California Cadet Corps Curriculum on Map Reading

"Advanced Land Navigation"

LEADERS KNOW THE WAY

Since 1911

Advanced Land Navigation Agenda

- C1. Advanced Map Reading Techniques
- C2. Land Navigation
- C3. Designing a Land Nav Course for your Cadet Corps Unit
- C4. Advanced Land Navigation Sports / Activities
- C5. Calling a 9-Line Medevac (Medical Evacuation)

CALIFORNIA
CADET CORPS

ADVANCED TECHNIQUES: INTERSECTION, RESECTION

C1. Use Intersection, Resection, and Modified Resection to locate a point on a topographic map.

CALIFORNIA
CADET CORPS

Intersection & Resection

- **Intersection** is a way to locate an unknown position on the ground by determining where azimuths from two or three known positions on the ground intersect.
- **Resection** is the method of locating one's position on a map by determining the grid azimuth to at least two (three is better) well defined locations that can be pinpointed on the map.
- **Modified resection** is the method of locating one's position on the map when the person is located on a linear feature on the ground, such as a road, canal, or stream.

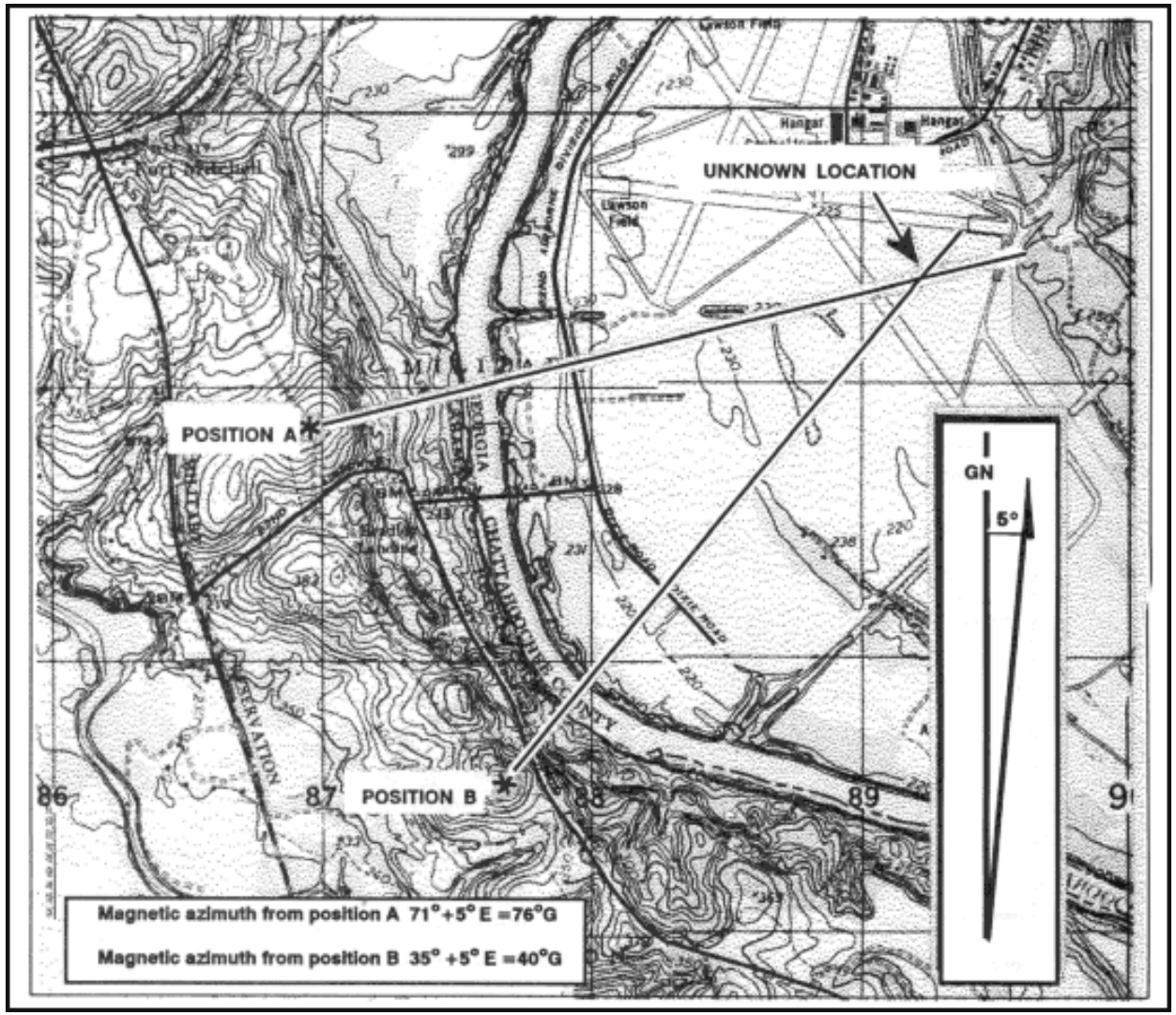
CALIFORNIA
CADET CORPS

Intersection
Map & Compass Method

(1) Orient the map using the compass.
(2) Locate and mark your position on the map,
(3) Determine the magnetic azimuth to the unknown position using the compass.
(4) Convert the magnetic azimuth to grid azimuth.
(5) Draw a line on the map from your position on this grid azimuth.
(6) Move to a second known point and repeat steps 1, 2, 3, 4, and 5.
(7) The location of the unknown position is where the lines cross on the map. Determine the grid coordinates to the desired accuracy.

CALIFORNIA
CADET CORPS

Intersection
Map & Compass Method



Intersection
Straight Edge Method

This method is used when you don't have a compass.

(1) Orient the map on a flat surface by the terrain association method.

(2) Locate and mark your position on the map

(3) Lay a straight edge on the map with one end at the user's position (A) as a pivot point; then, rotate the straightedge until the unknown point is sighted along the edge

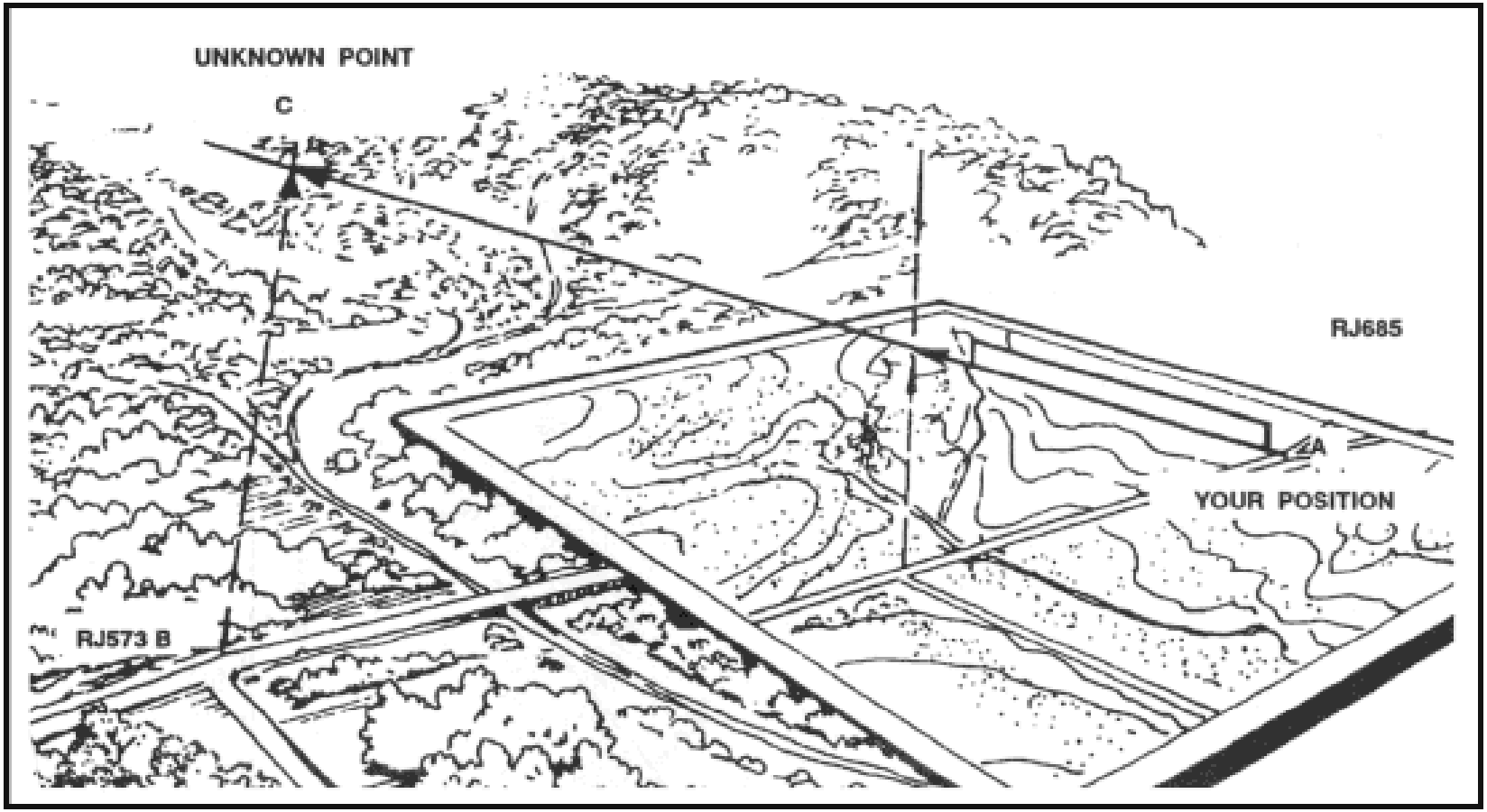
(4) Draw a line along the straight edge

(5) Repeat the above steps at position (B) and check for accuracy

(6) The intersection of the lines on the map is the location of the unknown point (C). Determine the grid coordinates to the desired accuracy

CALIFORNIA
CADET CORPS

Intersection
Straight Edge Method



CALIFORNIA
CADET CORPS

Resection

Again, Resection is the method of locating one's position on a map by determining the grid azimuth to at least two (three is better) well defined locations that can be pinpointed on the map.

- Start by locating three points on the ground that you can positively identify on the map.
- Determine the grid azimuths from your position to these terrain features.

CALIFORNIA
CADET CORPS

Resection

(1) Orient the map using the compass.

(2) Identify two or three known distant locations on the ground and mark them on the map.

(3) Measure the magnetic azimuth to one of the known positions from your location using a compass.

(4) Convert the magnetic azimuth to a grid azimuth.

