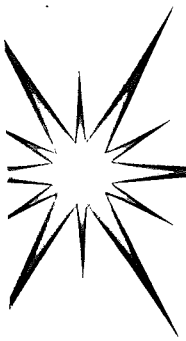


Naked Eye Astronomy

★ WHAT IS THERE?

- ✧ Stars –
  - ➢ ~9,000 fixed stars

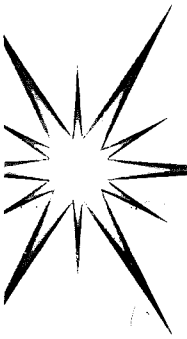
{ names, ---- magnitudes no parallax

- ✧ Milky Way
- ✧ Planets –
  - ➢ Mercury, Venus, Earth, Mars, Jupiter, Saturn
- ✧ Sun
- ✧ Moon
- ✧ Comets
- ✧ Shooting Stars (Meteorites)

Naked Eye Astronomy

★ WHAT IS THERE?

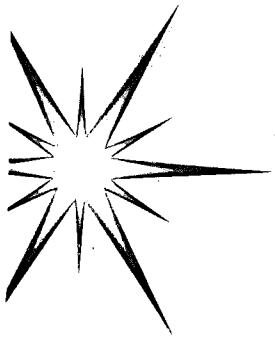
- ✧ Nebulae
  - ➢ Orion [local ≡ galactic] {1920s}
  - ➢ Andromeda [distant = extragalactic]



Naked Eye Astronomy

★ WHAT MAY WE LEARN?

- ➢ Structure of Solar System
  - ➢ Planets lie in a plane and orbit Sun under influence of Sun's gravity.
- ➢ Milky Way Galaxy is a flattened system.
- ➢ Stars are well separated from each other.
- ➢ Universe is finite not infinite with respect to age and/or space
- ➢ [WHY is sky <u>dark</u> at night?]



Le silence éternel de ces espaces infinis m'effraie.

The eternal silence of these infinite spaces terrifies me.

Blaise Pascal [1623–1662] on learning of Galileo's calculation of the average distance between stars.

HOW FAR CAN WE SEE?

DEPENDS ON ....

— TELESCOPE etc.

— LUMINOSITY OF OBJECT

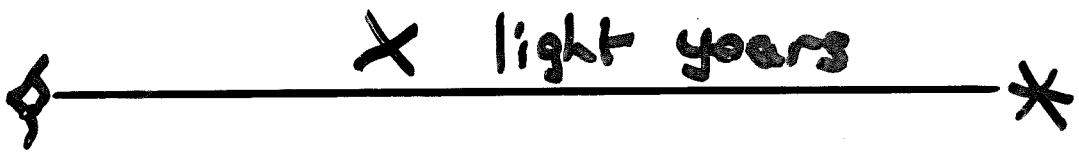
— AGE & STRUCTURE OF UNIVERSE

→ OLBER'S PARADOX
WHY IS SKY DARK AT NIGHT?

LOOK-BACK TIME

LIGHT TRAVELS AT A FINITE SPEED

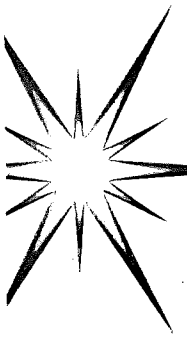
$C = 300,000$ km/s



WE SEE * AS IT WAS

X YEARS AGO

X YEARS IS THE LOOK-BACK TIME

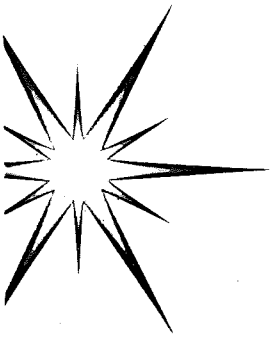


A Model Sky

★ CELESTIAL SPHERE

An imaginary sphere of very large radius surrounding Earth and to which the planets, stars, Sun and Moon seem to be attached.

- ✦ Only a mental crutch
- ✦ The Universe is much larger and much more interesting than this ancient scientific model of the Heavens.



- What fraction of the celestial sphere is visible at any given time?

