

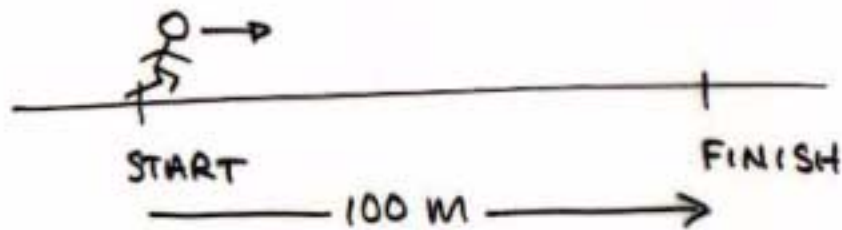
MEASUREMENT GRIDS

2-2 ↔ 2-5

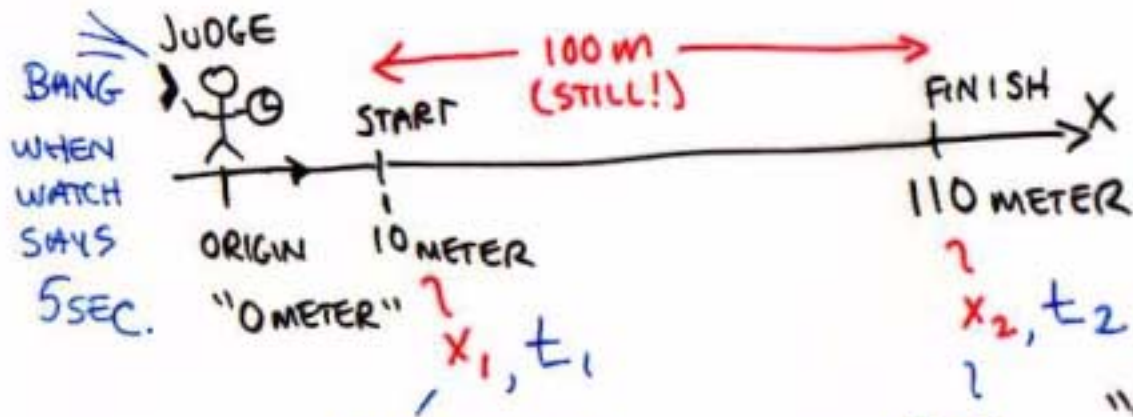
● POSITION

FRAME OF REF. FOR A FOOTRACE:

MOTION, (CHANGING LOCATION WITH TIME)



PICK A CONVENIENT "ORIGIN" ~ BENCHMARK FOR OTHER MEASUREMENTS.



$X_1 = 10 \text{ m}$ (M ≡ METER)

$X_2 = 110 \text{ m}$

- COORDINATES.

$\Delta X = (X_2 - X_1) = 100 \text{ m}$

TIME ON WATCH = 5 SEC

"ORIGIN" FOR TIME, TOO

TIME ON WATCH = 15 SEC

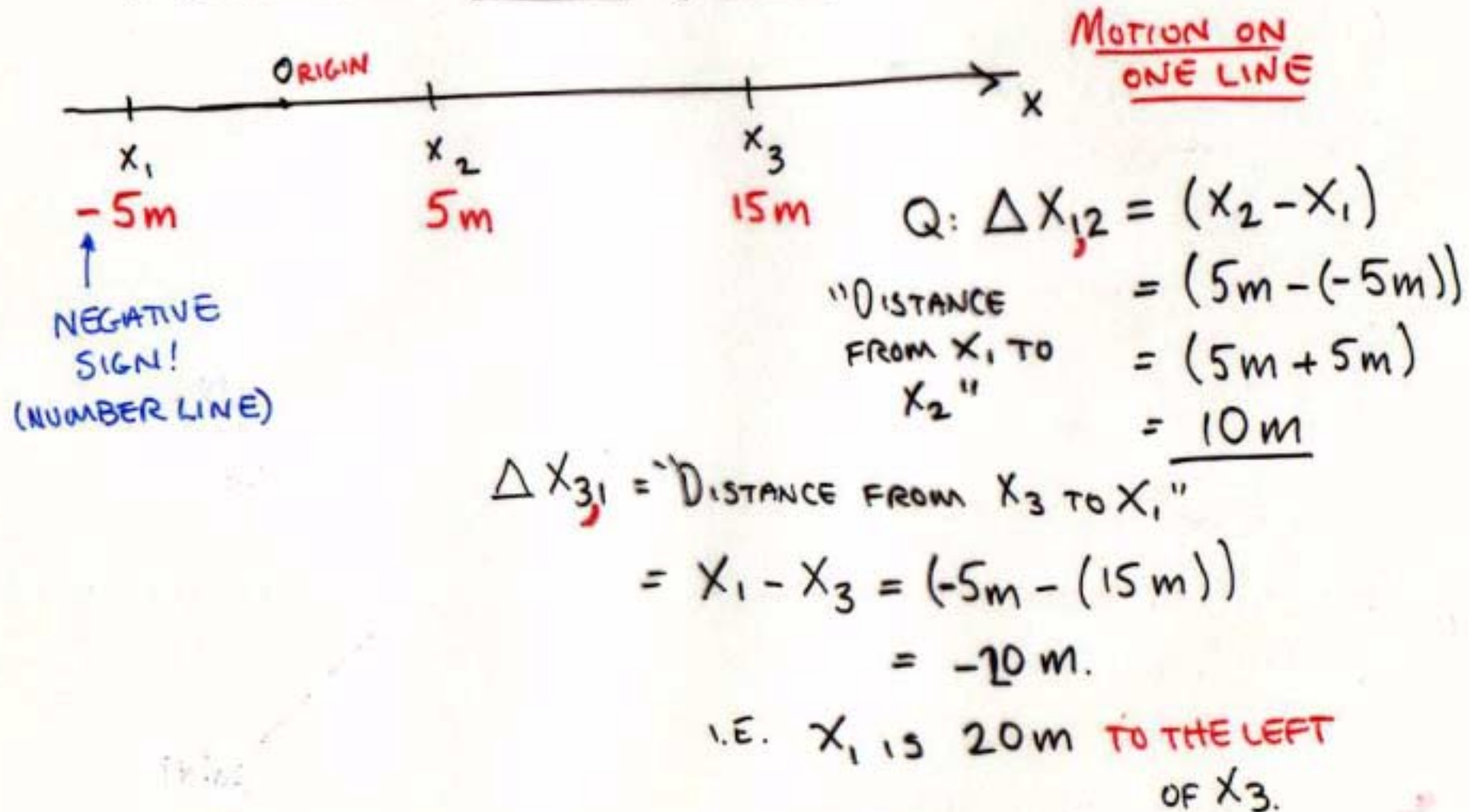
"THE CHANGE IN X"