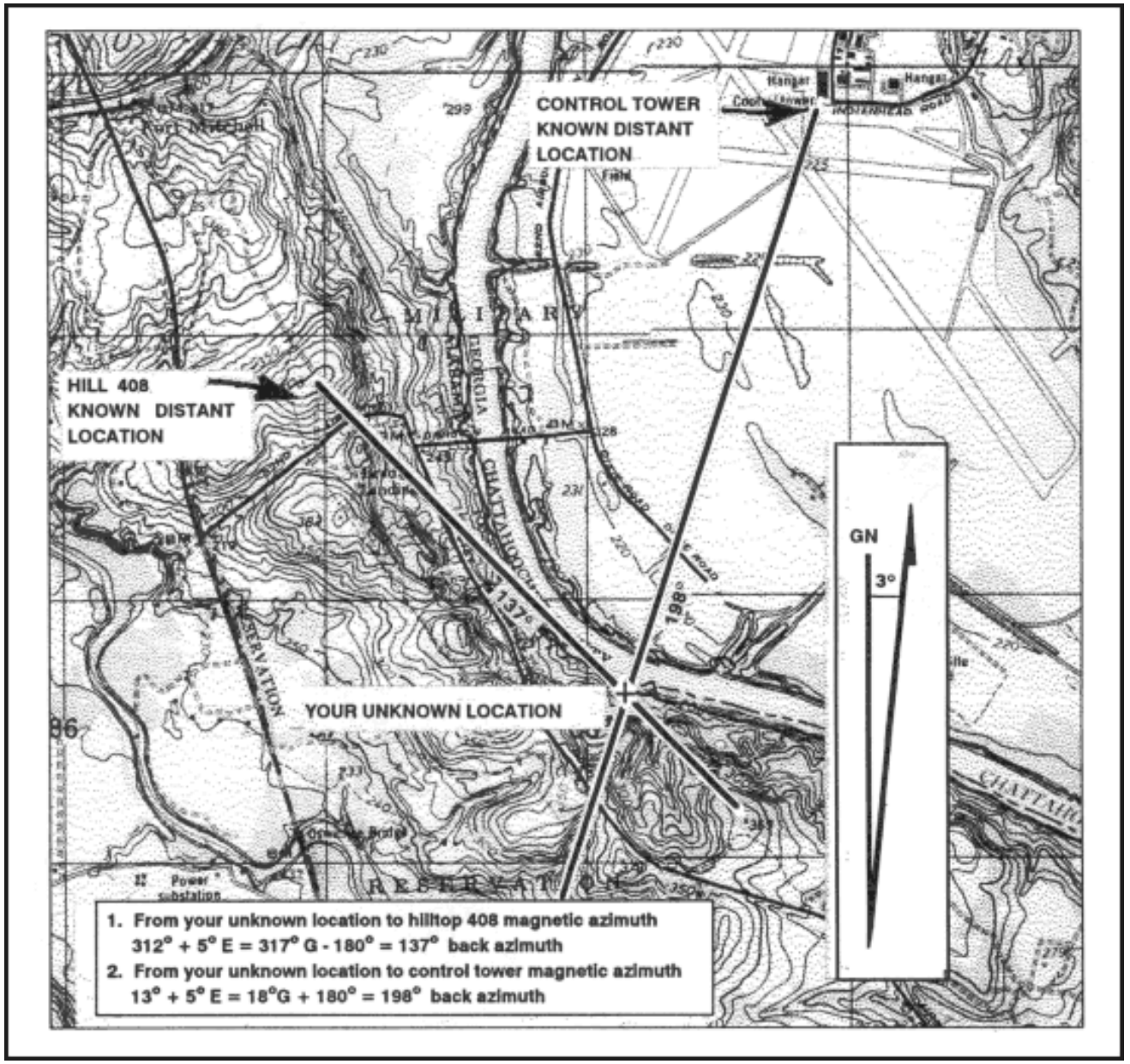
(5) Convert the grid azimuth to a **back azimuth**. Using a protractor, draw a line for the **back azimuth** on the map from the known position back toward your unknown position.

(6) Repeat 3, 4, and 5 for a second position and a third position, if desired.

(7) The intersection of the lines is your location. Determine the grid coordinates to the desired accuracy.

CALIFORNIA
CADET CORPS

Resection



CALIFORNIA
CADET CORPS

Determining Back Azimuth

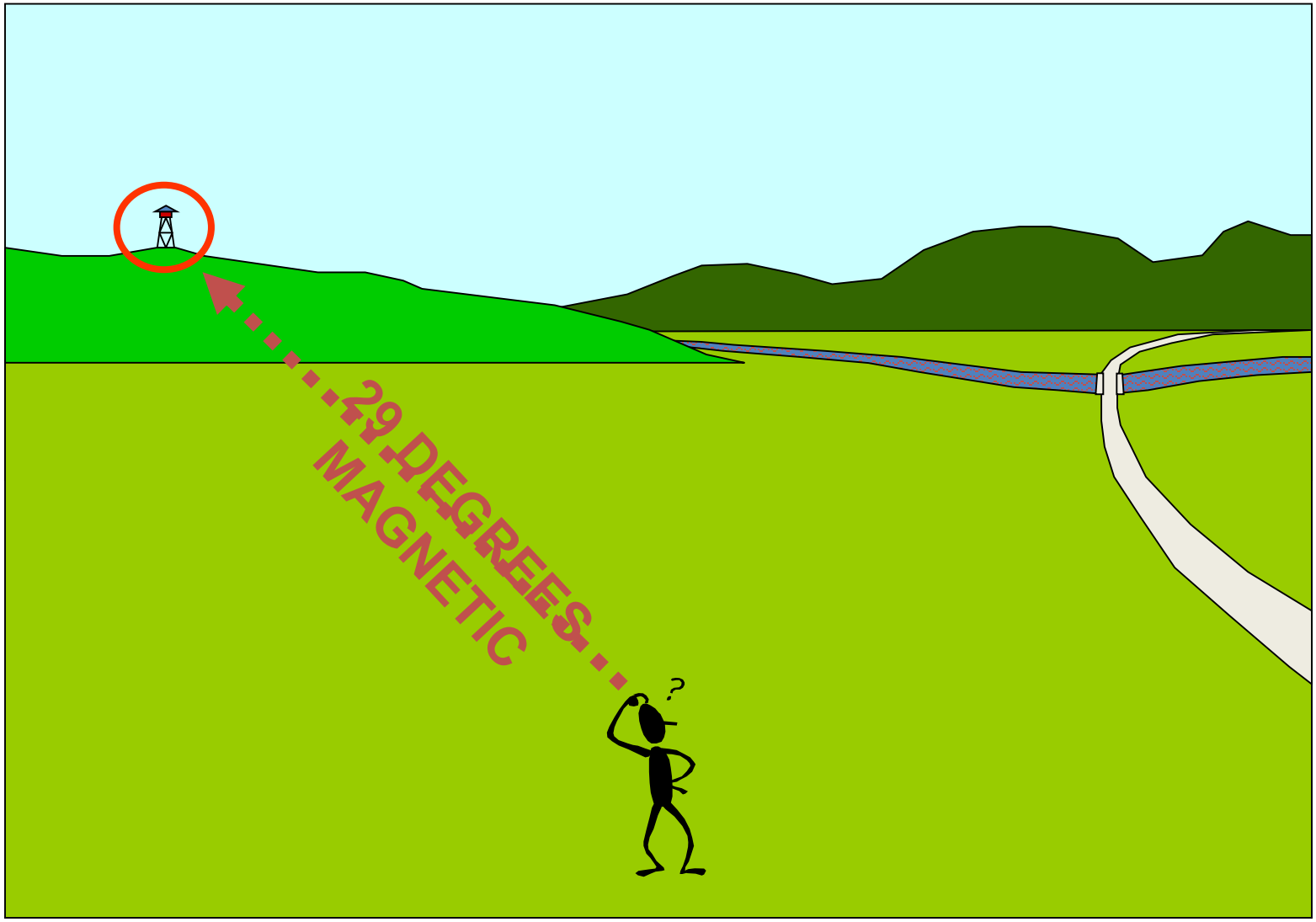
- Remember – a back azimuth is 180° from an azimuth.
- Simply add or subtract 180 degrees to or from your azimuth.
- If your azimuth is more than 180°, subtract.
- If your azimuth is less than 180°, add.
- The back azimuth has to be between 0° and 360°

CALIFORNIA
CADET CORPS

Step 2: Locate a feature or object that is identifiable on both the ground and the map, and mark the map location.

CALIFORNIA
CADET CORPS

Steps 3 & 4. Measure the magnetic azimuth to the known position and convert the magnetic azimuth to a grid azimuth.



CALIFORNIA
CADET CORPS

Do the Math!

STEP 3 & 4. MEASURE THE MAGNETIC AZIMUTH TO THE KNOWN POSITION AND CONVERT THE MAGNETIC AZIMUTH TO A GRID AZIMUTH.

MAGNETIC AZIMUTH: 29 DEGREES

EASTERLY G-M ANGLE: +21 DEGREES

GRID AZIMUTH: 50 DEGREES

CALIFORNIA CADET CORPS

Do the Math!

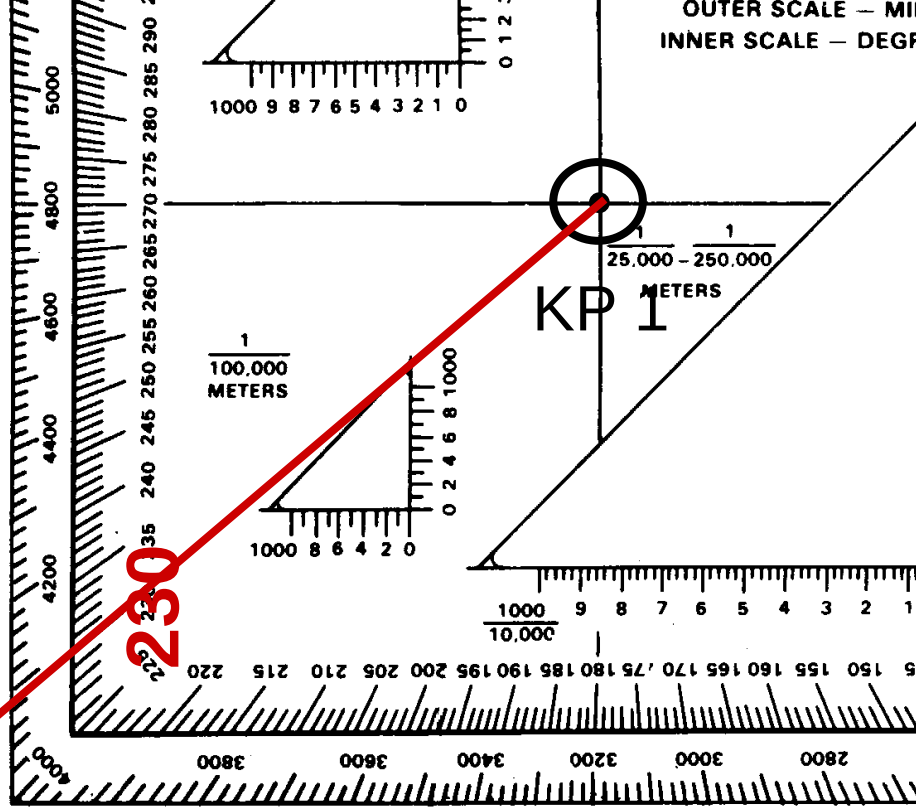
STEP 5. CHANGE THE GRID AZIMUTH TO A **BACK AZIMUTH** AND DRAW A LINE FROM THE KNOWN POSITION BACKWARD TOWARD YOUR UNKNOWN POSITION.

