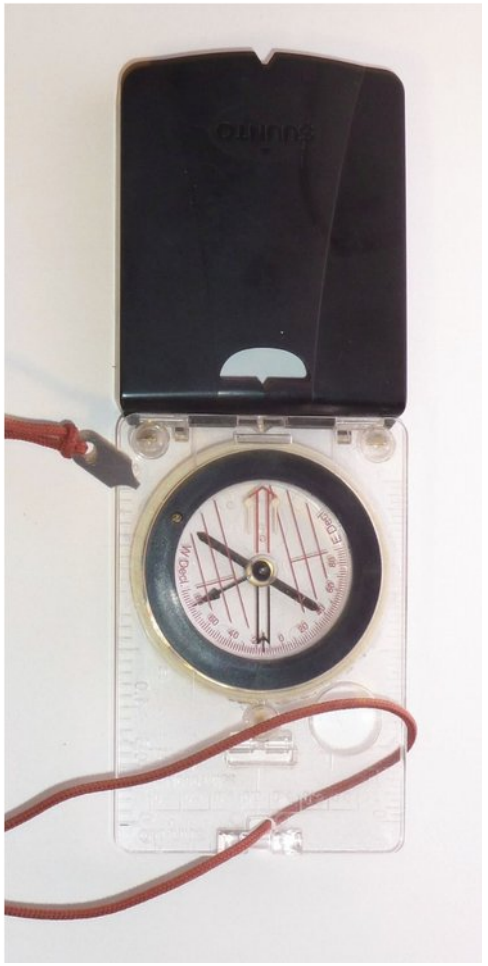
Land Navigation IV
Map and Compass

Compasses



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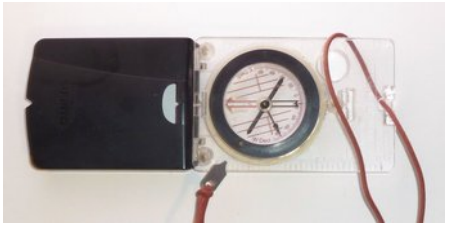
Compasses

- Orienteering/Baseplate
  - Good backup

- Lensatic
  - Can't set declination



- Orienteering/Baseplate & Mirror

- Pocket Transit
  - Too expensive – more than needed.

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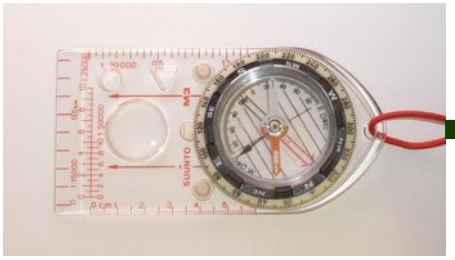
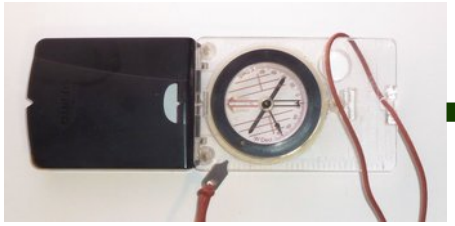
Compasses





- Protractor/Orienteering
  - Can be used as a protractor to measure bearings on a map.

- Lensatic
  - Need a separate protractor

- Pocket Transit
  - Need a separate protractor

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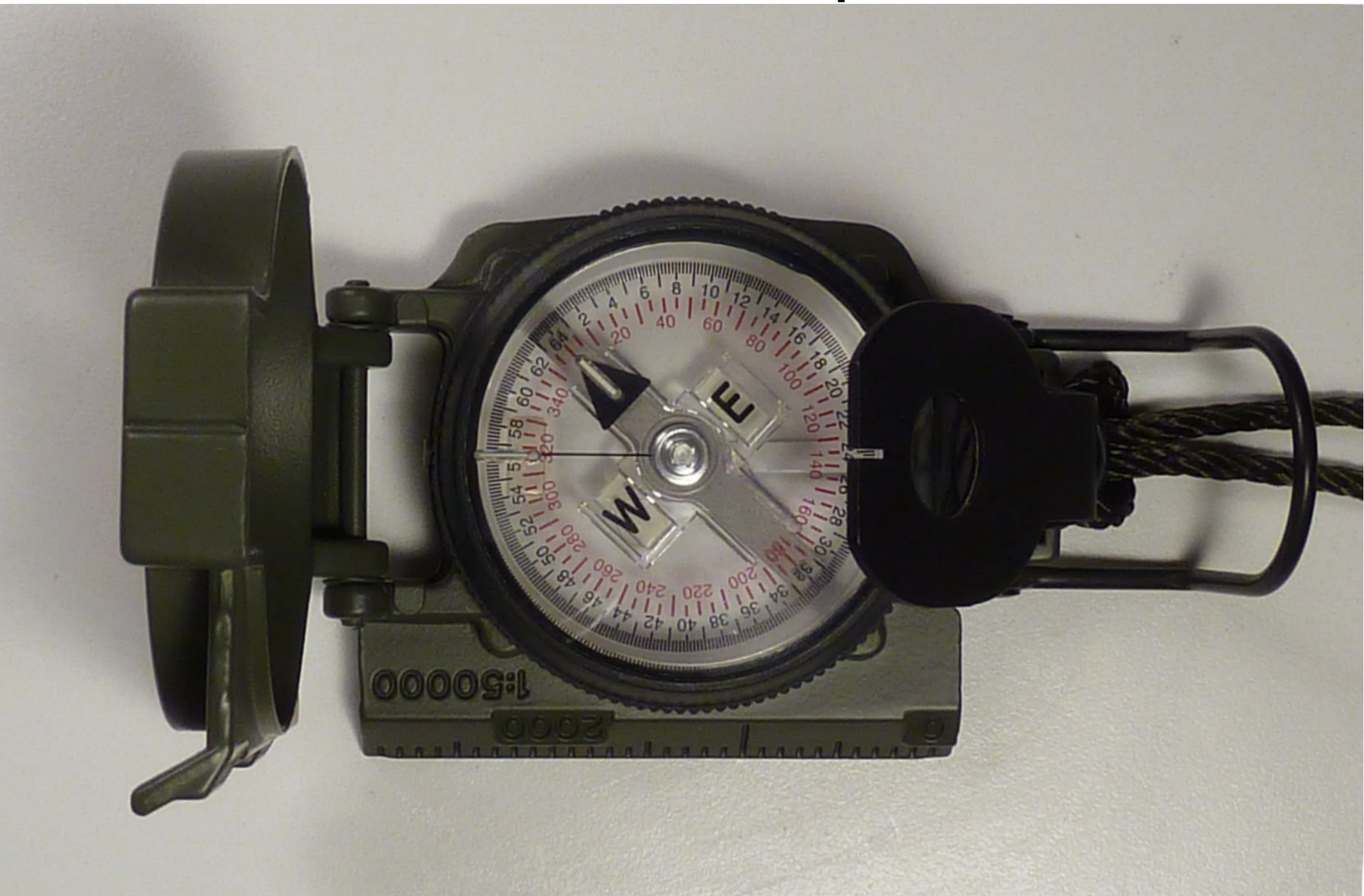
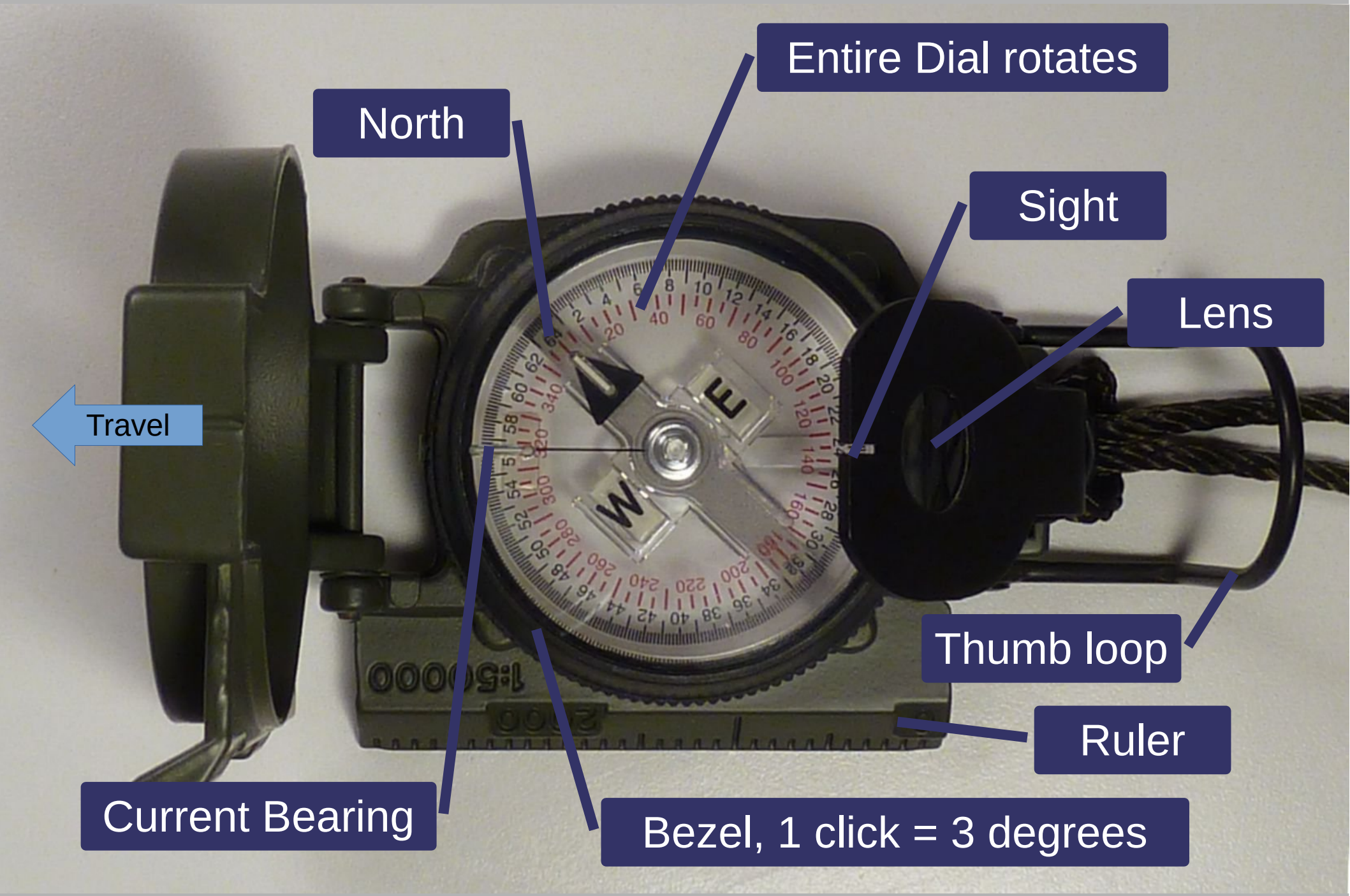
Lensatic Compass




Entire Dial rotates
North
Sight
Lens
Travel
Thumb loop
Ruler
Current Bearing
Bezel, 1 click = 3 degrees