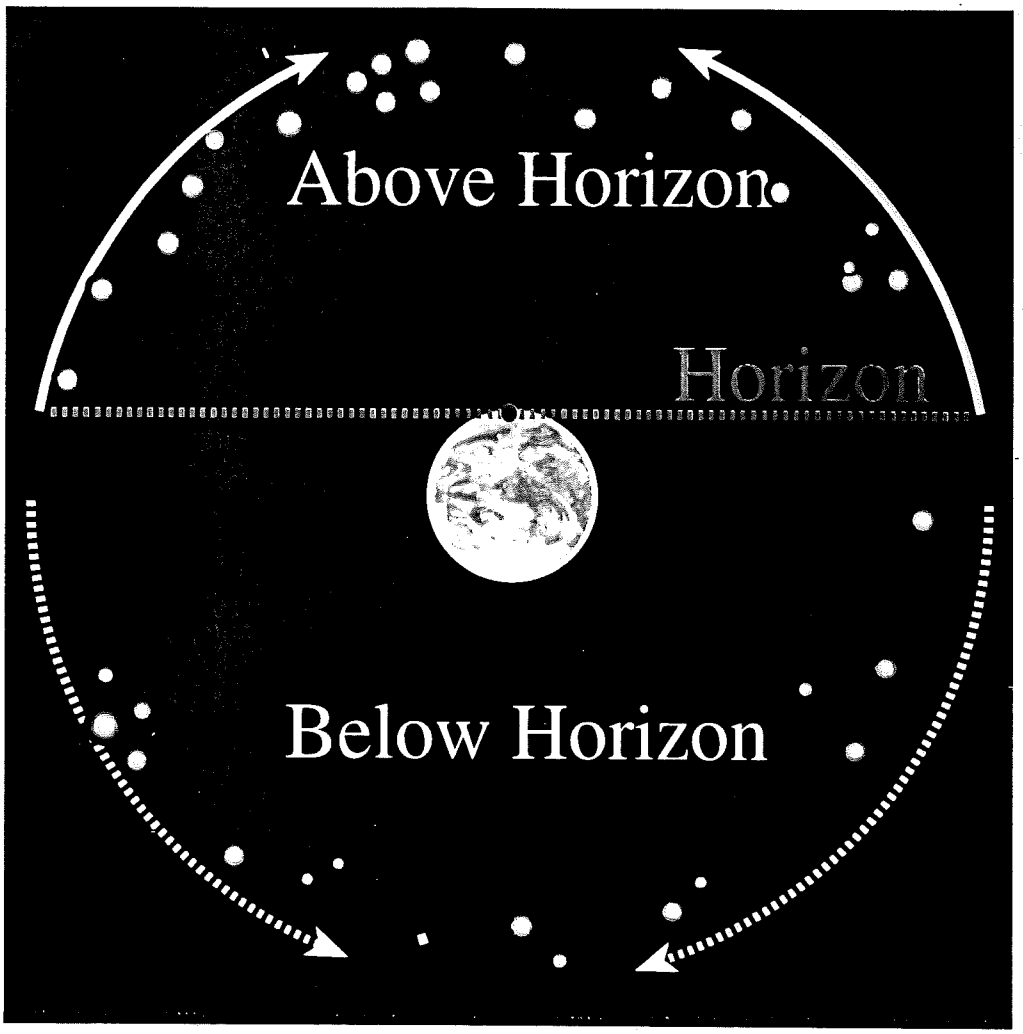
  100% 75% 50% 31% 0%

  Answer = 50%

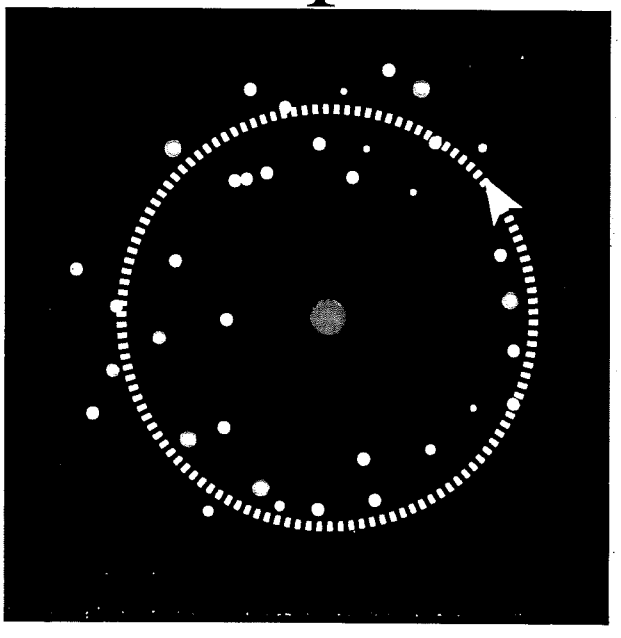
- If you saw all of the celestial sphere at any given time, where would you be?