$\Delta t = (t_2 - t_1) = 10 \text{ SEC}$

VELOCITY = $\frac{\Delta X}{\Delta t} = \frac{100 \text{ M}}{10 \text{ SEC}} = 10 \text{ m/s}$

□ MEASUREMENT GRIDS (CONT.)

- EVEN MORE ABSTRACT (SPARSE IN ITS DESCRIPTION)

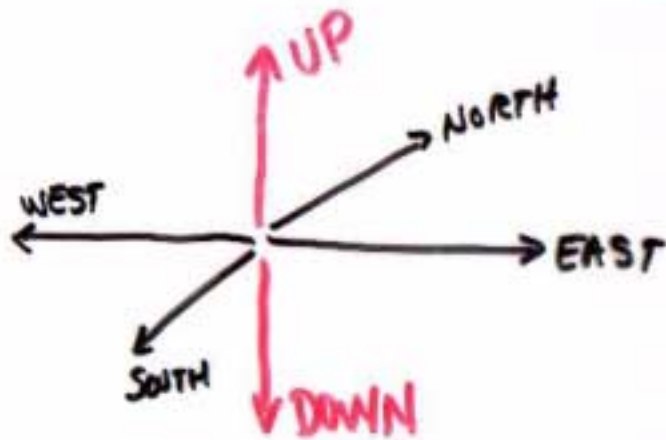


SIGN CONVENTION IS THE SAME AS A
NUMBER LINE _____

□ A FUNDAMENTAL FACT: WHAT EXP?

2-9

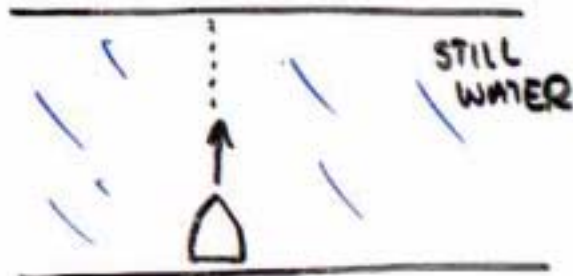
YOU - ANY OBJECT - CAN MOVE INDEPENDENTLY
IN ANY OF 3 MUTUALLY PERPENDICULAR DIRECTIONS.



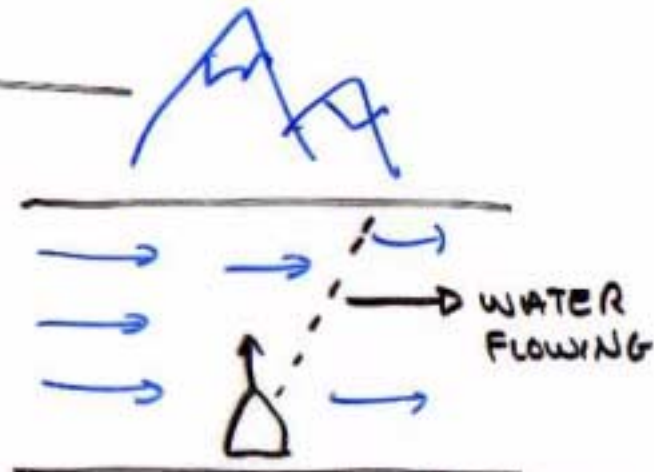
SPACE IS 3 DIMENSIONAL.

ANY MOTION E-W
IS INDEPENDENT OF N-S
MOTION.

TOP VIEW



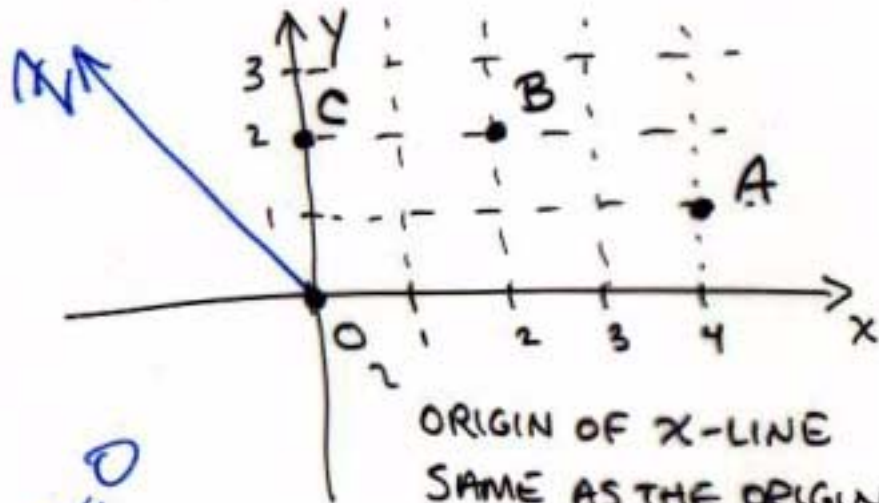
STRAIGHT
ACROSS



BOAT MOVES ACROSS
AND TO THE RIGHT
AT THE SAME TIME.

MEASUREMENT GRIDS

- MAPS ... 2 SIMULTANEOUS NUMBER LINES.



$x=0$

ORIGIN OF X-LINE
SAME AS THE ORIGIN
OF THE Y-LINE.

LOCATION?

A HAS $x=4$
 $y=1$.