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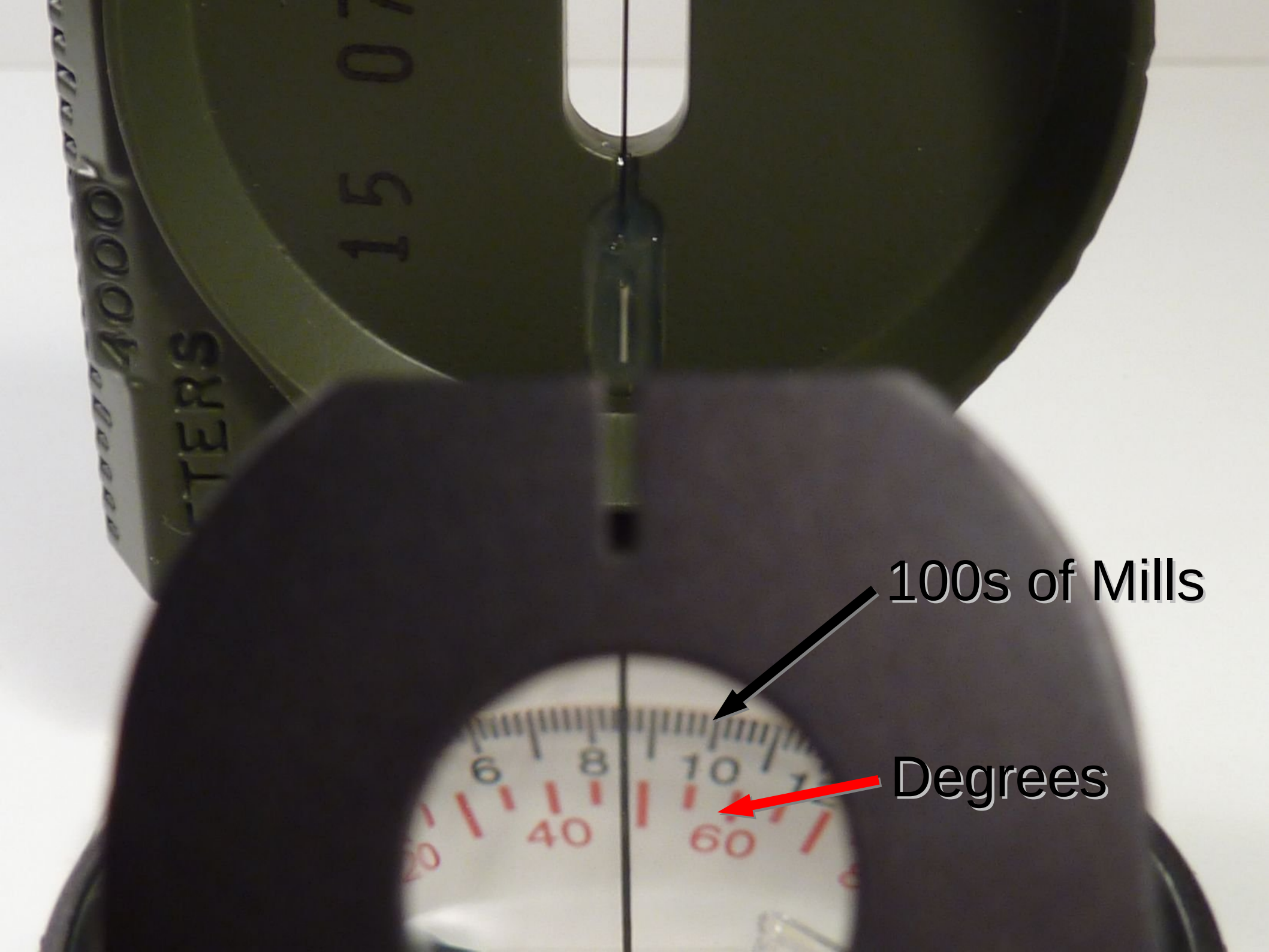
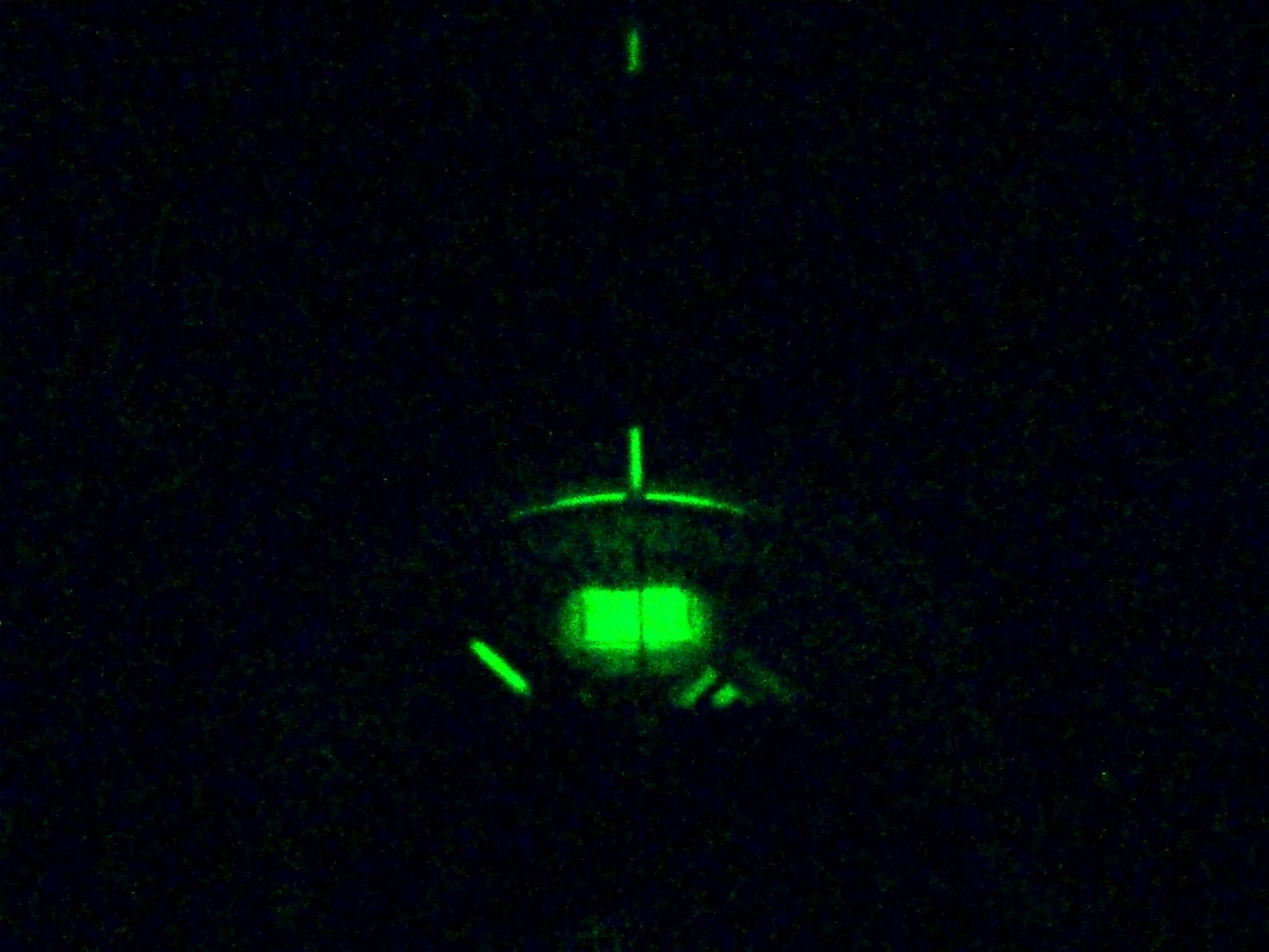
(U.S. Army photo by Staff Sgt. Mike Pryor)

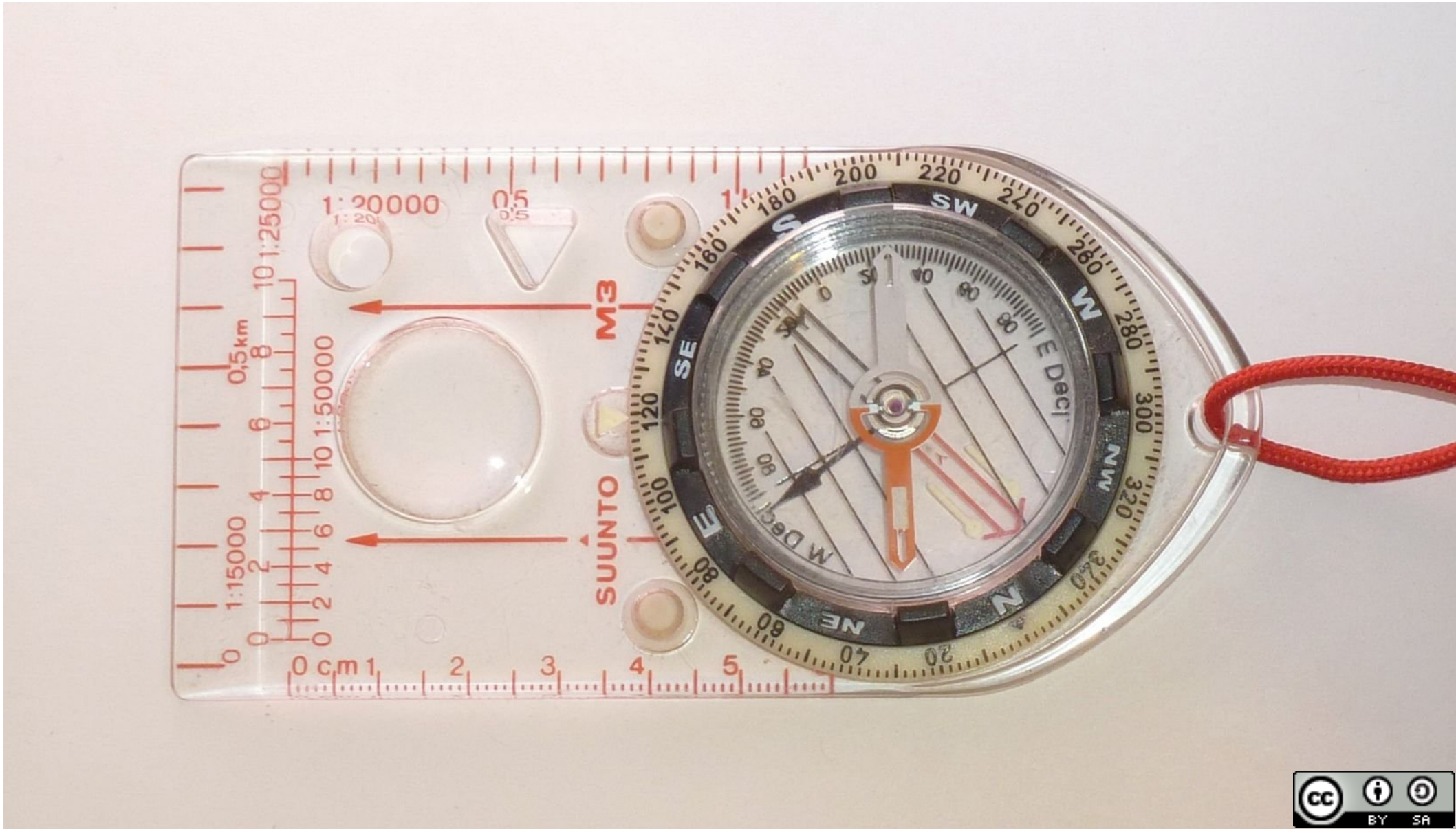

100s of Mills
Degrees

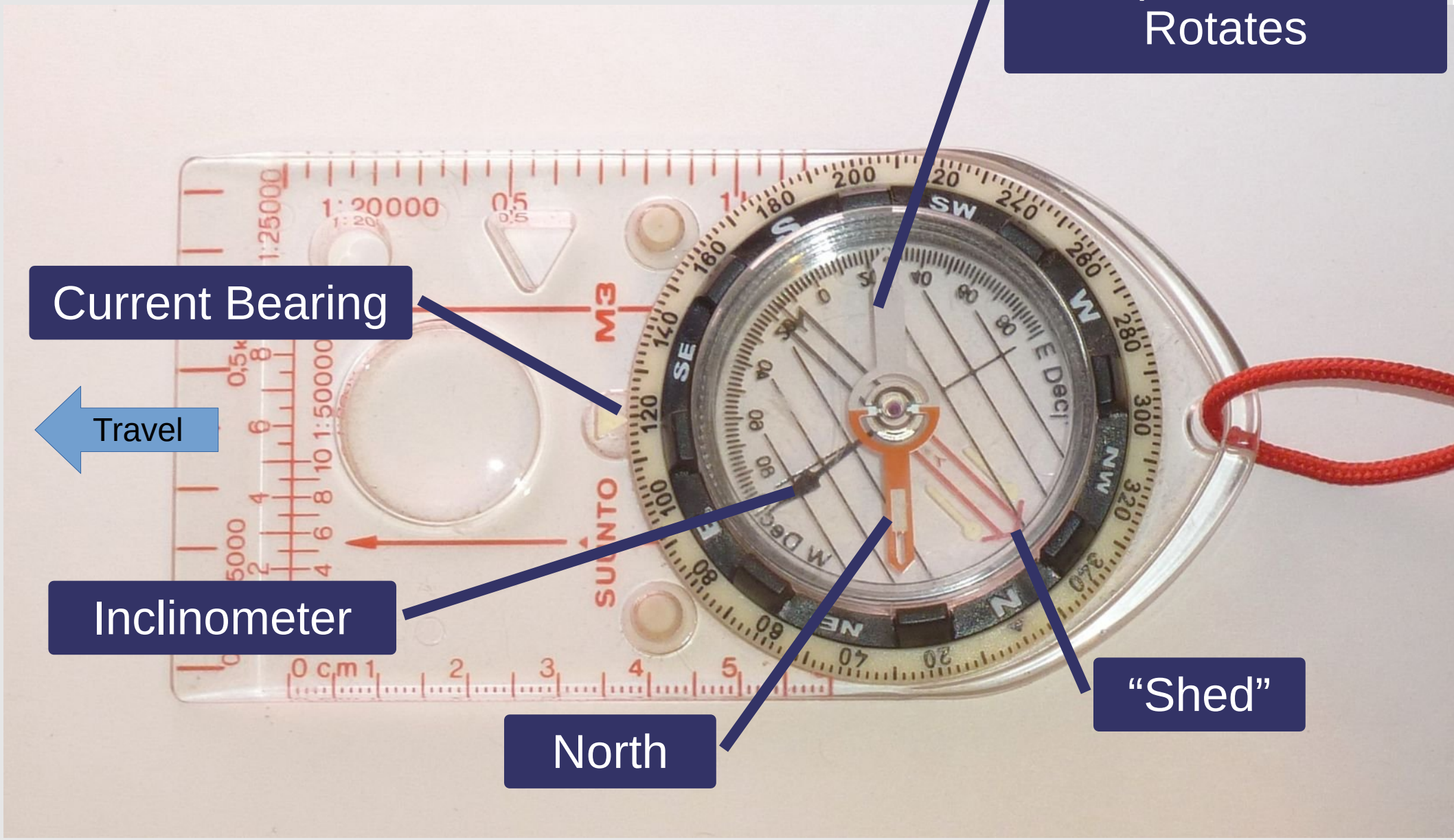


Angles

- Mill
  - **one mill is 1 meter at 1 km**
  - There are 6400 mills to 360 degrees
- Degree
  - one degree is 17.8 mills
  - **one degree error is about 18 meters in 1 km**
  - 5 degrees error is about 90 meters in 1 km

Baseplate/Orienteering Compass




Compass Needle Rotates
Current Bearing
Travel
Inclinometer
North
“Shed”

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Holding a baseplate compass

- Shoulders square to target.
- Hold at waist level.
- Look straight ahead at target.
- Look down at compass, adjust and read bearing.
- Navigating on a bearing: Move, looking at compass and target until you are square to the target.