  Answer = in space and far from Earth and other solid objects

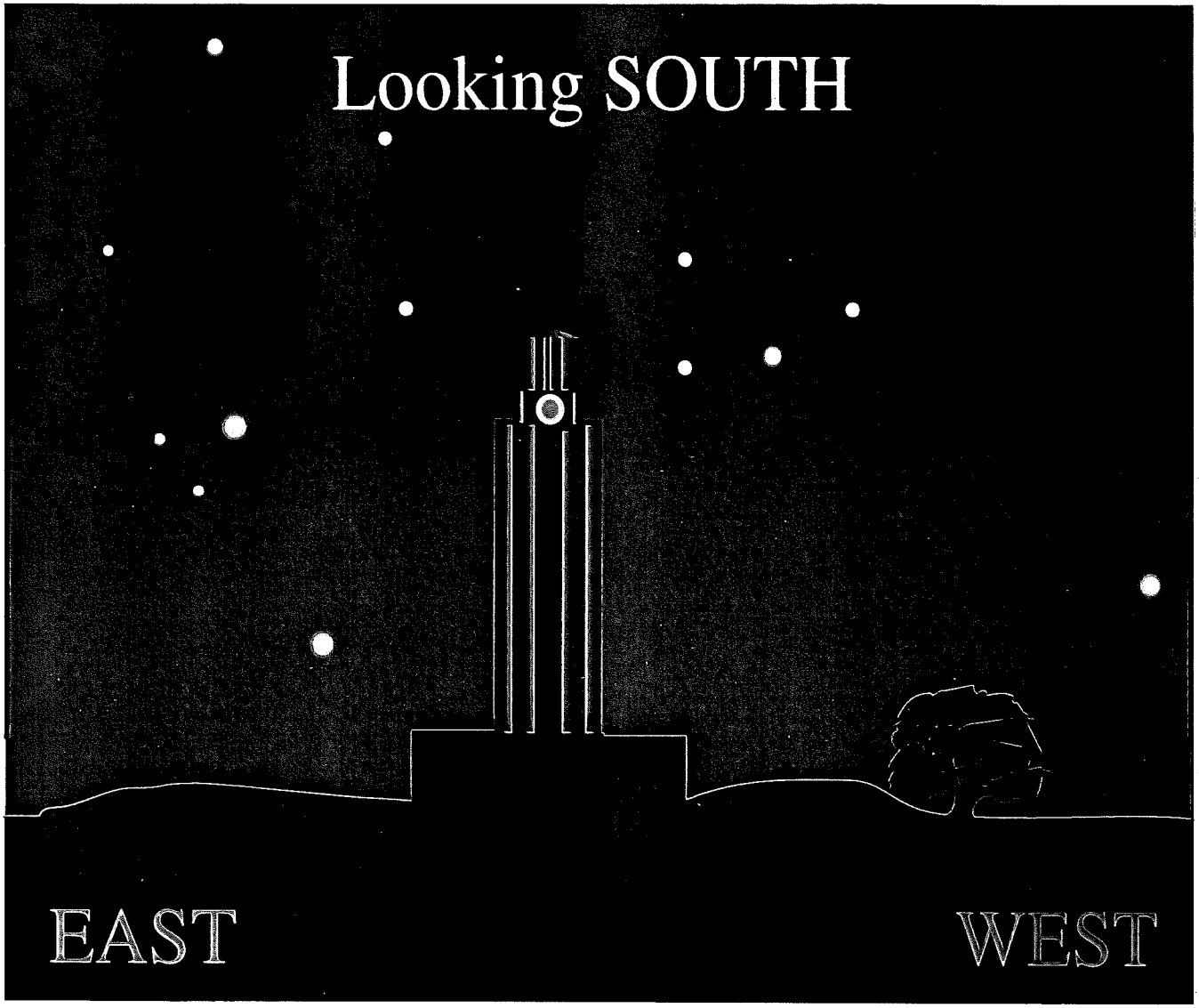
On Earth



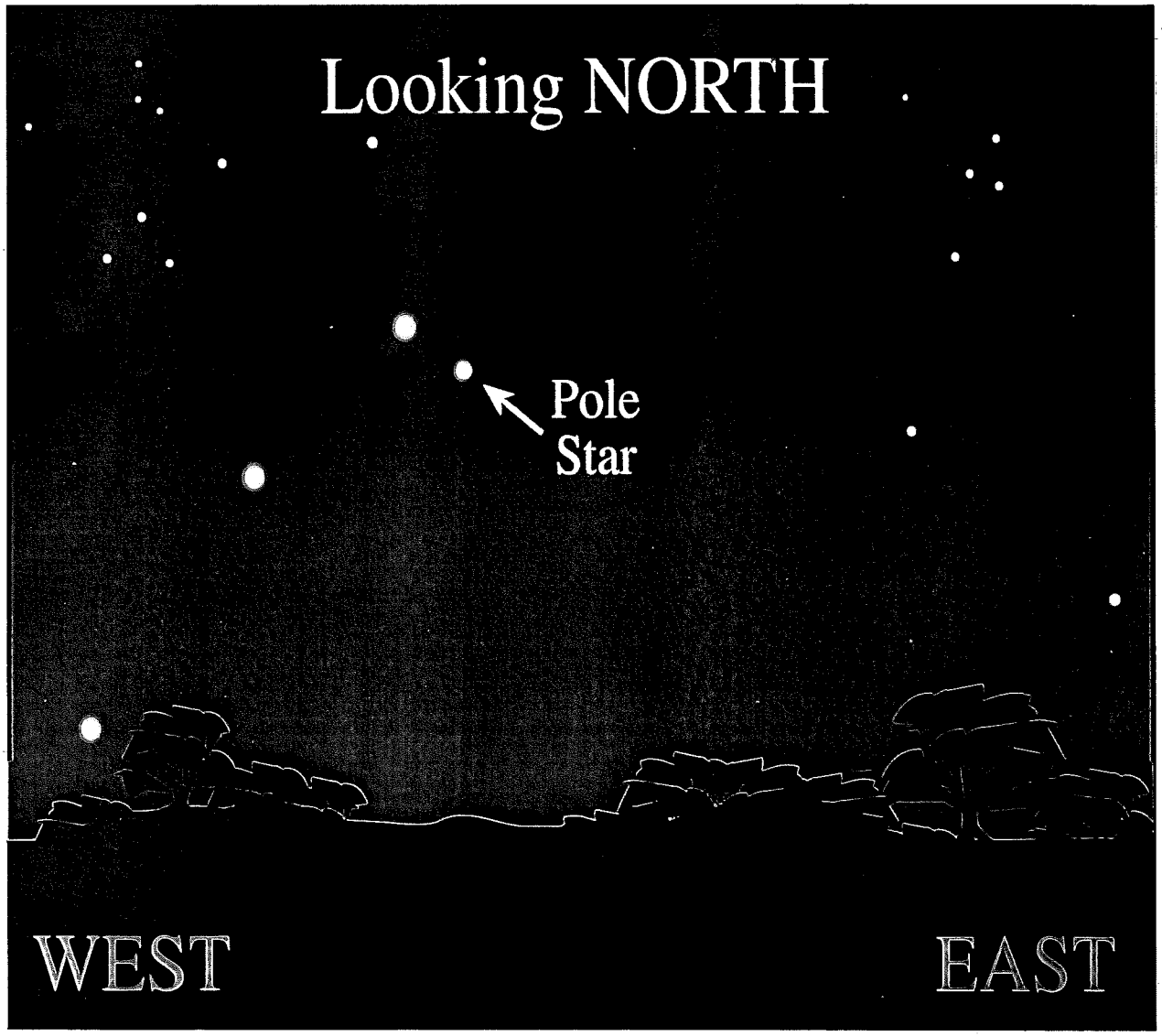
In Space



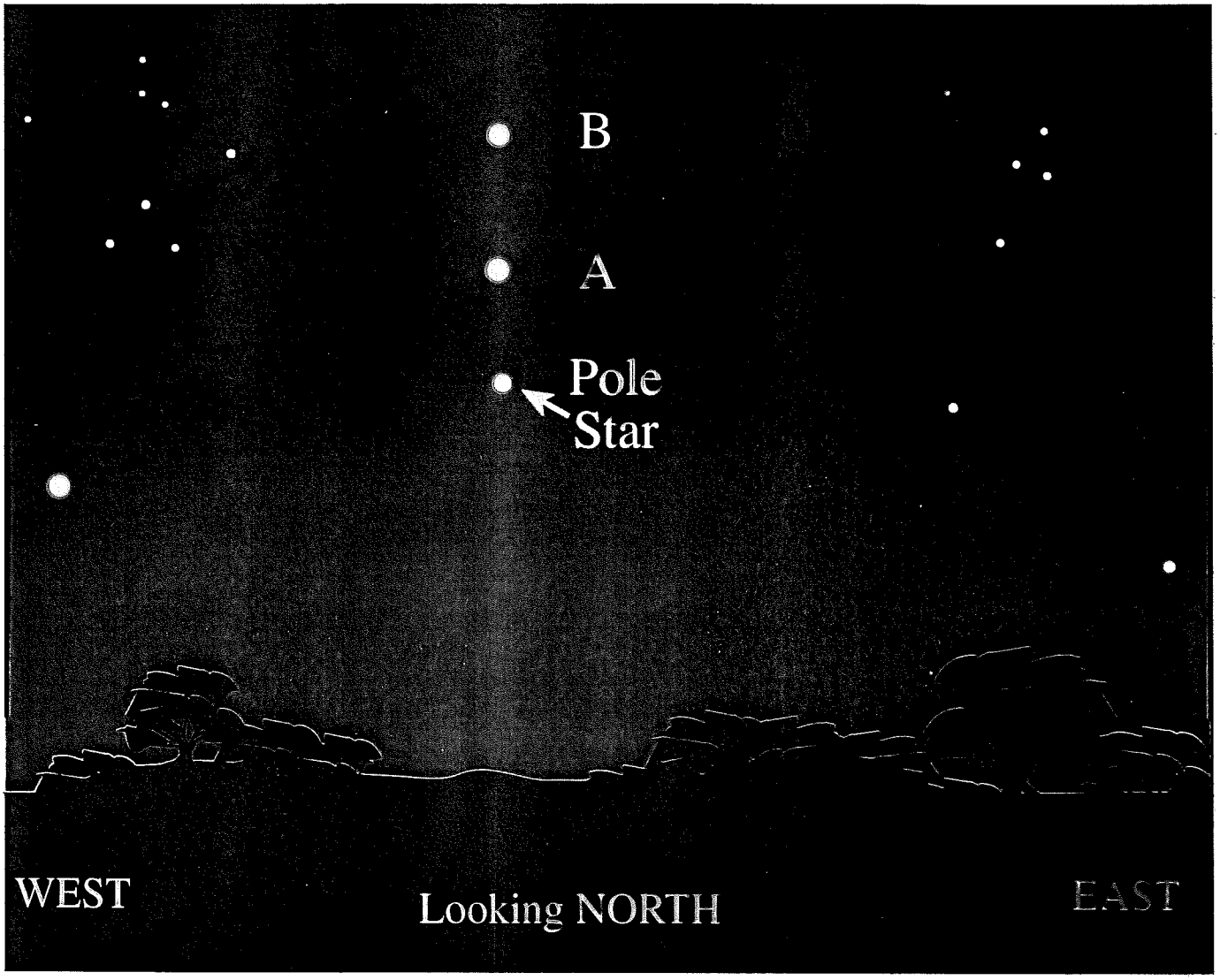
All of Celestial Sphere is visible



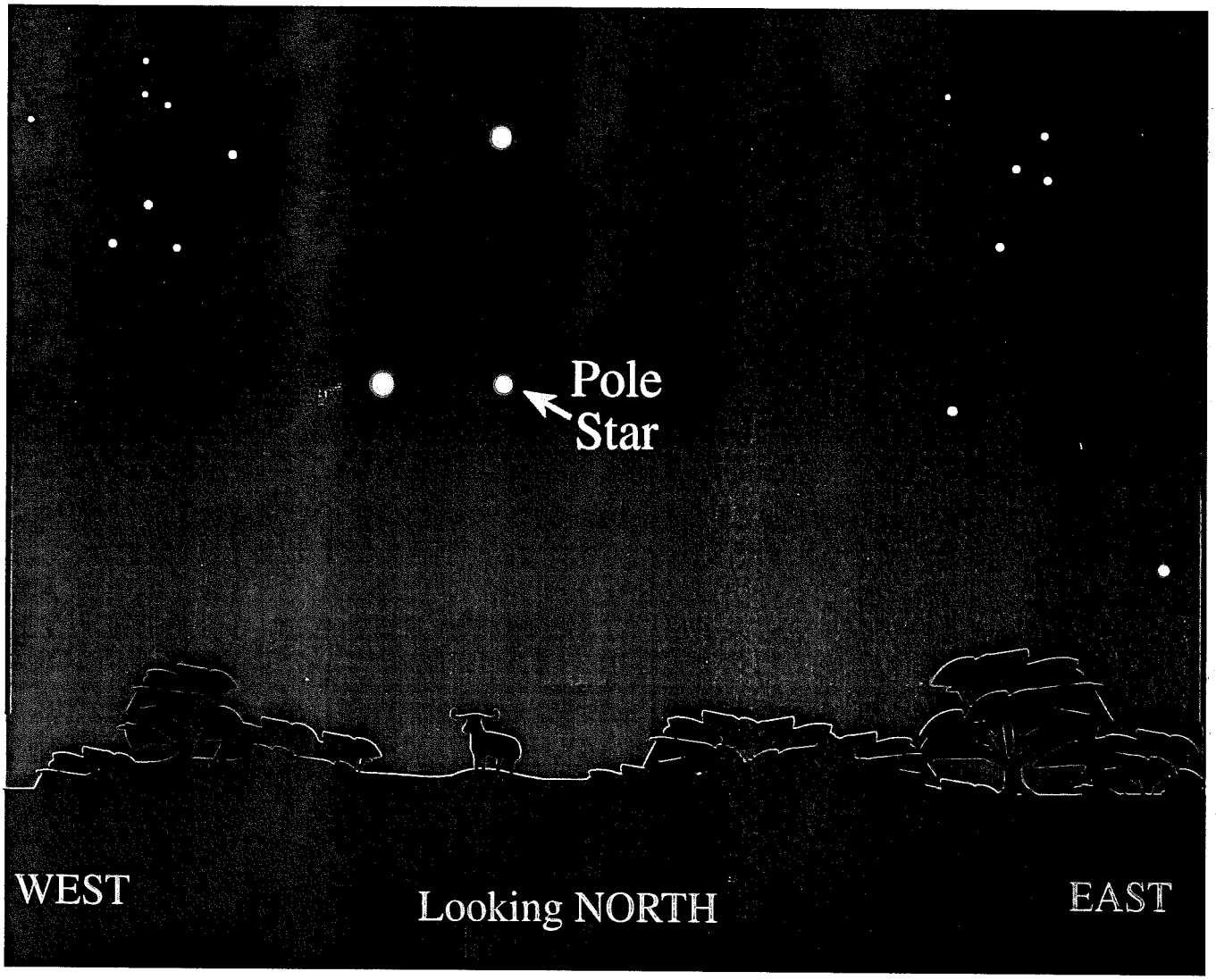
- ★ Stars rise in E and set in W
- ★ Maintain relative positions (fixed Stars)
- ★ Reappear at same position day later (23hrs 56min)



- ★ How do these stars 'move' across the sky?