LOCATION = $(x, y) = (4, 1)$

LOCATION FOR B:

B HAS $x=2$
 $y=2$

LOCATION = $(2, 2)$

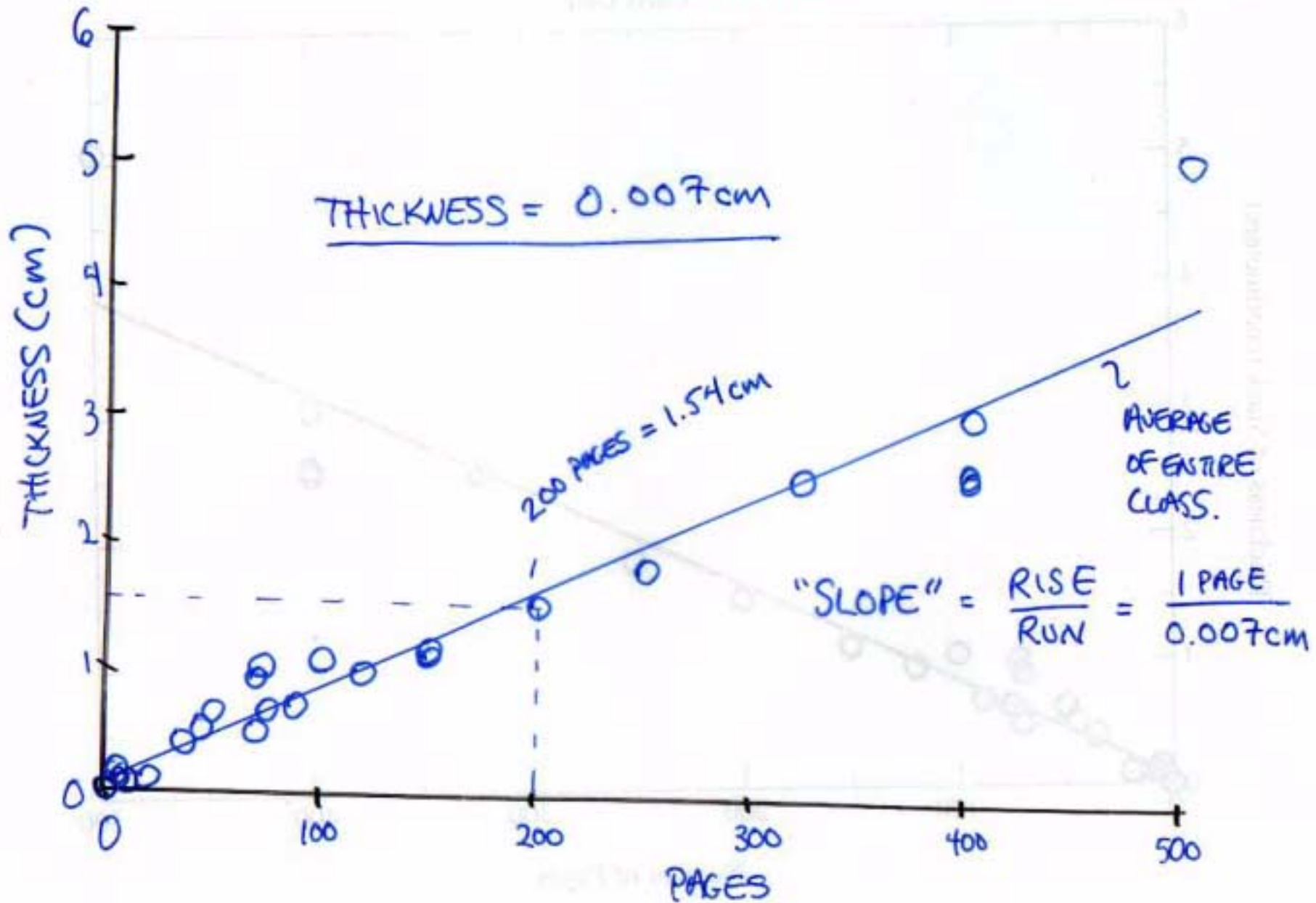
LOCATION FOR C:

C HAS $x=0$
 $y=2$

LOCATION = $(0, 2)$

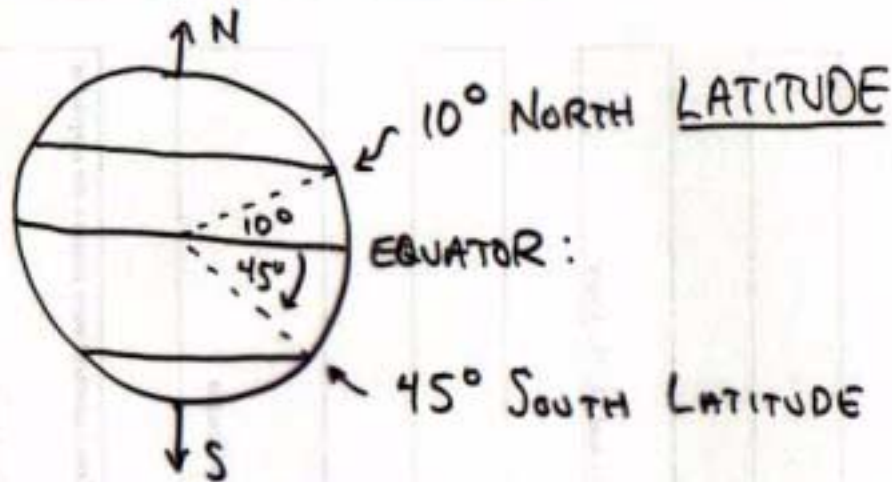
NO NEED TO STOP AT 2 — 3 AND SO ON ...
SO ON?!? YES ...