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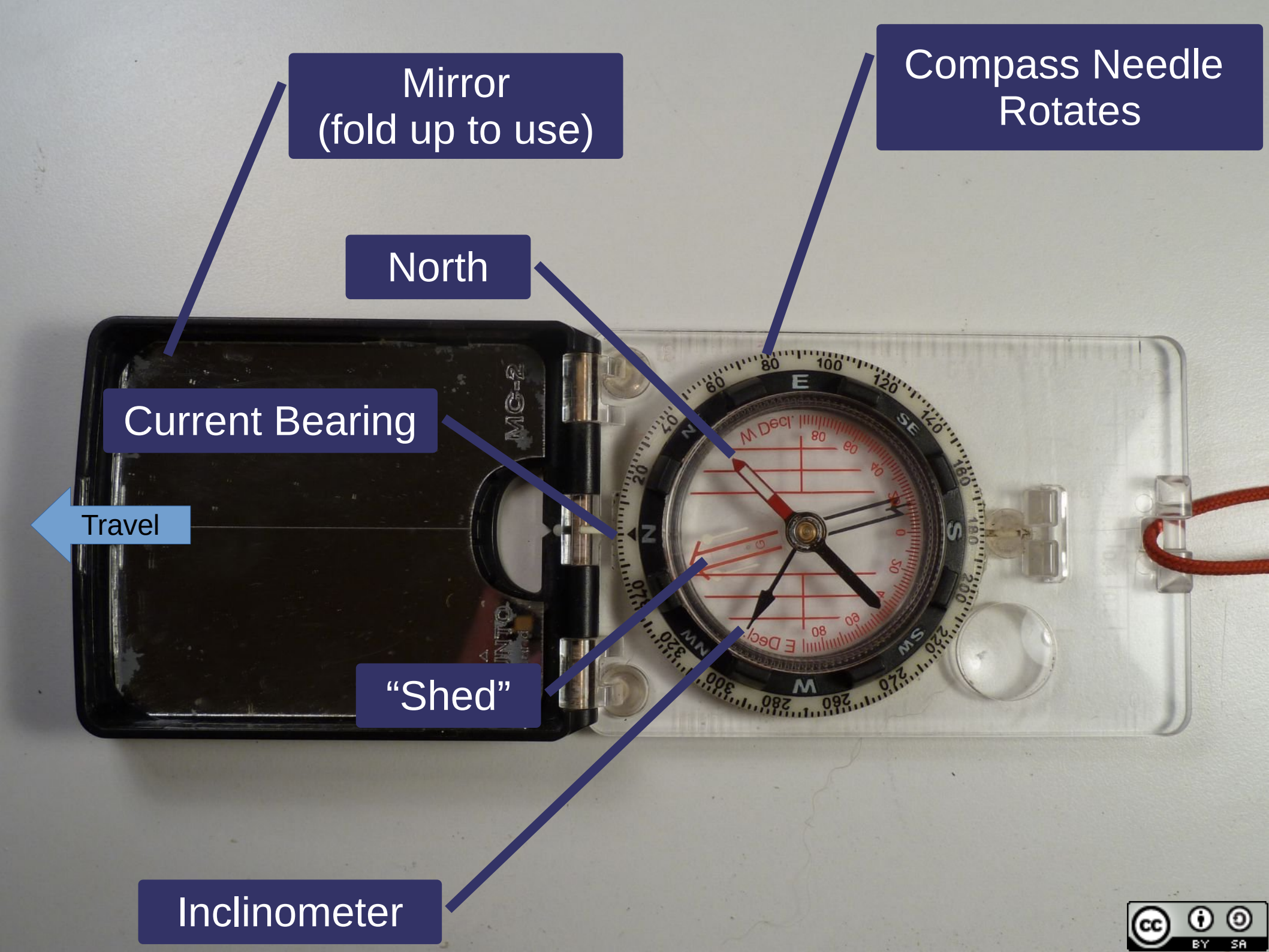
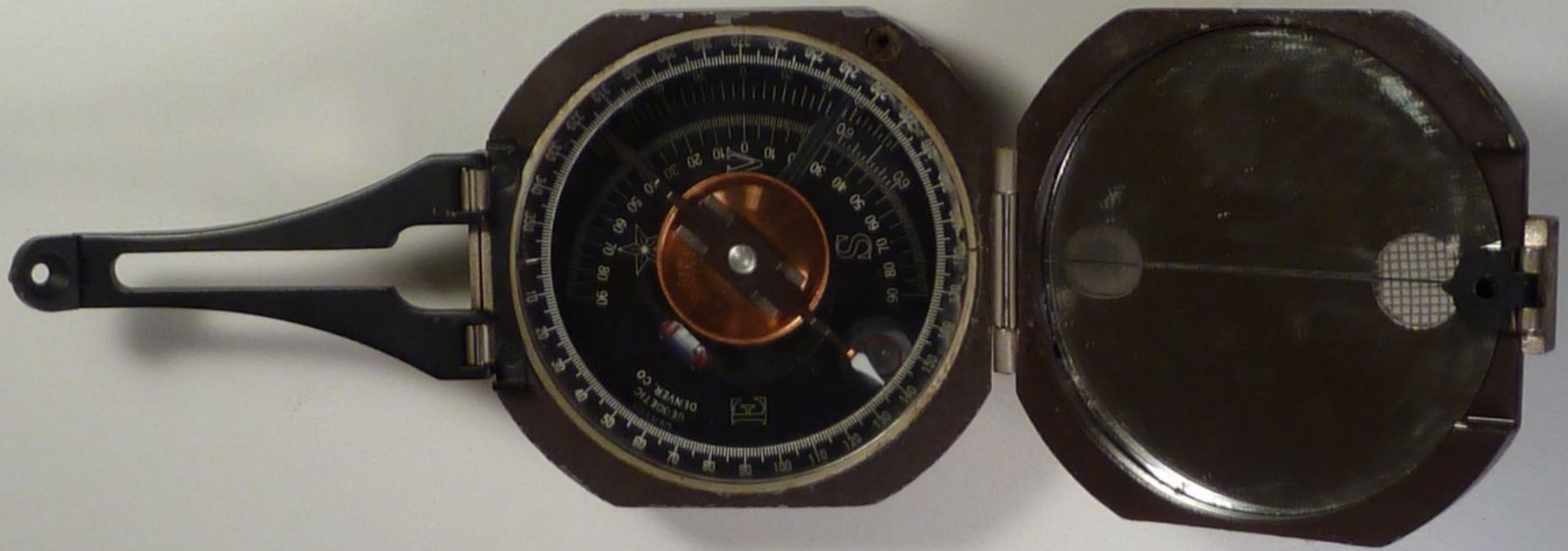

Mirror
(fold up to use)
Compass Needle
Rotates
North
Current Bearing
Travel
“Shed”
Inclinometer

cc BY SA

Geologist's pocket transit
“Brunton”



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Holding a compass

- Baseplate
  - Waist level
- Lensatic
  - To eye
  - Waist level (folded flat)
- Mirror
  - Eye level, away from face
  - Waist level (folded flat)

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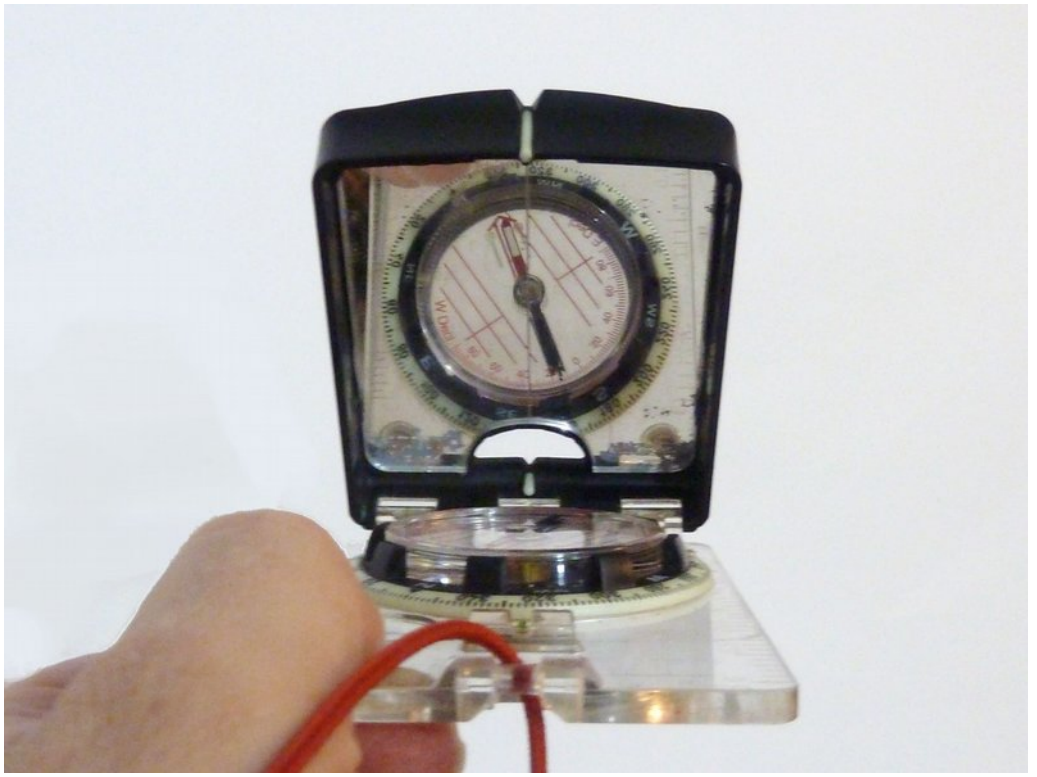
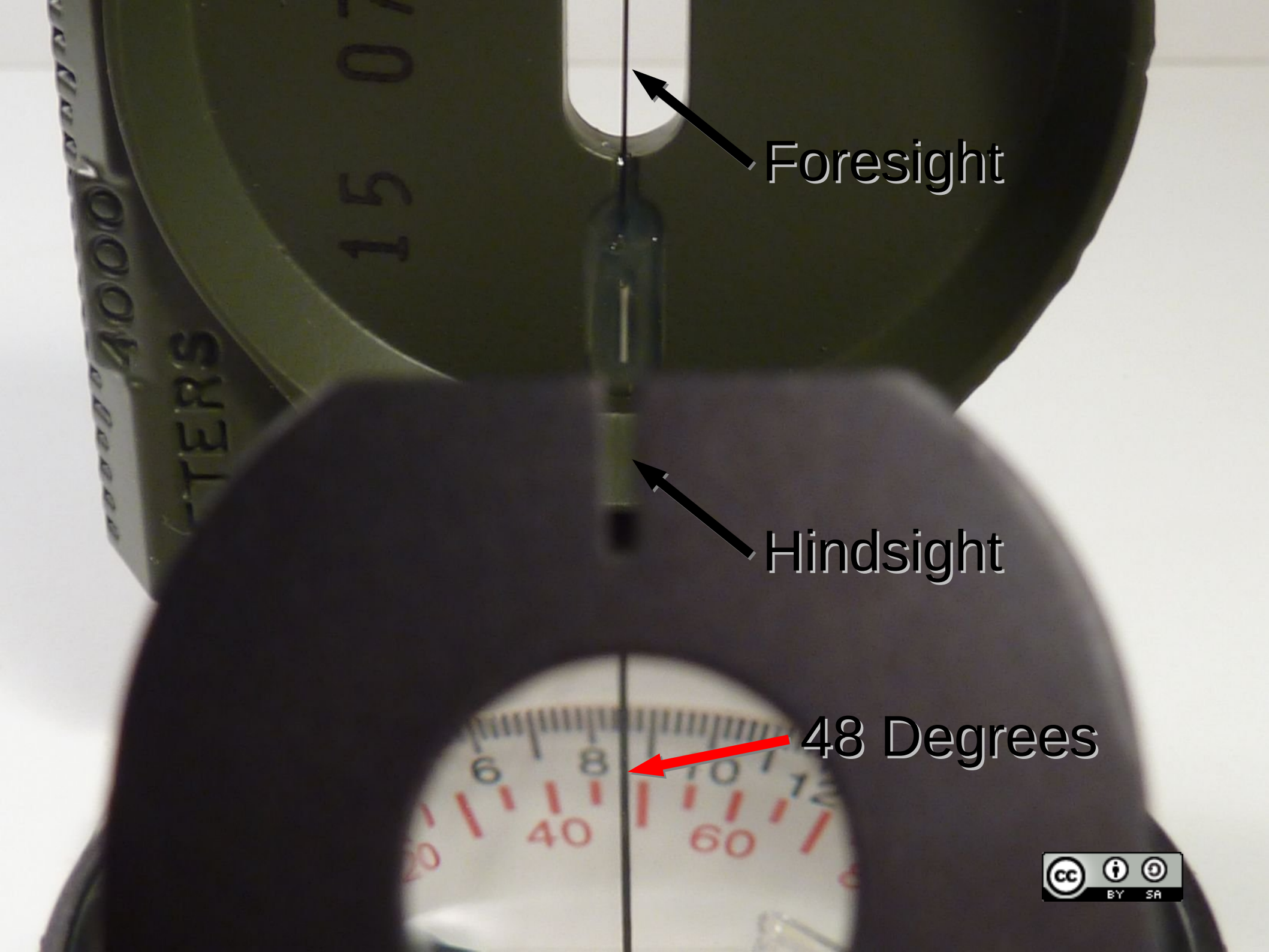
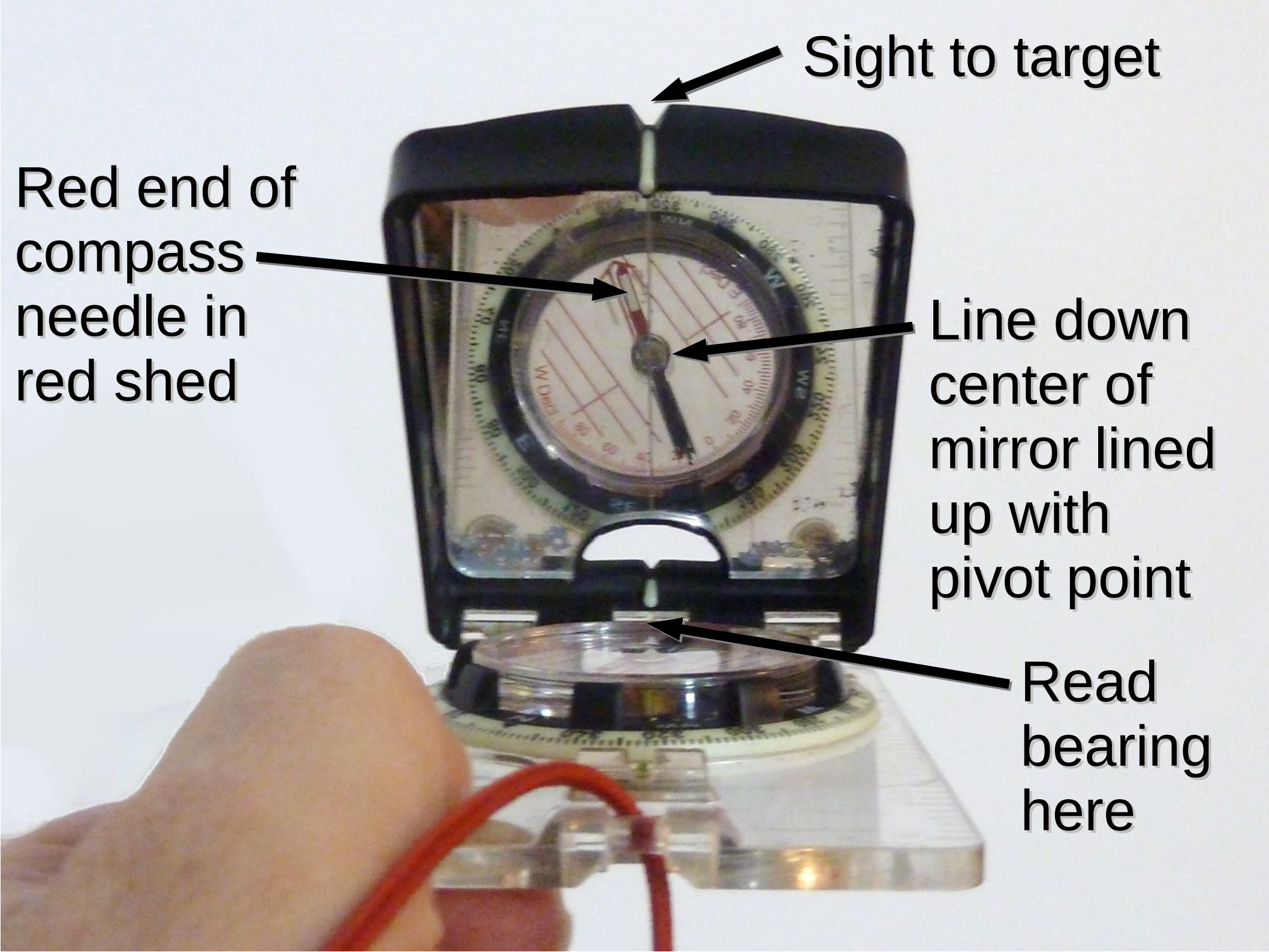
Not next to metal objects...

