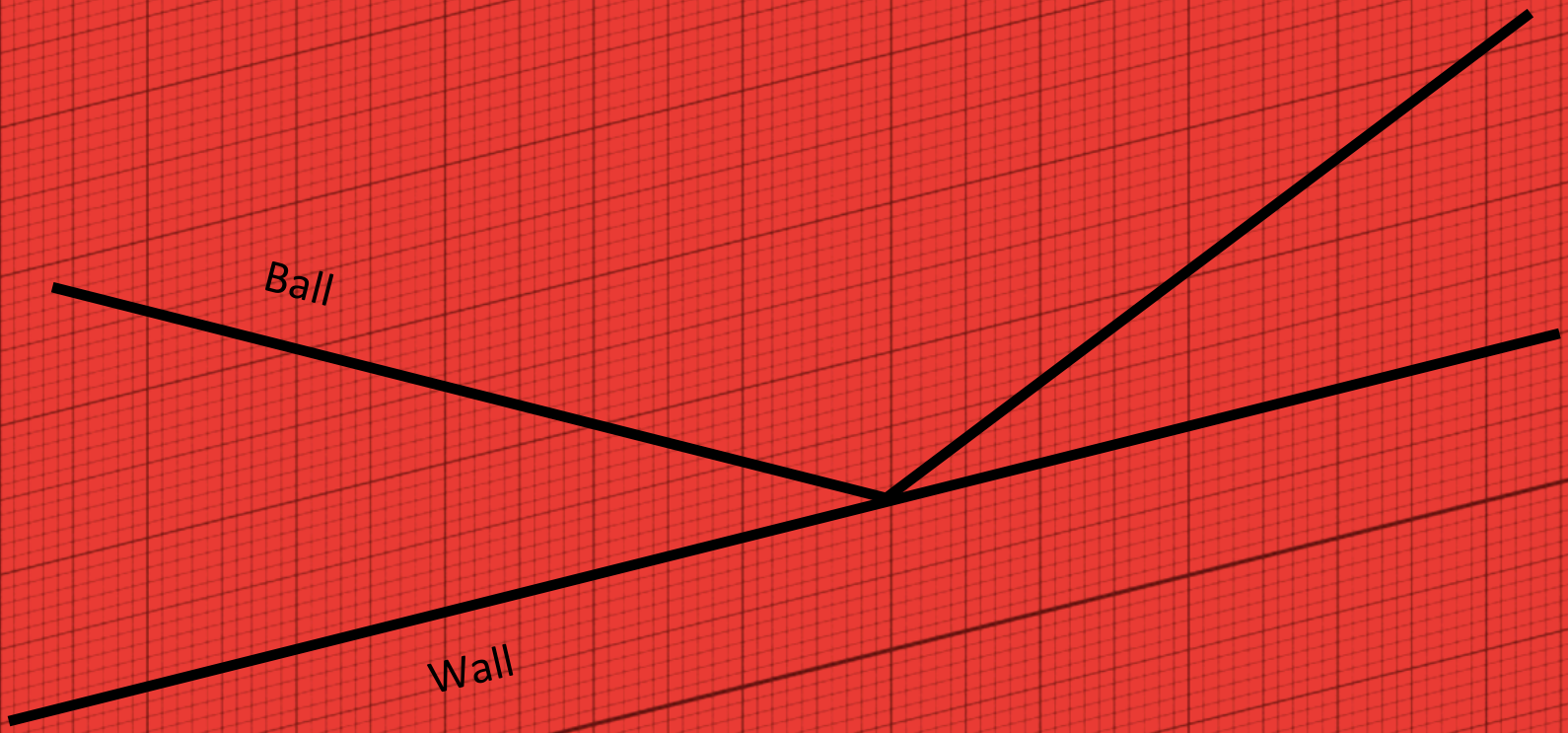
$$d =$$

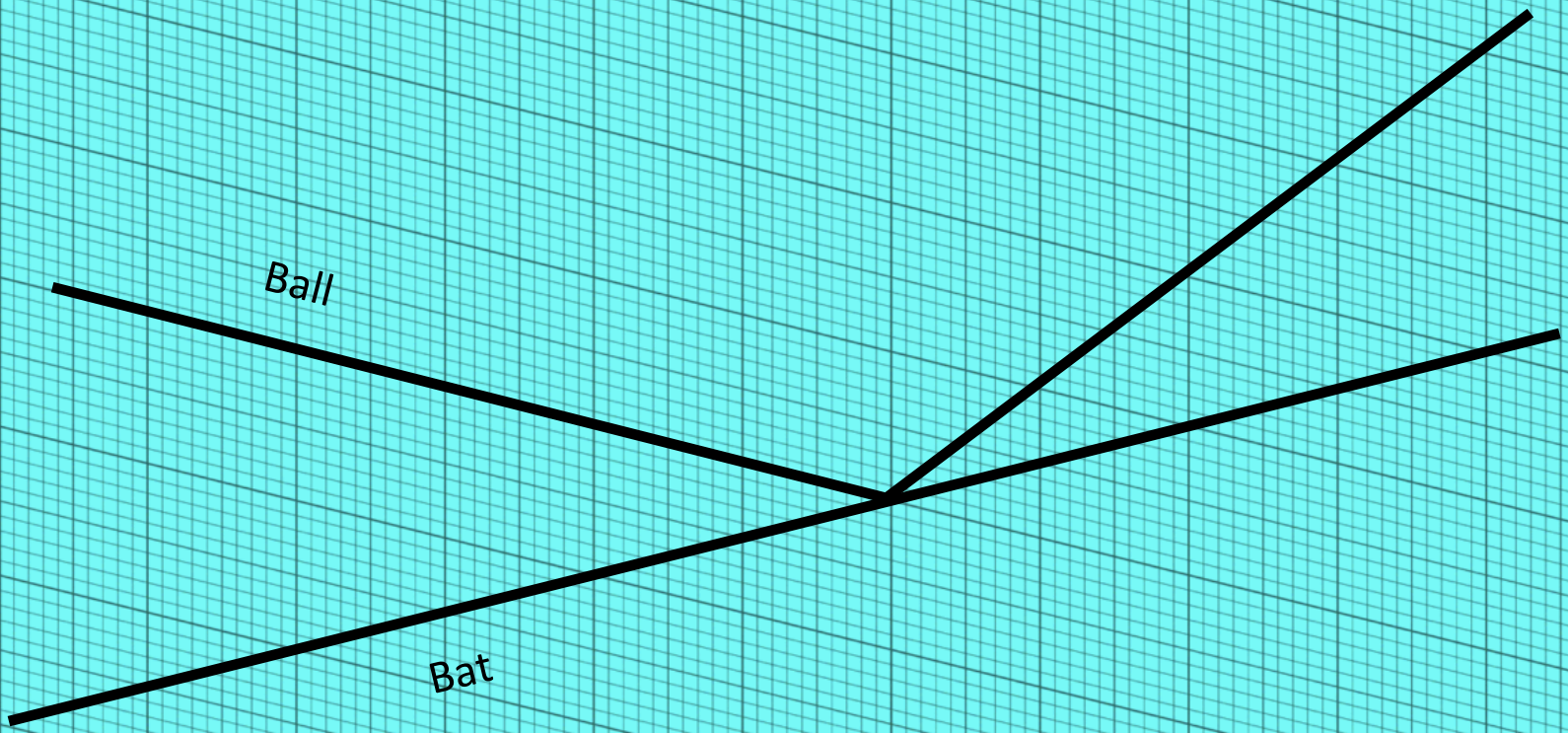
Example III: Galilean Relativity

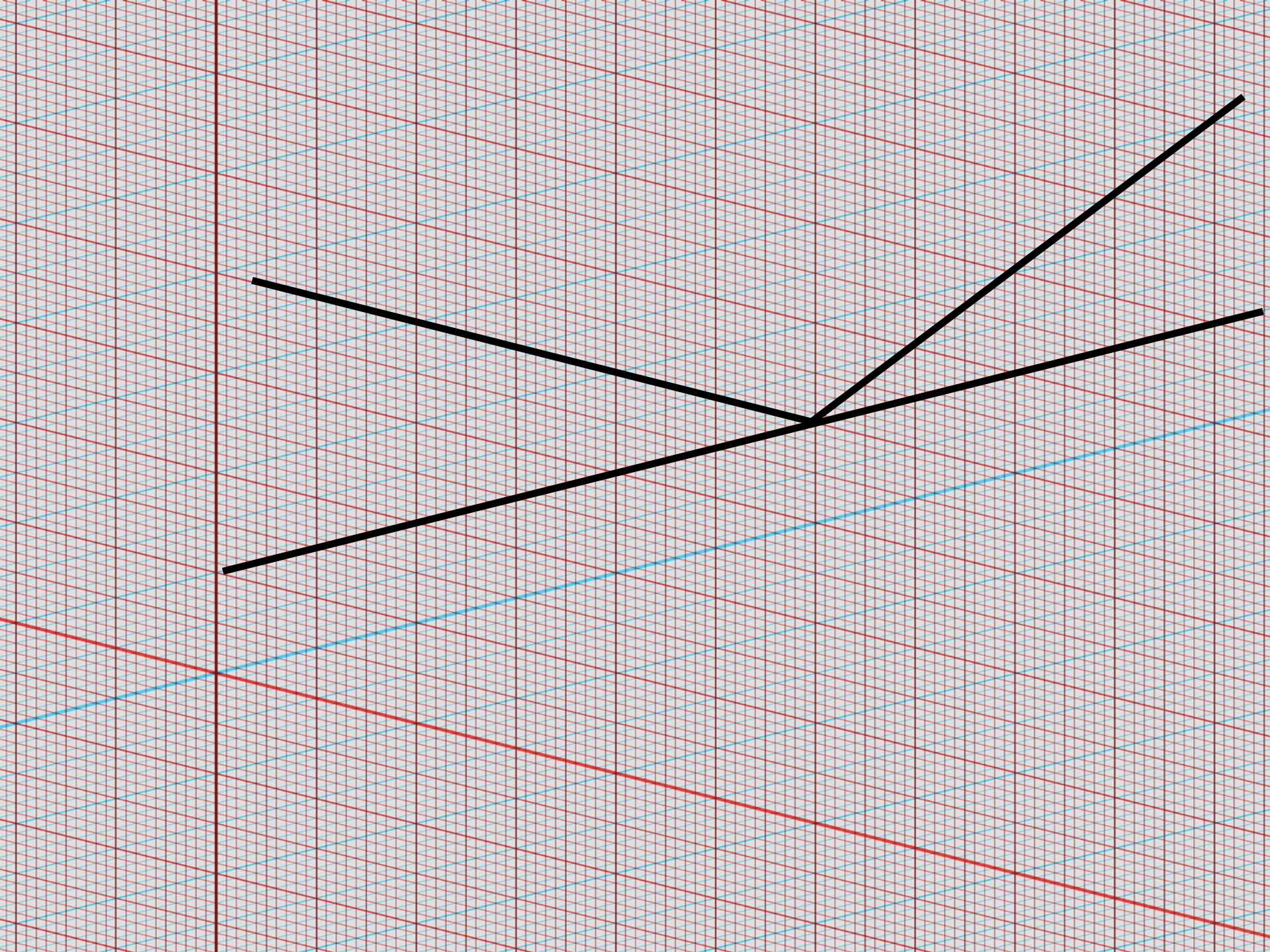
- Galilean relativity is the principle that Newton's