1. All observers see sunrise 12° north of east.

2. Retrograde motion: planets sometimes reverse their direction of travel relative to the stars. Explained by epicycle: planet moves on circle that orbits earth.

Example:

- May
- July
- Sept
3. Observe Venus when it has maximum apparent distance from the sun:

\[ \theta = \text{measured} \]

\[ \text{right triangle can be solved for } R_{\text{Venus}}/R_{\text{Earth}} \]

4. The very precise observations of Tycho Brahe could not be fit by Copernicus' epicycles.

5. \( \nu; = 0 \) \[ \Rightarrow \Delta y = -\frac{1}{2} g \Delta t^2 \quad (\text{const accel}) \]

\[ g = -\frac{2 \Delta y}{\Delta t^2} = 6 \text{ m/s}^2 \]

6. \( \text{sys} = \text{person} \)

\[ \vec{F}_{\text{person, boat vert}} \quad \vec{F}_{\text{person, boat horiz}} \quad \vec{F}_{\text{person, grav}} \]

\[ \rightarrow \text{direction person is moving} \]
Notation: \( F_{A,B} = \text{force on } A \text{ due to } B \)

\[ N_3 \Rightarrow F_{\text{person, boat vert}} = F_{\text{boat, person vert}} \]

\[ F_{\text{person, boat horiz}} = F_{\text{boat, person vert}} \]