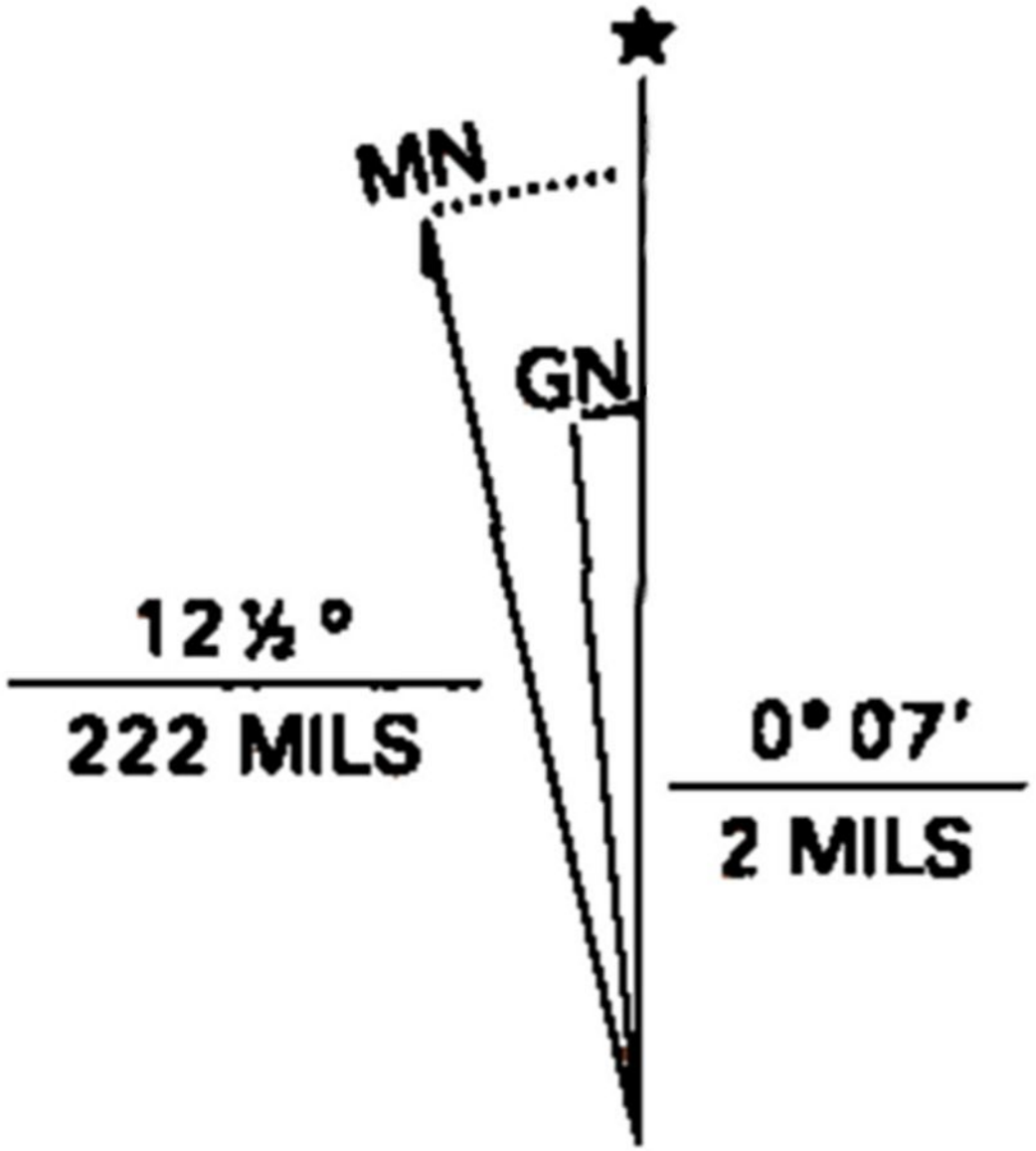
- Compass needle orients to north in the local magnetic field.
- Nearby magnetic objects (vehicles, radios).
- Nearby metal objects (metal tables, rebar in reinforced concrete)
- Iron Ore deposits
- Local natural magnetic variation

Sighting and shooting a bearing




Foresight
Hindsight
48 Degrees


Sight to target
Red end of compass needle in red shed
Line down center of mirror lined up with pivot point
Read bearing here

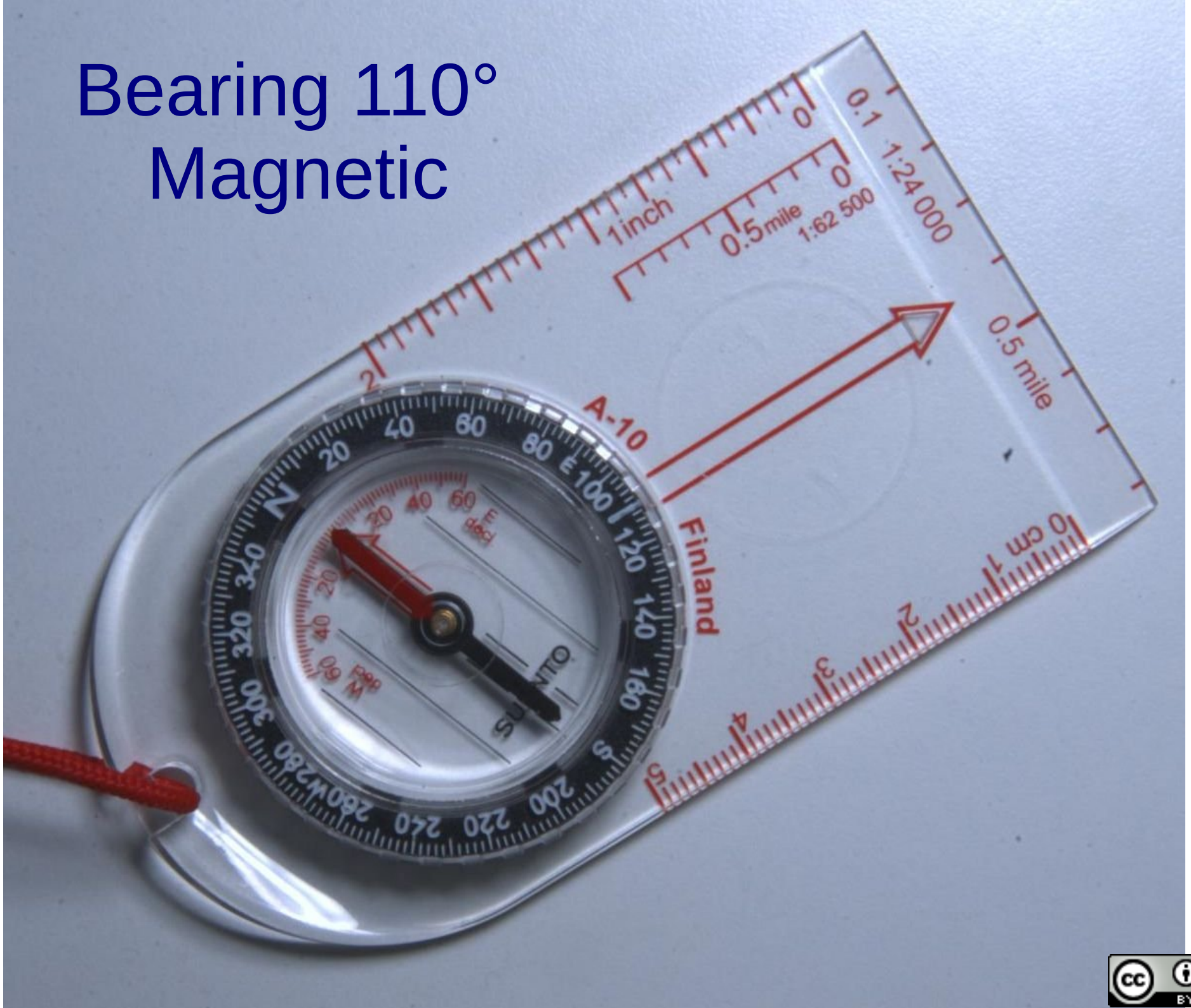


UTM GRID AND 1998 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

Declination & Adjustable Compasses

- Ignore it (OK if near agonic line)
- Do math (Correct for declination)
  - Everyone in the field works with magnetic north
  - People at base do the math, communicate magnetic.
- **Set declination on compass**
  - **Everyone works with true north**
- Mark magnetic north lines on map
  - Everyone works with magnetic north

Bearing 110° Magnetic



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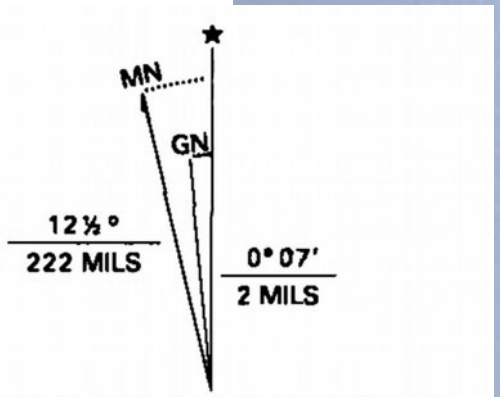

Bearing 110° True

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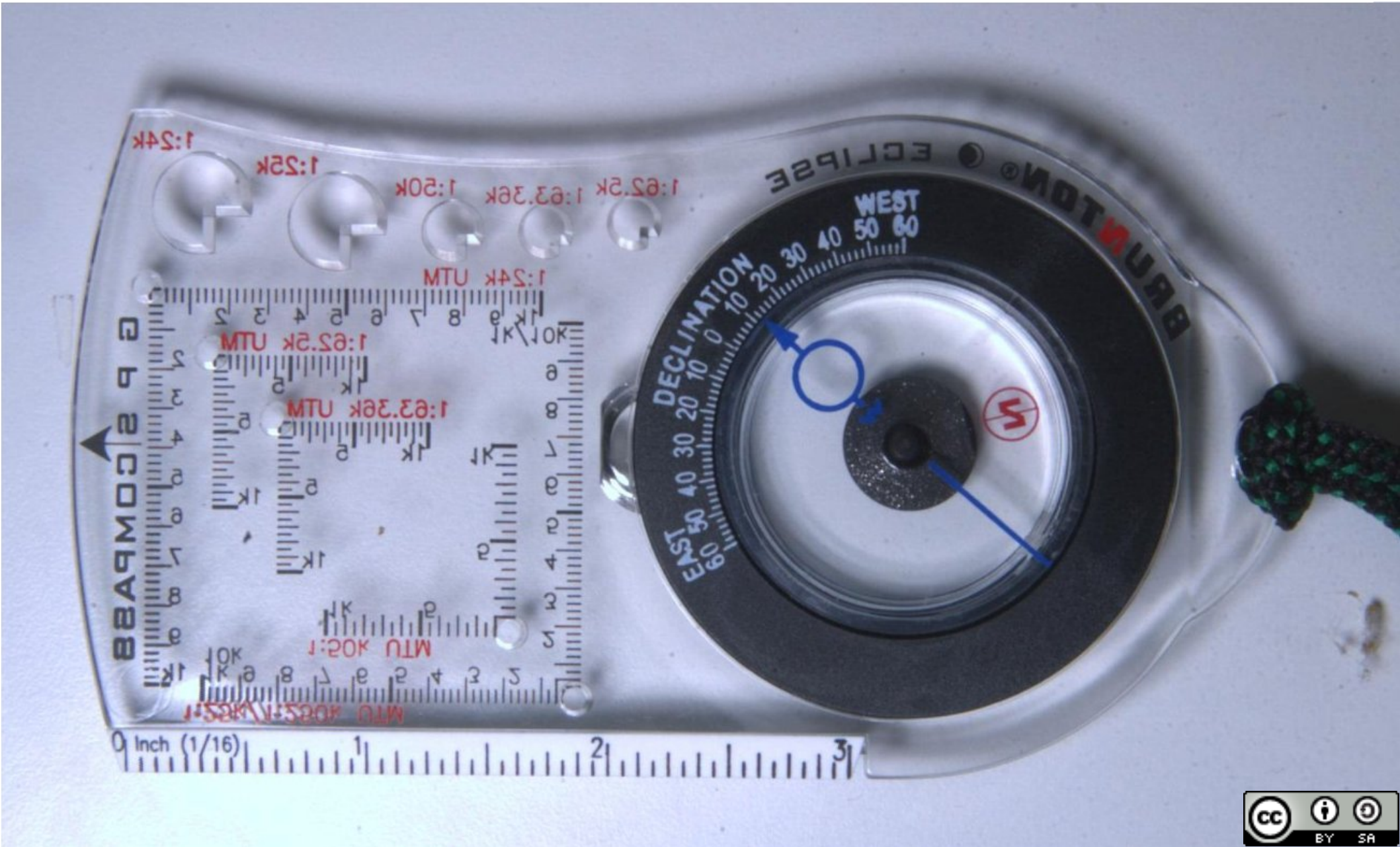
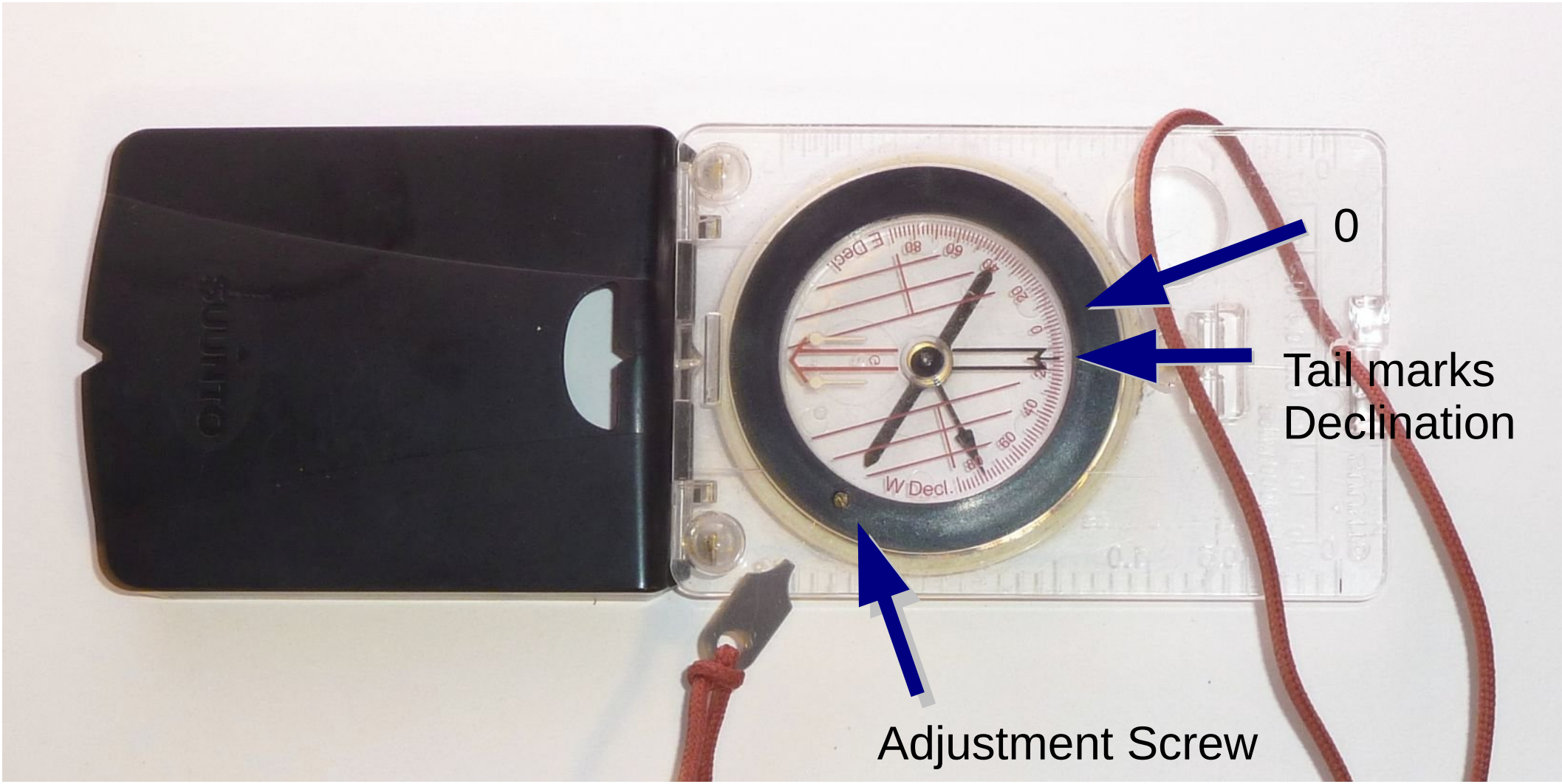
Declination Adjustment