GRID AZIMUTH: 50 DEGREES

ADD: +180 DEGREES

GRID BACK AZIMUTH: 230 DEGREES

CALIFORNIA
CADET CORPS



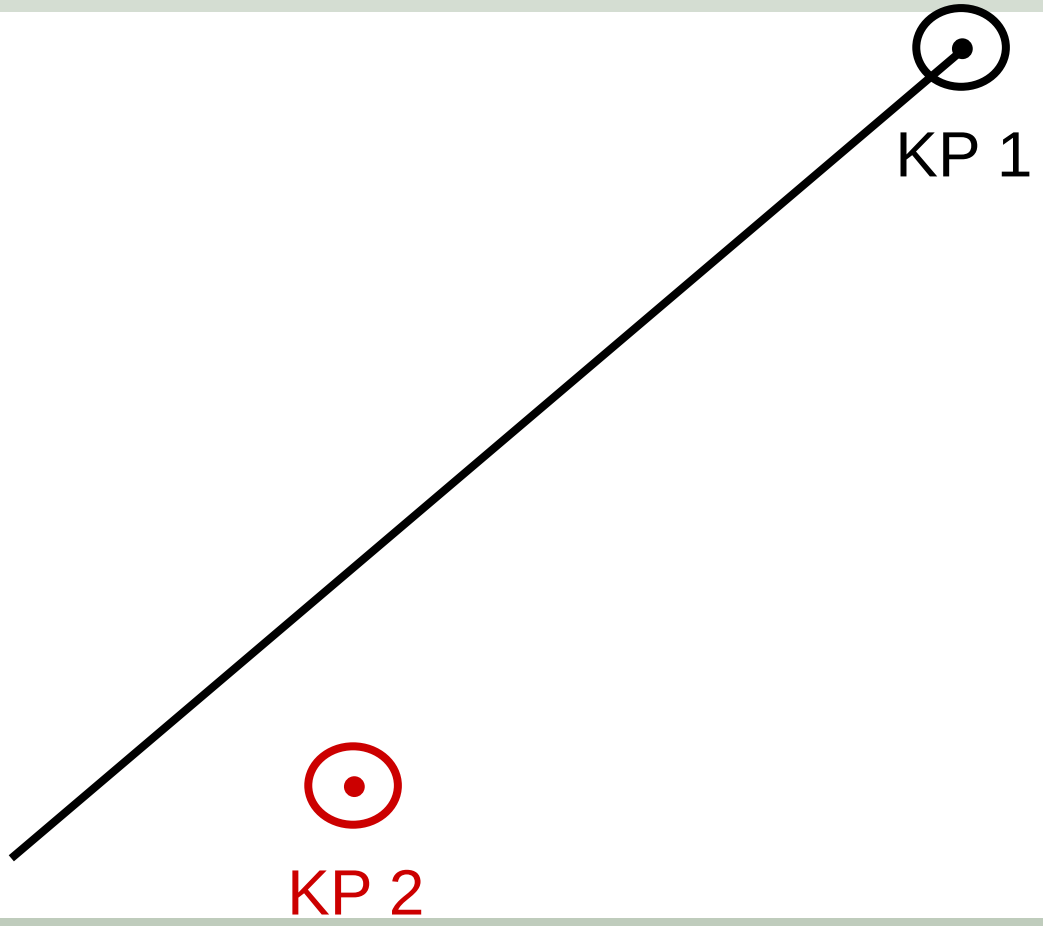
STEP 3. CHANGE THE GRID AZIMUTH TO A BACK AZIMUTH AND DRAW A LINE FROM THE KNOWN POSITION BACKWARD TOWARD YOUR UNKNOWN POSITION.

Step 2. Locate a second feature or object that is identifiable on both the ground and the map and mark the map location.

EXAMPLE: BRIDGE LOCATED AT
EG15008389

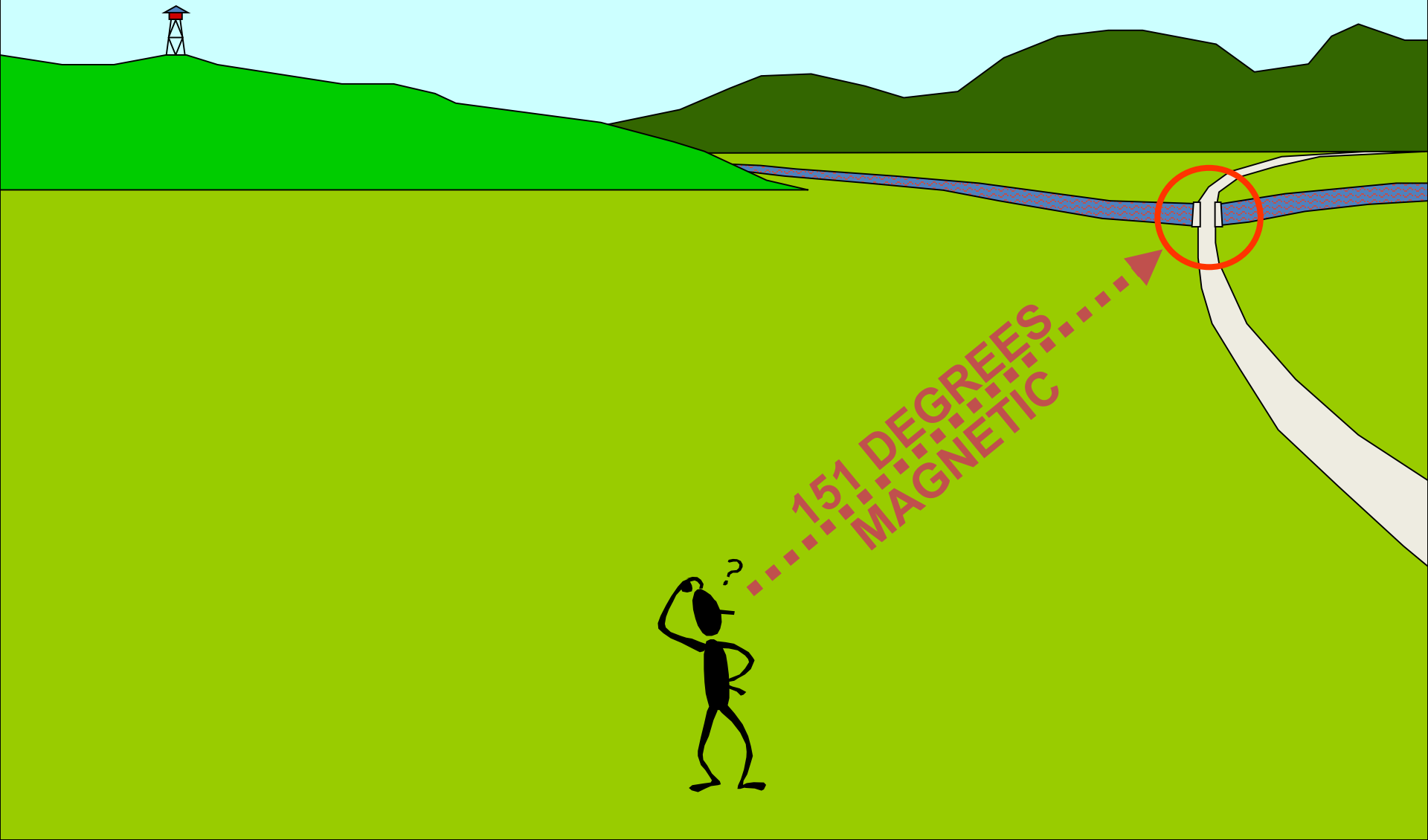
CALIFORNIA CADET CORPS

EXAMPLE: BRIDGE LOCATED AT **EG15008389**



STEP 4. LOCATE A SECOND FEATURE OR OBJECT THAT IS IDENTIFIABLE ON BOTH THE GROUND AND THE MAP AND MARK THE MAP LOCATION.

Steps 3 & 4. Measure the magnetic azimuth to the second known position and convert the magnetic azimuth to a grid azimuth.



CALIFORNIA
CADET CORPS

STEPS 3&4. MEASURE THE MAGNETIC AZIMUTH TO THE SECOND KNOWN POSITION AND CONVERT THE MAGNETIC AZIMUTH TO A GRID AZIMUTH.

MAGNETIC AZIMUTH: 151 DEGREES

EASTERLY G-M ANGLE: +21 DEGREES

GRID AZIMUTH: 172 DEGREES

CALIFORNIA
CADET CORPS

STEP 5. CHANGE THE GRID AZIMUTH TO A BACK AZIMUTH AND DRAW A LINE FROM THE SECOND KNOWN POSITION BACKWARD TOWARD YOUR UNKNOWN POSITION.

