

Orienteering

Presented by

Chris Houlberg

Scoutmaster Troop 119

What is Orienteering

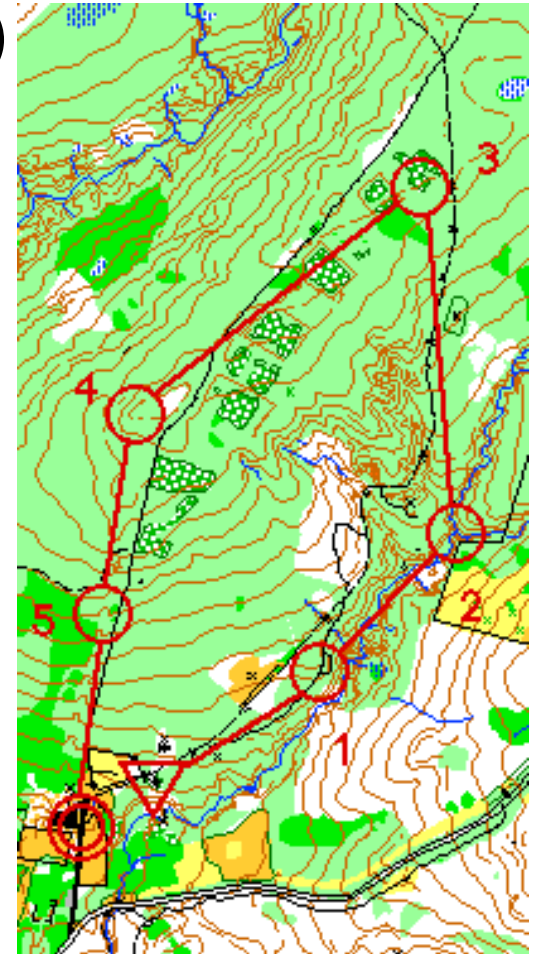
- Orienteering is a Sport
 - Walk in the Woods
 - Competitive event
 - Participants use an Accurate Detailed Map and Description to find Points in a Landscape
- Orienteering is a Merit Badge
 - Requirements Revised January 1, 2004
 - Know Basic First Aid
 - Know how to use Map and Compass
 - Participate in and Teach Orienteering

Orienteering Course

- Consists of a Start, Series of Control Sites and a Finish
- Control Sites
 - On a Map they are Marked by Circles, Connected by Lines and Numbered in the Order in which they are to be Visited
 - On the Ground they are Marked by Flags
- Control Site Visits are Verified
 - Punch hanging next to the Control Flag
 - Participants must Punch their Control Card
- Route between Controls is not Specified
- Several Course Levels are usually Available at a Meet

Orienteering Map & Description

- Most Orienteering Maps (based on topographic)
 - 5 Color
 - 5 Meter Contour Lines
 - Scale of 1:15,000 (1 cm => 150 m)
 - A Series of North Lines (magnetic) for Reference
- Course Levels Range from Beginner (White) to Expert (Blue)
- WHITE 3.5 km 75 m climb
 - Start: Corner of the field
 - 1 BL trail junction
 - 2 JC stream junction
 - 3 PG SW corner of the evergreens
 - 4 MP SW end of the knoll
 - 5 BL upper part of the reentrant
 - Finish: NE corner of the building (350 m)



Topographic Map Symbols

BATHYMETRIC FEATURES

Area exposed at mean low tide; sounding datum line***	
Channel***	
Sunken rock***	

BUILDINGS AND RELATED FEATURES

Building	
School; house of worship	
Athletic field	
Built-up area	
Forest headquarters*	
Ranger district office*	
Guard station or work center*	
Racetrack or raceway	
Airport, paved landing strip, runway, taxiway, or apron	
Unpaved landing strip	
Well (other than water), windmill or wind generator	
Tanks	
Covered reservoir	
Gaging station	
Located or landmark object (feature as labeled)	
Boat ramp or boat access*	
Roadside park or rest area	
Picnic area	
Campground	
Winter recreation area*	
Cemetery	

COASTAL FEATURES

Foreshore flat	
Coral or rock reef	
Rock, bare or awash; dangerous to navigation	
Group of rocks, bare or awash	
Exposed wreck	
Depth curve; sounding	
Breakwater, pier, jetty, or wharf	
Seawall	
Oil or gas well; platform	

BOUNDARIES

National	
State or territorial	
County or equivalent	
Civil township or equivalent	
Incorporated city or equivalent	
Federally administered park, reservation, or monument (external)	
Federally administered park, reservation, or monument (internal)	
State forest, park, reservation, or monument and large county park	
Forest Service administrative area*	
Forest Service ranger district*	
National Forest System land status, Forest Service lands*	
National Forest System land status, non-Forest Service lands*	
Small park (county or city)	

CONTOURS

Topographic

Index	
Approximate or indefinite	
Intermediate	
Approximate or indefinite	
Supplementary	
Depression	
Cut	
Fill	
Continental divide	

Bathymetric

Index***	
Intermediate***	
Index primary***	
Primary***	
Supplementary***	

CONTROL DATA AND MONUMENTS

Principal point**		3-20
U.S. mineral or location monument		USMM 438
River mileage marker		Mile 69
Boundary monument		
Third-order or better elevation, with tablet		BM 9134 BM 277
Third-order or better elevation, recoverable mark, no tablet		5628
With number and elevation		67 4567
Horizontal control		
Third-order or better, permanent mark		Neace Neace
With third-order or better elevation		BM 52 Pike BM393
With checked spot elevation		1012
Coincident with found section corner		Cactus Cactus
Unmonumented**		

Topographic Map Symbols (Cont.)

CONTROL DATA AND MONUMENTS – *continued*

Vertical control

Third-order or better elevation, with tablet	BM × 5280
Third-order or better elevation, recoverable mark, no tablet	× 528
Bench mark coincident with found section corner	BM + 5280
Spot elevation	× 7523

GLACIERS AND PERMANENT SNOWFIELDS

Contours and limits	
Formlines	
Glacial advance	
Glacial retreat	

RIVERS, LAKES, AND CANALS

Perennial stream	
Perennial river	
Intermittent stream	
Intermittent river	
Disappearing stream	
Falls, small	
Falls, large	
Rapids, small	
Rapids, large	
Masonry dam	
Dam with lock	
Dam carrying road	

LAND SURVEYS

Public land survey system

Range or Township line	
Location approximate	
Location doubtful	
Protracted	
Protracted (AK 1:63,360-scale)	
Range or Township labels	R1E T2N R3W T4S
Section line	
Location approximate	
Location doubtful	
Protracted	
Protracted (AK 1:63,360-scale)	
Section numbers	1 - 36 1 - 36
Found section corner	
Found closing corner	
Witness corner	
Meander corner	
Weak corner*	

Other land surveys

Range or Township line	
Section line	
Land grant, mining claim, donation land claim, or tract	
Land grant, homestead, mineral, or other special survey monument	
Fence or field lines	

MINES AND CAVES

Quarry or open pit mine	
Gravel, sand, clay, or borrow pit	
Mine tunnel or cave entrance	
Mine shaft	
Prospect	x
Tailings	
Mine dump	
Former disposal site or mine	

PROJECTION AND GRIDS

Neatline	
Graticule tick	
Graticule intersection	
Datum shift tick	
State plane coordinate systems	
Primary zone tick	
Secondary zone tick	
Tertiary zone tick	
Quaternary zone tick	
Quintary zone tick	
Universal transverse metcator grid	
UTM grid (full grid)	
UTM grid ticks*	

RAILROADS AND RELATED FEATURES

Standard guage railroad, single track	
Standard guage railroad, multiple track	
Narrow guage railroad, single track	
Narrow guage railroad, multiple track	
Railroad siding	
Railroad in highway	
Railroad in road	
Railroad in light duty road*	
Railroad underpass; overpass	
Railroad bridge; drawbridge	
Railroad tunnel	
Railroad yard	
Railroad turntable; roundhouse	

MARINE SHORELINES

Shoreline	
Apparent (edge of vegetation)***	
Indefinite or unsurveyed	

Topographic Map Symbols (Cont.)

RIVERS, LAKES, AND CANALS – *continued*

Perennial lake/pond	
Intermittent lake/pond	
Dry lake/pond	
Narrow wash	
Wide wash	
Canal, flume, or aqueduct with lock	
Elevated aqueduct, flume, or conduit	
Aqueduct tunnel	
Water well, geyser, fumarole, or mud pot	
Spring or seep	

SUBMERGED AREAS AND BOGS

Marsh or swamp	
Submerged marsh or swamp	
Wooded marsh or swamp	
Submerged wooded marsh or swamp	
Land subject to inundation	

ROADS AND RELATED FEATURES

Please note: Roads on Provisional-edition maps are not classified as primary, secondary, or light duty. These roads are all classified as improved roads and are symbolized the same as light duty roads.

Primary highway	
Secondary highway	
Light duty road	
Light duty road, paved*	
Light duty road, gravel*	
Light duty road, dirt*	
Light duty road, unspecified*	
Unimproved road	
Unimproved road*	
4WD road	
4WD road*	
Trail	
Highway or road with median strip	
Highway or road under construction	
Highway or road underpass; overpass	
Highway or road bridge; drawbridge	
Highway or road tunnel	
Road block, berm, or barrier*	
Gate on road*	
Trailhead*	

SURFACE FEATURES

Levee	
Sand or mud	
Disturbed surface	
Gravel beach or glacial moraine	
Tailings pond	

TRANSMISSION LINES AND PIPELINES

Power transmission line; pole; tower	
Telephone line	
Aboveground pipeline	
Underground pipeline	

VEGETATION

Woodland	
Shrubland	
Orchard	
Vineyard	
Mangrove	

International Orienteering Federation

Control Description Sheet Example

IOF Event Example				
M45, M50, W21				
5		7.6 km		210 m
1	101			
2	212			1.0
3	135			
4	246			
5	164			
○----- 120 ----->				
6	185			
7	178			
8	147			2.0
9	149			
○----- 250 ----->⊙				

Conces, Octavian Droobers

Control Descriptions for IOF Event Example		
Classes M45, M50, W21		
Course number 5.	Length 7.6 km.	Height climb 210 m.
Start	Road, wall junction	
1	101	Narrow marsh bend
2	212	North western boulder, 1m high, east side
3	135	Between thickets
4	246	Middle depression, east part
5	164	Eastern ruin, west side
Follow taped route 120m away from control		
6	185	Stone wall, ruined, south east corner (outside)
7	178	Spur, north west foot
8	147	Upper cliff, 2m high
9	149	Path crossing
Follow taped route 250m from last control to finish		

