Declination Adjustment



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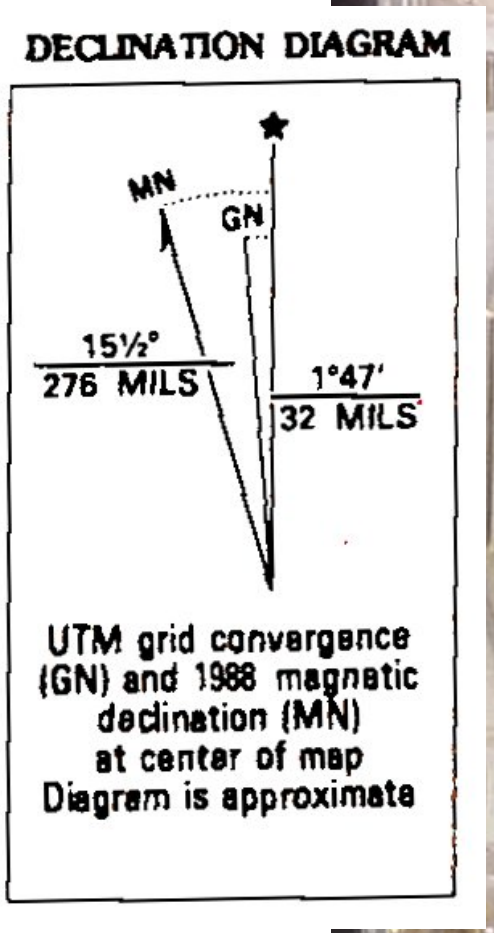

E Decl.

0

Tail marks
Declination
15° W

W Decl.

Adjustment Screw

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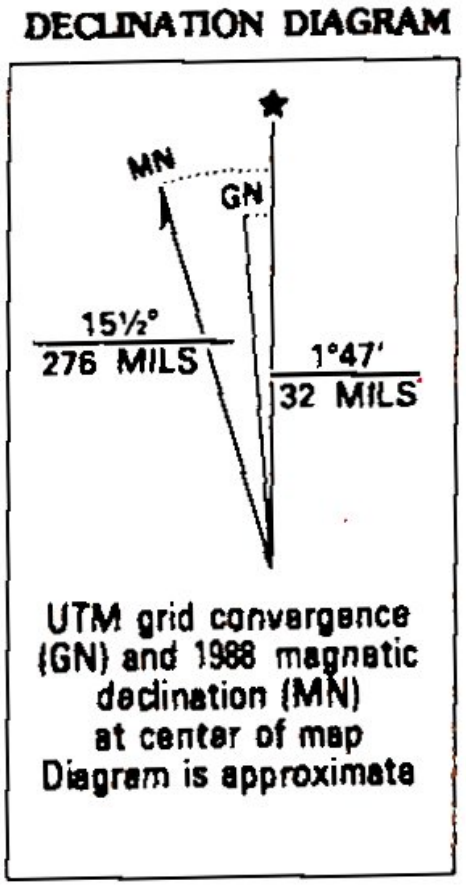
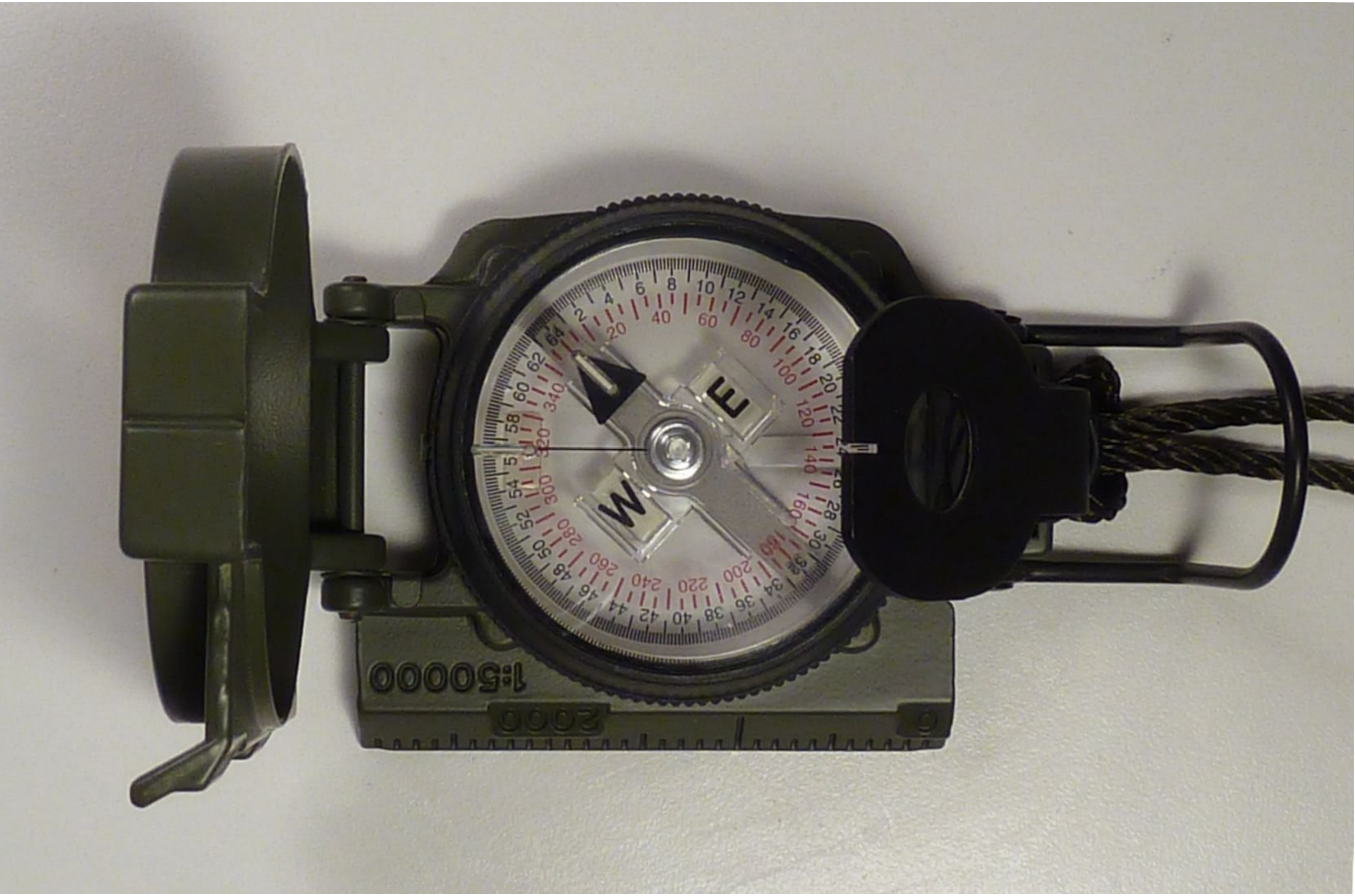
Sanity check



Is magnetic north west of true north?



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Declination & **Lensatic** Compasses

- Ignore it (OK if near agonic line)
- Do math (Correct for declination)
  - Everyone in the field works with magnetic north
  - People at base do the math
- ~~Set declination on compass~~
  - ~~Everyone works with true north~~
- Mark magnetic north lines on map
  - Everyone works with magnetic north

Do Math

- **Map to compass – West, Add**
  - Bearing measured on map: 45 degrees (true)
  - Declination 15 degrees west
  - Map to compass: 45 + 15 = 60 degrees (magnetic)

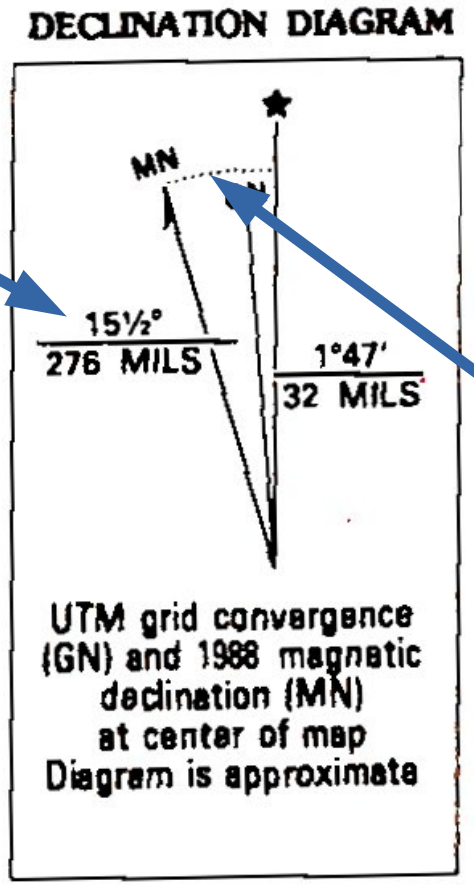
- **Map to compass – West, Add**
- Compass to map – West, Subtract
- Map to compass – East, Subtract
- Compass to map – East, Add

Who does the math?

- Everyone who is moving bearings to/from a map.
  - Do math to convert between magnetic and true bearings and plots on map.
- Everyone in field works with magnetic bearings
- Radio transmissions are magnetic bearings.

Adding A Magnetic North Grid to a Map (Preparing a map for use with magnetic bearings)

Declination is 15 ½ º W



"Diagram is approximate"

