Arcball

* intuitive rotation with a mouse

→ translate
  ↠ move the camera position in the scene
  in camera up/down and left/right direction

→ scale
  ↠ move camera closer or further from scene

→ rotate
  ↠ harder
  use "arcball"
  imagine a ball surrounding the scene

* click → mouse grabs onto sphere surface
* drag → mouse pulls sphere with it
* rotations are directly from click point to current point
Case I
\[(x, y) \text{ in unit circle}\]
\[x^2 + y^2 = 1\]
\[\exists (x', y', z') = (x, y, \sqrt{1 - x^2 - y^2}) \Rightarrow \text{point on sphere}\]

Case II
\[(x, y) \text{ outside unit circle}\]
Find closest point to \((x, y, 0)\)
\[\left(\frac{x}{\sqrt{x^2 + y^2}}, \frac{y}{\sqrt{x^2 + y^2}}, 0\right) \Rightarrow \text{point on sphere}\]

Hope two points on unit sphere \(u, v\), \(u, v\) \(\|u\| = \|v\| = 1\)
Find rotation \(R\) so \(Ru = v\)
\(w = u \times v \Rightarrow \) rotation axis

\[Ru = v\]
\[Rw = w\]
\[R(u \times w) = v \times w\]

\[R(u, w, u \times w) = (v, w, v \times w)\]

\[m\]

\[N\]

\[R = NM^{-1}\]