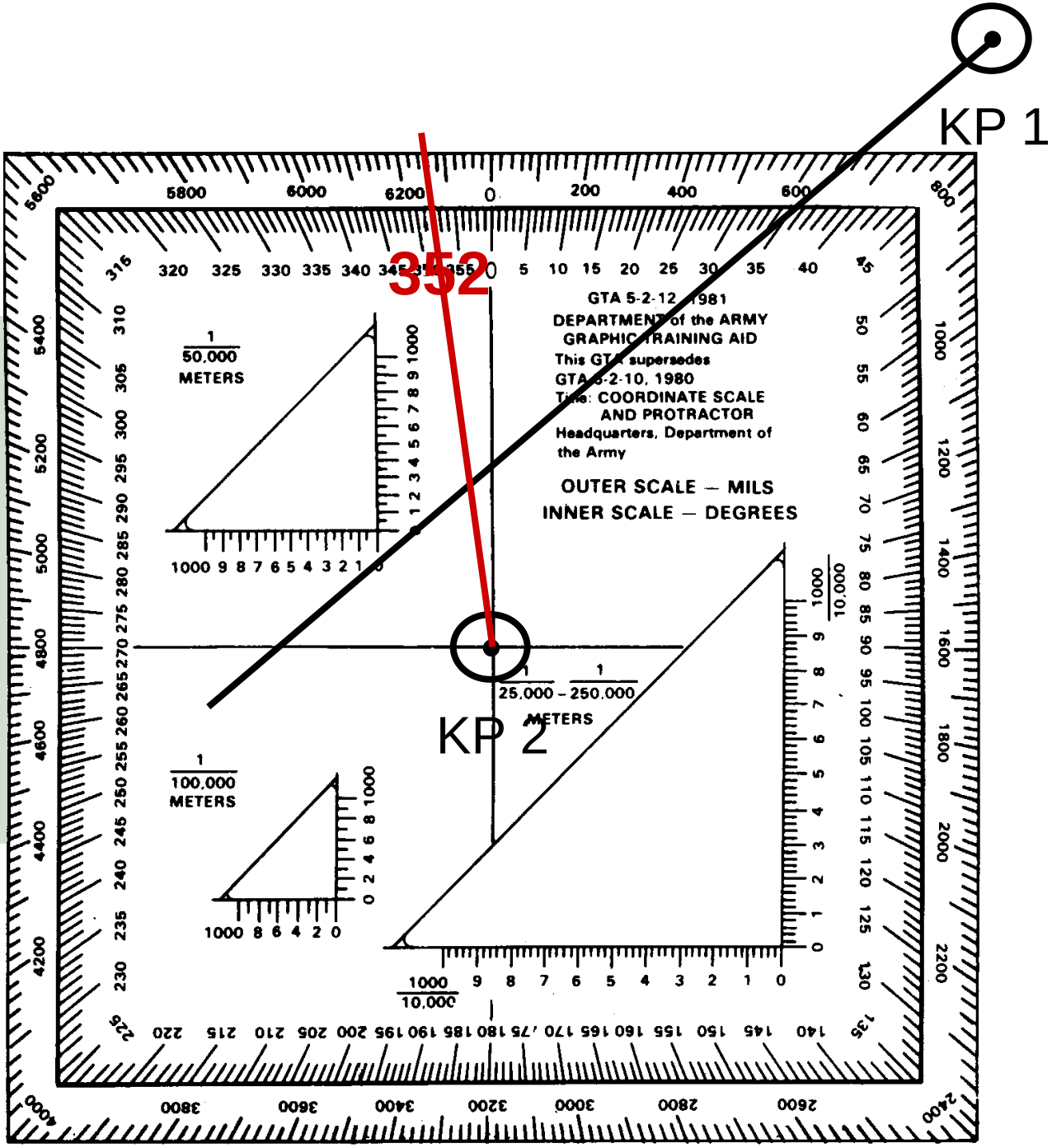
GRID AZIMUTH: 172 DEGREES

ADD: +180 DEGREES

GRID BACK AZIMUTH: 352 DEGREES

CALIFORNIA
CADET CORPS

Step 5. Convert the grid azimuth to a back azimuth and draw a line from the second known position backward toward your unknown position.

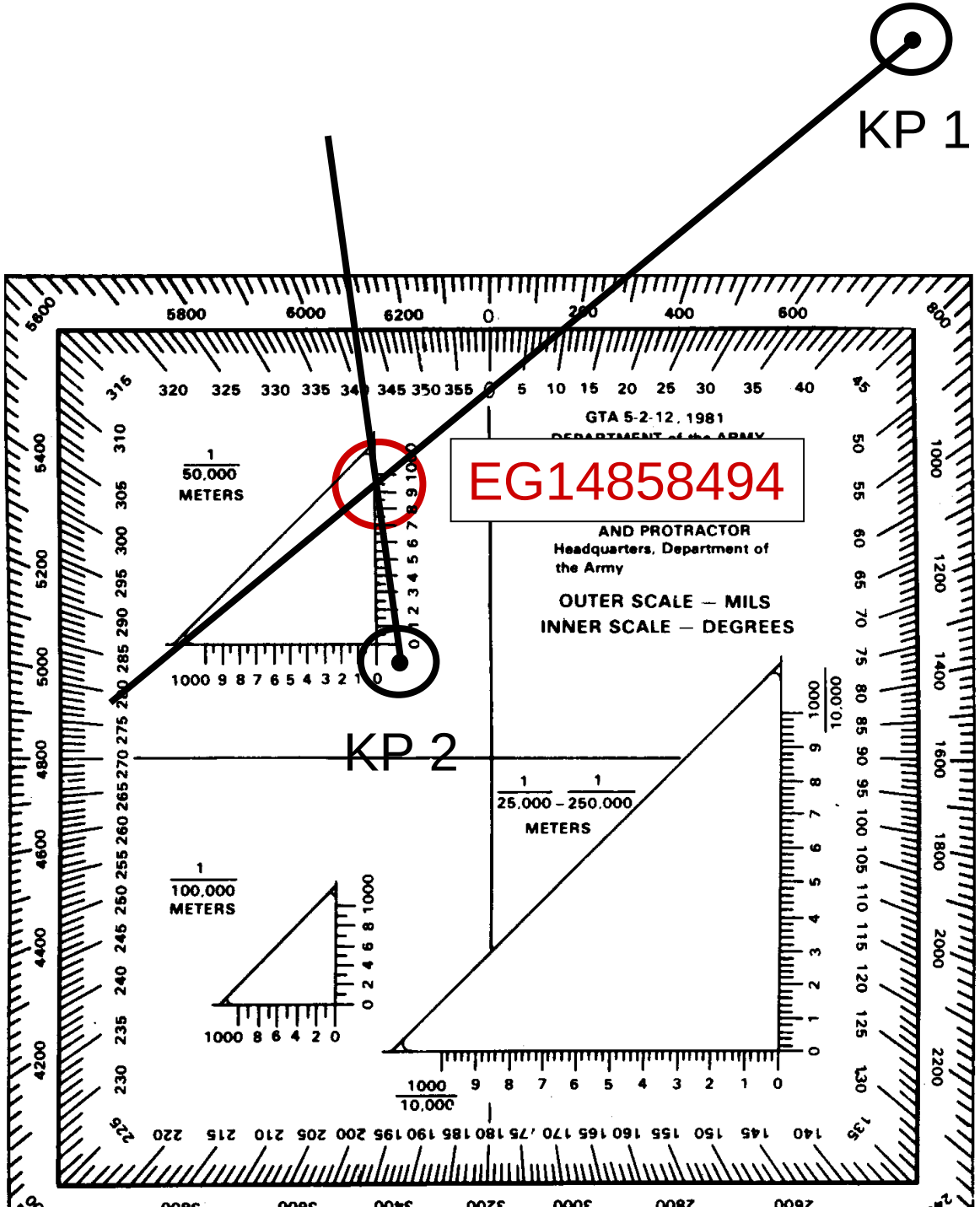


CALIFORNIA
CADET CORPS

- Step 6 is to repeat Steps 2-5
- Resection is more accurate if you use three points of reference

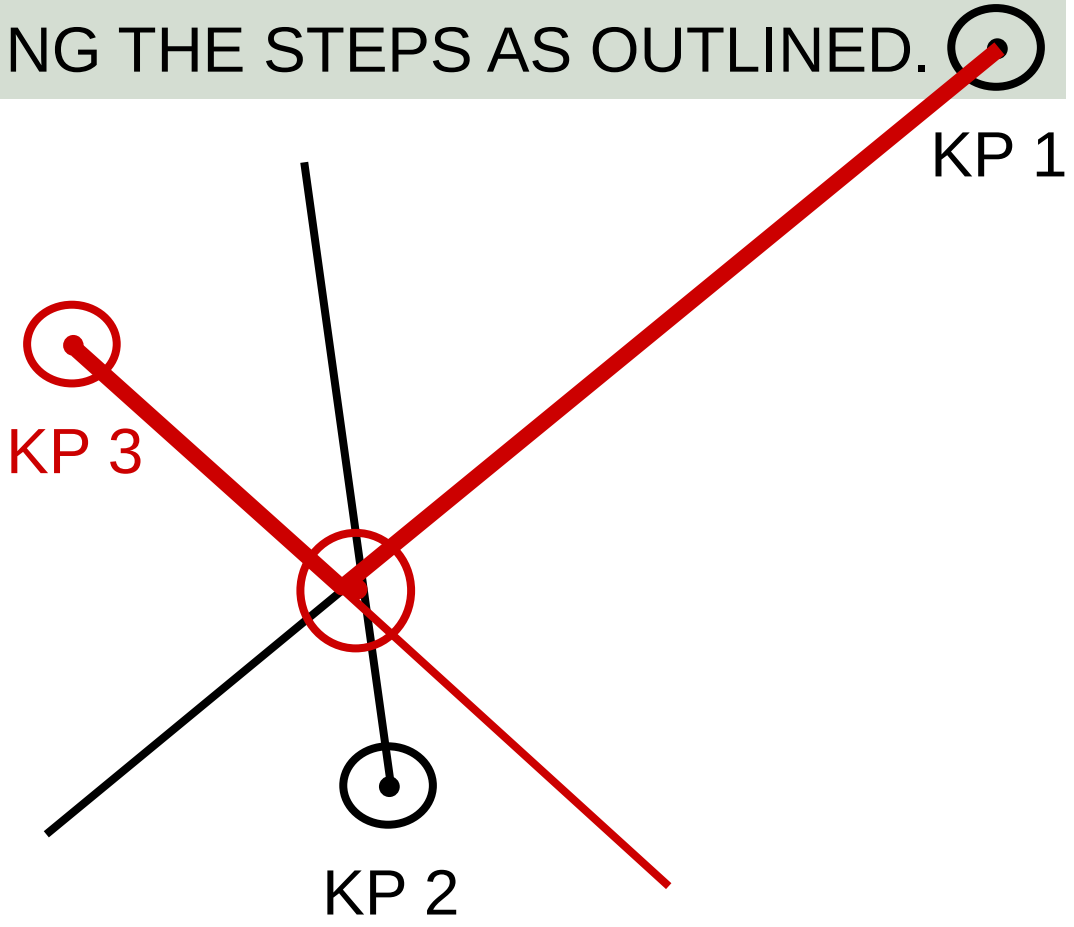
CALIFORNIA
CADET CORPS

STEP 7. THE POINT WHERE THE TWO LINES INTERSECT IS YOUR LOCATION.



CALIFORNIA CADET CORPS

FOR A CHECK ON ACCURACY, YOU SHOULD CONSTRUCT A THIRD LINE FOLLOWING THE STEPS AS OUTLINED.



WHENEVER POSSIBLE, CHOOSE LOCATIONS THAT WILL GIVE YOU A LARGER ANGLE WHERE THE LINES INTERSECT TO INCREASE ACCURACY.

CALIFORNIA
CADET CORPS

Resection Without a Compass

1. Orient the map to the ground.
2. Locate at least two known positions on the ground and mark them on the map.
3. Lay a straight edge with one end at the first known position as a pivot point, then rotate the straight edge toward yourself until you sight the known position along the edge.
4. Draw a line along the straight edge.
5. Repeat procedures 1 thru 4 for the next known position.
6. The intersection of lines is the location of your position.
7. Again, check for accuracy, you may use a third position.