Angle between N and MN in the diagram may not be 15 ½ º

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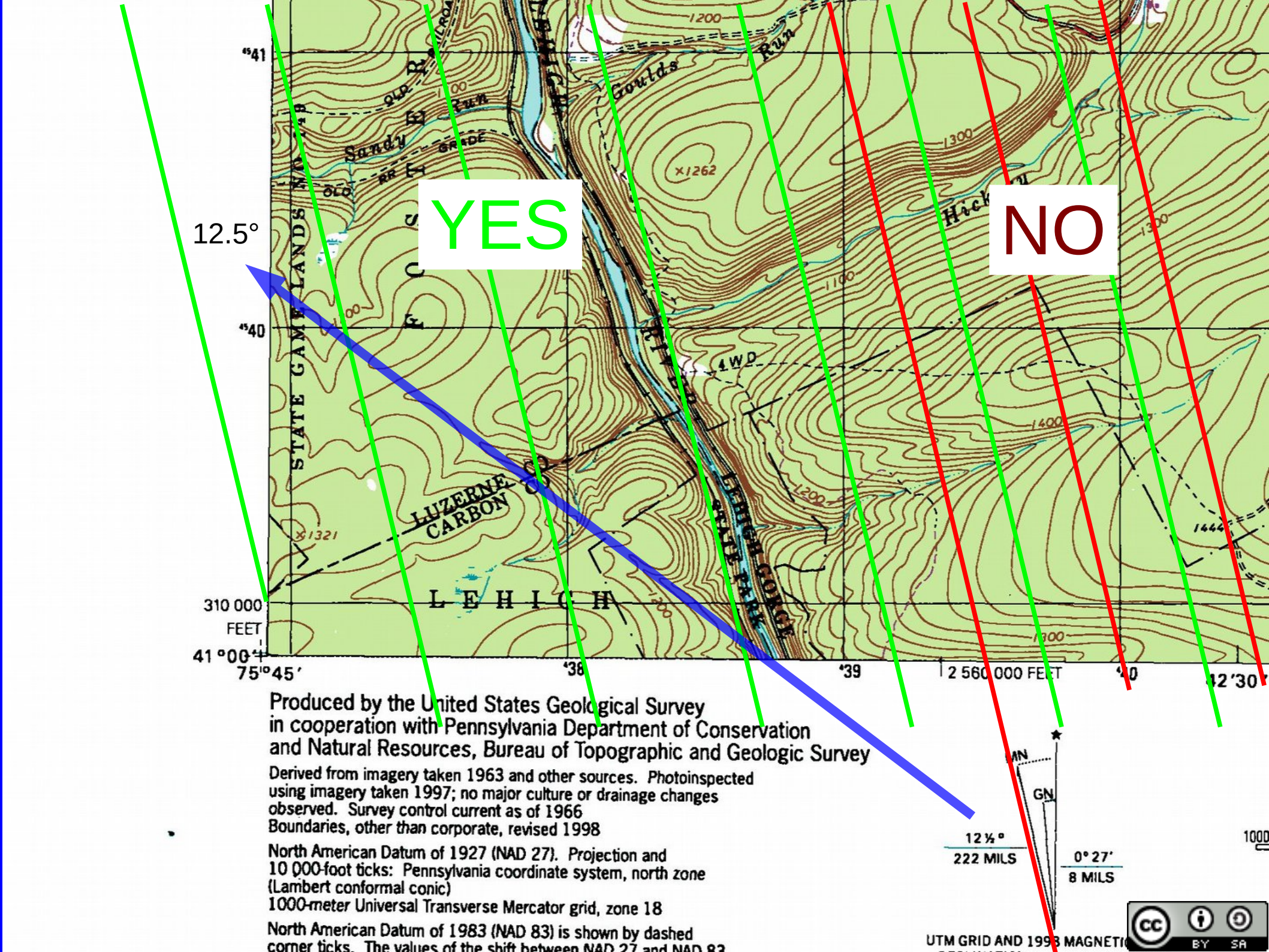
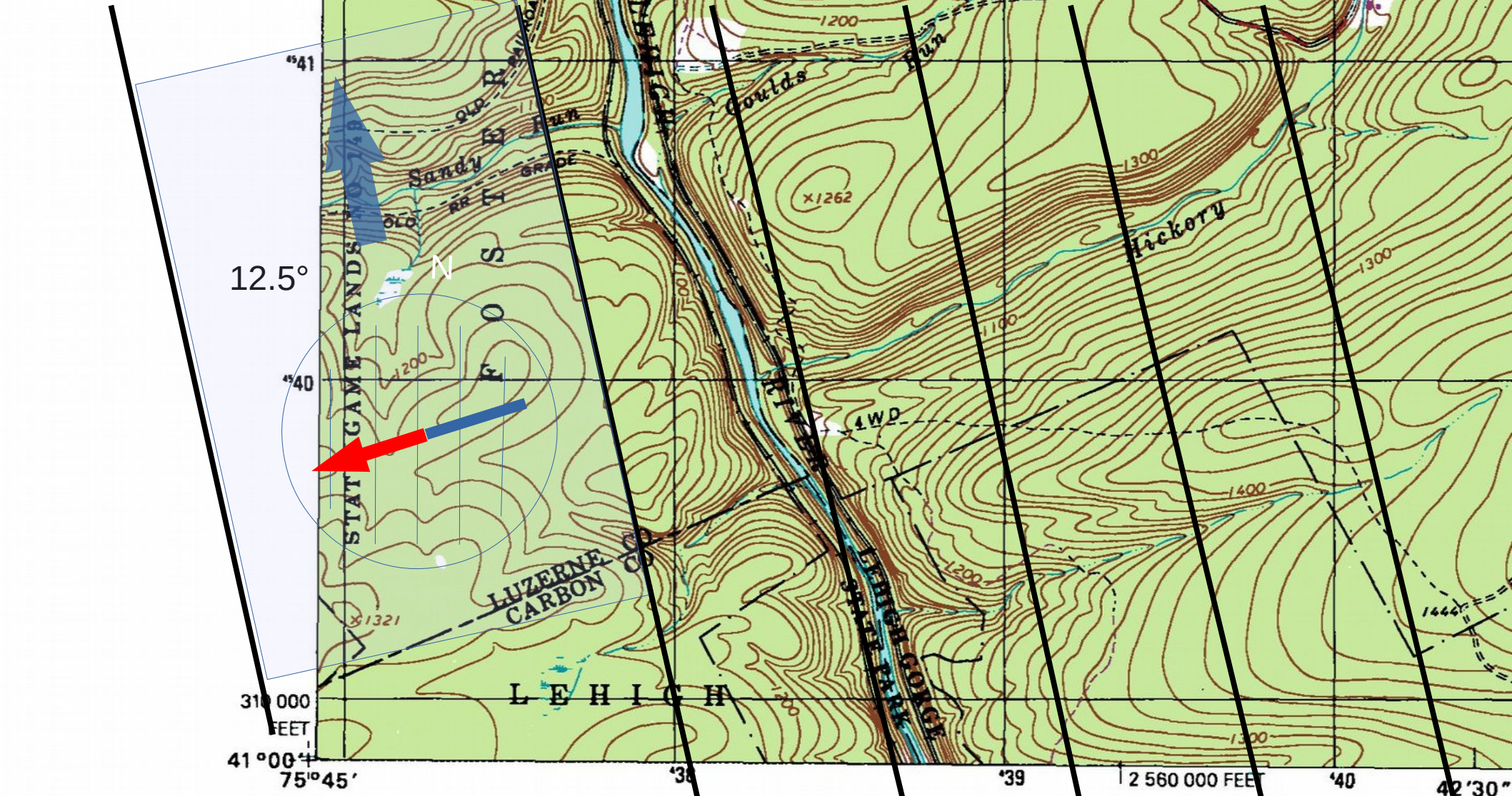

YES
NO
12.5°
STATE GAME LANDS NO. 119
LUZERNE CO.
CARBON CO.
L E H I G H
Gould's Run
Sandy Run
Old R.R. Grade
Lehigh Gorge State Park
1WD
×1262
×1321
1200
1300
1400
1100
310 000 FEET
41°00'
75°45'
2 560 000 FEET
Produced by the United States Geological Survey
in cooperation with Pennsylvania Department of Conservation
and Natural Resources, Bureau of Topographic and Geologic Survey
Derived from imagery taken 1963 and other sources. Photoinspected using imagery taken 1997; no major culture or drainage changes observed. Survey control current as of 1966
Boundaries, other than corporate, revised 1998
North American Datum of 1927 (NAD 27). Projection and 10 000-foot ticks: Pennsylvania coordinate system, north zone (Lambert conformal conic)
1000-meter Universal Transverse Mercator grid, zone 18
North American Datum of 1983 (NAD 83) is shown by dashed corner ticks. The values of the shift between NAD 27 and NAD 83
12½°
222 MILS
0° 27'
8 MILS
UTM GRID AND 1993 MAGNETI



Produced by the United States Geological Survey
in cooperation with Pennsylvania Department of Conservation
and Natural Resources, Bureau of Topographic and Geologic Survey

Derived from imagery taken 1963 and other sources. Photoinspected using imagery taken 1997; no major culture or drainage changes observed. Survey control current as of 1966
Boundaries, other than corporate, revised 1998

North American Datum of 1927 (NAD 27). Projection and 10 000-foot ticks: Pennsylvania coordinate system, north zone (Lambert conformal conic)
1000-meter Universal Transverse Mercator grid, zone 18

North American Datum of 1983 (NAD 83) is shown by dashed corner ticks. The values of the shift between NAD 27 and NAD 83 for 7.5-minute intersections are obtainable from National Geodetic

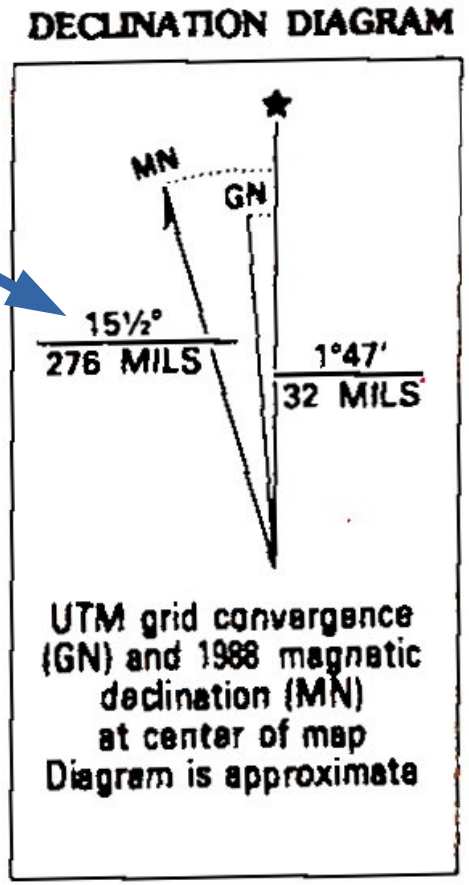
MN
GN
12½°
222 MILS
0°27'
8 MILS

UTM GRID AND 1998 MAGNETIC
DECLINATION AT CENTER OF

CC BY SA

What happens if you don’t account for declination?

15 ½ º W



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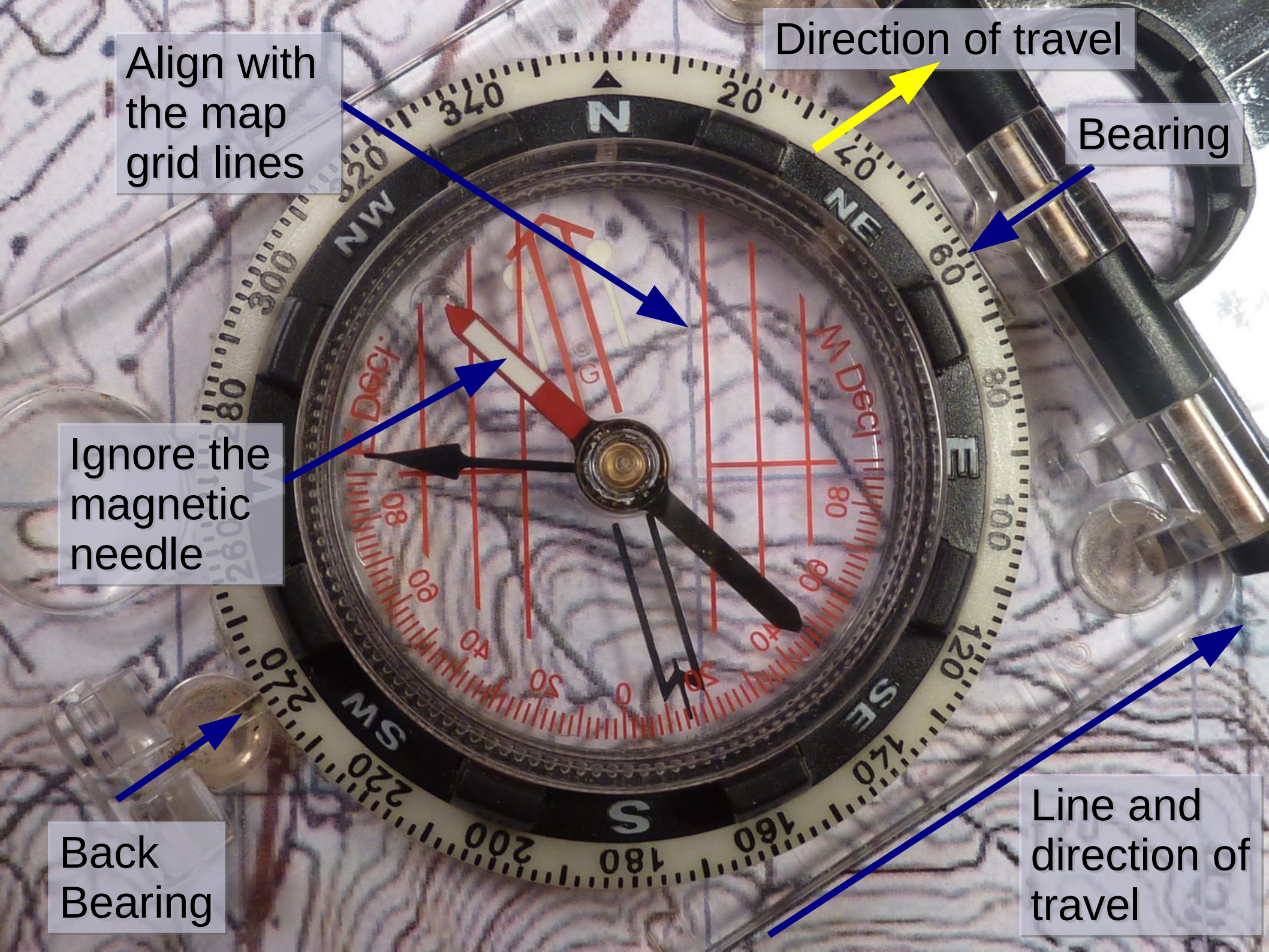
Measuring bearings on a map.


Direction of travel
Line and direction of travel
N
NE
E
SE
S
SW
W
NW
E Decl.
M Decl.

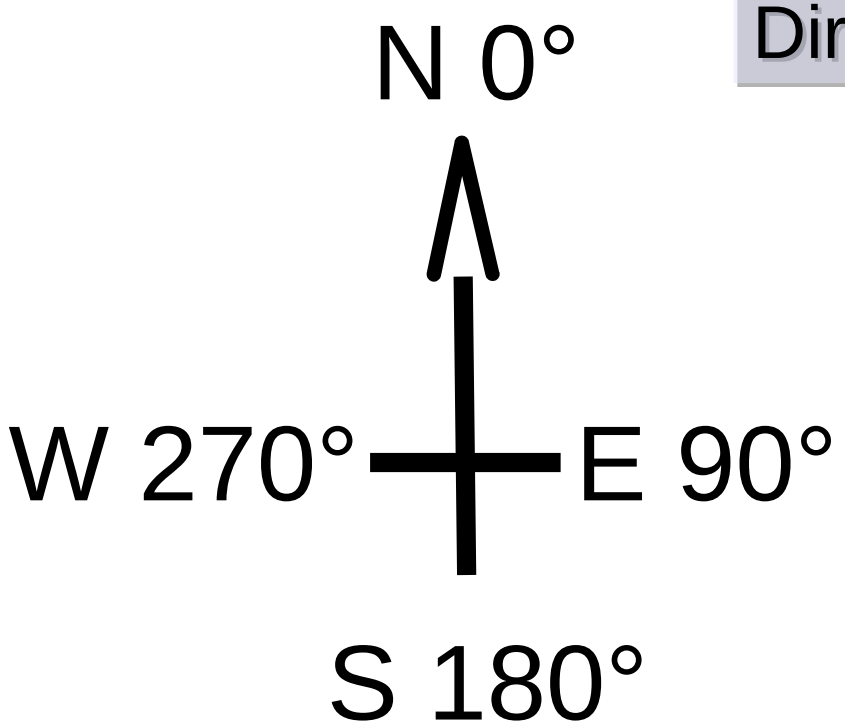

Direction of travel
Align with the map grid lines
Bearing
Ignore the magnetic needle
Back Bearing
Line and direction of travel
N
NE
E
SE
S
SW
NW
M Decl
G Decl