Control Description Sheet

Explanation










- Column 1: Control Number Listed in Sequence
- Column 2: Control Code
 - Number Greater than 30
 - Used to Reference a Control Site
- Column 3: Which Feature among Similar Features
- Column 4: Control Feature
- Column 5: Appearance (further explanation of feature)
- Column 6: Dimensions/Combinations
- Column 7: Location of the Control Flag
- Column 8: Other Important Information

Orienteering Control Symbols

- Land Forms












	Terrace		Hill
	Spur		Knoll
	Re-entrant		Saddle
	Earth bank		Depression
	Quarry		Small depression
	Earth wall		Pit
	Erosion gully		Broken ground
	Small erosion gully		Ant hill (termite mound)

- Rock and Boulders











	Cliff, rock face
	Rock pillar
	Cave
	Boulder
	Boulder field
	Boulder
	Stony ground
	Bare rock
	Narrow passage

Orienteering Control Symbols

- Water and Marsh











	Lake
	Pond
	Water hole
	River, stream, watercourse
	Minor water channel, ditch
	Narrow march
	Marsh
	Firm ground in marsh
	Well
	Spring
	Water tank, water trough













- Vegetation

	Open land
	Semi-open land
	Forest corner
	Clearing
	Thicket
	Linear thicket
	Vegetation boundary
	Cope
	Distinctive tree
	Tree stump, root stock


Orienteering Control Symbols

- Man Made

	Road
	Track/path
	Ride
	Bridge
	Power line
	Power line pylon
	Tunnel
	Stone wall
	Fence
	Crossing point

	Building
	Paved areas
	Ruin
	Pipeline
	Tower
	Shooting platform
	Boundary stone, cairn
	Fodder rack
	Charcoal burning ground
	Monument or statue
	Building pass through
	Stairway

- Special Features

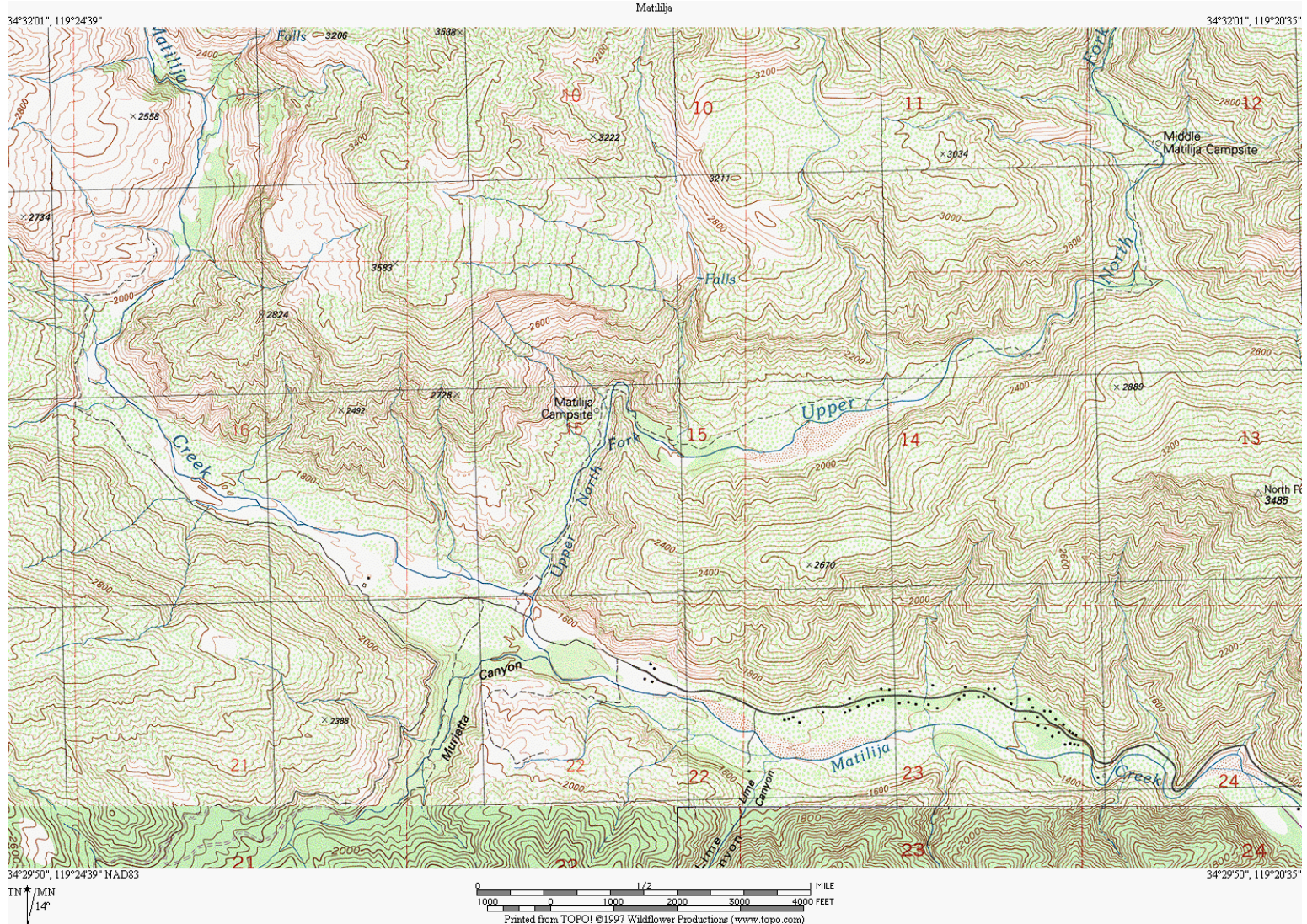
	Special item - an explanation will be supplied to competitors in the pre-race information
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Control Card

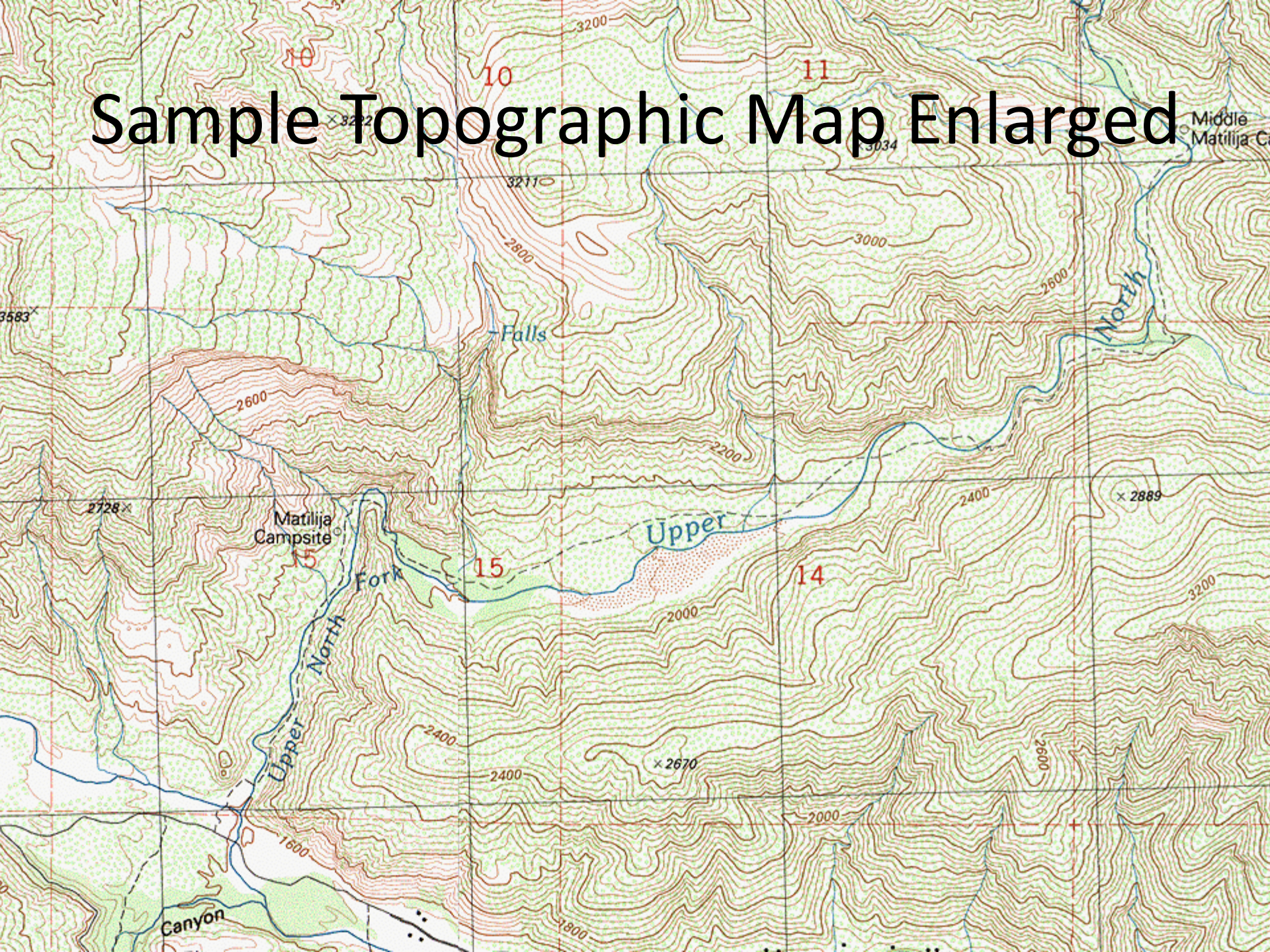
6	5	4	3	2	1
12	11	10	9	8	7
18	17	16	15	14	13
Punch patterns	22	21	20	19	

The image shows a 4x6 grid of punch patterns. The cells are numbered 1 through 22. The bottom-left cell (row 4, column 1) contains the text "Punch patterns". Two arrows originate from this text: one points to cell 3 (row 1, column 4) and the other points to cell 9 (row 2, column 4). Cells 1, 2, 3, 4, 5, and 6 contain various punch patterns. Cell 7 is empty. Cell 8 contains a punch pattern. Cell 9 contains a punch pattern. Cell 10 is empty. Cell 11 is empty. Cell 12 is empty. Cell 13 is empty. Cell 14 is empty. Cell 15 is empty. Cell 16 is empty. Cell 17 is empty. Cell 18 is empty. Cell 19 is empty. Cell 20 is empty. Cell 21 is empty. Cell 22 is empty.