Laws apply in all inertial reference frames.

- Observers moving at different velocities will have different, but consistent, views of the universe.

- The link between the two views is described by the Galilean Transformation:


Ball
Wall


Ball
Bat



Example IV: Special Relativity

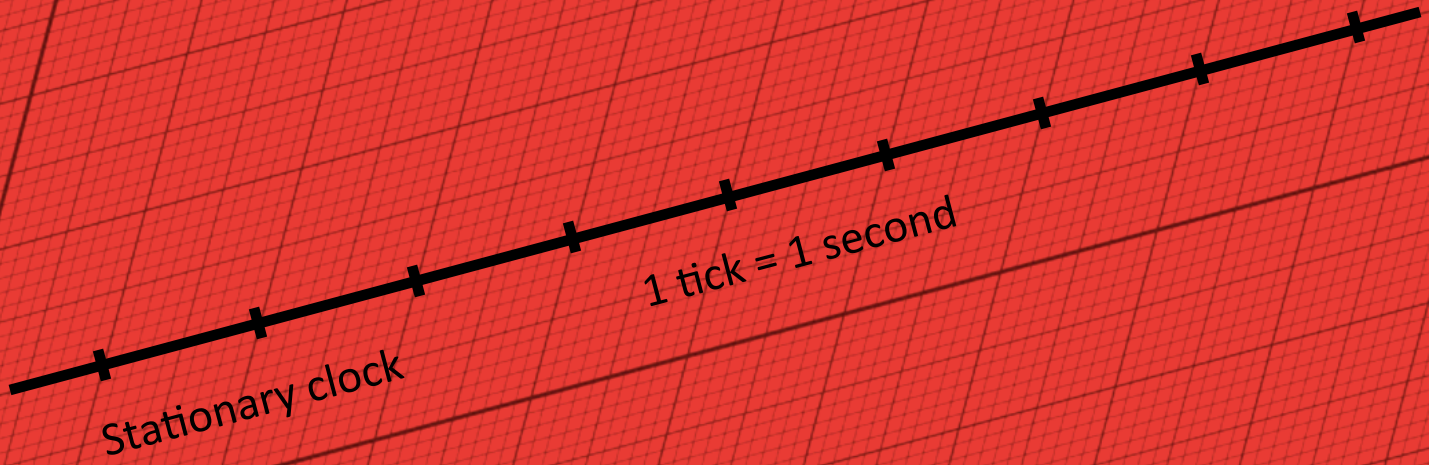
- Special relativity is the principle that the laws of physics apply in all inertial reference frames.