Sanity Check

Bearing

60°

Direction of travel



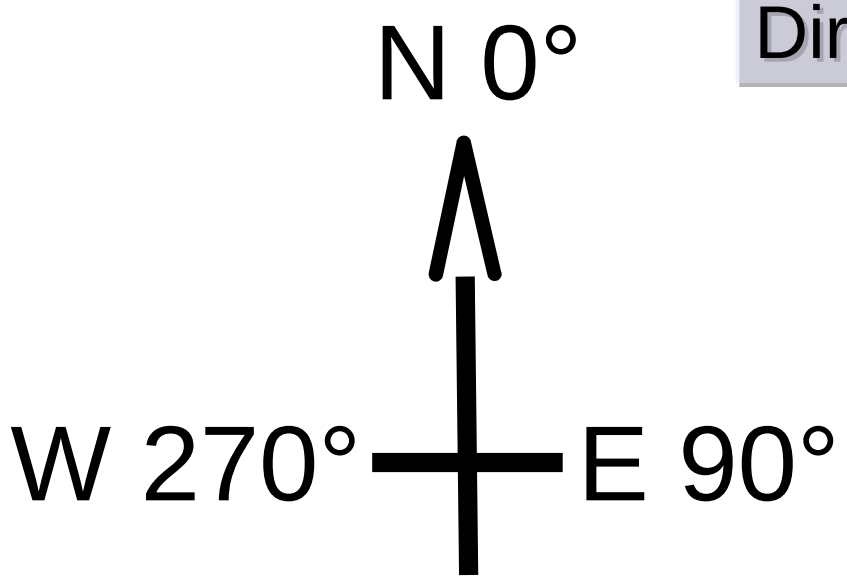
Line and direction of travel

CC BY SA

Sanity Check

Bearing

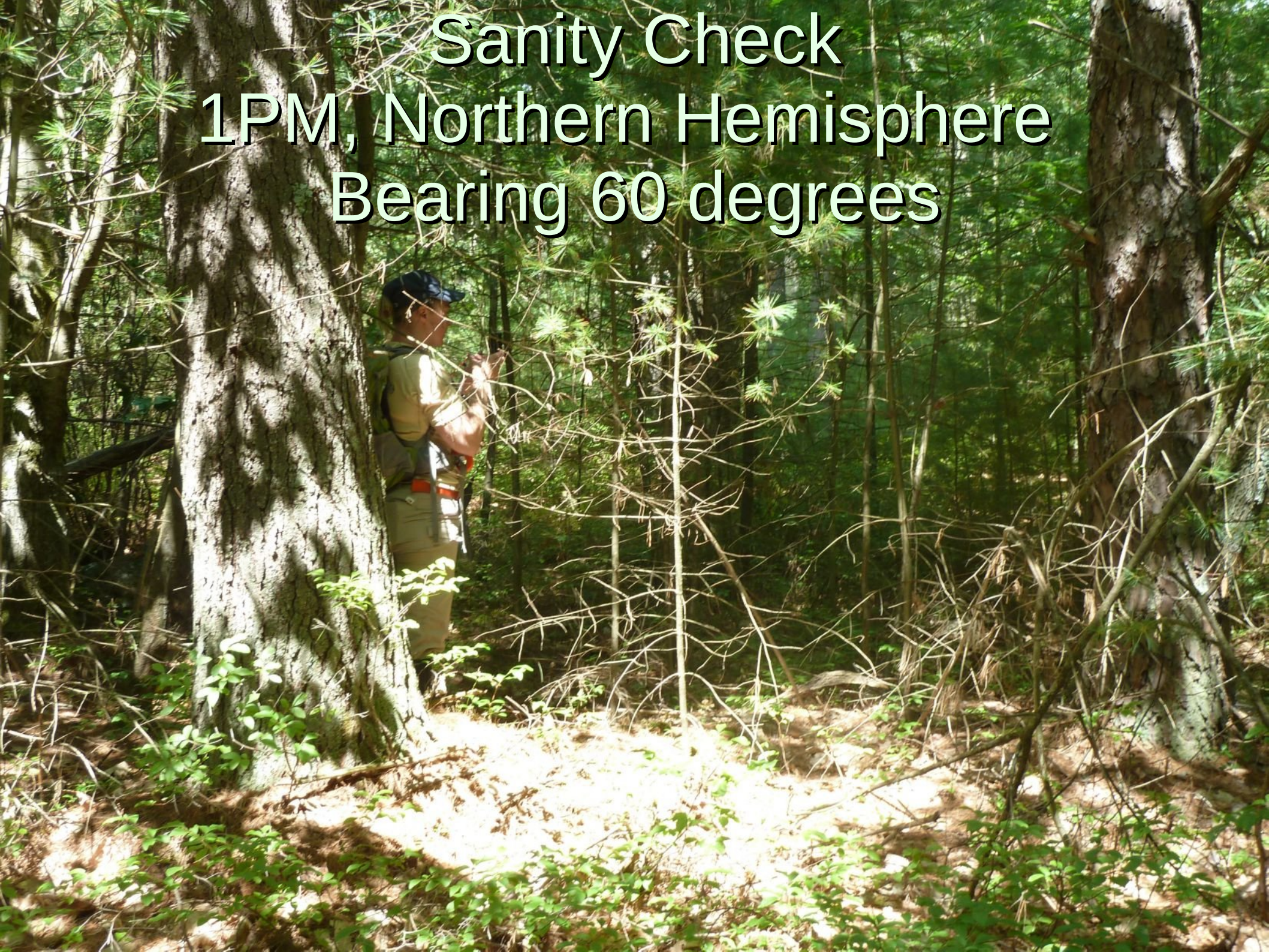
240°



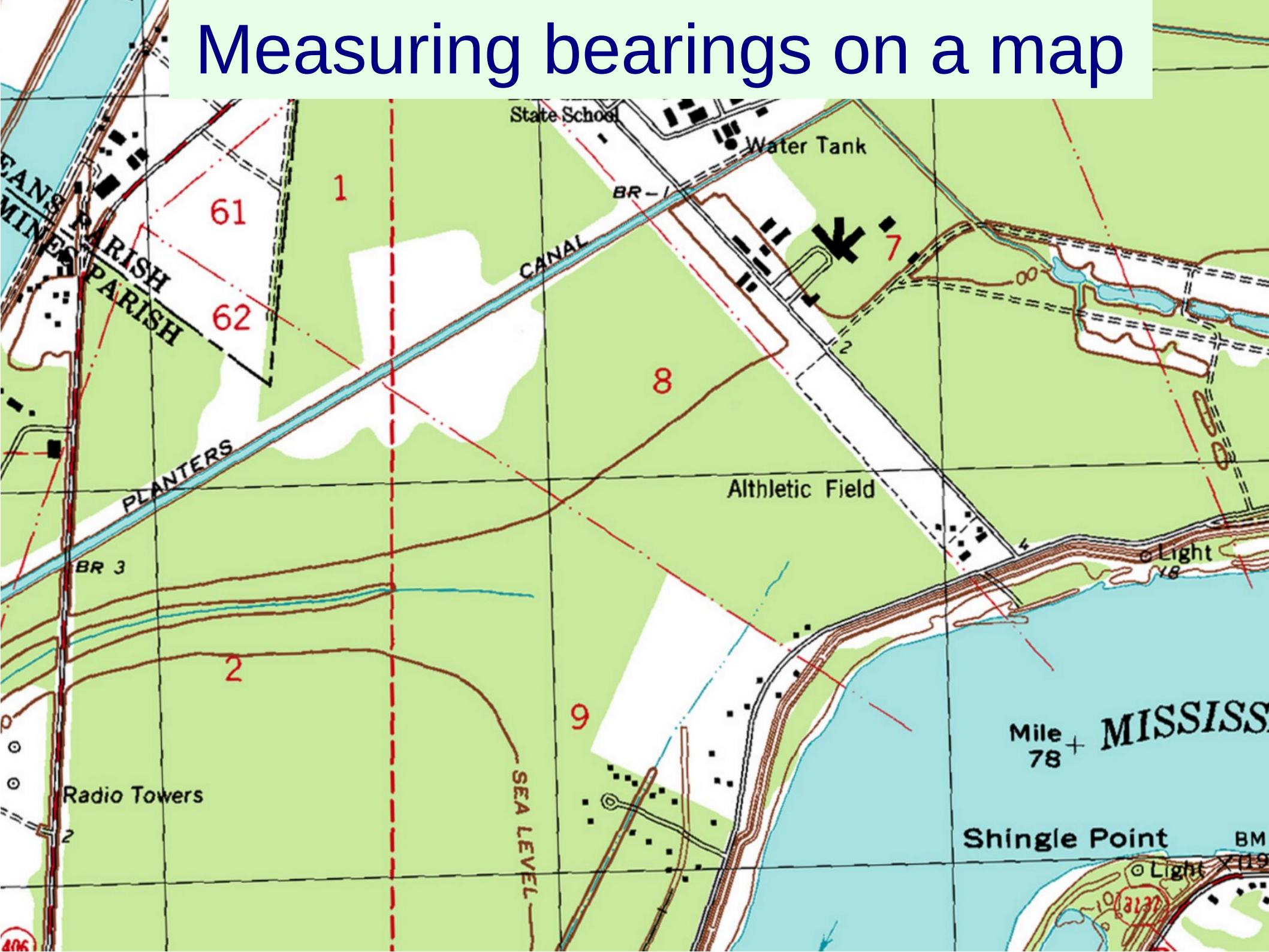
Direction of travel

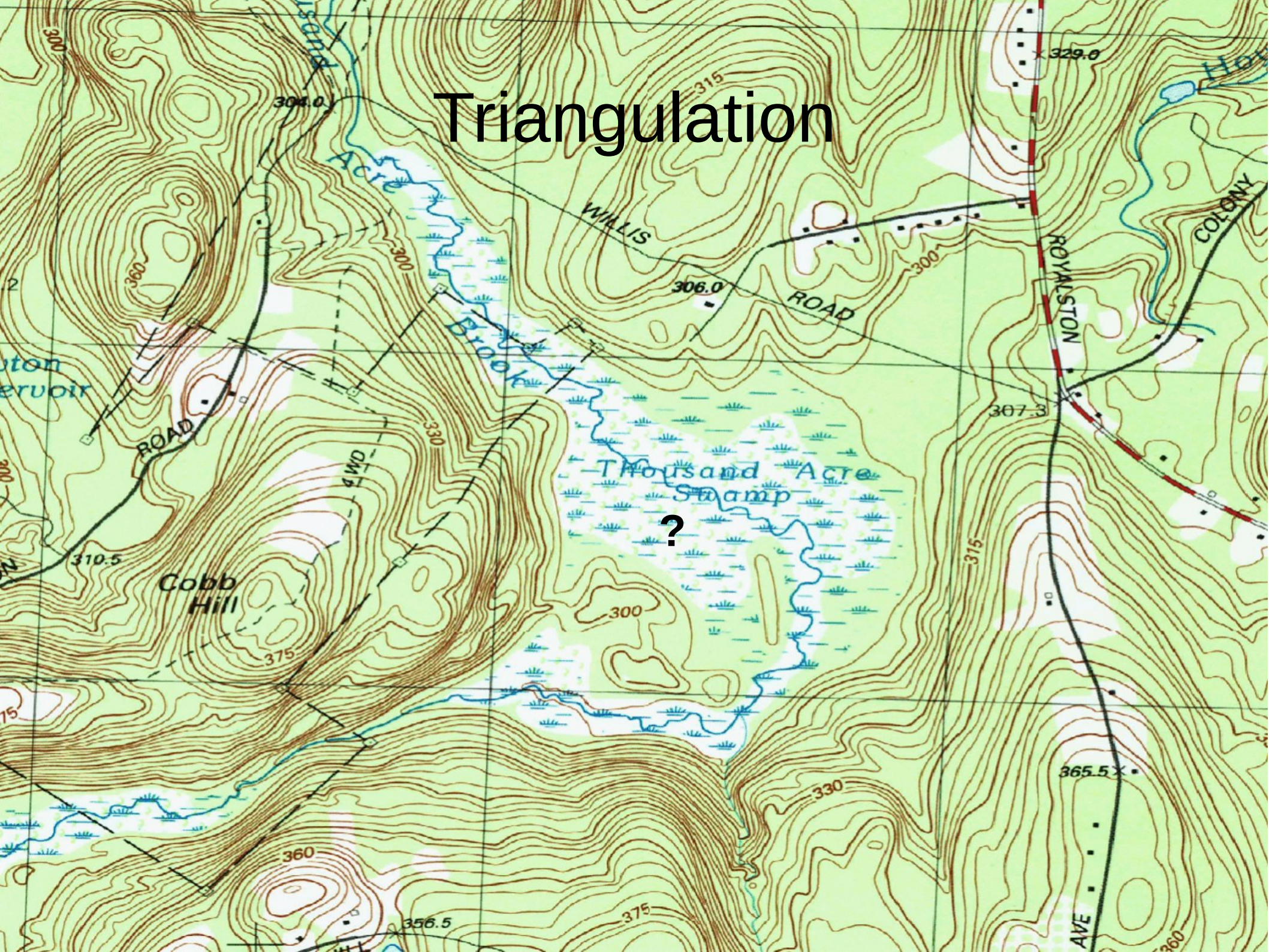
Line and direction of travel

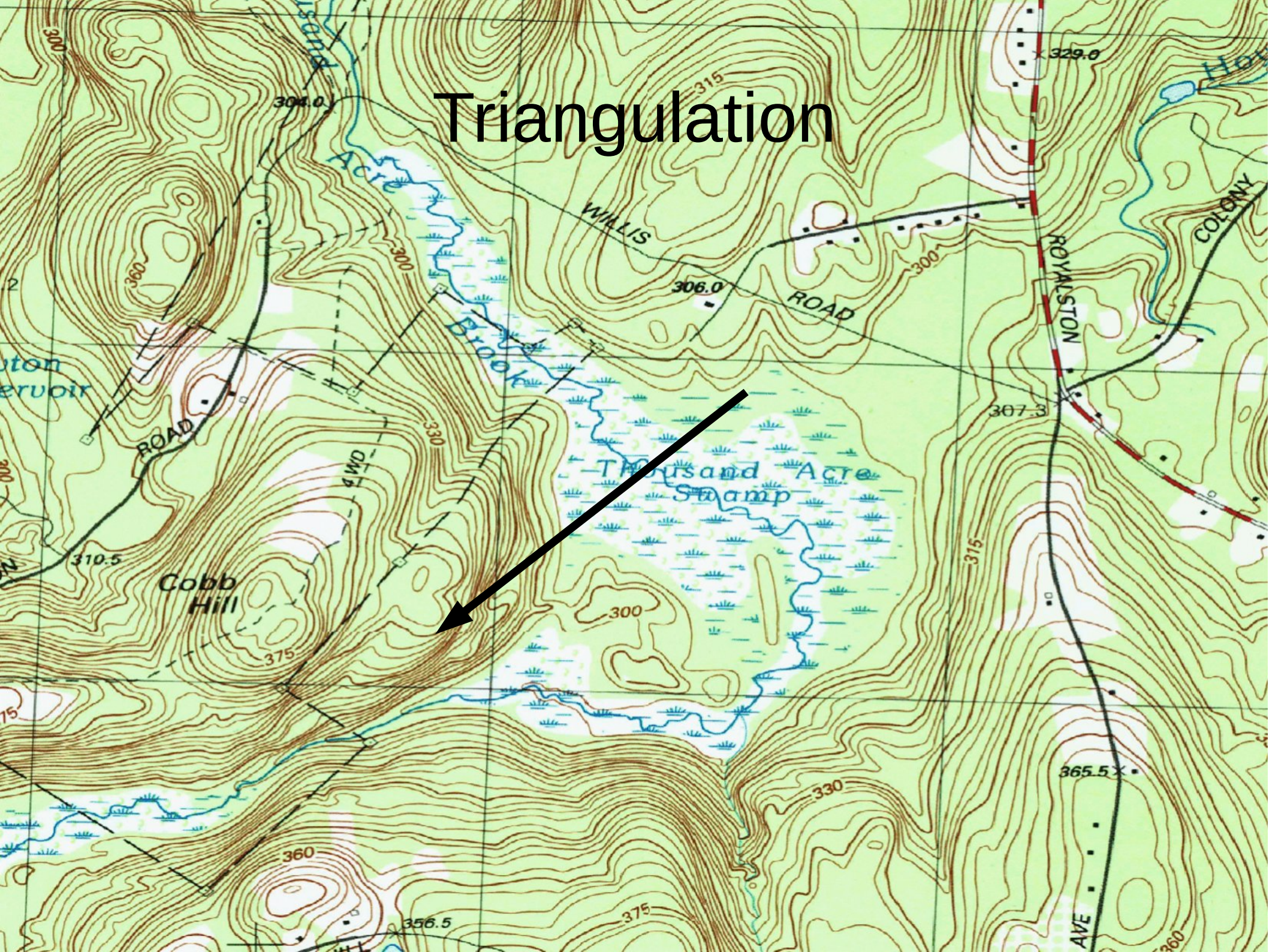
CC BY SA

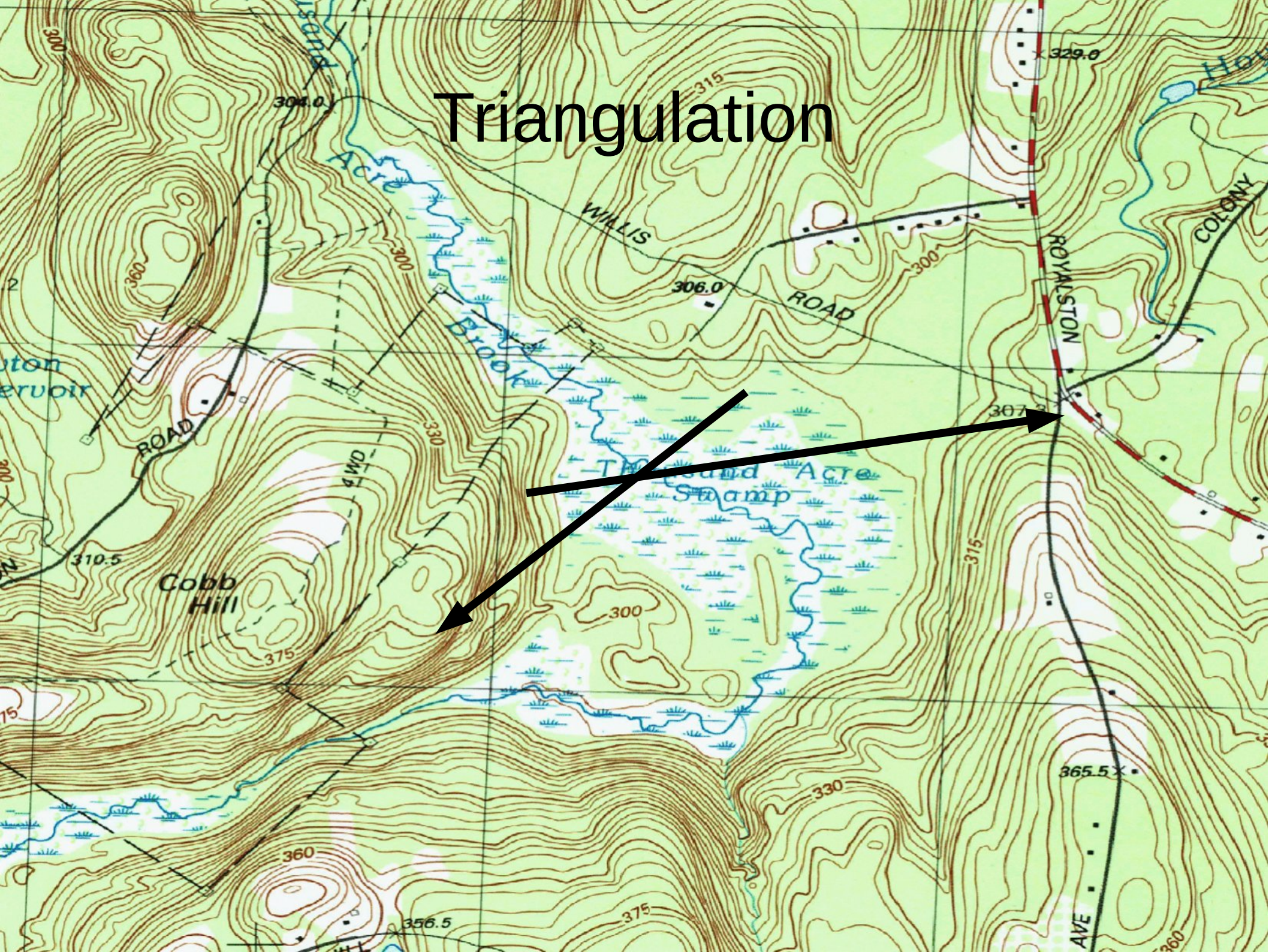

Sanity Check
1PM, Northern Hemisphere
Bearing 60 degrees

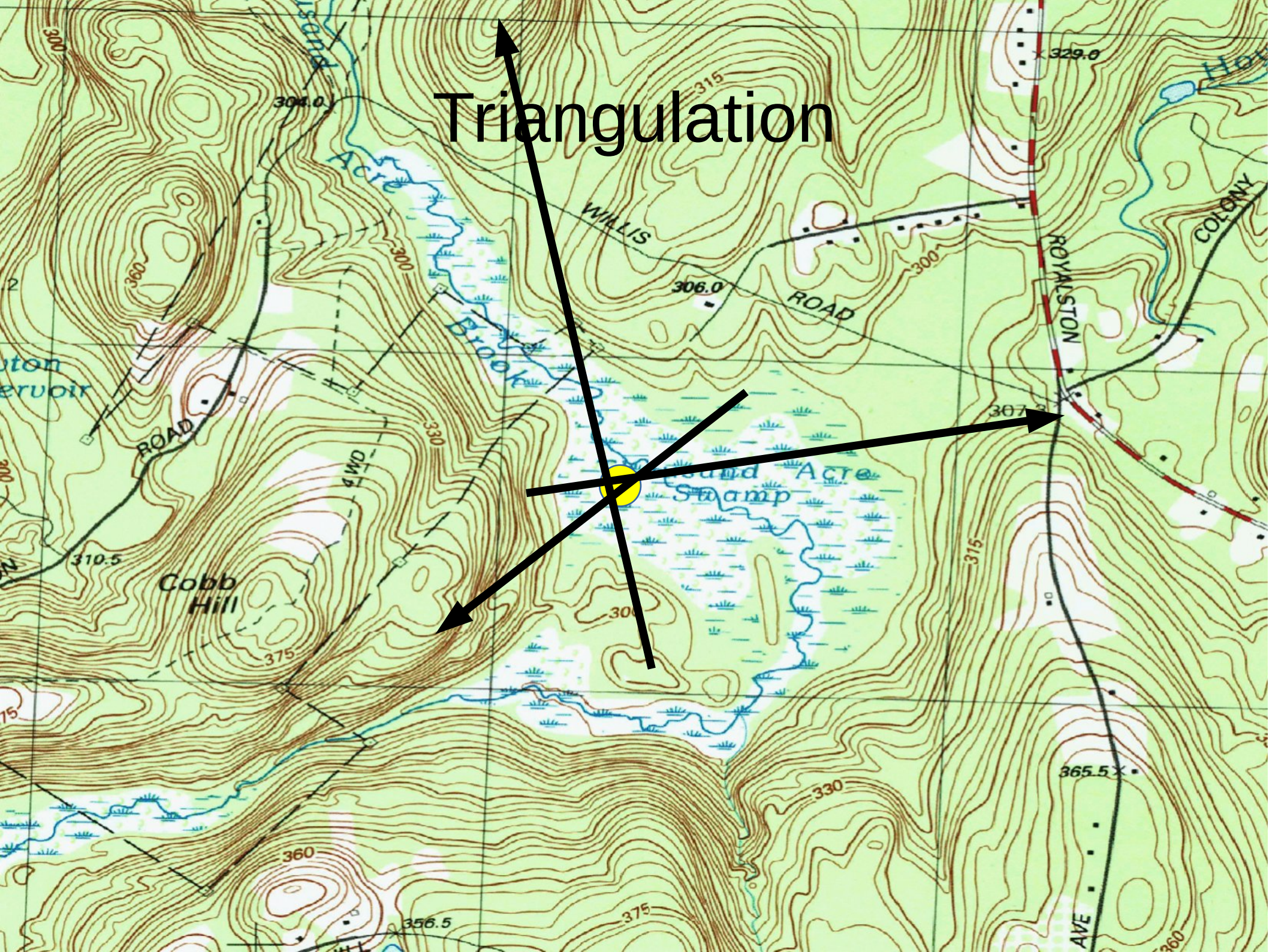
Measuring bearings on a map



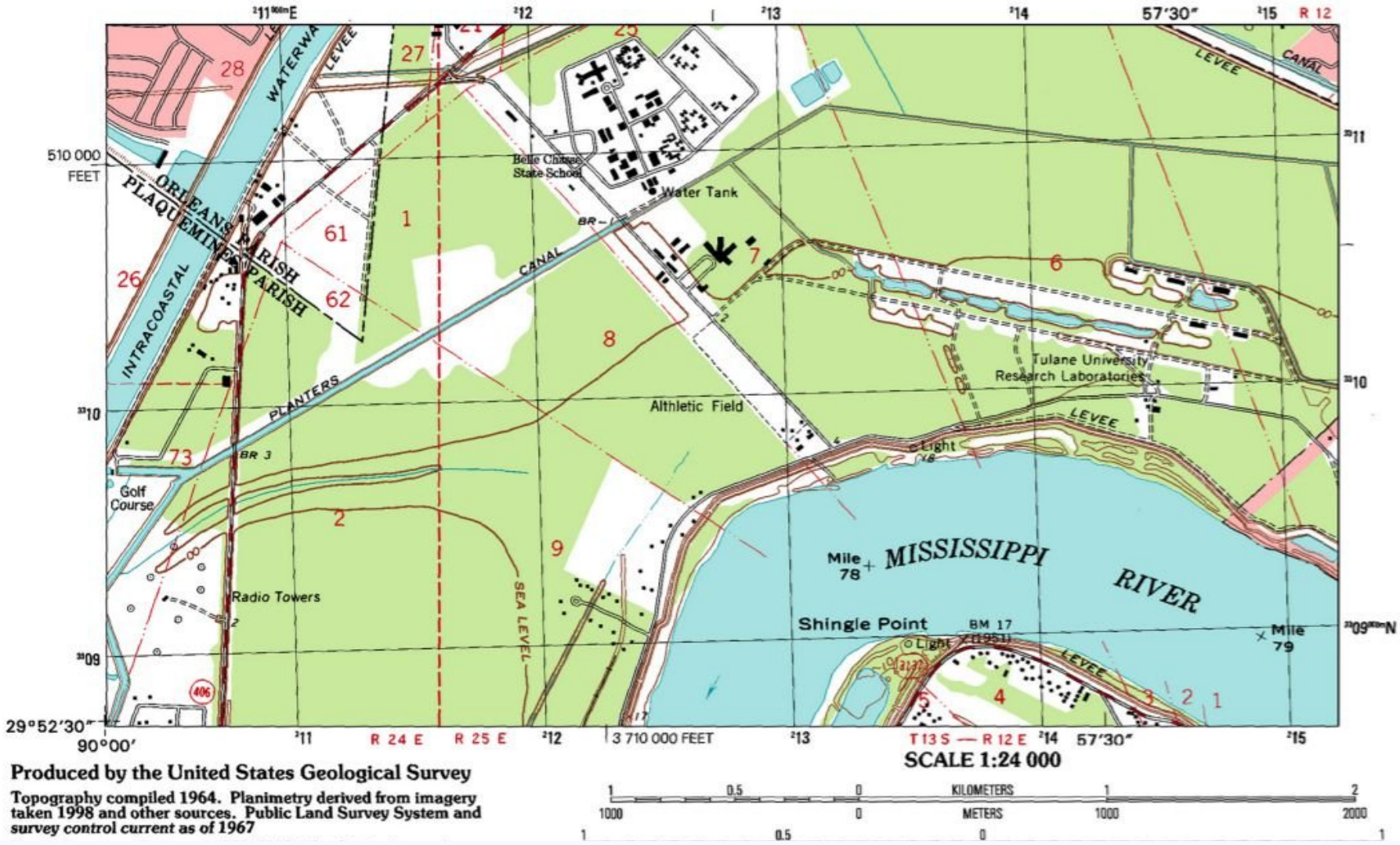

Triangulation
?
Thousand Acre Swamp
Cobb Hill
WILLIS ROAD
ROYALSTON
COLONY
ROAD
Acre Brook
329.0
306.0
307.3
310.5
365.5
356.5


Triangulation
Thousand Acre Swamp
Cobb Hill
WILLIS ROAD
ROYALSTON
COLONY
Thousand Acre Brook
304.0
306.0
307.3
310.5
329.0
356.5