"LOCATION GRID AS A METAPHOR"



MEASUREMENT GRID FOR THE STARS (+ EARTH)

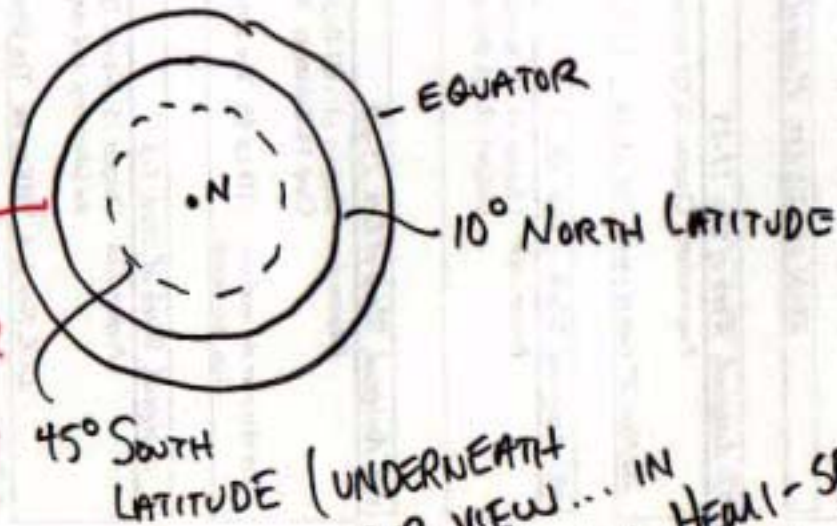
2-13...2-16



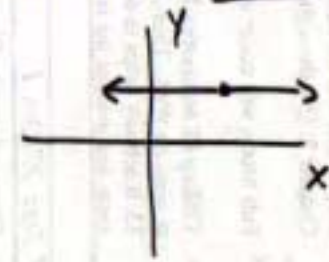
TAKE-HOME EXPT. # 2
MEASURES THE LATITUDE OF L.A.!

IF YOU WALK DIRECTLY EAST OR WEST YOU STAY AT THE SAME LATITUDE.

TOP VIEW:



CIRCLES, SMALLER THAN EQUATOR!

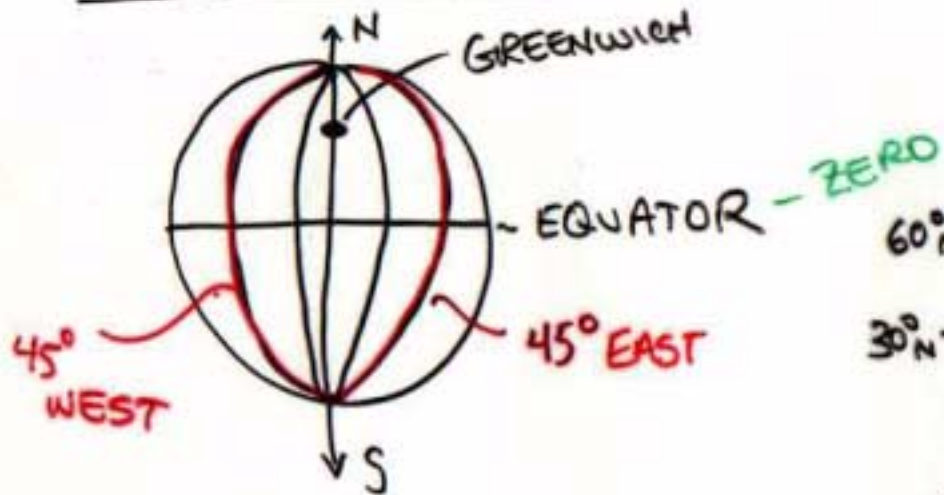


IF YOU ~~MOVE~~ MOVE // TO X-AXIS, YOUR Y-POSITION DOESN'T CHANGE.

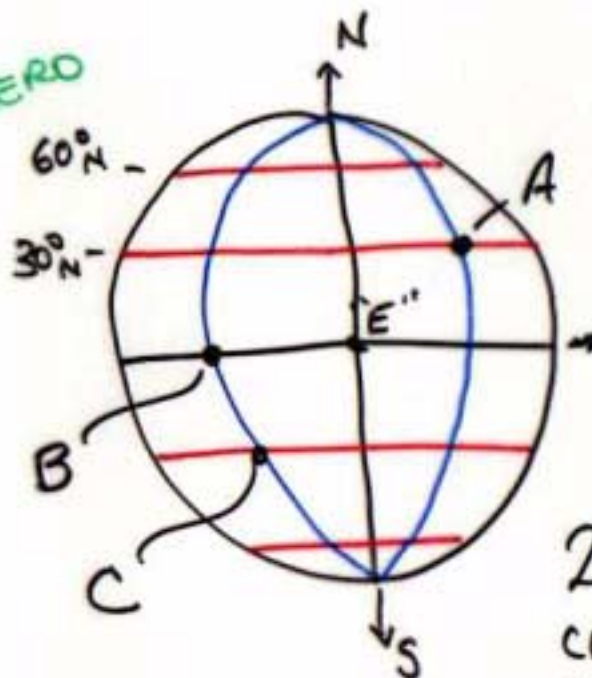
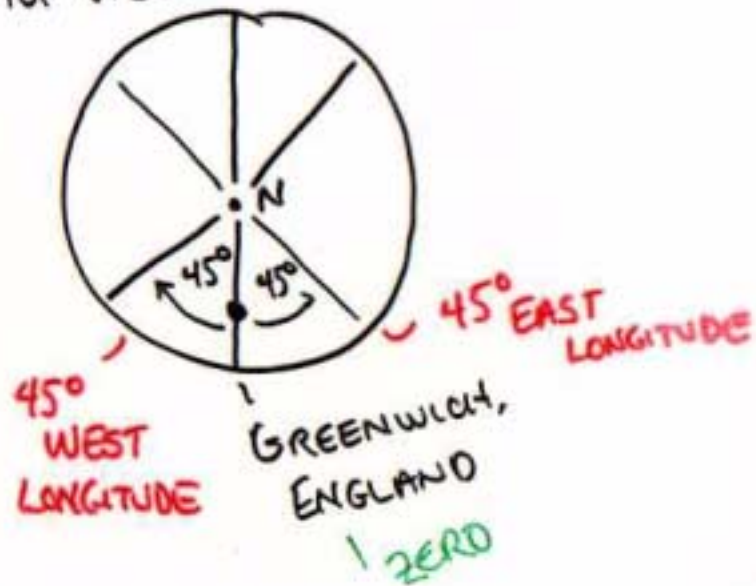
LATITUDE \approx "X" COORD.
 WHAT'S LIKE "Y" COORD?