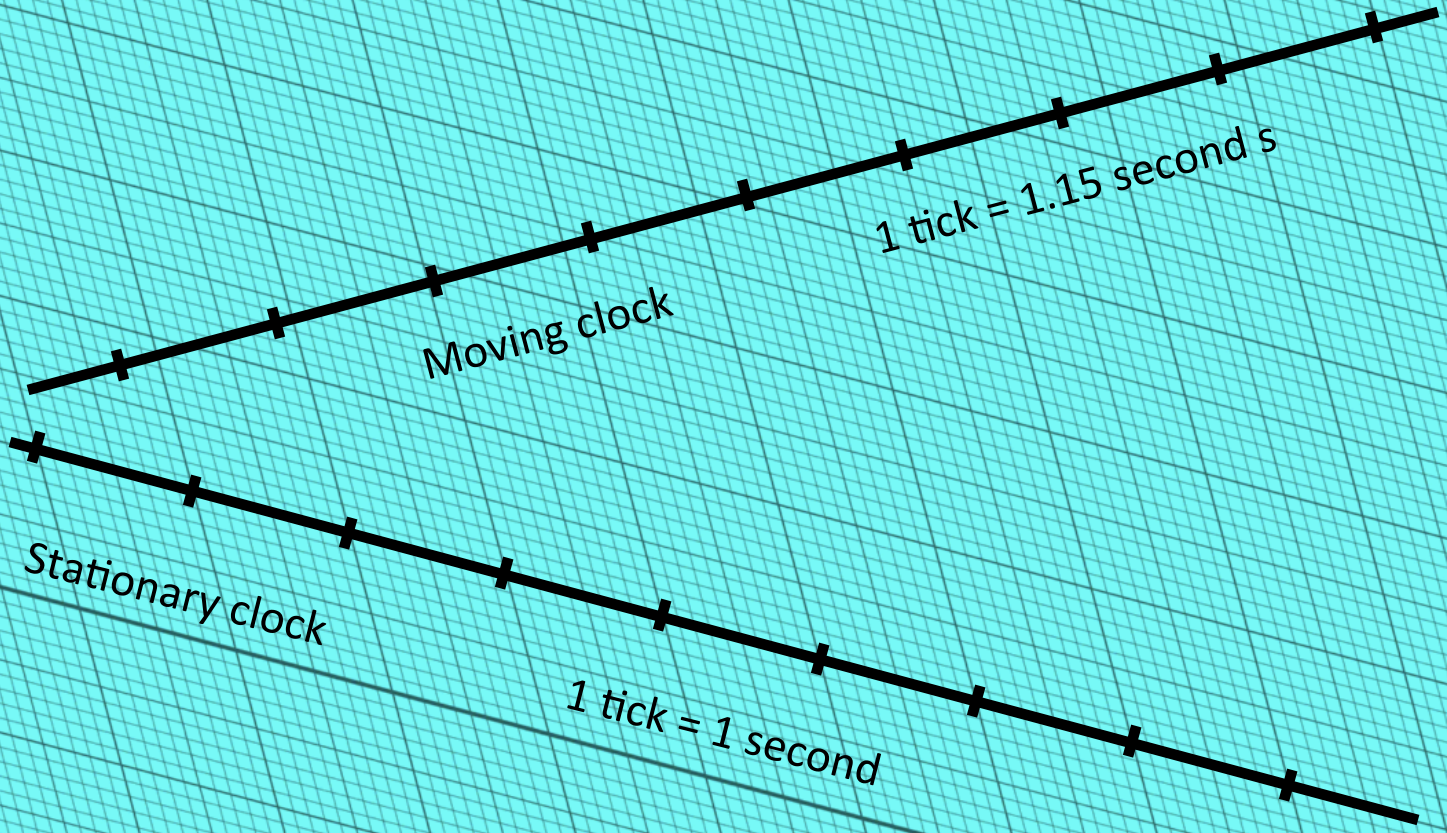
- Observers moving at different velocities will have different, but consistent, views of the universe.