365.5


Triangulation
Acre
Brook
WILLIS
ROAD
ROYALSTON
COLONY
Swamp
Cobb
Hill
304.0
306.0
310.5
329.0
365.5
356.5
300
315
330
360
375


Triangulation
WILLIS
ROAD
ROYALSTON
COLONY
Acre
Brook
Sand Acre
Swamp
Cobb
Hill
ROAD
329.0
306.0
310.5
356.5
365.5
300
315
330
360
375

US National Grid Training Map



Produced by the United States Geological Survey

Topography compiled 1964. Planimetry derived from imagery taken 1998 and other sources. Public Land Survey System and survey control current as of 1967

Triangulation

QUADRANGLE LOCATION

6	7	8

7 Belle Chasse
8 Delacroix

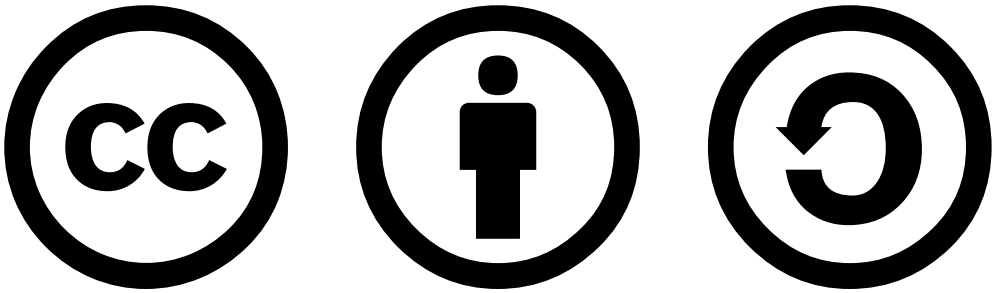
ADJOINING 7.5' QUADRANGLE NAMES
LA 200A

Grid Zone Designation
16R

UTM GRID AND 2000 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

Orient map to north

- By Landmarks
- With Compass



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