CALIFORNIA CADET CORPS

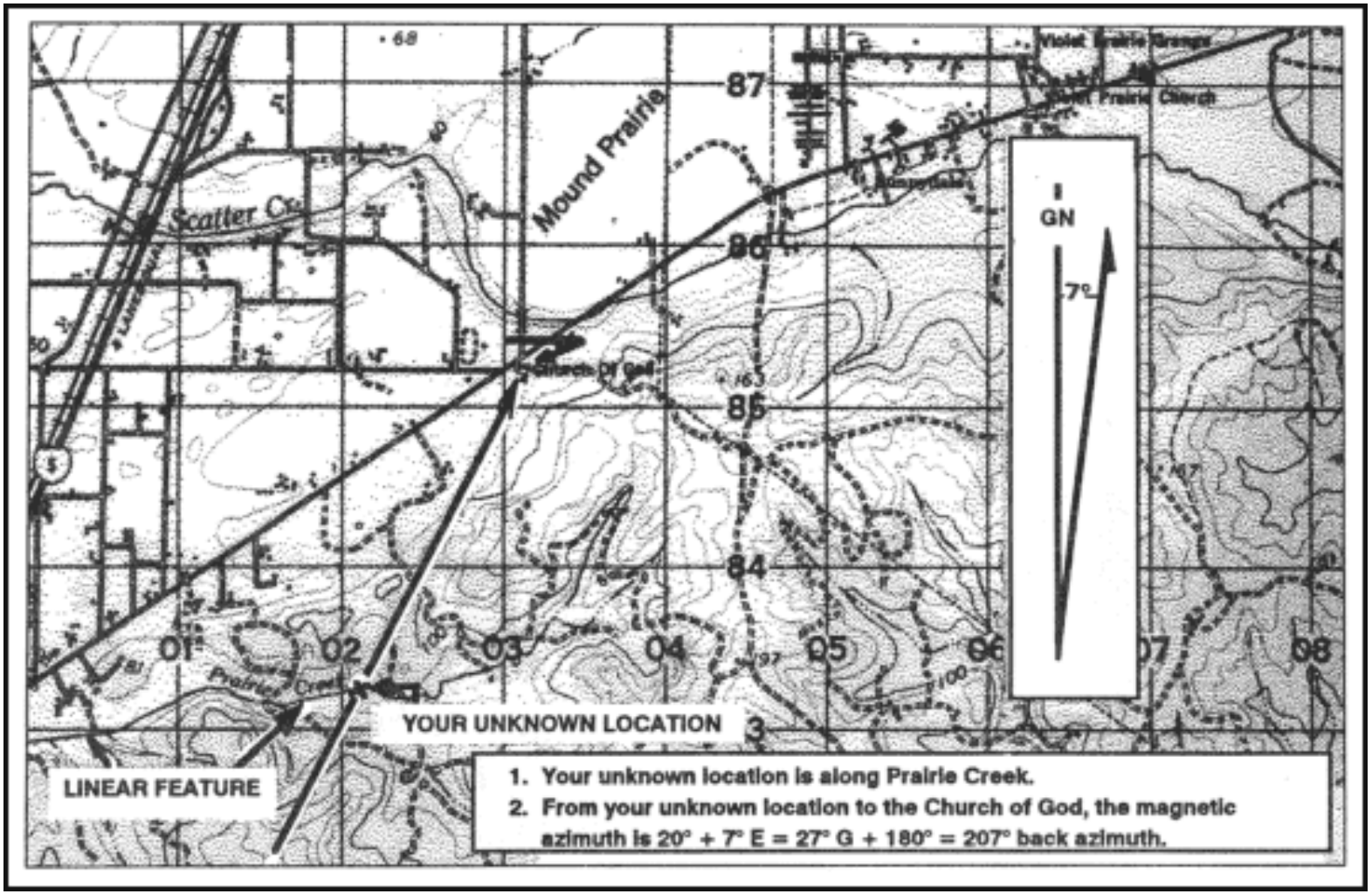
Modified Resection

Modified resection is the method of locating one's position on the map when the person is located on a linear feature on the ground, such as a road, canal, or stream.

1. Orient the map using a compass or by terrain association.
2. Find a distant point that can be identified on the ground and on the map.
3. Determine the magnetic azimuth from your location to the distant known point.
4. Convert the magnetic azimuth to a grid azimuth.
5. Convert the grid azimuth to a back azimuth. Using a protractor, draw a line for the back azimuth on the map from the known position back toward your unknown position.
6. The location of the user is where the line crosses the linear feature. Determine the grid coordinates to the desired accuracy.

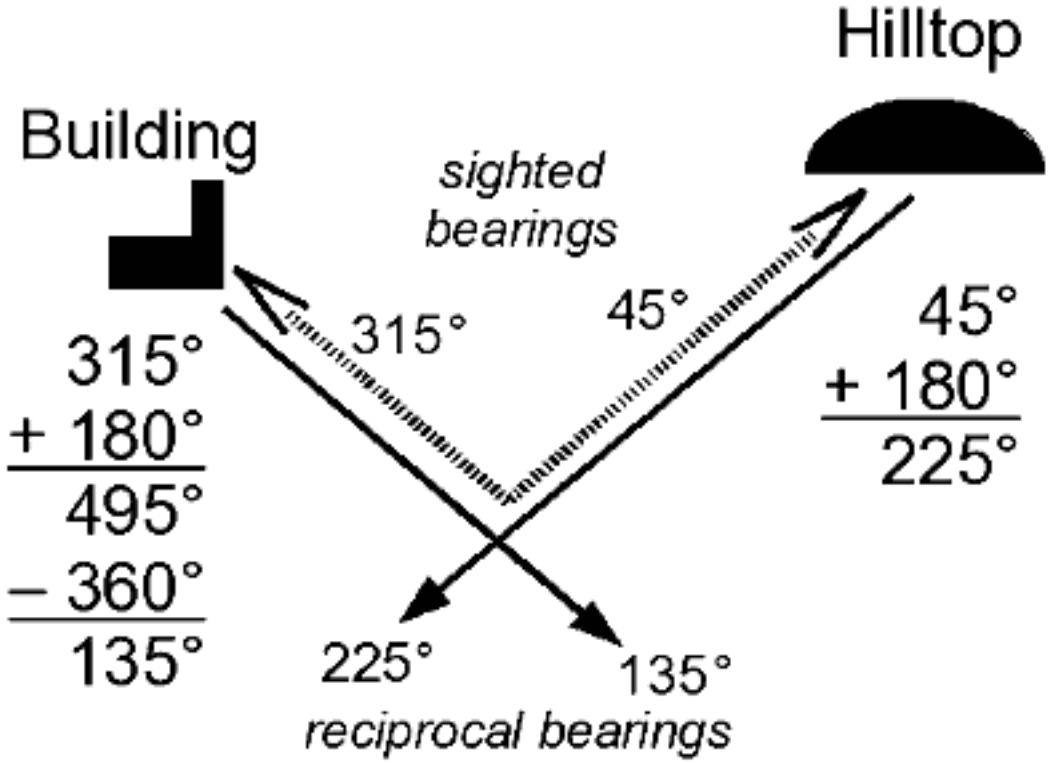
CALIFORNIA
CADET CORPS

Modified Resection



Check on Learning

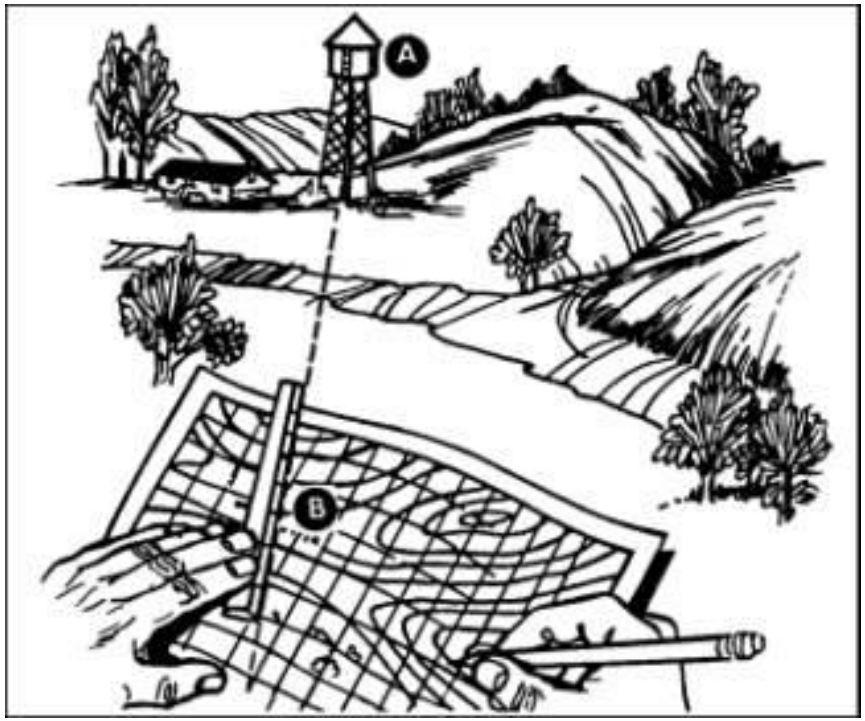
1. In this example, what is the navigator trying to do?
2. She uses the term "reciprocal bearings". What do we call that?
3. What step did this navigator forget to do?



CALIFORNIA
CADET CORPS

Check on Learning

1. In this example, what is the navigator trying to do?
2. Would the house be a good second object to align to? Why or Why not?



CALIFORNIA
CADET CORPS

LAND NAVIGATION (LAND NAV)

C2. Put all your map reading and compass skills together to complete a land navigation course.

CALIFORNIA
CADET CORPS

Land Nav Course

- A true Land Nav Course will put most of your knowledge about map reading and compass use together.
- Courses are, of course, different, and may challenge you in different ways.
- The differences might include what skills they require you to demonstrate, the terrain, and the distance between points.

CALIFORNIA CADET CORPS

Land Nav Skills

A Land Nav Course may require you to do any of the following:

- Plot a grid coordinate and grid azimuth
- Convert between magnetic & grid azimuths
- Receive a distance and direction to travel from a known point (polar coordinate)
- Travel to a given grid coordinate
- Locate a terrain feature on map & ground
- Map Reading / Interpretation
- Use terrain association to orient your map
- Measure distance and/or keep a pace count
- Use a compass
- Move around an obstacle

Plot a Grid Coordinate & Grid Azimuth on a Map

Example: Starting point is GE08651264. Point 1 is on a grid azimuth of 74° from the starting point, at 375 meters.