Sample Topographic Map



Sample Topographic Map Enlarged



Orienteering for Advancement Second and First Class Ranks

- Buddy System
- Basic First Aid
 - Cuts, Scratches and Blisters
 - Snake, Insect and Tick Bites
 - Poisonous Plants and Animals
 - Dehydration, Sun Burn, Hypo and Hyperthermia
- How to use a Map
- How to use a Compass

Orienteering for Advancement

Second Class Rank

- Demonstrate how to use a Map and Compass
 - Orient a Map
 - Explain what the Map Symbols Mean
- Take a 5-mile Map and Compass Hike
 - Use existing Map and Compass to Determine your Location at several Points along your Route or
 - Make your own Map showing your Route
 - Show Significant Features
 - Show Compass Rose
 - Identify the Map Symbols you used

Orienteering for Advancement

First Class Rank

- Using a Compass Complete an Orienteering Course of at least 1-mile
 - Measure the Height of a Tree and/or Tower
 - Measure the Width of a Ditch and/or River
- How to Find you Way Without a Compass
 - In the Day using the Sun
 - Watch Method
 - Stick and Shadow or Equal Length Shadow Methods
 - Sun Compass
 - At Night using the Constellations or the Moon

Orienteering Merit Badge

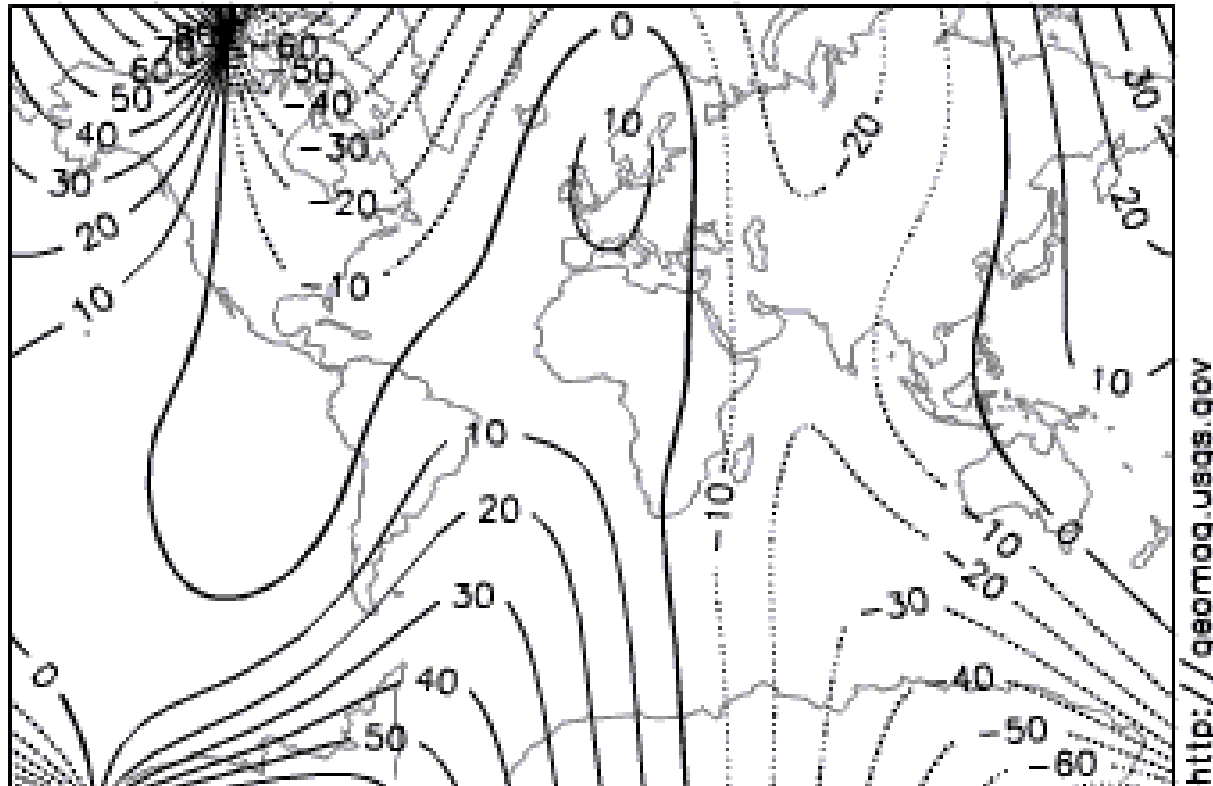
- Show that you know first aid for the types of injuries that could occur while orienteering, including cuts, scratches, blisters, snakebite, insect stings, tick bites, heat and cold reactions (sunburn, heatstroke, heat exhaustion, hypothermia), and dehydration. Explain to your counselor why you should be able to identify poisonous plants and poisonous animals that are found in your area.
- Explain what orienteering is.
- Do the following:
 - Explain how a compass works. Describe the features of an orienteering compass.
 - In the field, show how to take a compass bearing and follow it.
- Do the following:
 - Explain how a topographic map shows terrain features. Point out and name five terrain features on a map and in the field.
 - Point out and name 10 symbols on a topographic map.
 - Explain the meaning of *declination*. Tell why you must consider declination when using map and compass together.
 - Show a topographic map with magnetic north-south lines.
 - Show how to measure distances using an orienteering compass.
 - Show how to orient a map using a compass.
- Set up a 100-meter pace course. Determine your walking and running pace for 100 meters. Tell why it is important to pace-count.
- Do the following:
 - Identify 20 international control description symbols. Tell the meaning of each symbol.
 - Show a control description sheet and explain the information provided.
 - Explain the following terms and tell when you would use them: attack point, collecting feature, aiming off, contouring, reading ahead, handrail, relocation, rough versus fine orienteering.
- Do the following:
 - Take part in three orienteering events. One of these must be a cross-country course.
 - After each event, write a report with
 - a copy of the master map and control description sheet ,
 - a copy of the route you took on the course,
 - a discussion of how you could improve your time between control points, and
 - a list of your major weaknesses on this course . Describe what you could do to improve.
- Do ONE of the following:
 - Set up a cross-country course of at least 2,000 meters long with at least five control markers. Prepare the master map and control description sheet.
 - Set up a score-orienteering course with 12 control points and a time limit of at least 60 minutes. Prepare the master map and control description sheet.
- Act as an official during an orienteering even. This may be during the running of the course you set up for requirement 8.
- Teach orienteering techniques to your patrol, troop or crew.

How to Use a Map

- Use a Current Map (things change)
- Look for the Key
- Identify Map Symbols (landmarks)
- Check the Scale
- Identify North
 - Find Compass Rose (north arrow)
 - Locate Latitude and Longitude Lines
 - Identify Declination
 - Difference between True North and Magnetic North
 - Needed to Properly Orient the Map
 - When labeled usually found along the Bottom of the Map
- Some Maps use other Coordinate Systems

Declination Changes with Time

1590
Declination (degrees east)

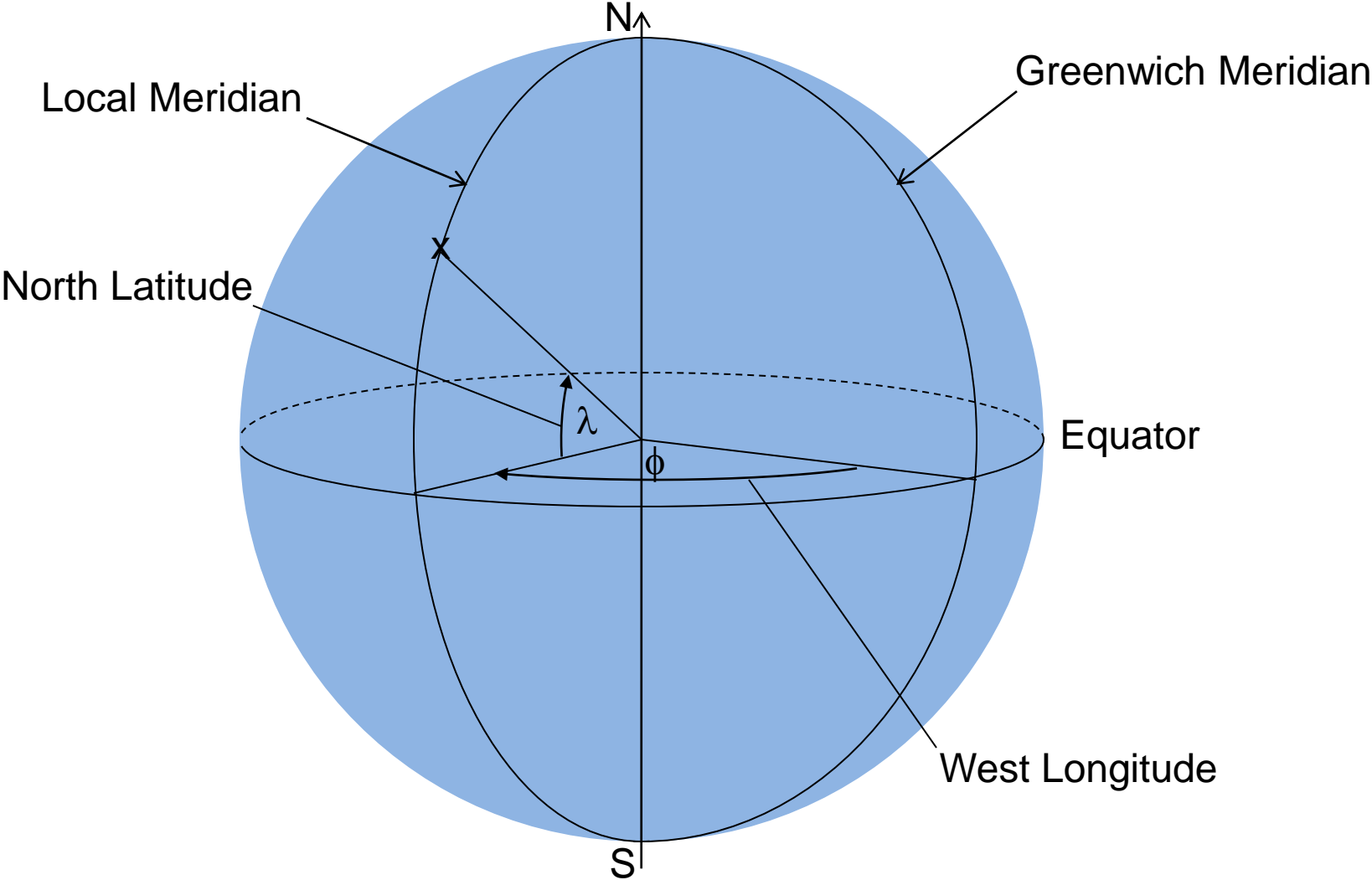


Model by A. Jackson, A. R. T. Jonkers, M. R. Walker,
Phil. Trans. R. Soc. London A (2000), 358, 957-990.

