MEASUREMENT GRIDS

- Position

FRAME OF REF. FOR A FOOTRACE:

- Motion, changing location with time

START 100 M FINISH

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

BANG

JUDGE

ORIGIN 10 METER "O METER" 100 M (STILL!)

"ORIGIN" FOR TIME, TOO

TIME ON WATCH = 5 sec

START

FINISH

X

110 METER

2

x_1, t_1

2

x_2, t_2

\Delta x = (x_2 - x_1) = 100 m

\Delta t = (t_2 - t_1) = 10 sec

\text{VELOCITY} = \frac{\Delta x}{\Delta t} = \frac{100 \text{ m}}{10 \text{ sec}} = 10 \text{ m/s}

x_1 = 10 \text{ m} (m = \text{meter})

x_2 = 110 \text{ m} - \text{coordinates}
MEASUREMENT GRIDS (cont.)

- **EVEN MORE ABSTRACT** (SPARSE IN ITS DESCRIPTION)

![Diagram showing a number line with points labeled as follows:
- Origin
- $x_1$: -5m
- $x_2$: 5m
- $x_3$: 15m

Q: \( \Delta x_{12} = (x_2 - x_1) \)

"Distance from $x_1$ to $x_2" = (5m - (-5m)) = \boxed{10m}"

\( \Delta x_{31} = "Distance from x_3 to x_1", \)

\( = x_1 - x_3 = (-5m - (15m)) = -20m \)

I.E. $x_1$ is 20m to the left of $x_3$."

SIGN CONVENTION IS THE SAME AS A NUMBER LINE ___________
A FUNDAMENTAL FACT: WHAT EXP?

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.

Still water

Straight across

Boat moves across and to the right at the same time.
MEASUREMENT GRIDS

- MAPS ... 2 SIMULTANEOUS NUMBER LINES.

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...
THICKNESS = 0.007 cm

200 pages = 1.54 cm

"SLOPE" = \frac{\text{RISE}}{\text{RUN}} = \frac{1 \text{ PAGE}}{0.007 \text{ cm}}

AVERAGE OF ENTIRE CLASS.

LOCATION GRID AS A METAPHORE.
Measurement Grid for the Stars (+ Earth)

10° North Latitude

10° North Latitude

45° South Latitude

Take-Home Expt. #2

Measures the Latitude of L.A.!

If you walk directly east or west you stay at the same latitude.

If you move parallel to the x-axis, your y-position doesn't change.

Latitude ≈ "x" coord.

What's like "y" coord?

Circles, smaller than equator!

45° South Latitude (underneath our view... in Southern Hemisphere half ball)
**Longitude**... Measurement Grid for the Earth

- EQUATOR - ZERO
- 45° EAST
  - 45° WEST

**Top View**

- 45° WEST
  - 45° EAST
  - 45° EAST LONGITUDE
  - GREENWICH, ENGLAND - ZERO

- A = 30°N, 45°E
- B = 0°N, 45°W
- C = 30°S, 45°W

Two 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"

NORTH STAR

45° N CELESTIAL LATITUDE

45° E CELESTIAL LONGITUDE

CELESTIAL SPHERE

O° E CELESTIAL LONGITUDE

THE WHOLE SHEBANG IS RotATING!

O° EARTH-LONGITUDE
GREENWICH ENGLAND

O° CELESTIAL LONGITUDE

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

2-16...2-18
Celestial Longitude

Reference for Longitude: Position of the Sun at the Vernal Equinox - Mar. 21 - Daylight Time = Night Length.

Mar 21, Celestial Coords Fixed to the Stars.

The Sun moves against the fixed stars! (Model!)
SPRING EQUINOX: MARCH 21ST.
Celestial "Grid"

- North Pole
- 90° N
- 45° N
- Equator
- 45° S
- 90° S
- South Pole
- 0° Celestial Longitude
- North Pole
- 90° W
- 90° E
- 180° W
- 180° E

Sun moves against the fixed stars!

Model:

- Solar Sphere (a bit slow!)
- Celestial Sphere

Spring Equinox - 3/21
Summer Solstice - 6/21
Autumn Equinox - 9/21
Winter Solstice - 12/21

Ecliptic "Plane"