- Plot GE08651264
- Plot grid azimuth of 74°
- Measure 375 meters on map scale
- Plot 375 meters along 74° line and figure out if there's a terrain feature you should look for at the next point
- Look at terrain features and figure out your best route
- Move out to that point

Movement Between Points

- You can go cross country, using compass and pace count
- You can look at your map to see if there's a road or trail, etc. that will be easier
- If you take a road, you need to keep reading your map to ensure you know where you are
- This technique is similar to Orienteering, and you can use those skills to be successful

CALIFORNIA
CADET CORPS

Grid Coordinate

Example: Move to GE08931241.

- Plot GE08931241 on your map
- Determine where it is in relation to where you are currently, what terrain is nearby, and the best way to get to that point
- Once you have a plan, move out!

CALIFORNIA
CADET CORPS

Azimuths

Example: Move on a magnetic azimuth of 210° for 550 meters to get to your next point.

- Convert magnetic to grid azimuth
- Plot the grid azimuth on your map from your current position
- Figure out what terrain feature is at that point
- Determine the best way to get there, and move out!

CALIFORNIA CADET CORPS

Orienteering vs Land Nav

What's the difference between a Compass Course, Orienteering, and Land Nav?

COMPASS

- Simplest
- Compass is Key
- Pace Count is Key
- Can be Small Area
- Urban Area not Ideal

ORIENTEERING

- Medium Skill
- Terrain Association is Key
- **Speed Also Key**
- Medium to Large Area
- Usually in Parks or Wilderness, but can be in Urban Terrain
- **Sport / Competition**

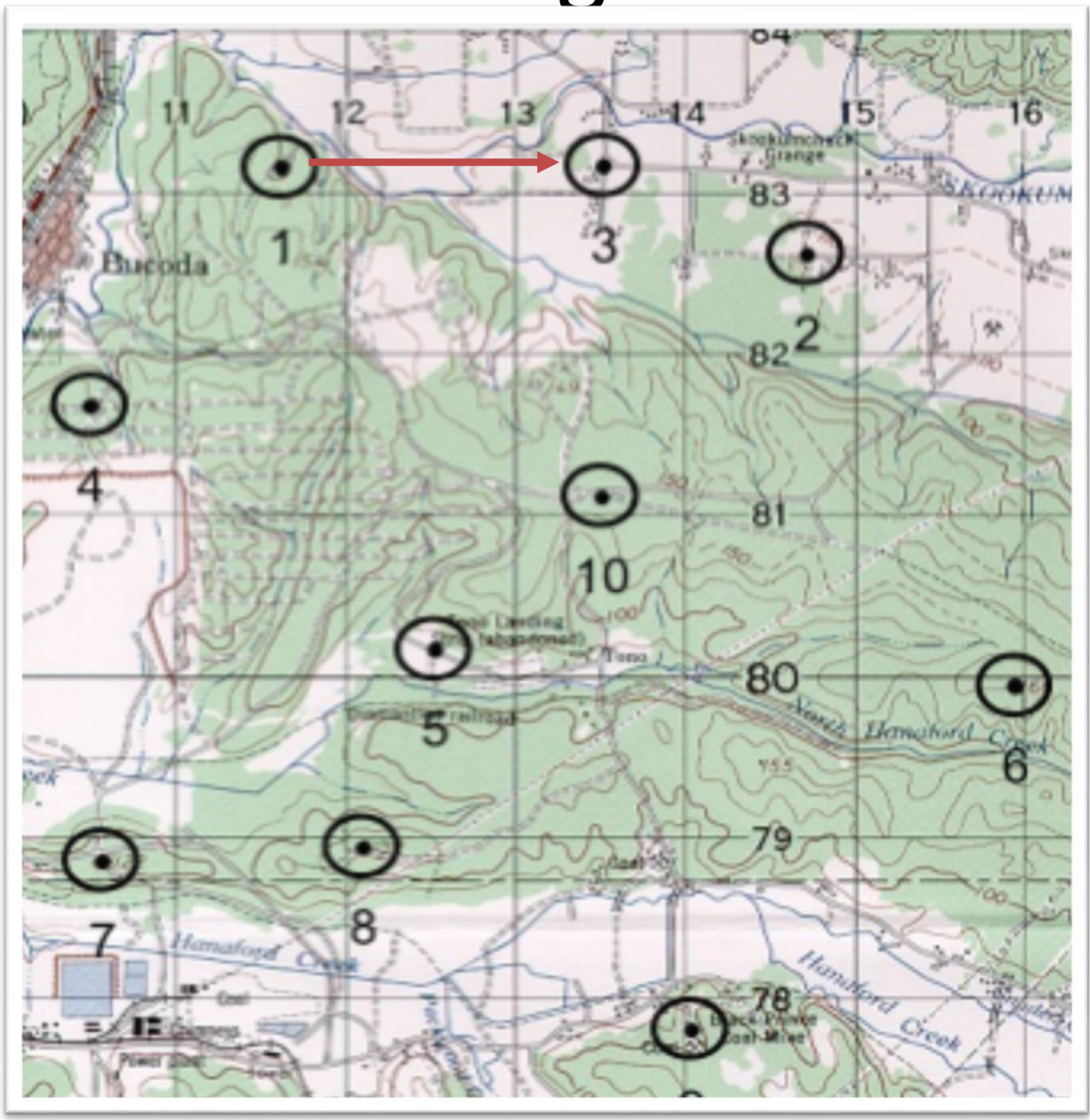
LAND NAV

- Medium/Advanced Skills
- Map Reading Skills are Key
- Compass, Pace Count, and Terrain Assn also Important
- Medium to Large Area
- Focused on Wilderness/Parks
- **Focus of Military Training**

CALIFORNIA CADET CORPS

Check on Learning

1) Your task is to go from 1 to 3. Declination is 12 deg East.
    1) What magnetic course should you take.
    2) What's your Pace count to get there?



CALIFORNIA
CADET CORPS

DESIGNING A LAND NAV COURSE FOR YOUR CACC UNIT

C3. Design a Land Nav Course for your Battalion or Brigade

CALIFORNIA
CADET CORPS

Land Nav Course

- What is your challenge?
- You may have been tasked to develop a Land Nav Course for your unit's bivouac
- You may just want to give your cadets more of a challenge and practice Land Nav
- Either way, YOU CAN design your own Land Nav Course!

CALIFORNIA
CADET CORPS

Land Nav Course

- You may not need to design your own course
  - Check in your area to see if there's an Orienteering Club or established courses you could convert to land nav
- Army and Marine bases probably have Land Nav Courses. You could go there.
- If not, don't despair – design your own!

Land Nav Course

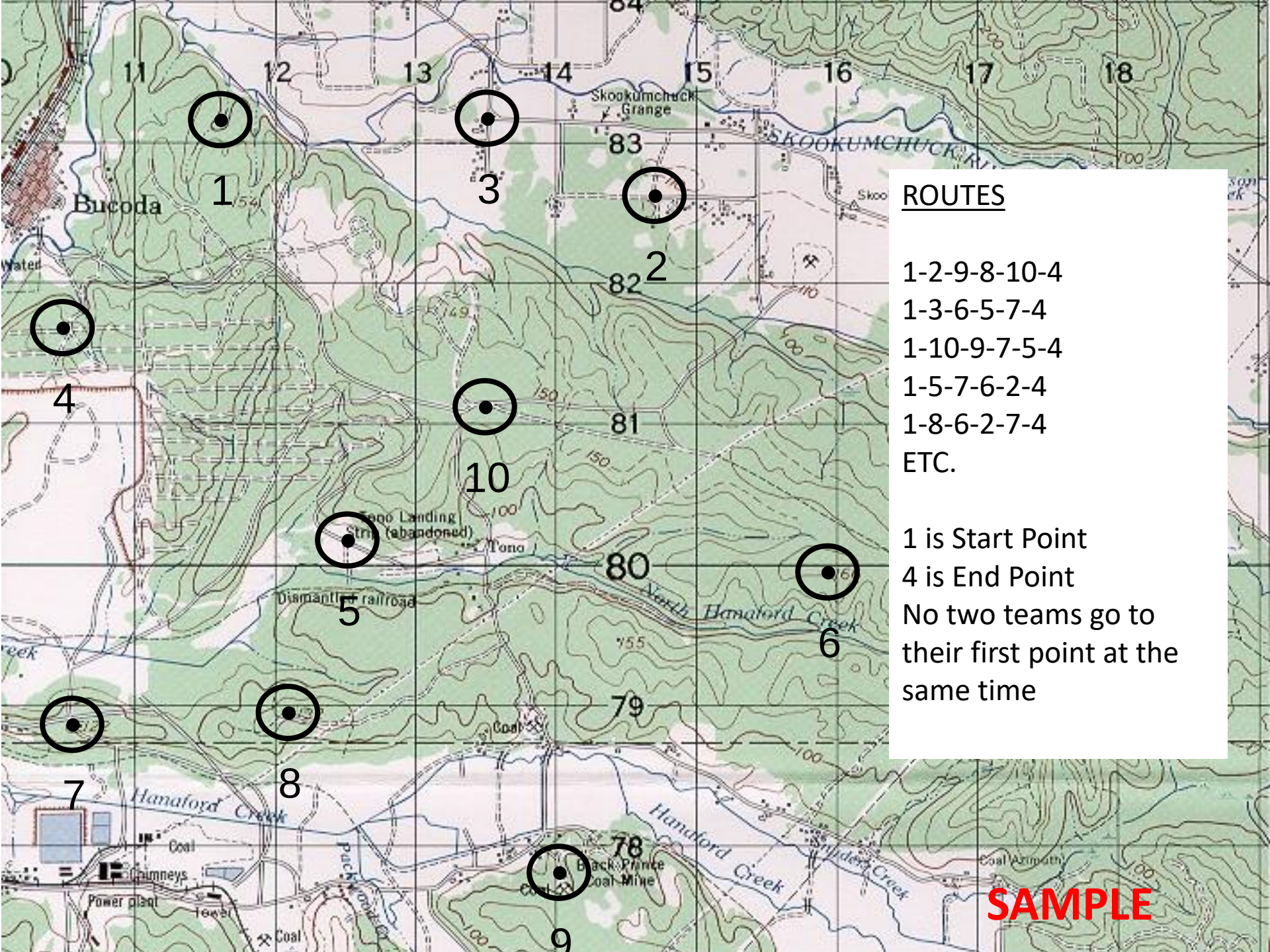
- Determine a location. Local/County or State Park nearby? Bivouac site? Military base?
- Get a map. Go on line!
- Plot key terrain features as your points
- Build your Control markers
- Design a scorecard that works for your course
- Decide what skills you want cadets to practice
- Develop enough different routes between various points so that cadets aren't just following each other between points

Routes

- Unlike Orienteering, teams on a Land Nav Course don't follow the same route.
- You might create 10 points on your course, but any given team will only go to 4 or 5 of them.
- The key is to make the routes logical and challenging, and to spread out teams on the same route so later teams don't catch up with earlier teams on the same route

Routes

- You also need to keep fairness in mind in designing the routes. The overall course should be about the same length for each team, though individual legs may be shorter or longer.
- You should run the course with some advanced cadets before you put your cadets on it


11
12
13
14
15
16
17
18
Skookumchuck Grange
SKOOKUMCHUCK
Bucoda
83
82
81
80
79
78
1
2
3
4
5
6
7
8
9
10
Tono Landing Strip (abandoned)
Tono
Diamantine railroad
North Hamaford Creek
Hamaford Creek
Coal
Chimneys
Power plant
Tower
Black Prince Coal Mine
Coal Azimuth
Snyder Creek
ROUTES
1-2-9-8-10-4
1-3-6-5-7-4
1-10-9-7-5-4
1-5-7-6-2-4
1-8-6-2-7-4
ETC.
1 is Start Point
4 is End Point
No two teams go to their first point at the same time
SAMPLE

CALIFORNIA CADET CORPS

Control Points

- At each point, you can have a card with instructions (for each team) to the next point.
- Instructions can challenge different skills: some might give magnetic direction + distance, some might give a grid coordinate, some might give grid direction and distance they have to plot on their map, etc.
- Usually you number the Control Marker, and the team just has to write down the number of the point they found.