- ★ What are Circumpolar Stars? Are circumpolar stars the same for a Texan, an Alaskan, and a Brazilian?

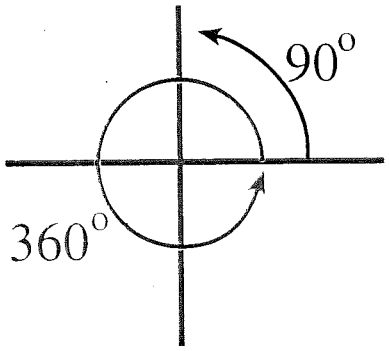


- Which star – A or B – will complete a revolution around the Pole Star first?



- How will this pair appear in ....hours time?

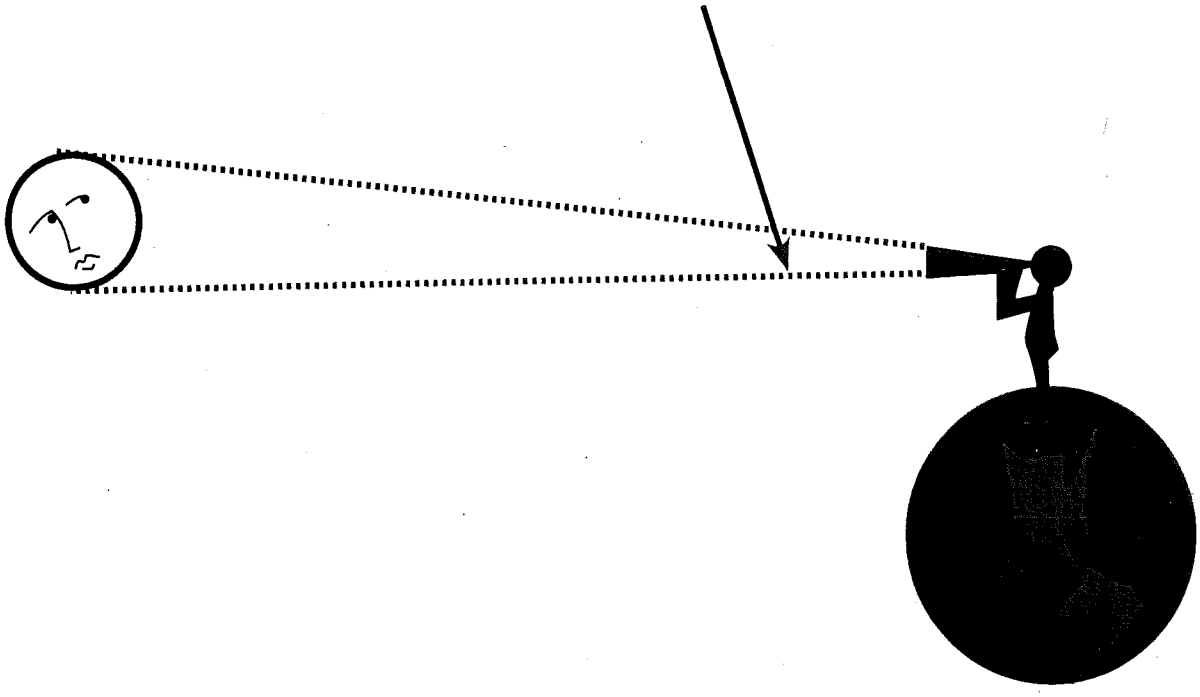
Positions on Celestial Sphere
ANGLES



1° = 60 minutes of arc (')

1' = 60 seconds of arc (")

Full Moon subtends $0^{\circ}.5$

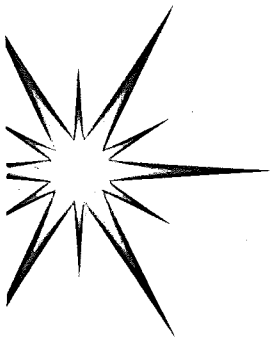


Why do the Fixed Stars move East to West?

