2 Dimensions More Hyperbolic Model

definitions & theorems from Origametry by Daniel Heath.

While working in a group make sure you:

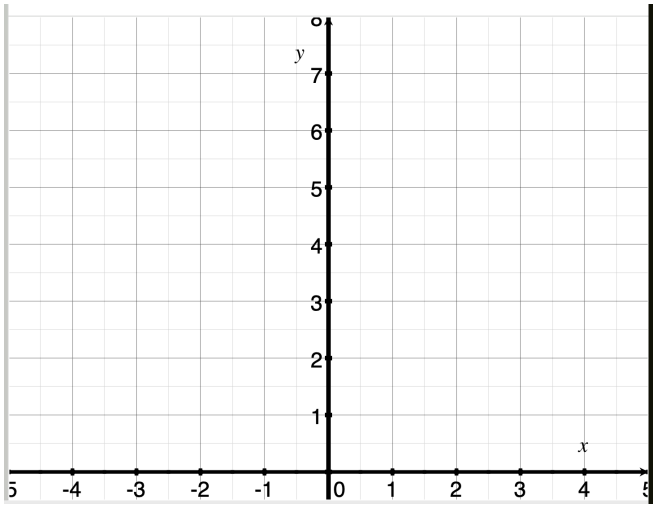
- Expect to make mistakes but be sure to reflect/learn from them!
- Are civil and are aware of your impact on others.
- Assume and engage with the strongest argument while assuming best intent.

Recall in the half plane model:

- a *point* will be an ordered pair of real numbers (x, y) with $y > 0$.
- a *line* will be either
  1. a vertical semi-line (at h is $\{(h, y)|y \in \mathbb{R}^+\}$), or
  2. an open semi-circle (with parameters h and r, $\{(x, y)|(x-h)^2+y^2 = r^2, r, y > 0\}$)

1. Sketch the line passing through $(3, 6)$ and $(3, 2)$ and find a parameterization.

2. Sketch the line passing through $(-2, 5)$ and $(2, 5)$ and find a parameterization.



3. Sketch the line passing through $(-2, 5)$ and $(2, 3)$ and find a parameterization.

Postulate Ruler for Half Plane Model. *Given* $(x(s), y(s))$ *for* $a \leq s \leq b$ *is a parameterization of a segment between points* $A = (x(a), y(a))$ *and* $B = (x(b), y(b))$, *the distance between* A *and* B *can be computed as:* $\left| \int_a^b \frac{\sqrt{dx^2 + dy^2}}{y} \, ds \right|$.

4. Find the distance between $(3, 6)$ and $(3, 2)$. (Note these are the same points from (1).)

Some Hyperbolic Trigonometric Definitions

$$\sinh(t) = \frac{e^t - e^{-t}}{2} \qquad \cosh(t) = \frac{e^t + e^{-t}}{2} \qquad \tanh(t) = \frac{\sinh(t)}{\cosh(t)} \qquad \operatorname{sech}(t) = \frac{1}{\cosh(t)}$$

5. To help with the distance computations we'll need a few derivatives handy:

   (a) Find $\frac{d}{dt}(\tanh(t))$

   (b) Find $\frac{d}{dt}(\operatorname{sech}(t))$