What are Latitude and Longitude

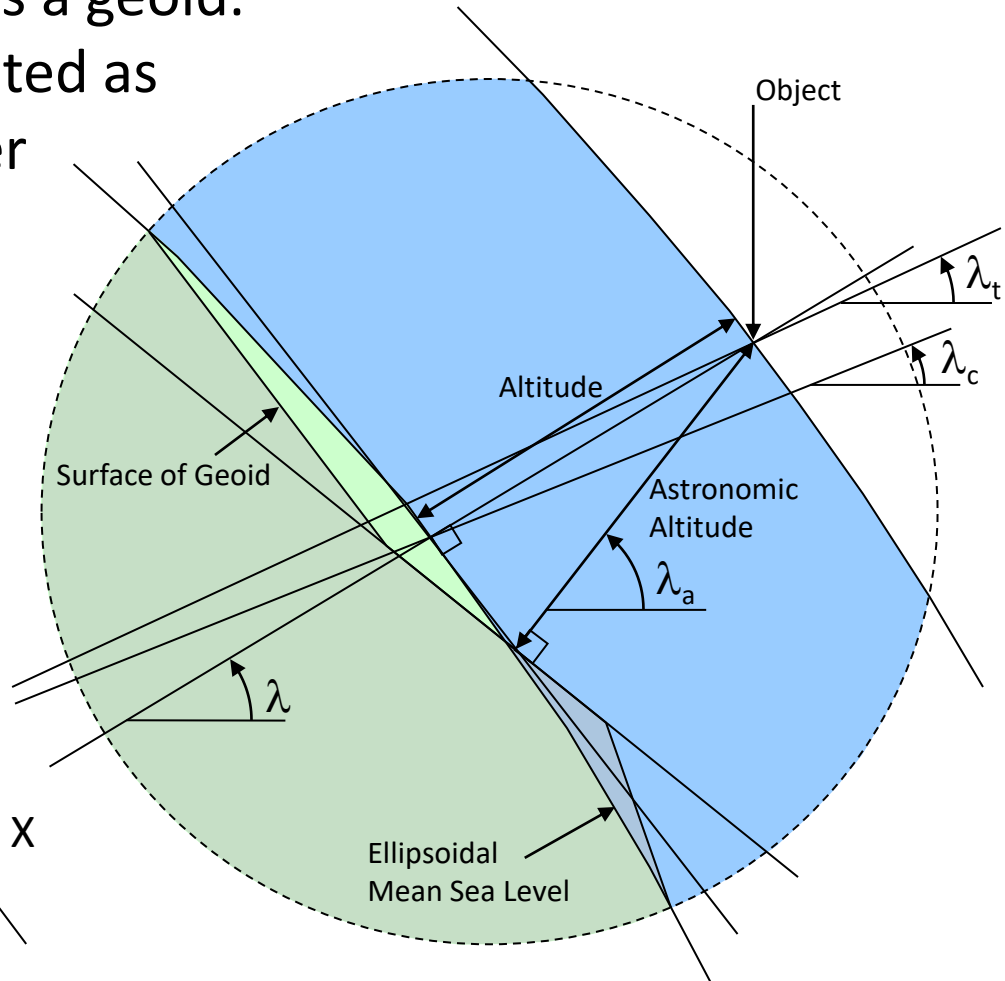
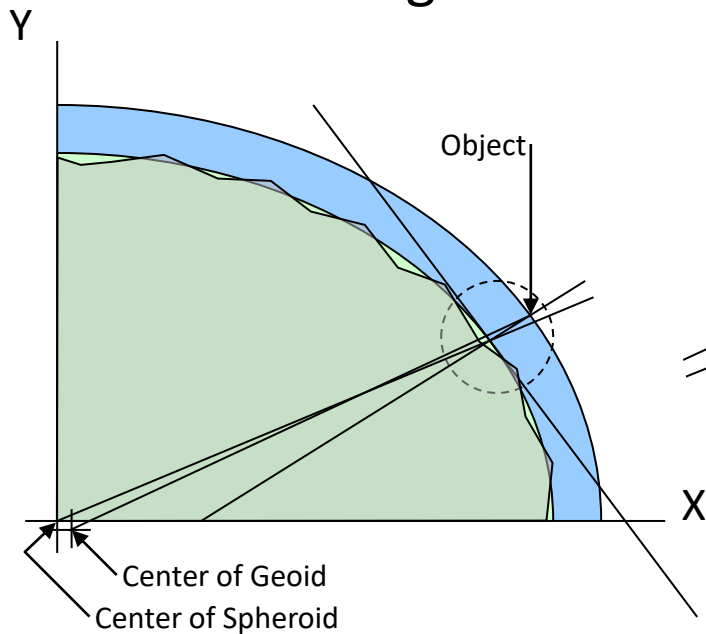
- Astronomic Latitude (λ_a): The angle a normal to the geoid makes to the celestial equatorial plane.
- Astronomic Longitude (ϕ_a): The angle the projection of a normal to the geoid on the equatorial plane makes to the Greenwich meridian.
- Other Definitions:
 - Terrestrial: Relative to Center of Earth Geoid
 - Geocentric: Relative to Center of Standard Ellipsoid
 - Geodetic: Relative to Normal of Standard Ellipsoid

Latitude and Longitude

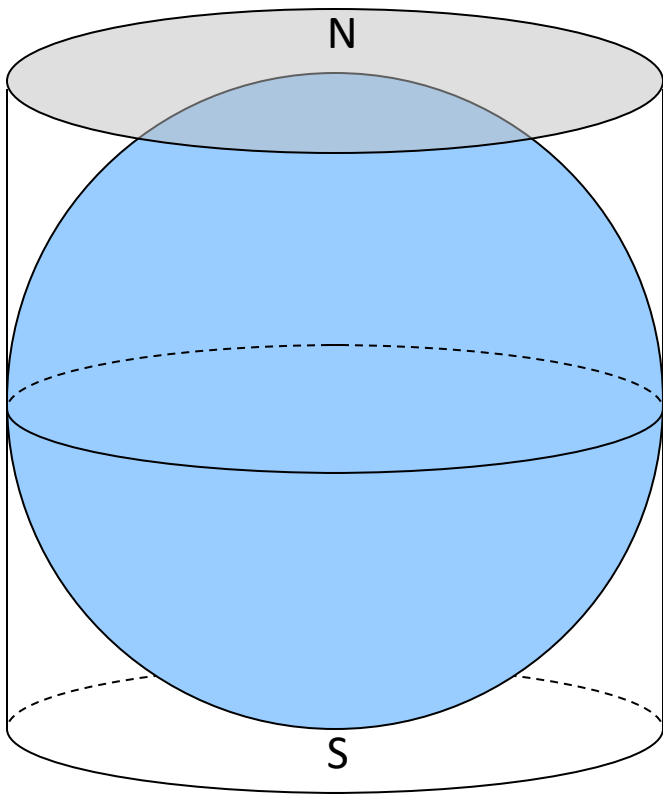


Problem with Latitude and Longitude

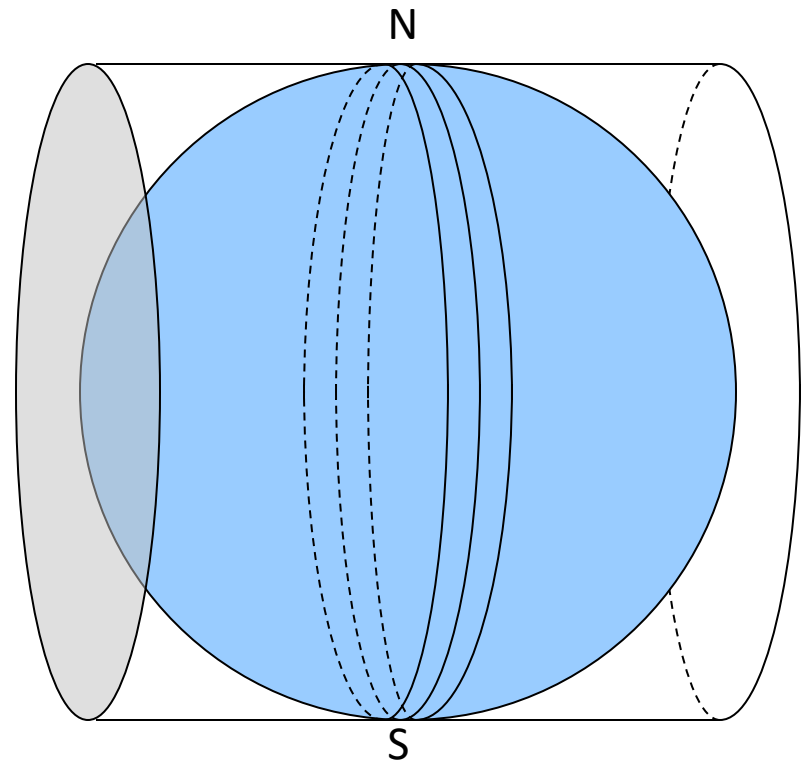
The shape of the Earth is a geoid.
This shape is approximated as
a Spheroid whose center
is not located at the
center of the geoid.