45° SOUTH LATITUDE (UNDERNEATH OUR VIEW... IN SOUTHERN HALF SPHERE) **HALF BALL**

□ LONGITUDE ... MEASUREMENT GRID FOR ☆'S + EARTH



TOP VIEW



A = 30°N,
45°E

B = 0°N,
45°W

C = 30°S,
45°W

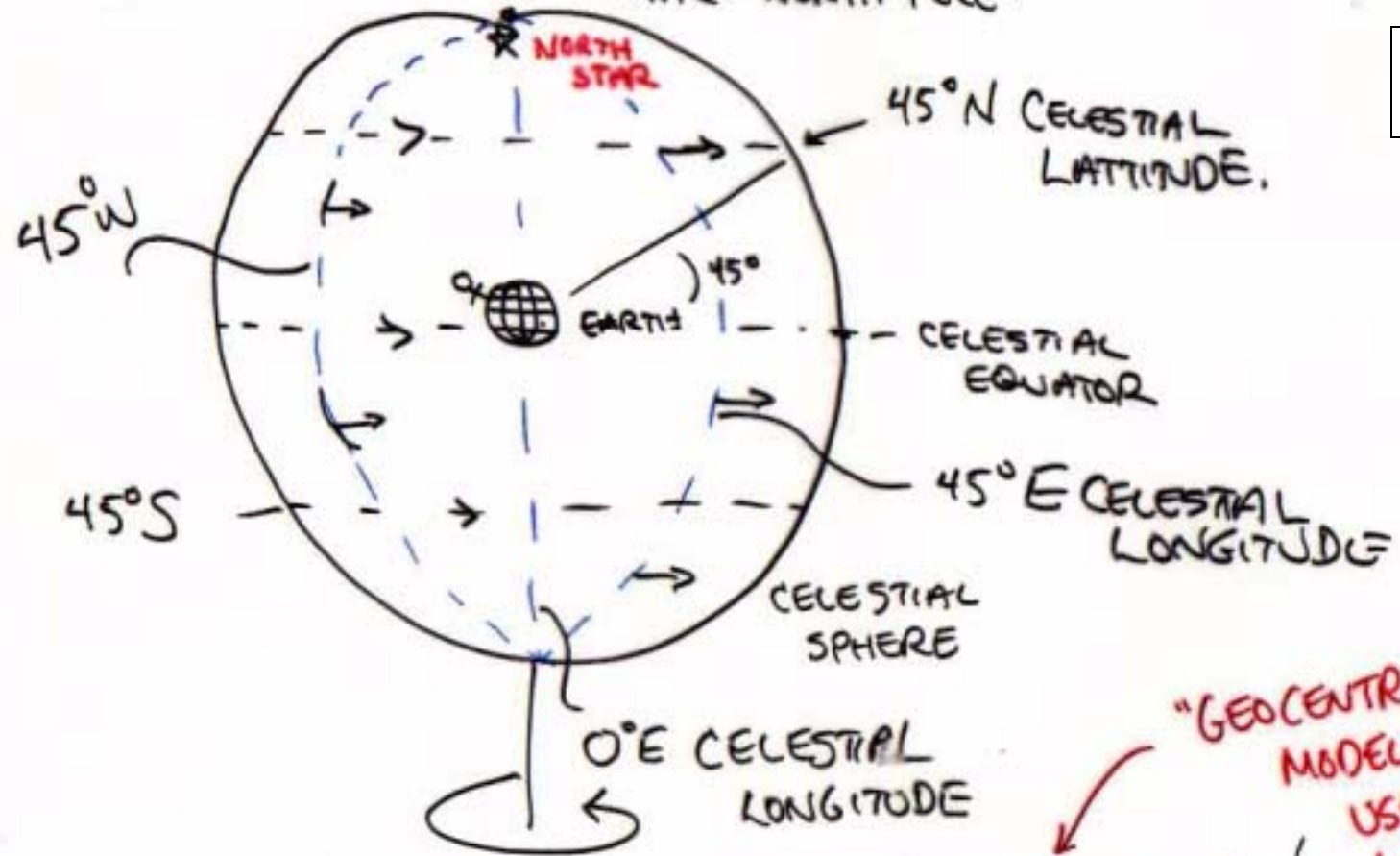
2 NUMBERS
CAN PLACE
ANY TOWN,
MOUNTAIN,
CAR, ANYTHING
ON THE SURFACE
OF THE EARTH.

□ GRID FOR THE STARS

- "CELESTIAL" LATITUDE
- "CELESTIAL" LONGITUDE

STAR-LIKE

CELESTIAL "NORTH POLE"



0° EARTH-LONGITUDE
GREENWICH ENGLAND

0° CELESTIAL LONGITUDE
?? ?? ?

2-16...2-18

THE WHOLE SHEBANG IS ROTATING!