Land Nav Course

- Write a simple OPLAN using CR 3-13
- Who – What – When – Where – Why
  - Our Bde is running a Land Nav Course at X Park on (date) as part of the X Brigade Bivouac
- Come up with rewards for winners (maybe a local veterans organization could sponsor this)
- Don’t forget your Risk Assessment!

CALIFORNIA
CADET CORPS

Check on Learning

1. What are some of the skills a Land Nav course can reinforce?

2. How can you mitigate these safety risks?
    1. Dehydration
    2. Getting Lost
    3. Injury

CALIFORNIA
CADET CORPS

ADVANCED LAND NAVIGATION SPORTS / ACTIVITIES

C4. Advanced Land Navigation Sports and Activities

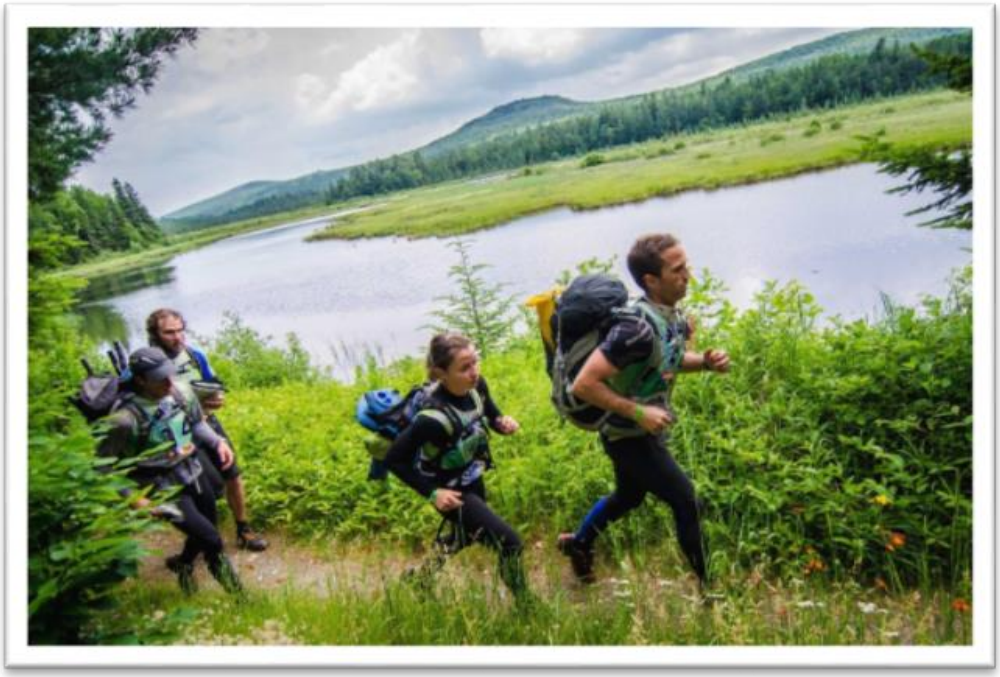
A)Identify the key characteristics of and the various skills required for advanced land navigation sports and activities.

B) Know the steps to take if you get lost in the wilderness.

CALIFORNIA CADET CORPS

Adventure Racing

- Length: 10-100 miles
- 2-5 person teams
- Just completing a race is often considered a victory.
- Emphasis on teamwork
- Teams that navigate well can beat more fit teams
- -Changing Disciplines:
  - Cross-country running
  - Orienteering and hiking
  - Canoeing / rafting
  - Rappelling
  - Mountain biking

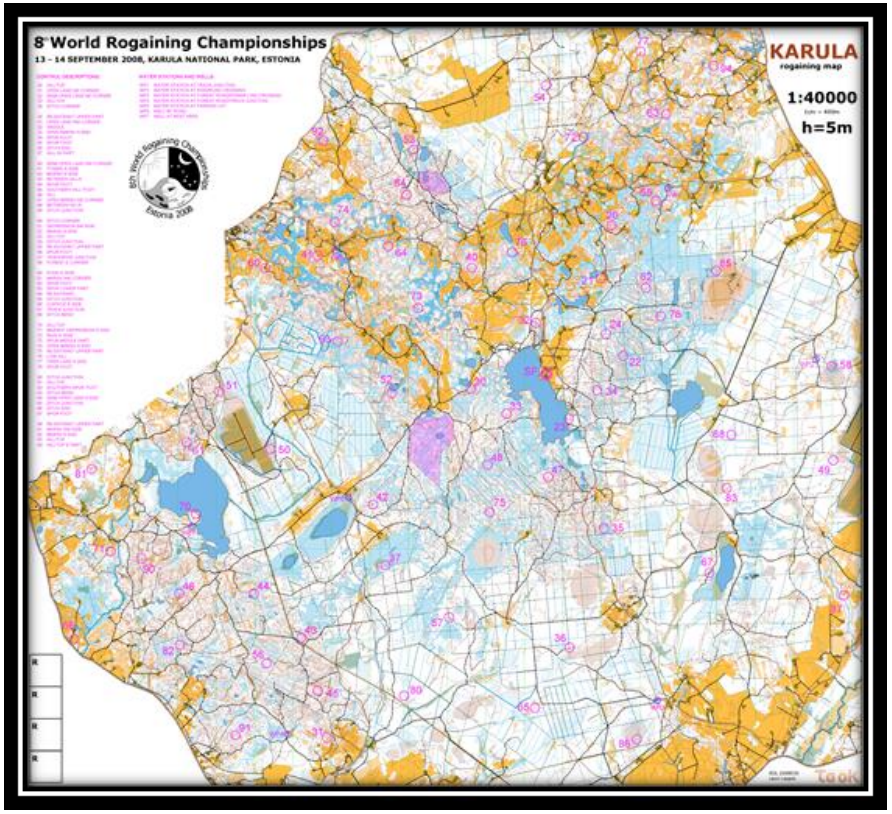


https://www.youtube.com/watch?v=occW94DgWT4

CALIFORNIA CADET CORPS

Rogaining

- Long distance cross-country navigation.
  - Route planning
  - Navigation between checkpoints using a variety of map types.
- Teams of 2–5 people
- Teams choose which checkpoints to visit within a time limit to **maximize scores**
- Features teamwork, endurance, competition, and an appreciation for the natural environment.
- Championship rogaines are 24 hours long, but rogaines can be as short as two hours.



https://www.bing.com/videos/search?q=rogaining&&view=detail&mid=31D34F69D7ED9194A31D31D34F69D7ED9194A31D&FORM=VRDGAR

CALIFORNIA
CADET CORPS

Ski Orienteering

- Orienteering on skis
- Network of crisscrossing ski trails
- Map Holder on chest
- Maps are specially designed with ski trails and display navigability

https://youtu.be/oUqaQicP8PU

CALIFORNIA CADET CORPS

Urban Orienteering

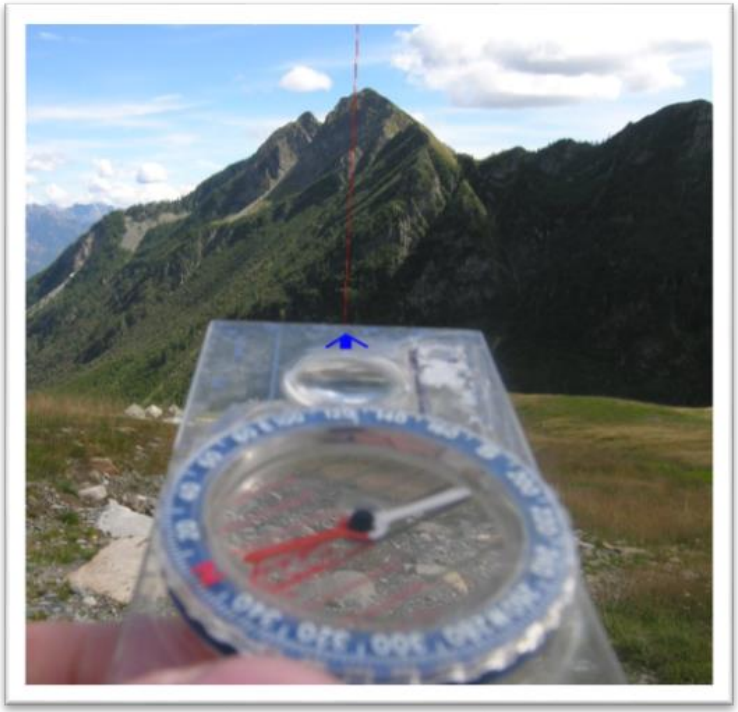
- Orienteering in a city environment
- Association to man-made environment
- Typically, shorter distance

https://www.bing.com/videos/search?q=urban+orienteering&&view=detail&mid=44E85A7A583EC8FD9E4944E85A7A583EC8FD9E49&FORM=VRDGAR

CALIFORNIA CADET CORPS

Backpacking Navigation

- Map and Compass is essential on a hike
- Practice your skills and be prepared
- Map
  - Guidebook maps are good for planning, but not for navigation
  - Topographical map is best
- Compass
  - Needle, Bezel, Orienting Line, Index lines, Direction of travel arrow
  - Taking a bearing
  - Line location / Triangulation
- GPS
  - Use to get your immediate present position
  - Use to navigate to waypoints
  - Use to track your hike
  - Battery-dependent
  - Can lose signal in dense brush or deep valleys
  - Always bring a map/compass as backup



Map, Compass & GPS - CleverHiker.com (13m 05sec YouTube Video)
https://www.youtube.com/watch?v=oAb6nC3slR4