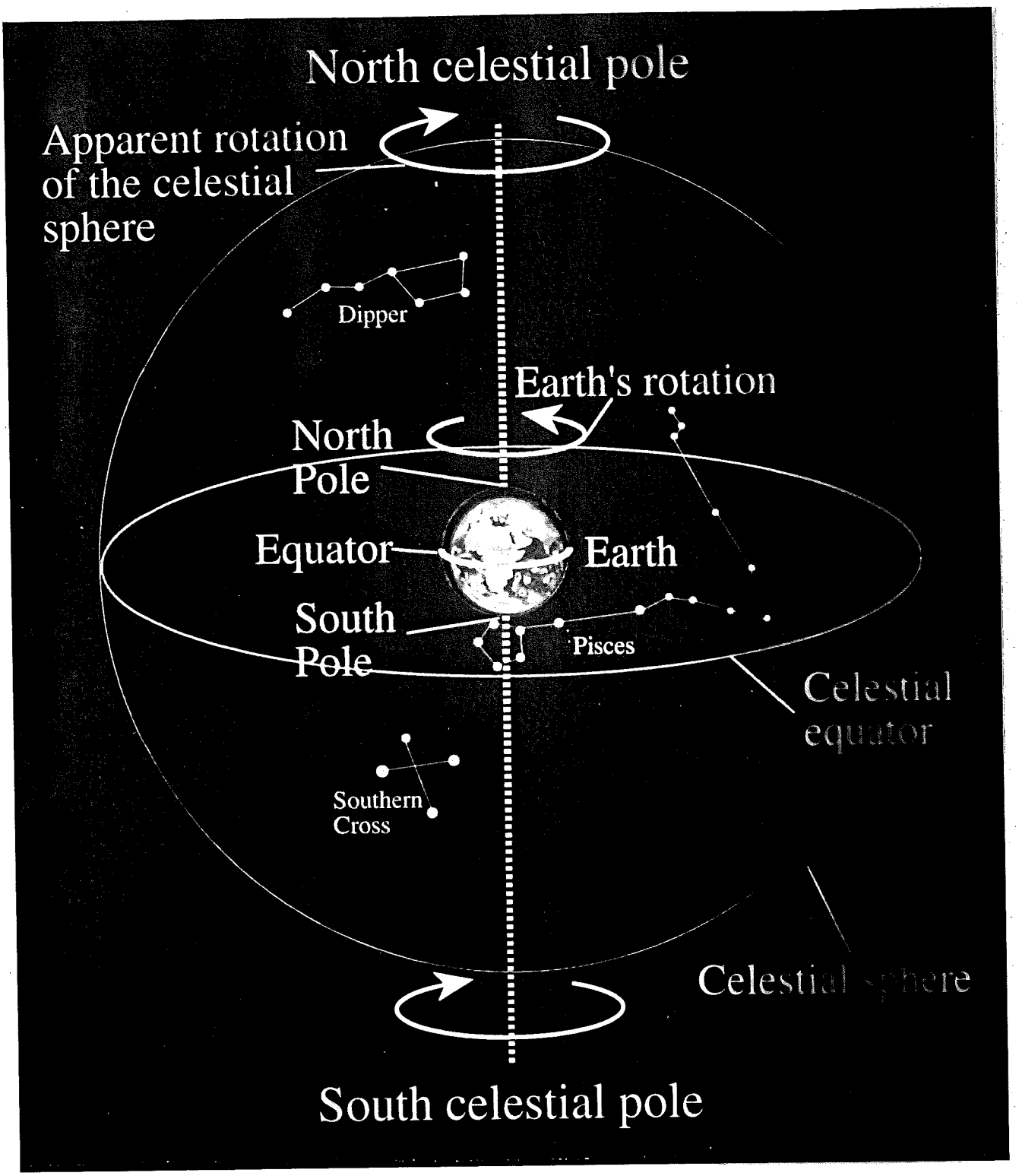
1. Celestial sphere rotates E $\rightarrow$ W around stationary Earth?

2. Earth rotates / spins on its axis (W $\rightarrow$ E)?

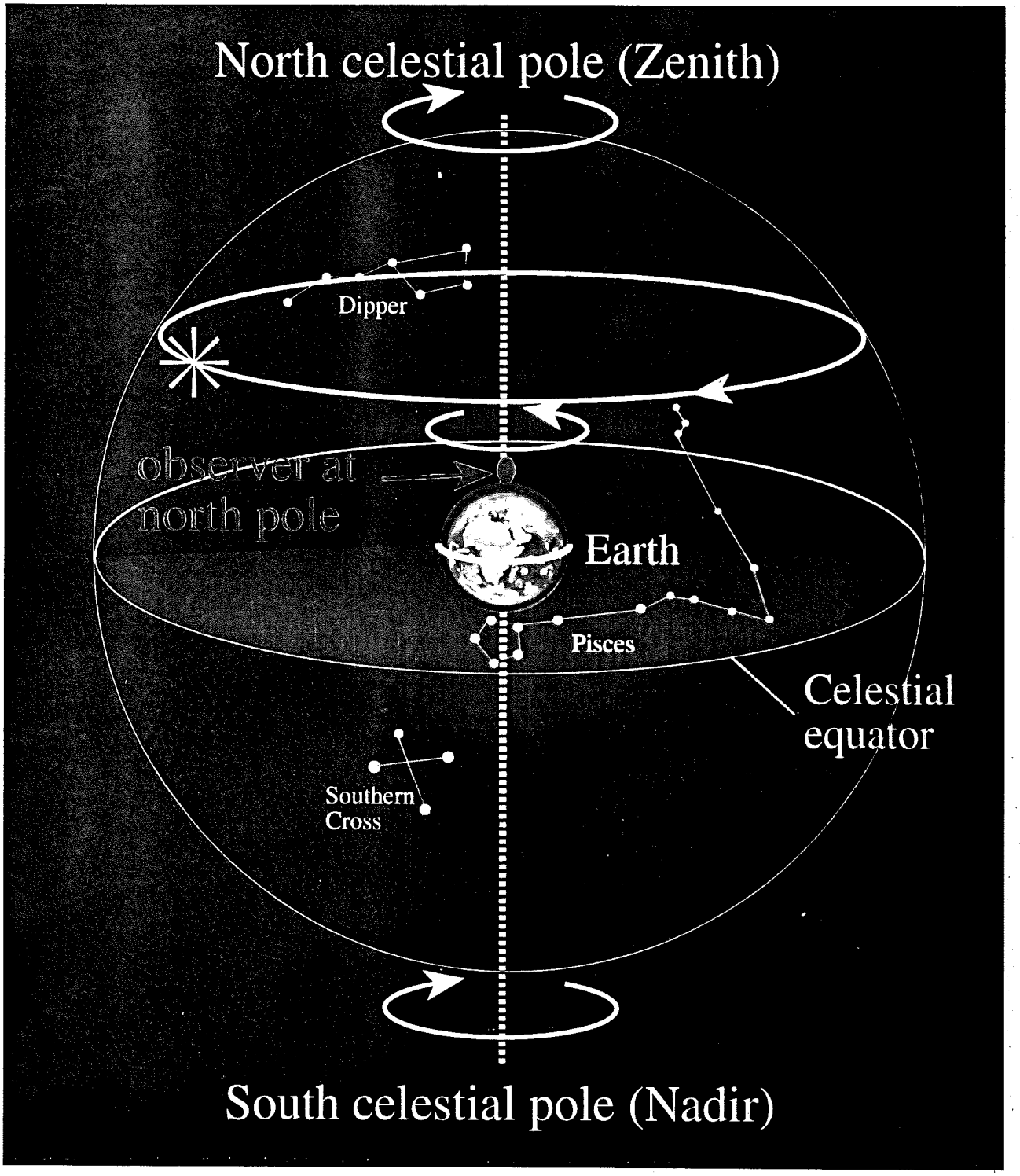
Correct Answer = 2.