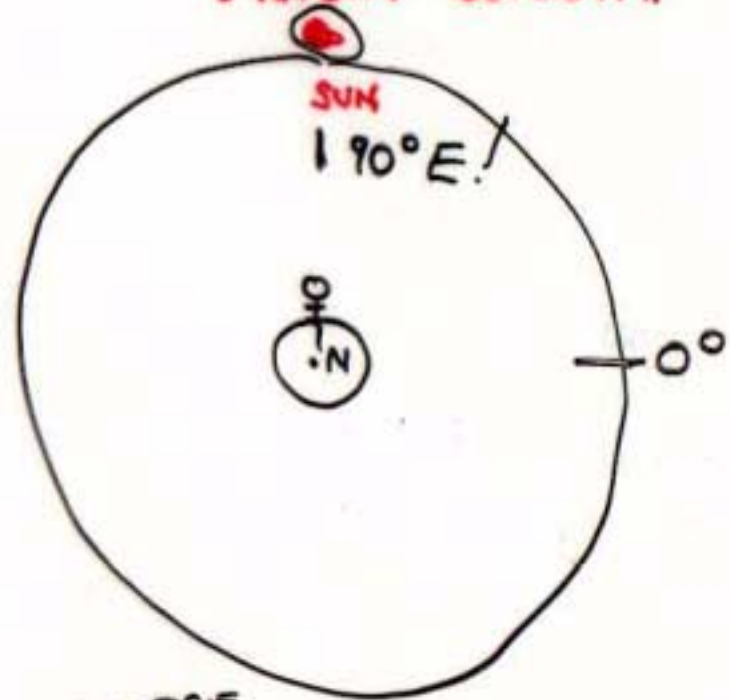
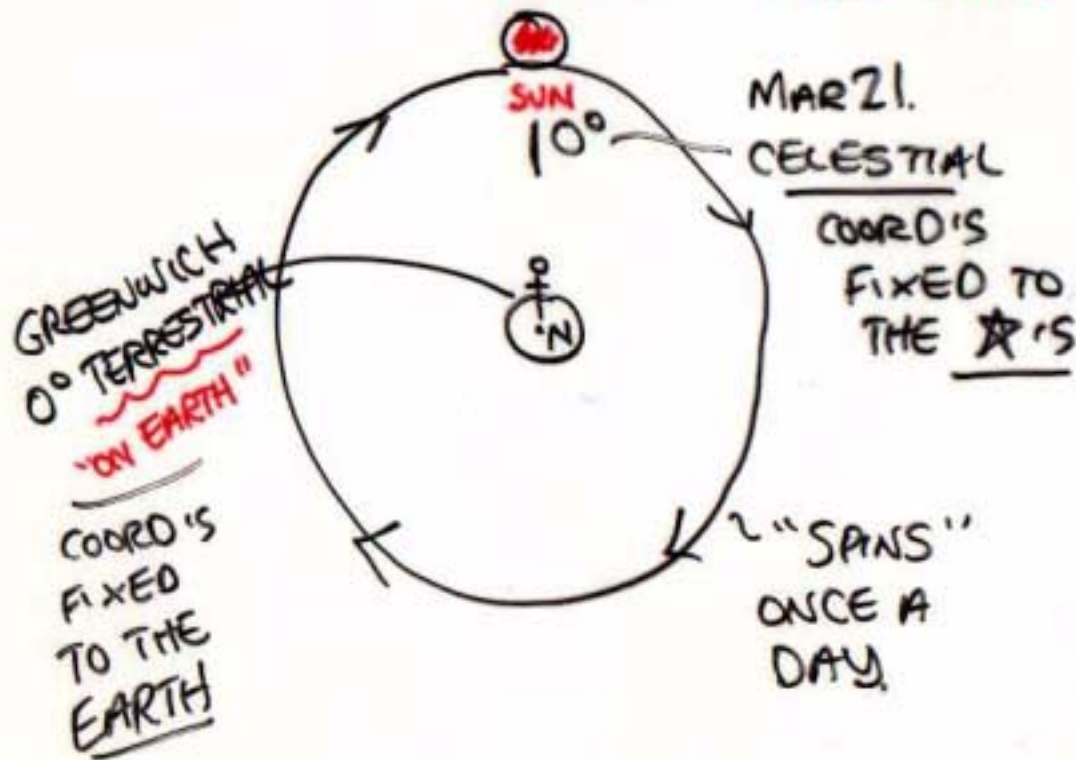
"GEOCENTRIC MODEL"
USEFUL.
IS IT "TRUE"?

☐ CELESTIAL LONGITUDE

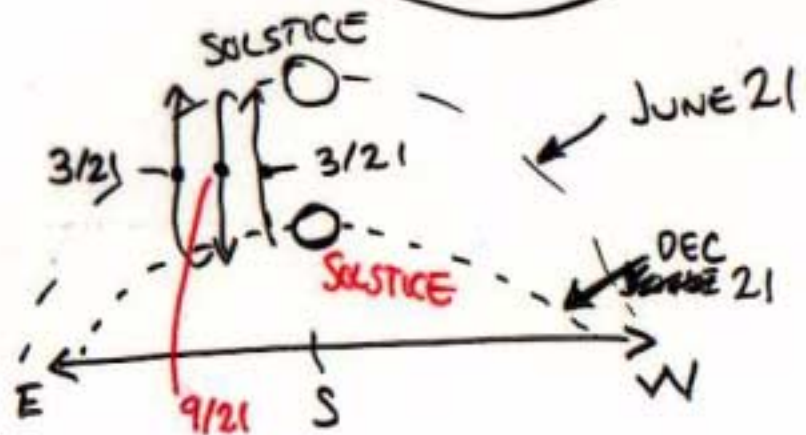
REFERENCE FOR LONGITUDE: POSITION OF THE SUN AT

THE VERNAL EQUINOX
SPRING EQUAL-PARTS

MAR. 21 - DAYLIGHT TIME
 = NIGHT LENGTH.