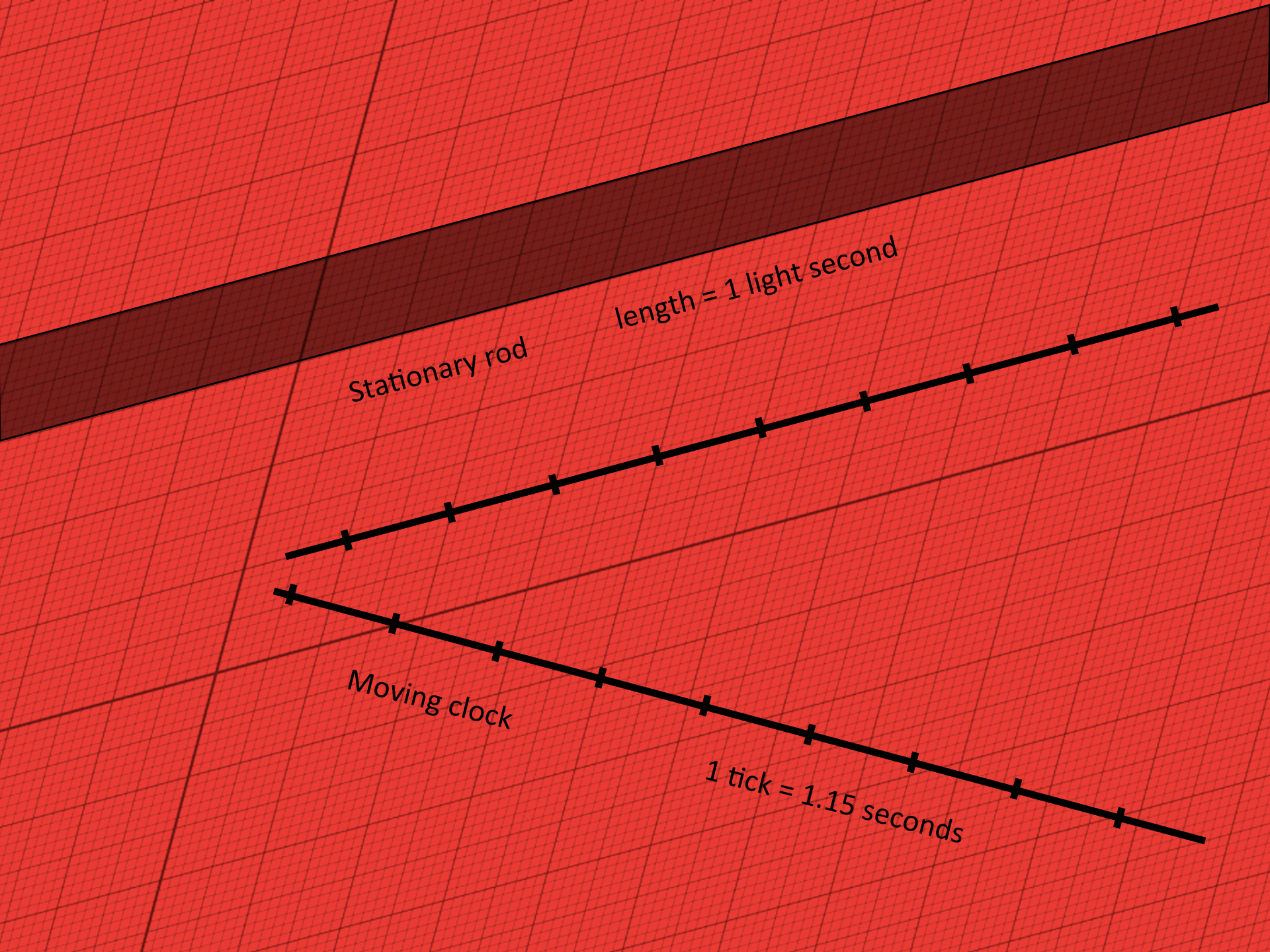
- The link between the two views is described by the Lorentz Transformation:

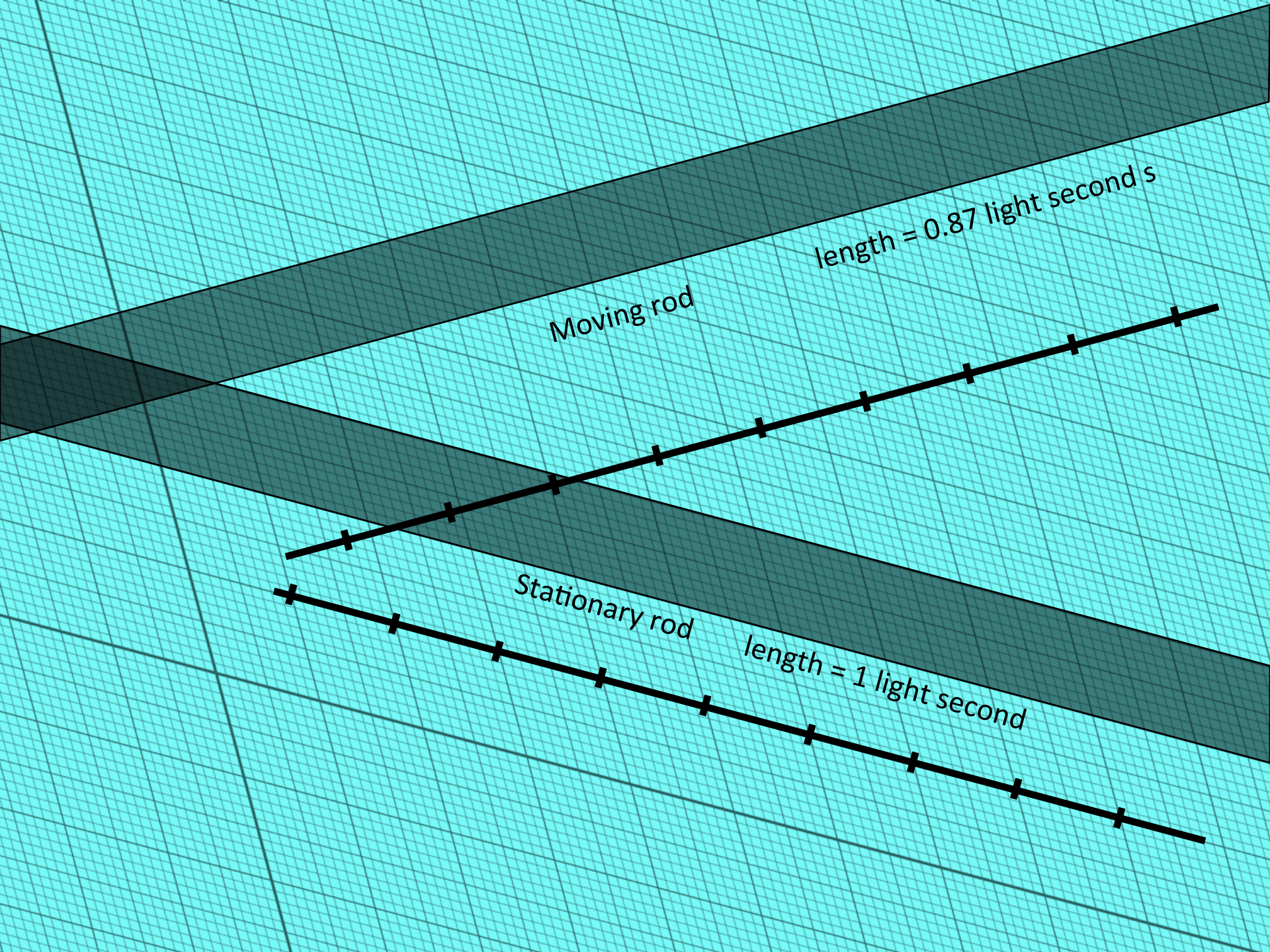
where

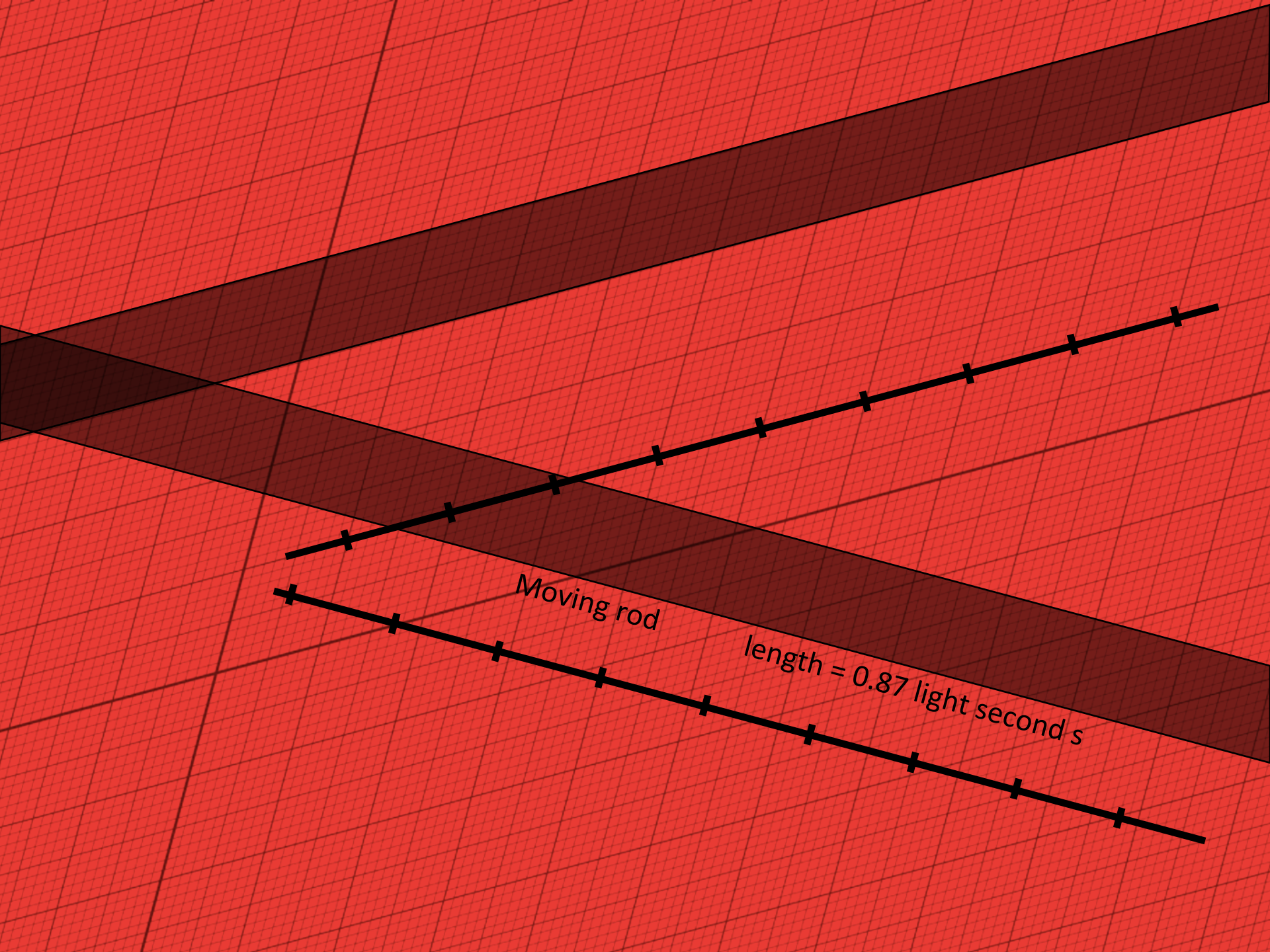
- If then and .


Stationary clock
1 tick = 1 second


1 tick = 1.15 second s
Moving clock
Stationary clock
1 tick = 1 second


Stationary rod
length = 1 light second
Moving clock
1 tick = 1.15 seconds


Moving rod
length = 0.87 light second s
Stationary rod
length = 1 light second


Moving rod
length = 0.87 light second s