Mercator Projections

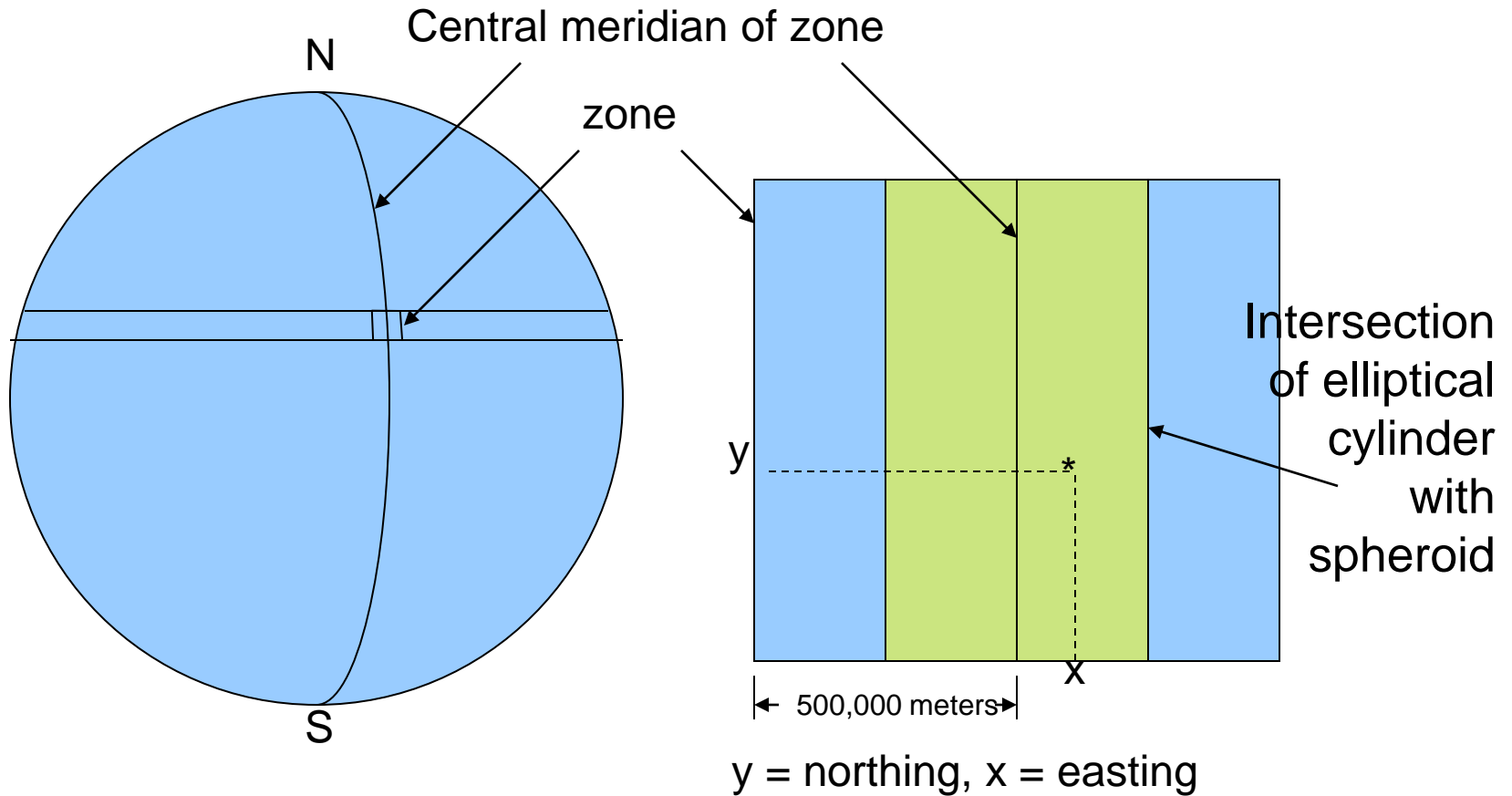


Mercator Projection



Transverse Mercator Projection

Universal Transverse Mercator (UTM)

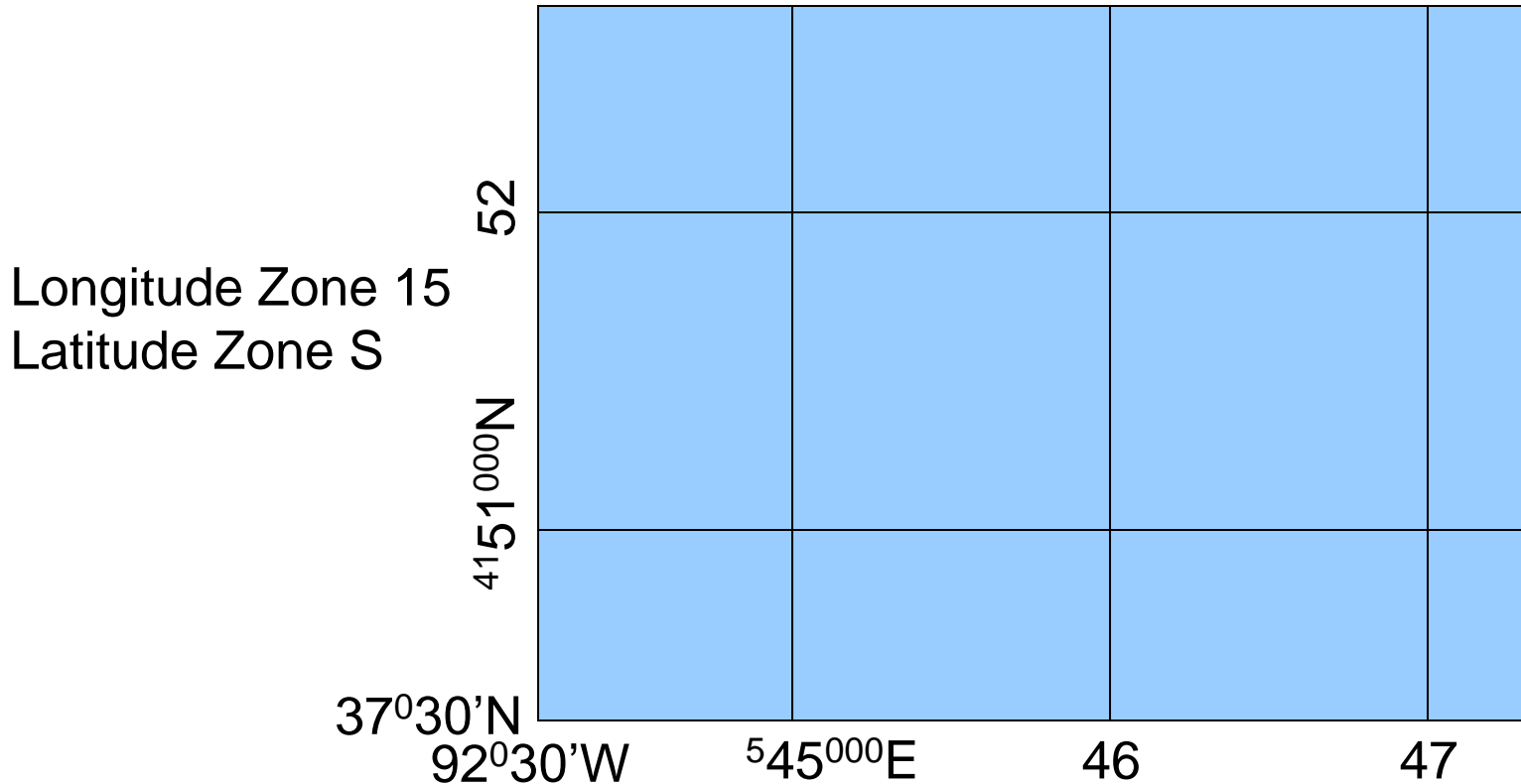


Universal Transverse Mercator Description

- An artificial grid system dividing the globe longitudinally into strips 6 degrees wide and divided latitudinally mostly 8 degrees tall.
- The grids are numbered in an easterly direction from 1 to 60 starting at -180 degrees longitude.
- The grids are lettered (not always used) in a northerly direction from A to Z starting at the South Pole (I and O are omitted).
 - South of 80 degrees south it is divided into two zones A and B
 - From 80 degrees south to 72 degrees north into 19 zones C through W
 - From 72 degrees north to 84 degrees north zone X
 - North of 84 degrees north it is divided into two zones Y and Z
- Each zone is further divided decimally
 - From the Central Meridian with a 500 kilometer (km) false easting to ensure a positive number.
 - When lettered latitudinal zones are not used the zone is numbered from the Equator (0 km) or to the Equator (10,000 km) in a northerly direction.
- The Polar Stereographic projection is usually used in the polar regions.

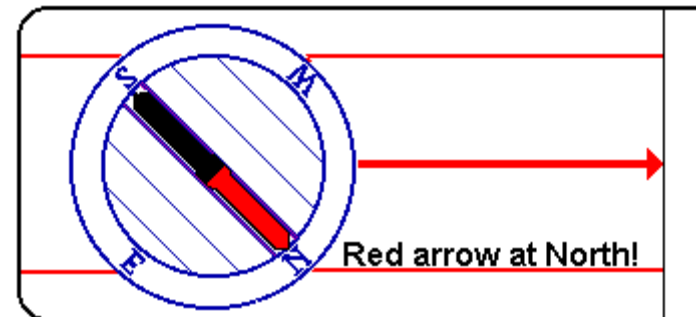
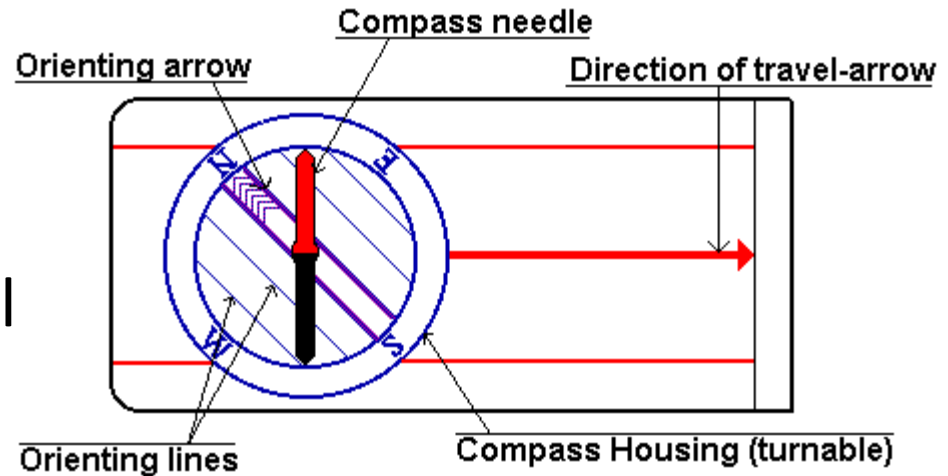
Reading a Map in UTM

Easting is always a 6 digit coordinate
Northing is always a 7 digit coordinate



How to Use a Compass to Take a Bearing

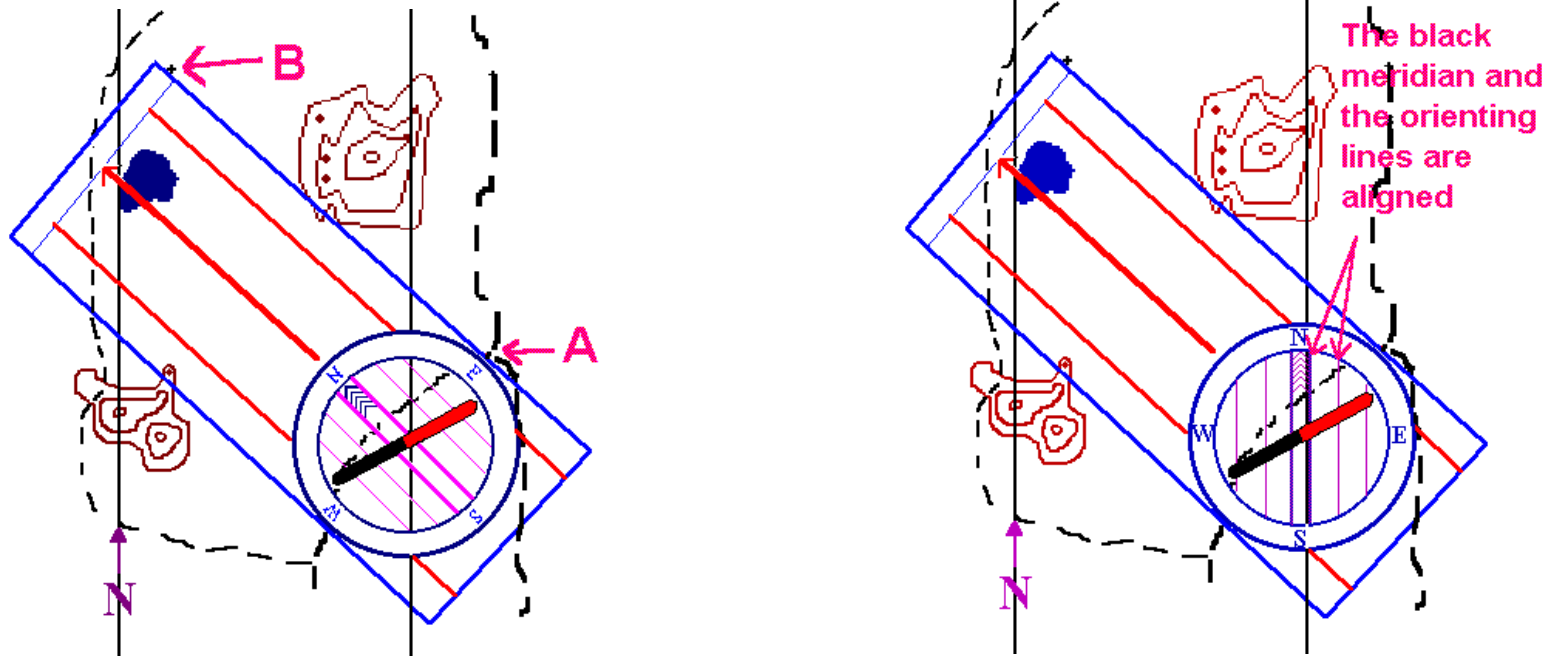
- Point Compass in Direction of Travel
- Hold Away from Belt Buckle or other Metal
- Adjust Orienting Arrow to Match Compass Needle
- Account for Declination
- Read Bearing from Compass Housing where Direction of Travel Arrow meets Compass Housing