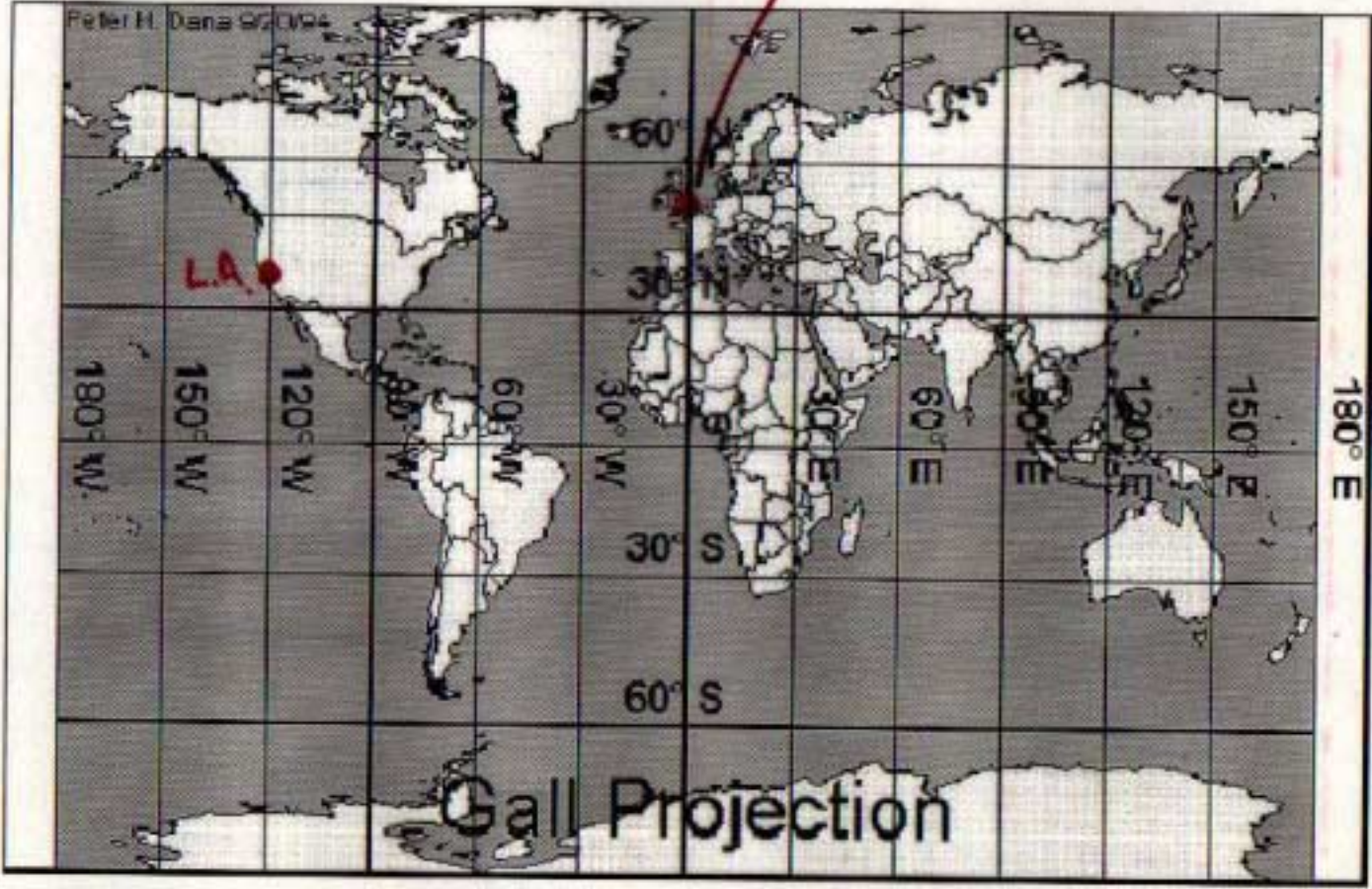


THE SUN MOVES
 AGAINST THE
 FIXED STARS!
 (MODEL!)