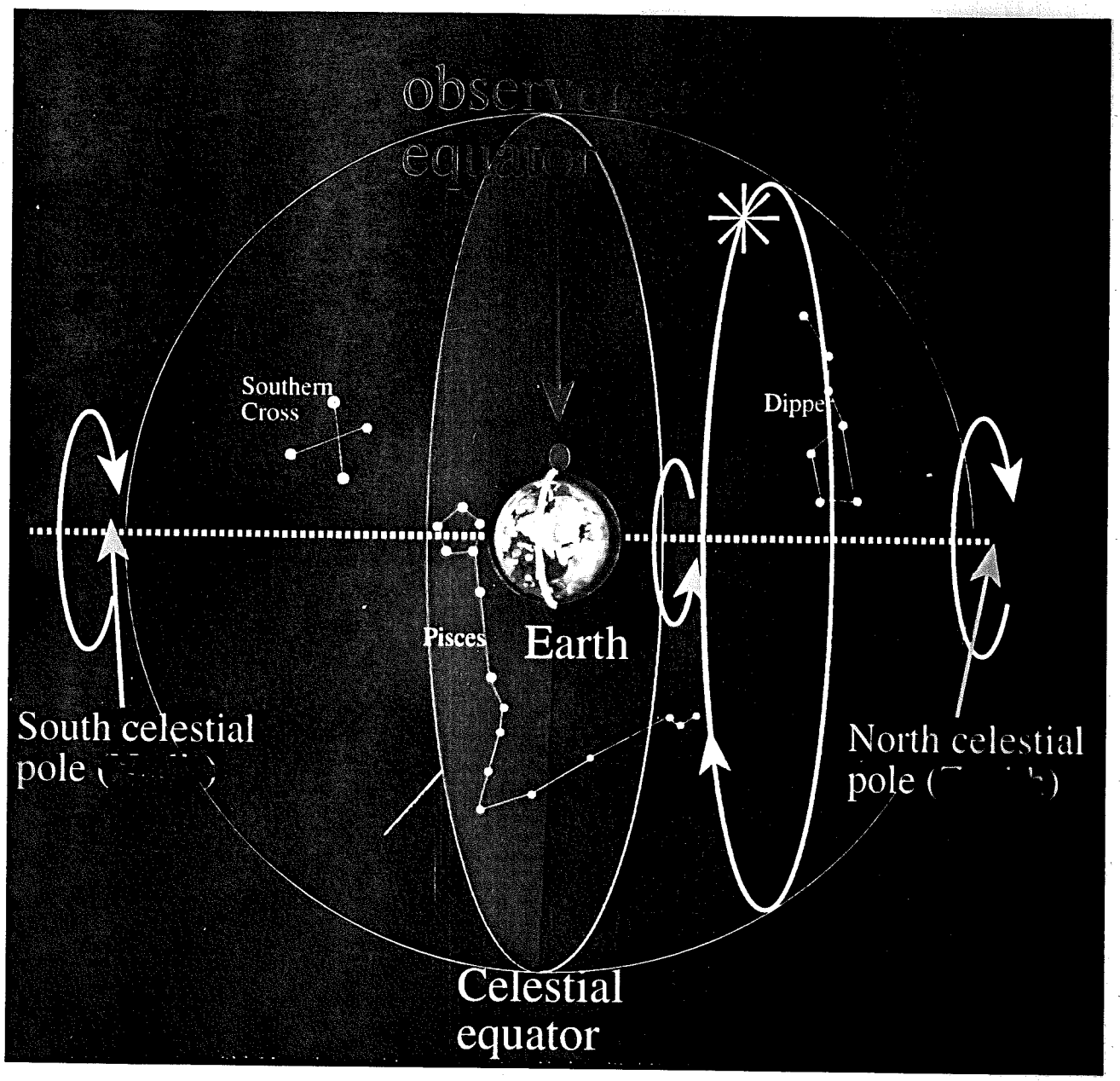
- See Classnotes 5
- "While every school child can tell you the Earth rotates, few college graduates can explain how we know this simplest of all astronomical facts."