How to Use a Compass to Orient a Map

- Place Map on Flat Surface
 - Avoid Surfaces with Metal (school lunch tables)
 - Use the Ground
- Avoid Places with Artificial Magnetic Fields
 - High Voltage Power Systems
 - Railroad Tracks
- Place Compass on Map so Direction of Travel Arrow Lines Up with Compass Rose North or Longitude Line
- Adjust Compass Housing so Orienting Arrow Lines up with Direction of Travel Arrow
- Adjust Compass Housing to Account for Magnetic Declination
- Rotate Map until Orienting Arrow Matches Compass Needle

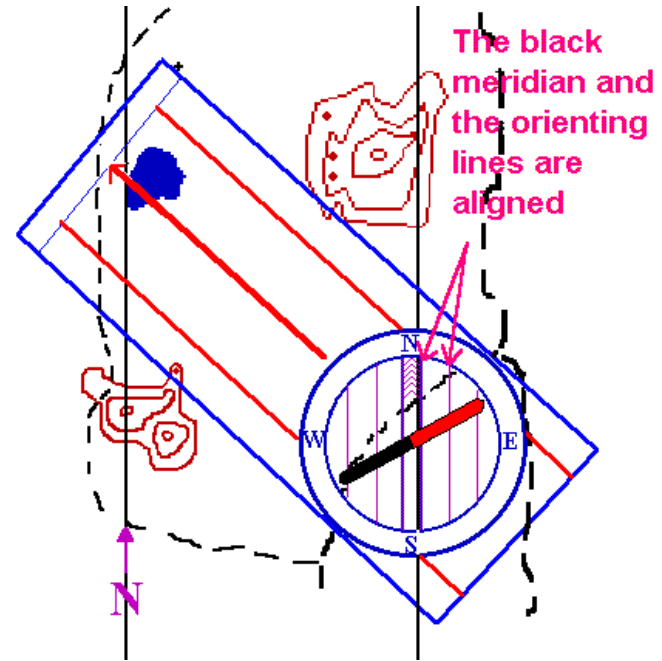
How to Use a Compass to Take a Bearing from a Map



- Place Compass on an Oriented Map so Direction of Travel Arrow Lines Up with Line Connecting Start and End Points
- Adjust Compass Housing so Orienting Lines Line Up with Meridian Lines
- Read Bearing from Compass Housing where Direction of Travel Arrow meets Compass Housing

Traveling to a Location on a Map

- There will Always be some Error in Map Readings
- Rule of Thumb: Uncertainty is 1/10 of Distance Traveled
- Intentionally Travel to the Left or Right of the Final Destination
- Sight on then Travel toward Object in Far Distance (do not watch compass)
- When the Calculated Distance is Traveled the Destination will be to the Right or Left Respectively

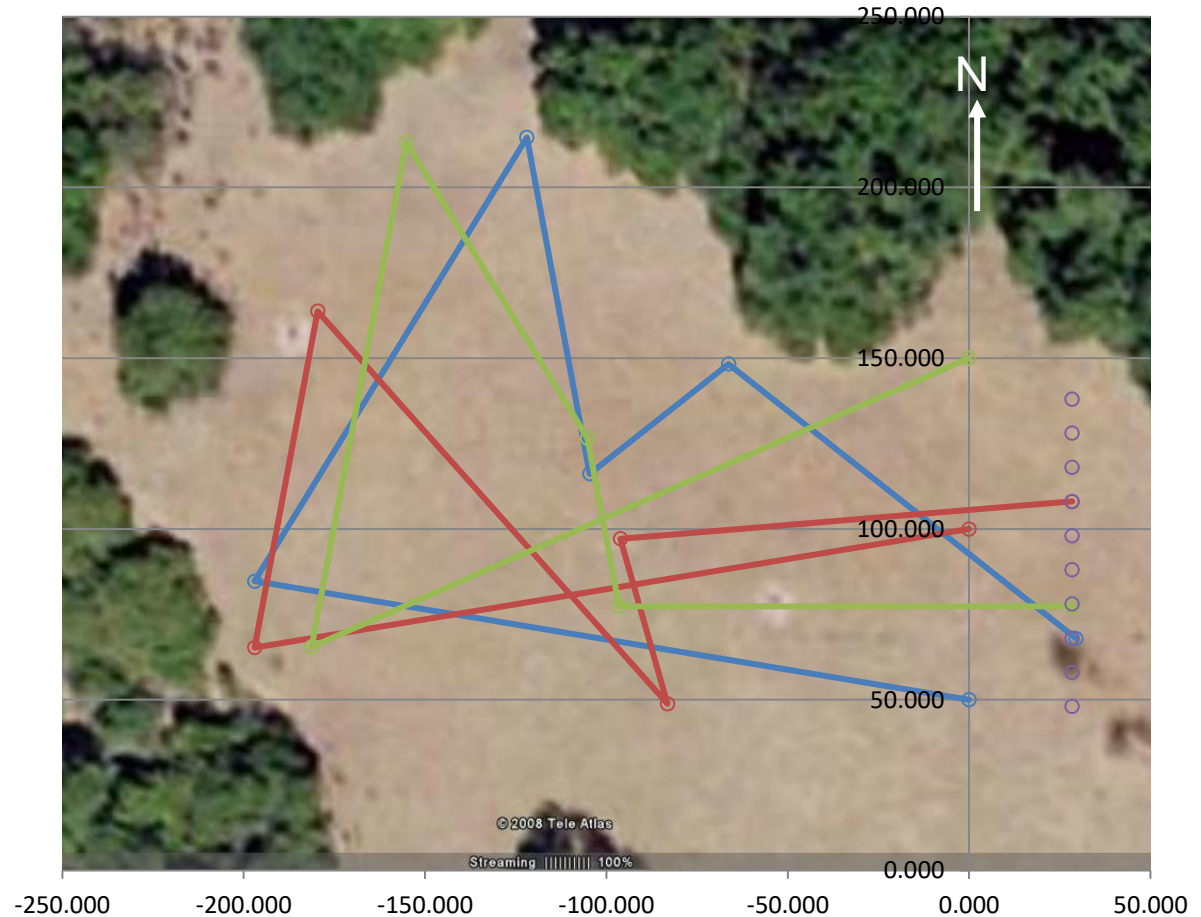


Camporee Treasure Hunt

San Miguel	
Distance	Bearing
200	245
150	10
100	150
50	170
125	90

Santa Cruz	
Distance	Bearing
200	260
100	10
150	140
50	345
125	85

Anacapa	
Distance	Bearing
200	280
150	30
100	170
50	50
125	130



Distances are in feet and Bearings are True (non-magnetic)
 Account for 14 degree Magnetic Declination

Measuring the Height of a Tree

- Method 1 (Stick Method)

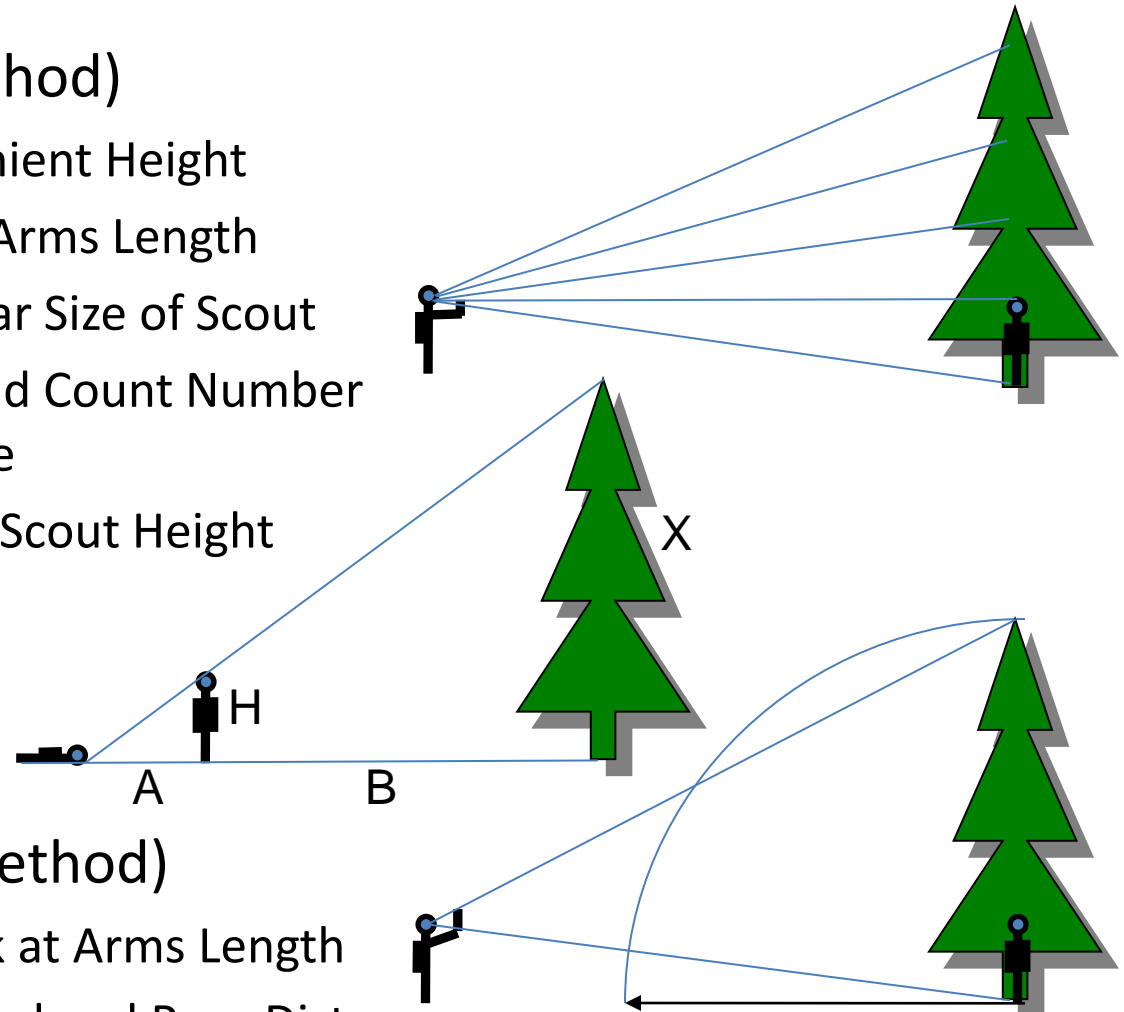
- Find Scout of Convenient Height
- Put Stick in Hand at Arms Length
- Adjust Stick to Appear Size of Scout
- With Stick Project and Count Number of Scouts Up the Tree
- Multiply Number by Scout Height