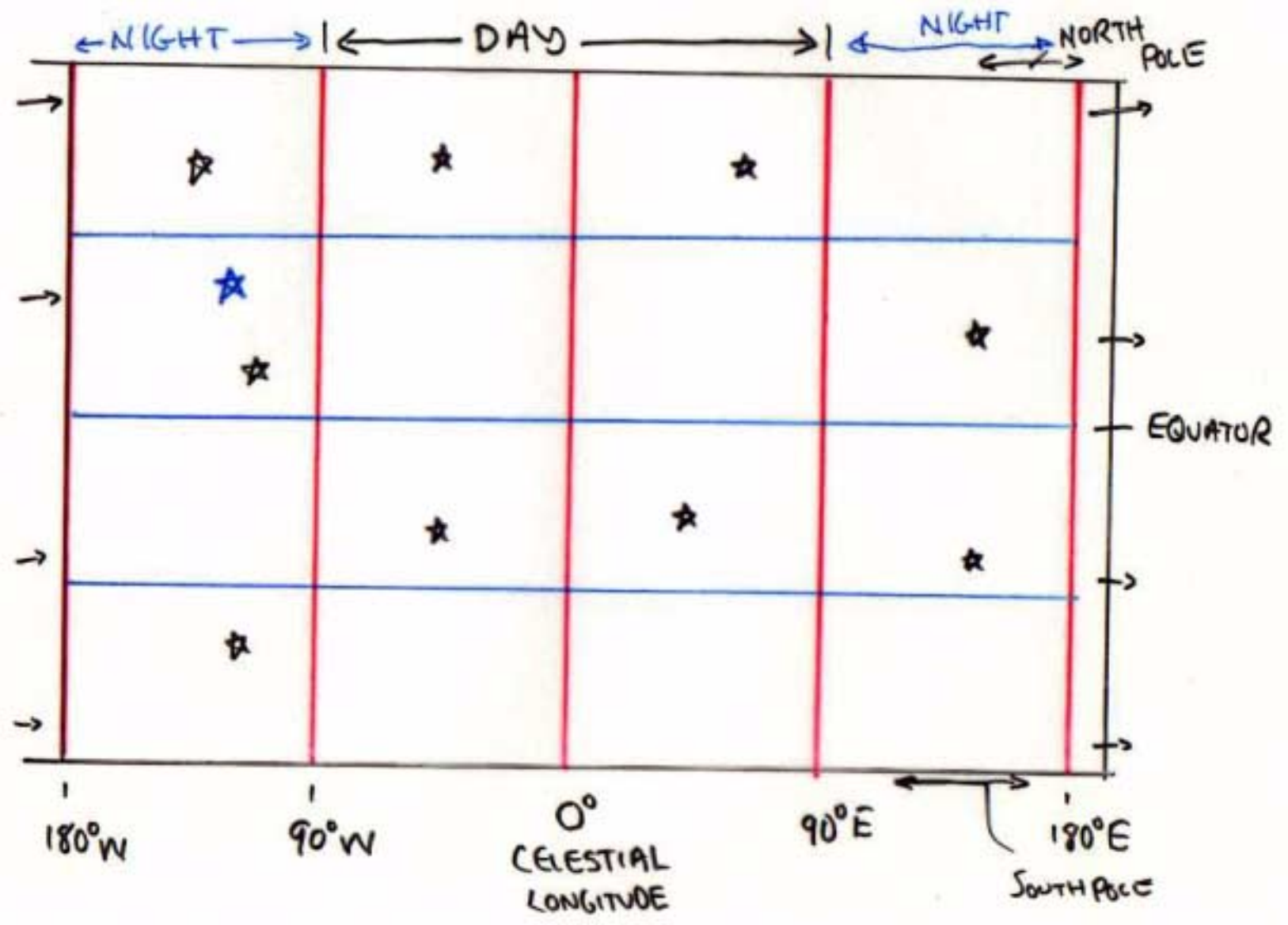


e-NIGHT →

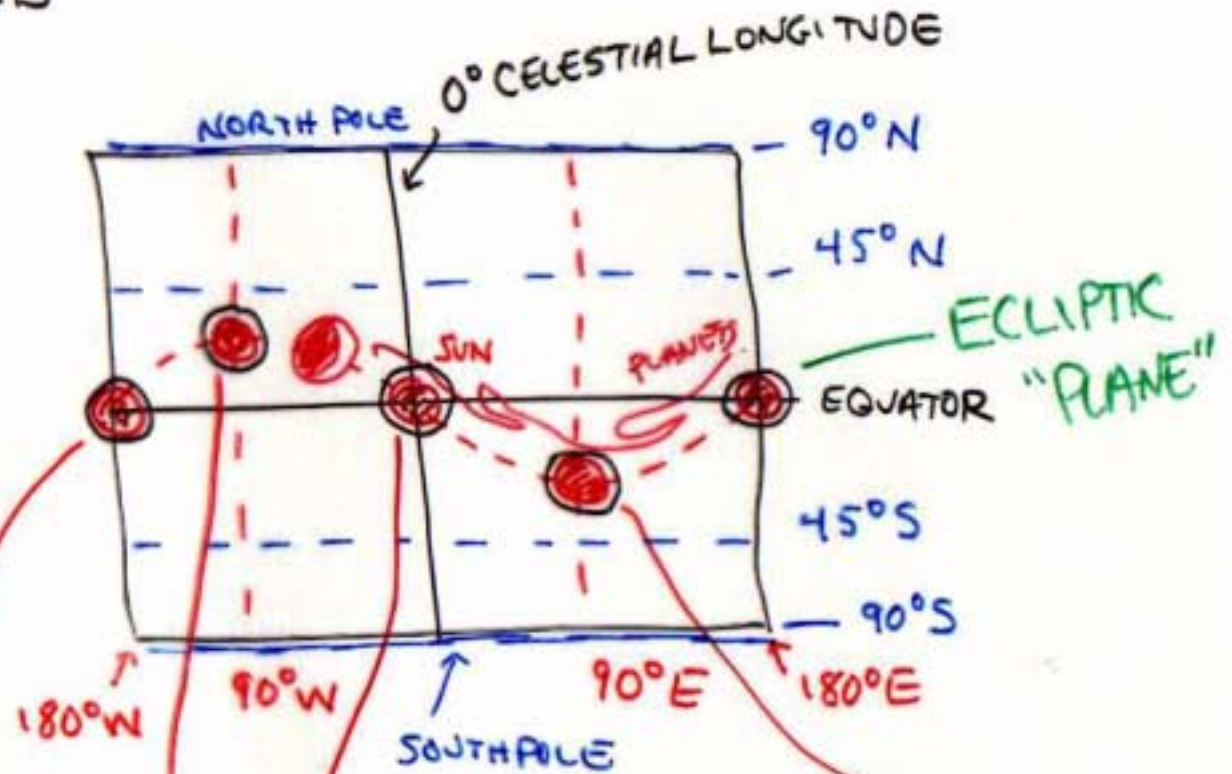
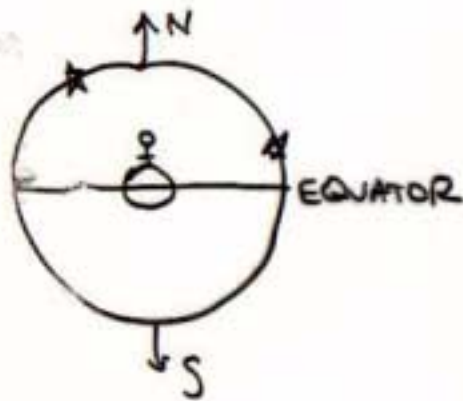
ROYAL OBSERVATORY,
GREENWICH
ENGLAND



SPRING EQUINOX; MARCH 21ST.

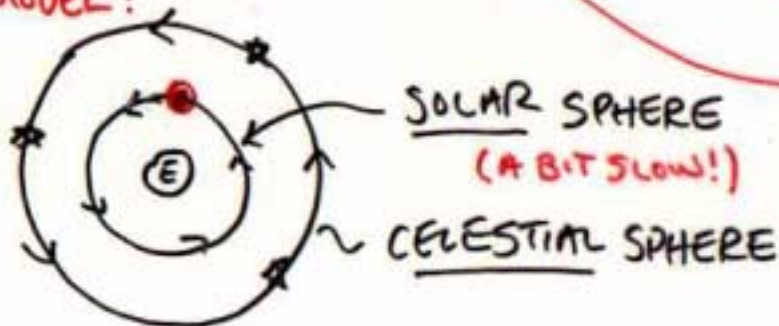


☐ CELESTIAL "GRID"



SUN MOVES AGAINST THE FIXED STARS!

MODEL:



SPRING EQUINOX - 3/21

SUMMER SOLSTICE - 6/21

AUTUMN EQUINOX - 9/21

WINTER SOLSTICE - 12/21