Backpacking / Not Getting Lost

- Practice your skills
- Give a friend your detailed itinerary
- **Pay Attention** to your map, to terrain, to time, to elevation, and to the trail
  - Use main landmarks
  - Pay close attention to trail junction signs
  - Avg hiker covers 2-3 miles per hour
  - Pay attention to elevation changes
  - Watch the trail

Backpacking / What to Do if You're Lost

- **STOP** the moment things don't look right
  - Take a few minutes to look around
  - Don't be afraid to walk back the way you came
  - Be a detective not a victim
  - When was the last time you were "On Trail"
  - Don't bushwack off a trail
  - If completely lost, stay calm despite adrenaline level climb-DON'T RUN
    - Sit down eat, drink, and study the map
    - If Dark is coming, set up shelter and stay the night
    - 2 choices: Stay and wait, or walk yourself out
      - Generally, stay and wait is better, UNLESS no one knows where you are
      - If walking out, walk towards the nearest road-head away from mountains and head downstream if following rivers

STOP

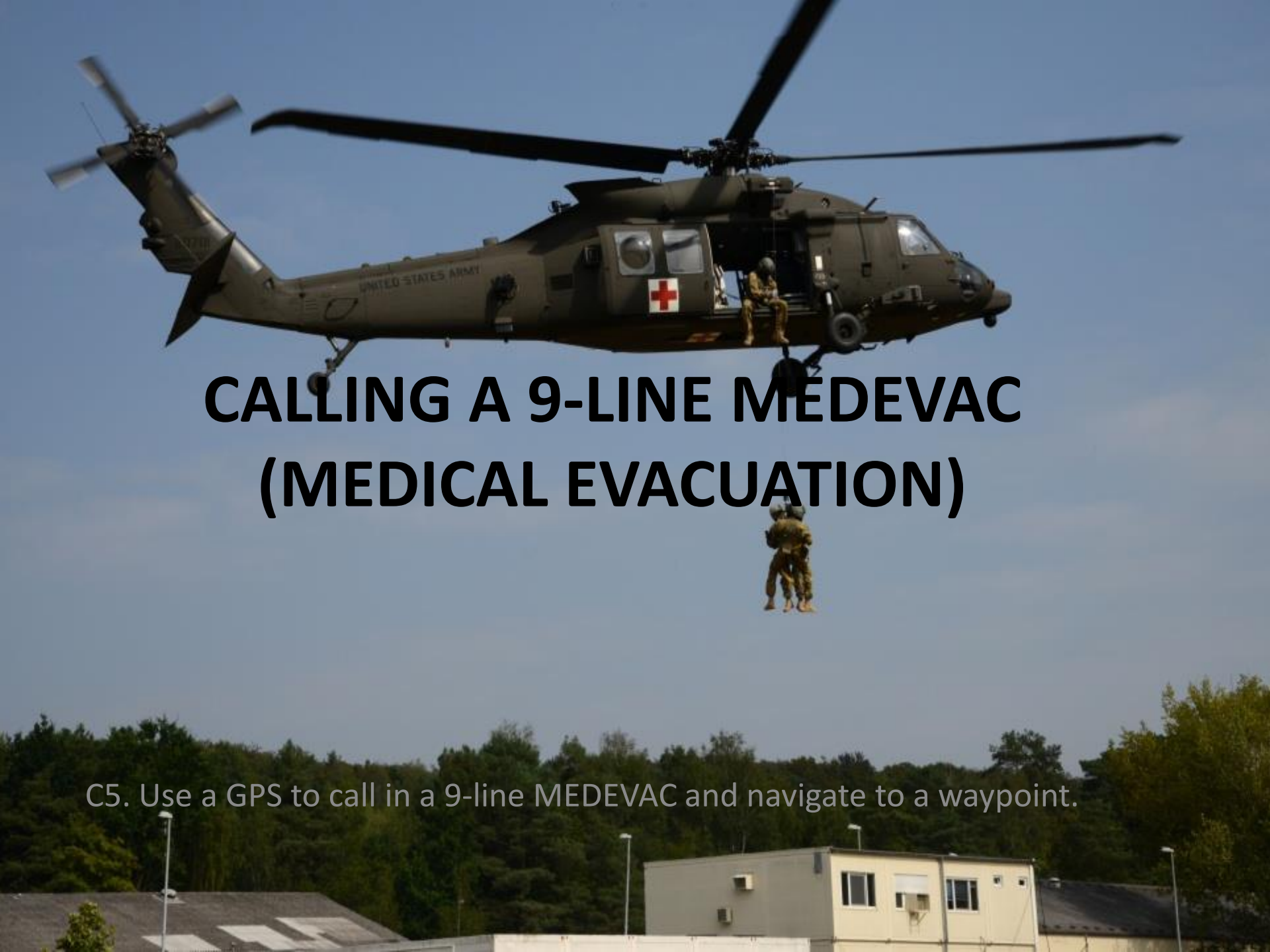
Stop
Think
Observe
Plan

CALIFORNIA CADET CORPS

Check on Learning

1. Backpacking
2. Ski Orienteering
3. Urban Orienteering
4. Adventure Racing
5. Rogaining

A. Done on snow covered trails for speed.
B. Each racer on the Team, must always be within 100m of each other
C. You pick which checkpoints you will go to so you can maximize your score.
D. Individual sport done in city areas
E. Long distance wilderness hiking done over multiple days.



CALLING A 9-LINE MEDEVAC (MEDICAL EVACUATION)

C5. Use a GPS to call in a 9-line MEDEVAC and navigate to a waypoint.

9-Line Medevac

- The US Army uses a 9-Line Medevac request for ground forces to communicate a request for medical evacuation.
- This procedure is covered here in Land Navigation so that Cadets will be able to identify their present position at all times, and be able to accurately call in the location of the pick-up site.
- This skill may be practiced in both Survival and Medical training.
- Core to success on line 1, is to understand who may be picking them up and to be able to convert grid coordinates into Lat/Long and the reverse.

9-Line Format

MEDEVAC REQUEST FORM GTA 08-01-004

LINE	ITEM	EVACUATION REQUEST MESSAGE
1	Location of Pickup Site.	Grid Coordinates (US Army) or Lat/Long (USAF/USCG/USN/Civ)
2	Radio Frequ., Call Sign, & Suffix.	
3	No. of Patients by Precedence.	A – Urgent B - Urgent Surgical C – Priority D – Routine E - Convenience
4	Special Equipment Required.	A – None B – Hoist C - Extraction equipment D - Ventilator
5	Number of Patients by Type.	A – Litter B – Ambulatory
6	XXXXXXXXXXXXXXXXXXX	
6	Number and Type of Wound, Injury, or Illness (Peacetime).	Number and types of wounds, injuries, and illnesses
7	Method of Marking Pickup Site.	A – Panels B – Pyrotechnic C - Smoke D – None E - Other
8	Patient Nationality and Status.	A - US Military B - US Civilian C - Non-US Military D - Non-US Civilian
9	XXXXXXXXXXXXXXXXXXX	
9	Terrain Description (Peacetime).	

This publication contains technical or operational information that is for official Government use only. Distribution is limited to U.S. Government agencies. Requests from outside U.S. Government agencies for release of this publication under the Freedom of Information Act or the Foreign Military Sales Program must be made to Commander USATSC, ATTN: GTA Program Manager ATIC-ITST-T, Fort Eustis, VA 23064-5166. DESTRUCTION NOTICE: Destroy by any method that will prevent disclosure of contents or reconstruction of document.

AUG 2002 (This supersedes GTA 08-01-004 MAY 1997)

DISTRIBUTION: US ARMY TRAINING SUPPORT CENTERS (TSCs)
HEADQUARTERS, DEPARTMENT OF THE ARMY,
ATTN: ATIC-ITST-T, GTA Program, Fort Eustis, VA 23604-5166

Scenario

- Situation: You are participating in a survival training exercise and you are located at grid coordinates EG 05959122 near the end of a dirt road in a flat area surrounded by forest. You must request medical evacuation for two Cadets from your unit. The call sign you use is X69 and the frequency is 36.90. One casualty has been bitten by a rattlesnake and is having difficulty breathing and the other has a fracture of the right leg. Medical personnel state that the first casualty needs a ventilator and antivenom and the other casualty is routine. You have fluorescent orange panel to mark the pickup location in the center of the road, but there isn't enough room for a helicopter to land.

9-Line

Situation: You are participating in a survival training exercise and you are located at grid coordinates EG 05959122 near the end of a dirt road in a flat area surrounded by forest. You must request medical evacuation for two Cadets from your unit. The call sign you use is X69 and the frequency is 36.90. One casualty has been bitten by a rattlesnake and is having difficulty breathing and the other has a fracture of the right leg. Medical personnel state that the first casualty needs a ventilator and antivenom and the other casualty is routine. You have fluorescent orange panel to mark the pickup location in the center of the road, but there isn't enough room for a helicopter to land. A California Army National Guard helicopter is on alert for your exercise.

MEDEVAC REQUEST FORM — GTA 08-01-004

LINE	ITEM	EVACUATION REQUEST MESSAGE
1	Location of Pickup Site.	**LINE 1)** ECHO GOLF 05959122
2	Radio Frequ., Call Sign, & Suffix.	**LINE 2)** FOXTROT MIKE 36.90, X-RAY69
3	No. of Patients by Precedence.	**LINE 3)** 1 ALPHA, 1 DELTA
4	Special Equipment Required.	**LINE 4)** BRAVO AND DELTA
5	Number of Patients by Type.	**LINE 5**) 1 ALPHA, 1 BRAVO
6	Security of Pickup Site (Wartime).	**LINE 6)** PATIENT 1: VENOMOUS SNAKE BITE AND DIFFICULTY BREATHING, PATIENT 2: FRACTURED RIGHT LEG
6	Number and Type of Wound, Injury, or Illness (Peacetime).	
7	Method of Marking Pickup Site.	**LINE 7**) ALPHA
8	Patient Nationality and Status.	**LINE 8**) BRAVO
9	NBC Contamination (Wartime).	**LINE 9**) END OF DIRT ROAD SURROUNDED BY FOREST
9	Terrain Description (Peacetime).	

Check on Learning

- A Coast Guard helicopter is coming to rescue you off your sinking boat. Do you relay lat/long coordinates or grid coordinates?
- If you have a GPS, how do you get your present position?
  - What datum would you use?
  - How do you know when the GPS is accurate?
- How would you get your position if you didn't have a GPS?

Advanced Land Navigation Summary

- C1. Advanced Map Reading Techniques
- C2. Land Navigation
- C3. Designing a Land Nav Course for your Cadet Corps Unit
- C4. Advanced Land Navigation Sports / Activities
- C5. Calling a 9-Line Medevac (Medical Evacuation)