- Method 2

- Similar Triangles
- $X = H * (A + B)/A$

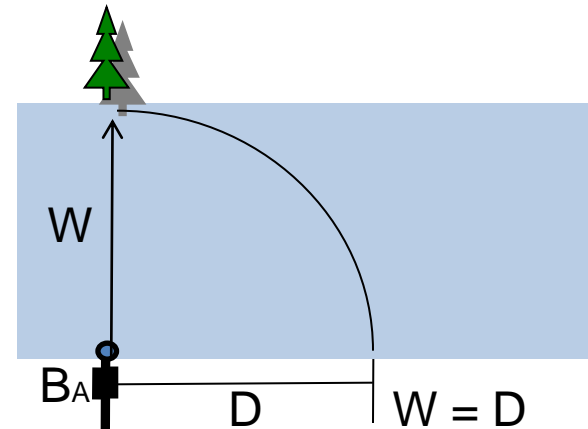
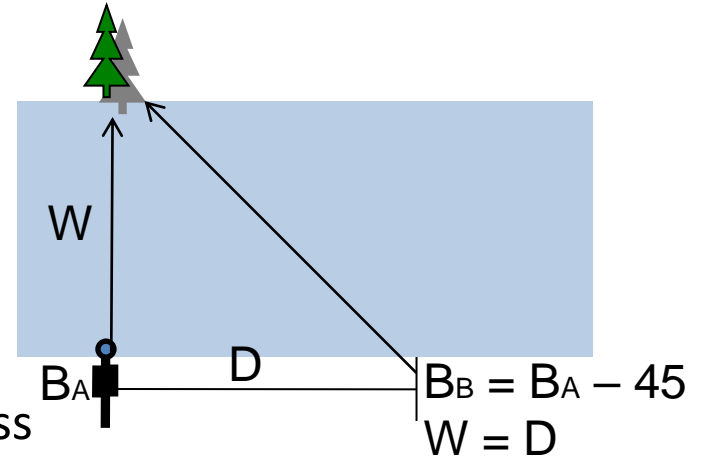
- Method 3 (Felling Method)

- Cover Tree with Stick at Arms Length
- Project Tree to Ground and Pace Distance



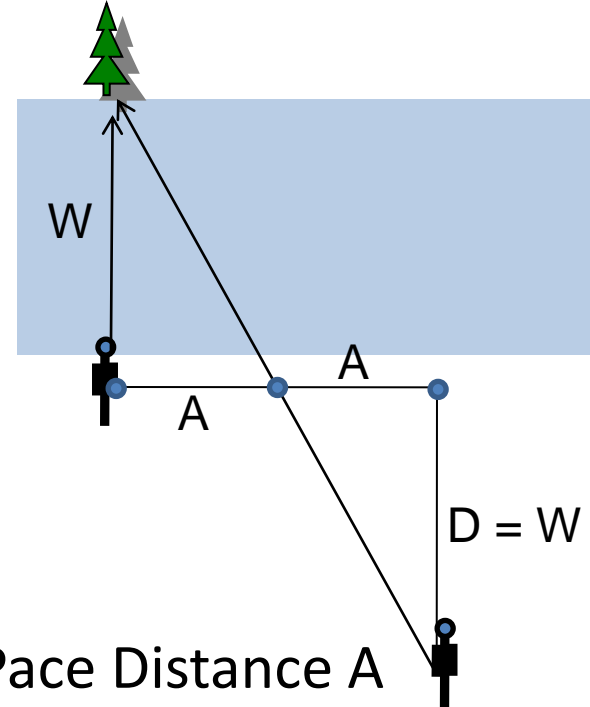
Measuring the Width of River

- Method 1 (Compass Method)
 - Take Bearing to Object Directly Across River
 - Pace off Distance at a Right Angle Until Bearing to Object is 45 degrees Less
 - Width equals Distance
- Method 2 (Salute Method)
 - With Hand at Arms Length Point to Object Directly Across River
 - Turn 90 degrees and Observe Location Pointed to
 - Pace Distance to Location for Width of River



Measuring the Width of River

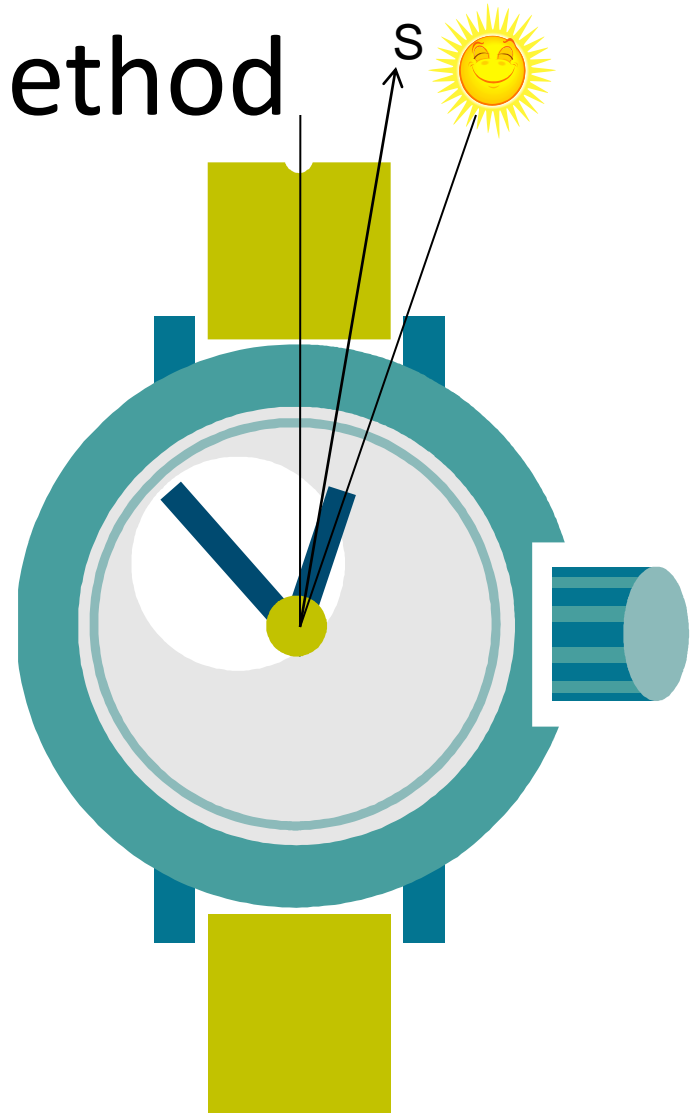
- Method 3 (Stick Method)
 - Put Stick in Ground Opposite an Object Across River
 - Pace Distance A at a Right Angle to Line of Sight to Object
 - Put Second Stick in the Ground
 - Continue in Same Direction and Pace Distance A
 - Put Third Stick in the Ground
 - Pace Away from River until Second Stick is in the Line of Sight with the Object Across the River
 - Distance Paced Away from River is the Width of the River



Find Way Without a Compass

Watch Method

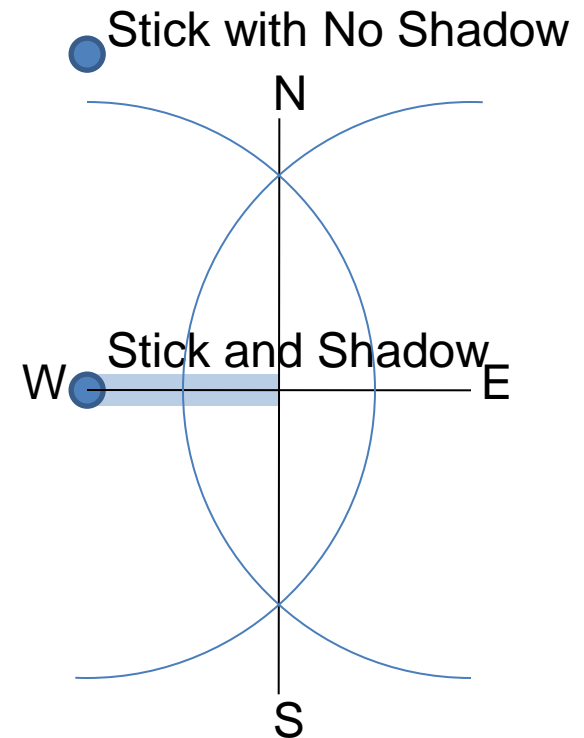
- Point Hour hand in the Direction of the Sun
- South is roughly in the Direction of a Line Bisecting the Angle formed by the Hour Hand and 12 o'clock



Find Way Without a Compass

Stick and Shadow Method

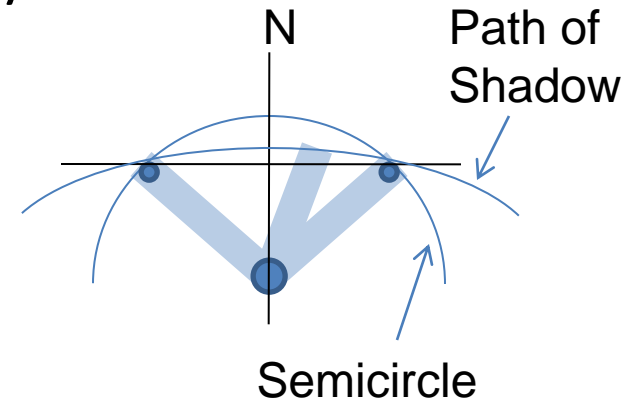
- Put Short Stick in Ground Aligned so there is No Shadow (points to Sun)
- Wait about an Hour and Draw a Line in the Dirt in the Direction of the Shadow
- A Line Constructed at a Right Angle to the First Line is a North-South Line