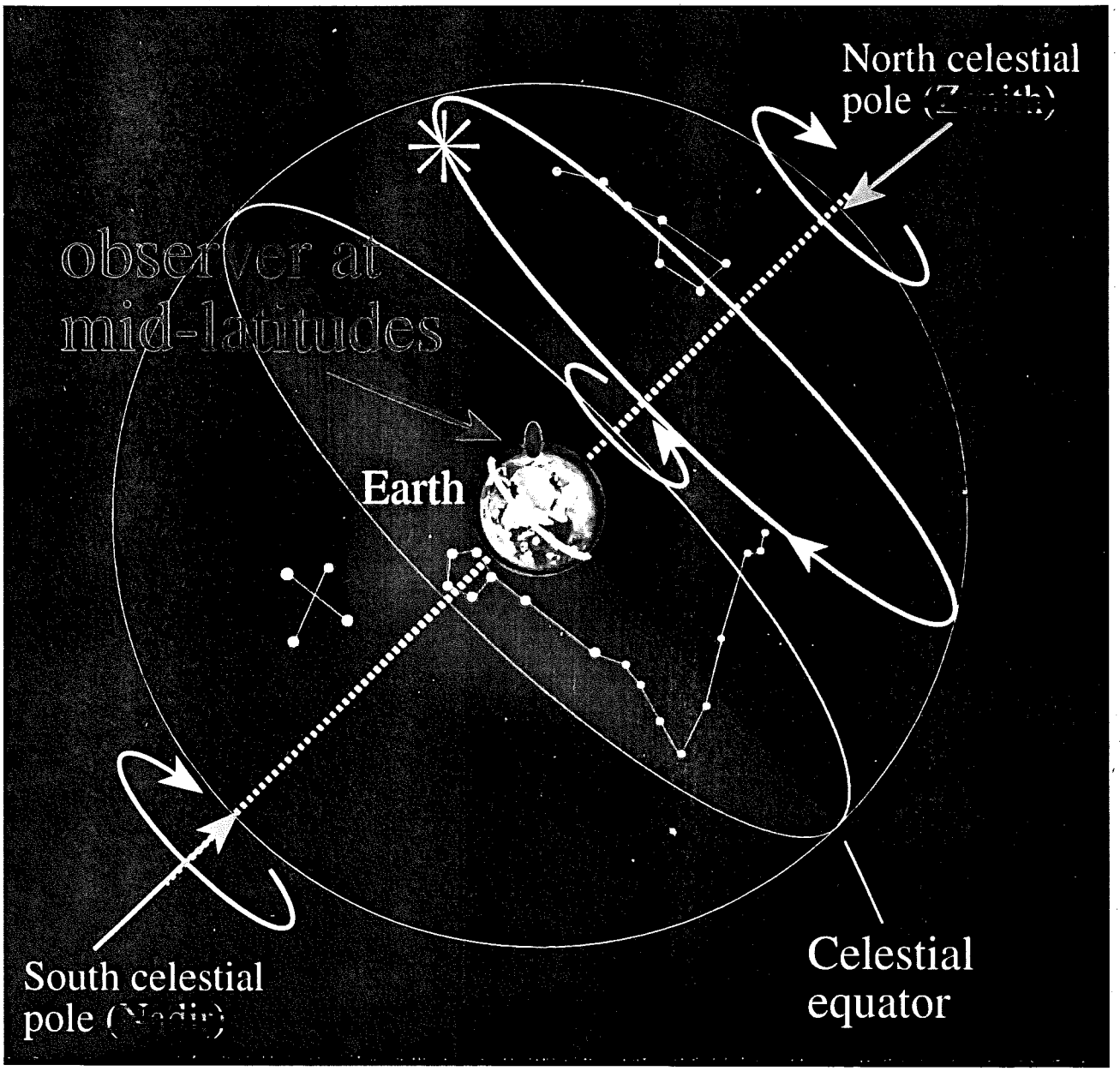
- Celestial Sphere's reference marks
  - N and S celestial poles
  - Celestial equator



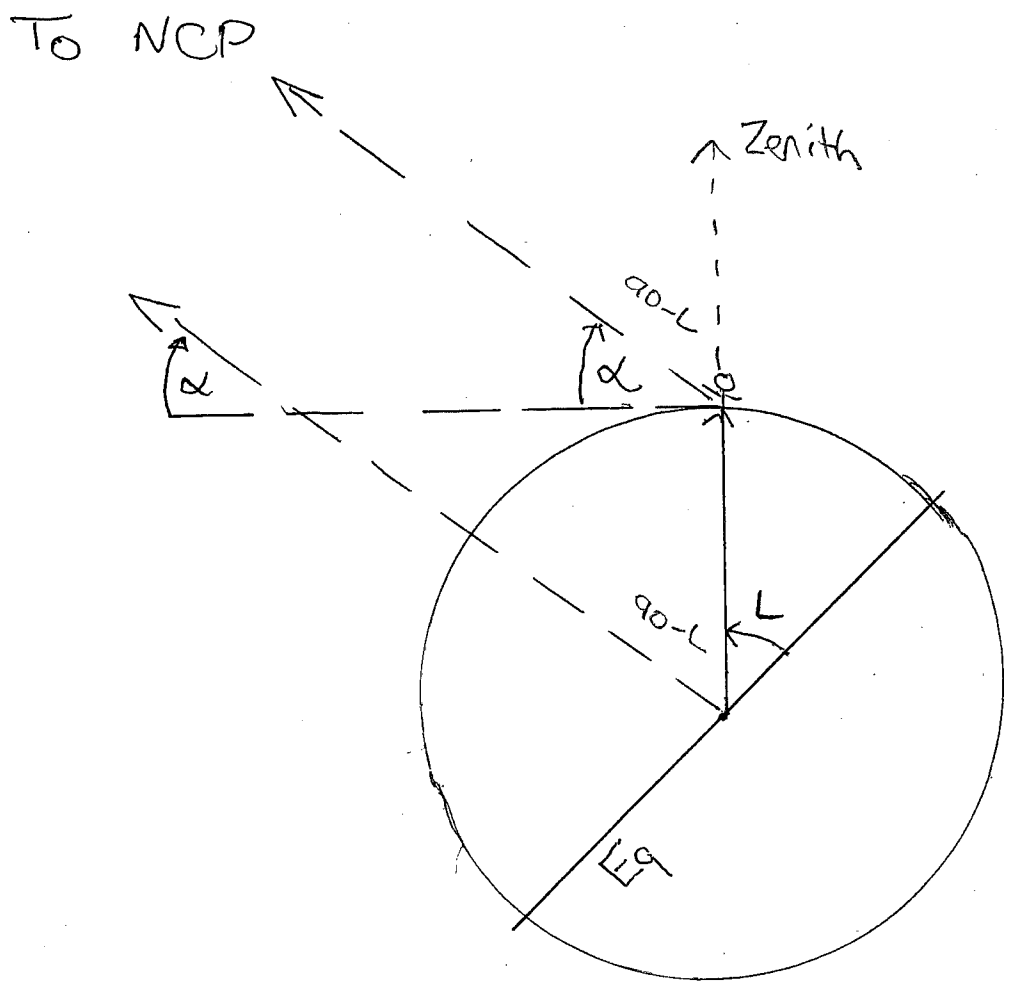
- What fraction of Celestial Sphere above the horizon?
- What is path of stars during 24 hrs?



- What is path of stars during 24 hrs?