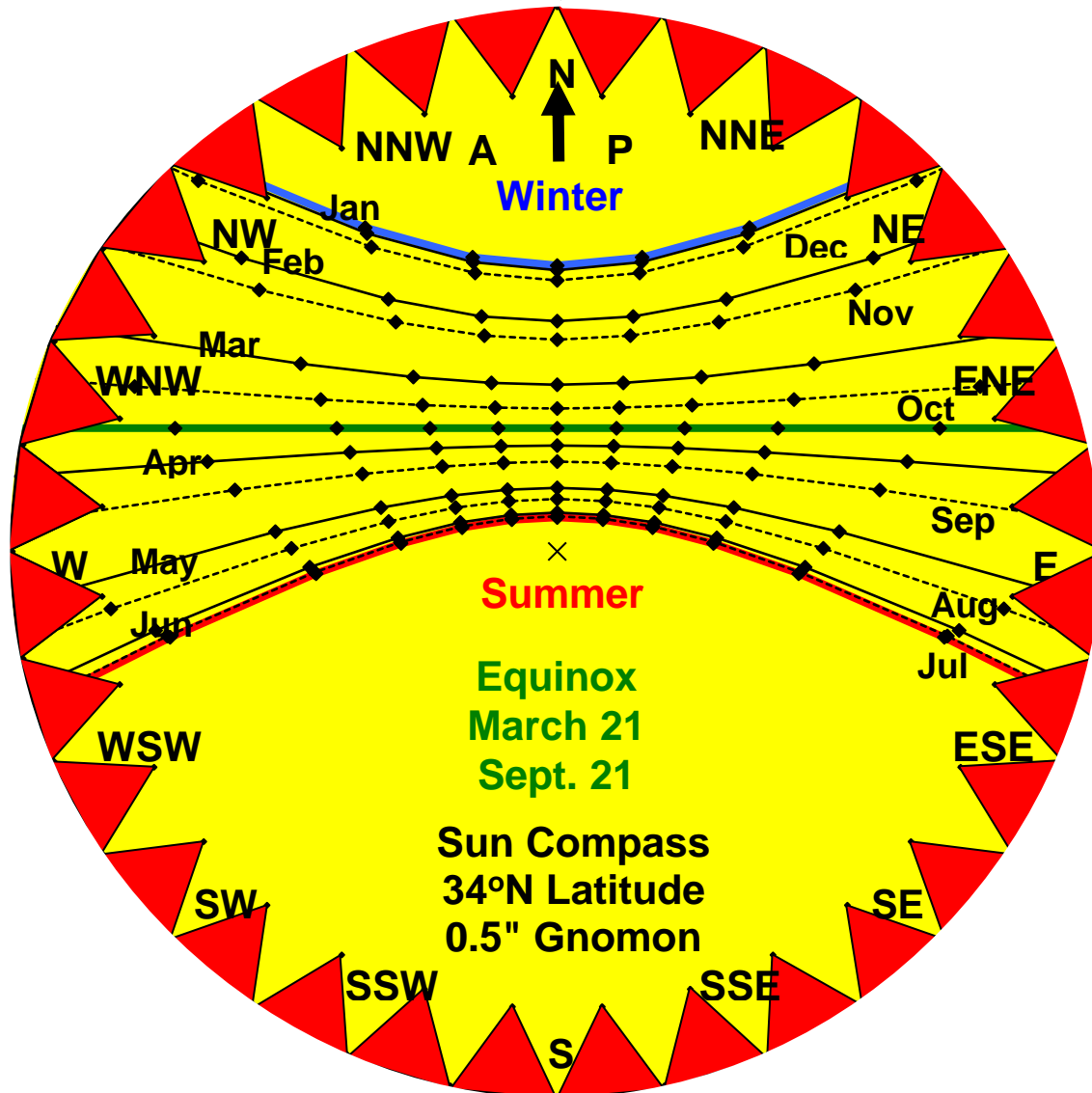
Find Way Without a Compass

Equal Length Shadow Method

- Put a Long Stick in the ground Vertically and Mark the End of its Shadow with a Small Stick
- Draw a Circular Arc with the Long Stick at its Center and the Small Stick on the Arc
- Wait until the Shadow again Intersects the Arc
- The Line Connecting the two Intersections of the Shadow with the Circular Arc is an East-West Line
- A Line Constructed Perpendicular to this East-West Line is a North-South Line



Sun Compass



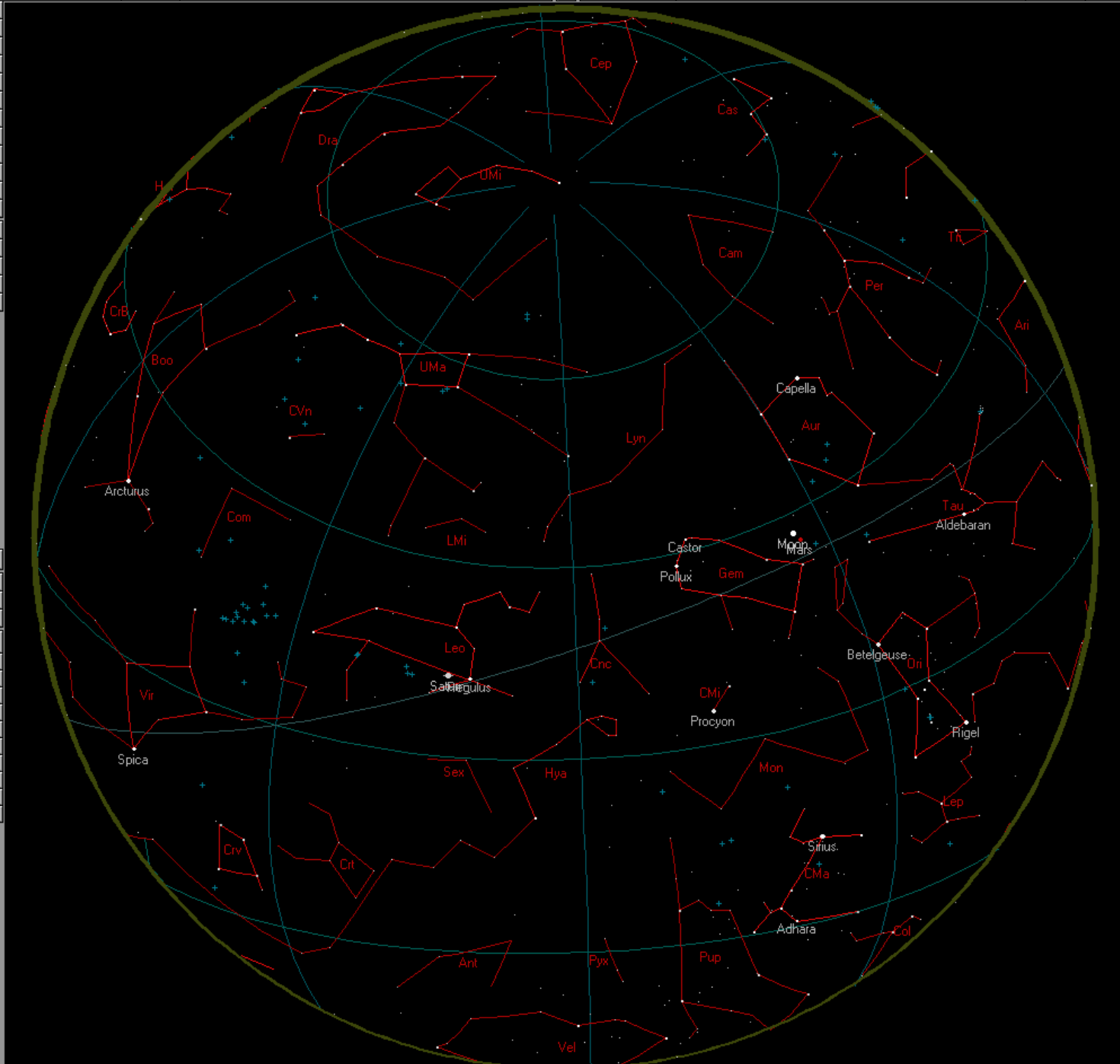
Find Way Without a Compass Using Constellations and Stars

- The Big Dipper Points to the North Star (almost)
- Any Northern Constellation or Star at it's Highest Altitude is in the Direction of North
 - Cassiopeia (the “W”)
 - Ursa Major (the Big Dipper)
- Any Southern Constellation or Star at it's Highest Altitude is in the Direction of South
 - Orion (the Hunter)
 - Leo (the Lion)
 - Sagittarius (the Teapot)

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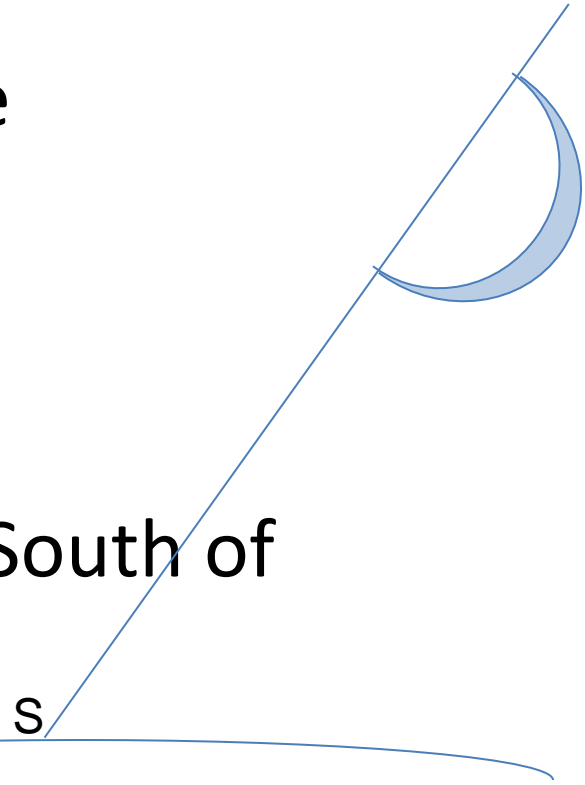


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Finding Way Without a Compass Using the Moon

- Imagine a Line Touching the Tips of the Moon's Crescent
- Extend this Line Until it Contacts the Horizon
- The Intersection is roughly South of an Observer in the Northern Hemisphere



Information Sources

- <http://www.orienteering.org>
- <http://www.learn-orienteering.org/>
- Boy Scout Handbook
- Orienteering Merit Badge Booklet
- <http://geomag.usgs.gov>
- SkyGlobe