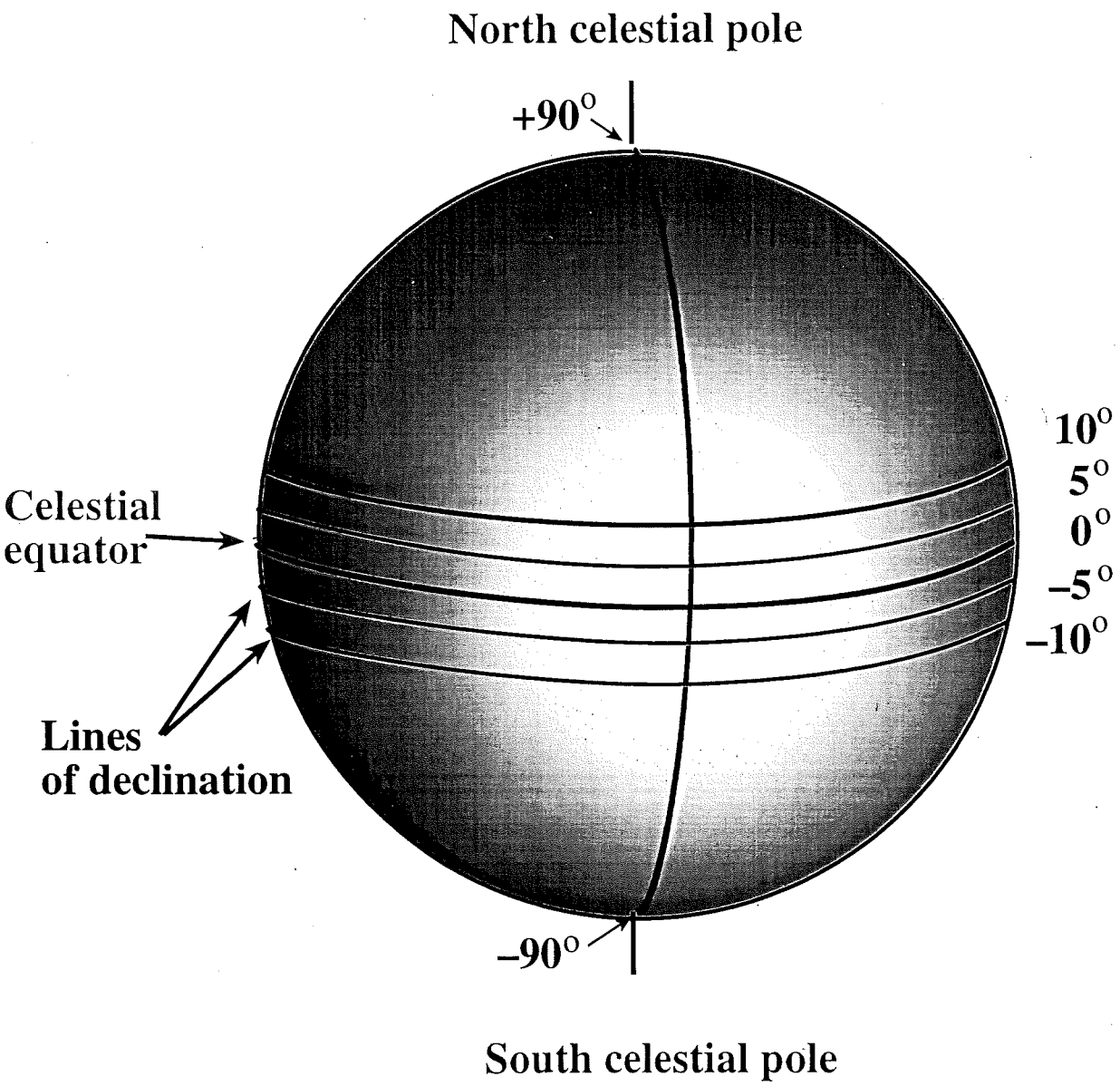


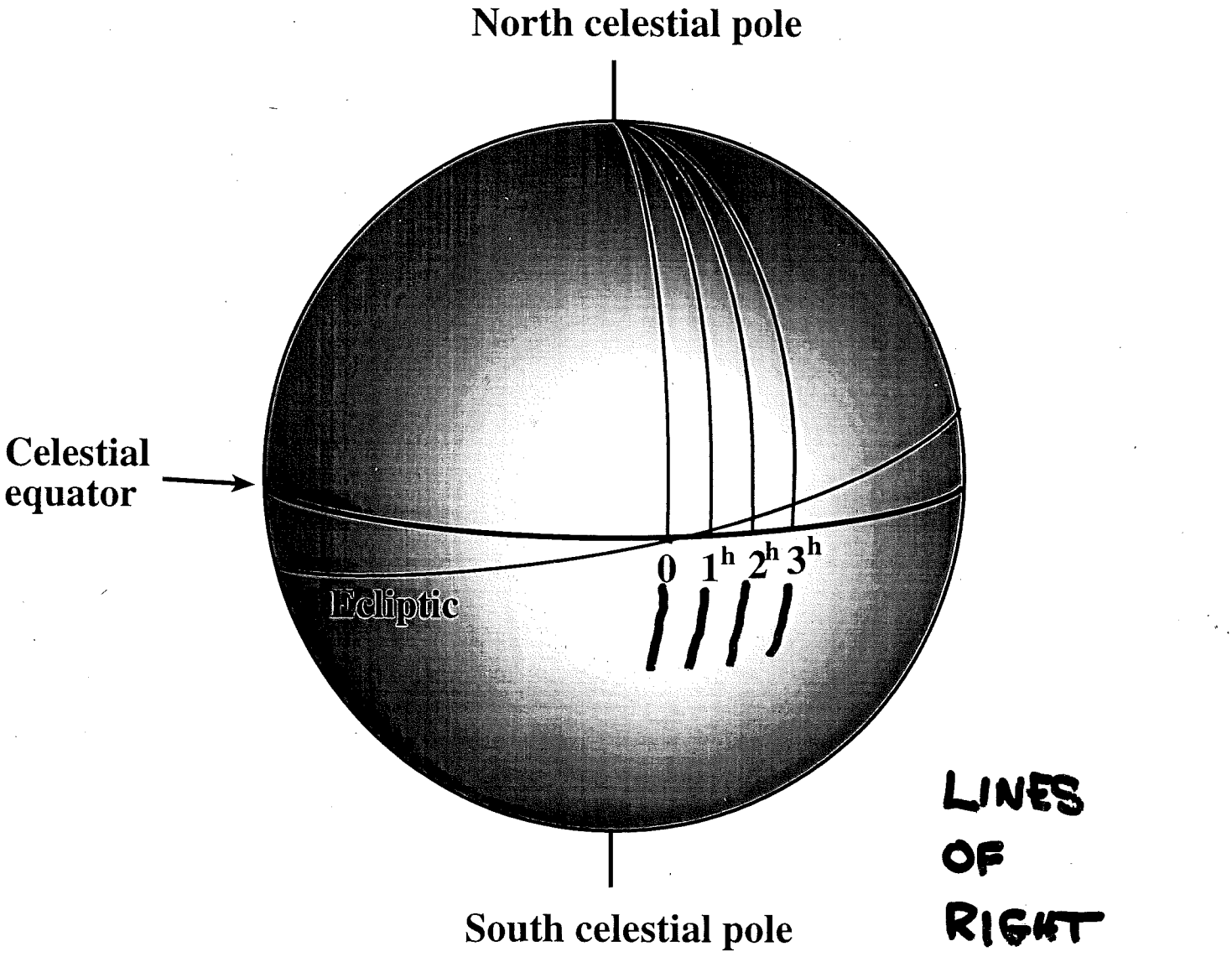
- What fraction of Celestial Sphere is above the horizon now? ...over 24 hours?
- Where are the circumpolar stars?



ALTITUDE OF POLE STAR
= OBSERVER'S LATITUDE

CELESTIAL SPHERE - Coordinates




North celestial pole
Celestial equator
Ecliptic
0
1h
2h
3h
South celestial pole
LINES OF RIGHT ASCENSION