

UNITED STATES MARINE CORPS
OFFICER CANDIDATES SCHOOL
TRAINING COMMAND
2189 ELROD AVENUE
QUANTICO, VA 22134-5003

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DEC 2008

LAND NAVIGATION 3

ENABLING LEARNING OBJECTIVES.

1. Given a military topographic map, protractor, and objective, identify the contour interval, without error and in accordance with Chapter 3 of FM 3-25.26. (0300-PAT-1002c)

2. Given a military topographic map, protractor, and objective, select the three types of contour lines found on a topographical map, in accordance with Chapter 10 of FM 3-25.26. (0300-PAT-1002e)

Given a military topographic map, protractor, and objective, identify the "terrain feature" at that specific coordinate, in accordance with Chapter 10 of FM 3-25.26. (0300-PAT-1002f)

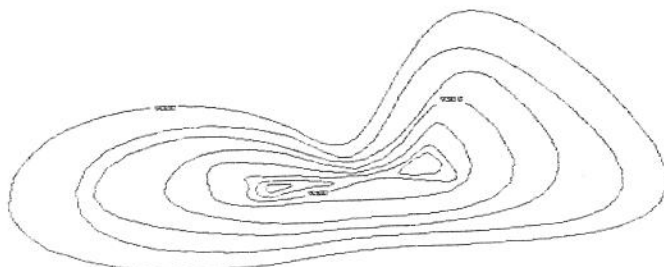
1. CONTOUR LINE. A line drawn on a map representing an imaginary line on the ground along which all points are at the same elevation.

a. Characteristics of contour lines indicate a vertical distance above or below a datum plane.

b. The vertical distance between adjacent contour lines is known as the contour interval, and the amount of the contour interval is given in the marginal information.

c. Starting as sea level, the zero contour, each contour line represents an elevation above sea level.

d. On most maps the contour lines indicate the nature of the slope.



2. TYPES OF CONTOUR LINES.

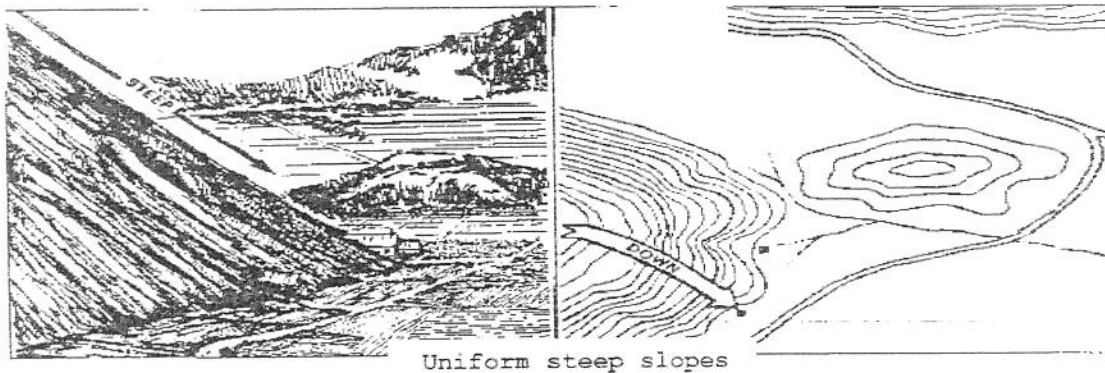
- a. Index Contour Line. Starting at zero elevation, every fifth contour line is drawn with a heavier line. These are known as index contours. Along each index contour the line is broken and its elevation is given.
- b. Intermediate Contour Line. The contour lines falling between index contours are called intermediate contours. They are drawn with a finer line than the index contours and do not have elevations given.
- c. Supplementary Contour Line. A third type of contour line that is not often used is the supplementary contour line. This line is depicted as a dashed line and is used to indicate an extreme change in elevation or terrain between two intermediate contour lines. Using the contour lines on a map, the elevation of any point may be determined by:
 - (1) Finding the contour lines on a map from the marginal information, and noting both the amount and the unit of measure.
 - (2) Finding the numbered contour line nearest the point for which the elevation is being sought.
 - (3) Determining the direction of the slope from the numbered contour lines index contour to the desired point.
 - (4) Counting the number of contour lines that must be crossed to go from the numbered index contour line to the desired point and noting the direction up or down. The number of lines crossed, multiplied by the contour interval is the distance above or below the starting value.
 - (5) If the desired point is on a contour line, its elevation is that of the contour line.
 - (6) For estimating elevation of a point between contours, most military needs are satisfied by estimating the elevation to an accuracy of one half the contour interval.

- (7) To estimate the elevation to the top of an unmarked hill, add half the contour interval to the elevation of the higher contour line around the hill.
- (8) To estimate the elevation of the bottom at a depression, subtract half the contour interval from the value of the lowest contour line around the depression.

3. RELIEF FEATURES.

a. Slopes. The spacing of the contour lines indicates the nature of the slopes.

- (1) Uniform steep slope. Contour lines evenly spaced and close together indicate a uniform steep slope. The closer the contour lines are to each other the steeper the slope.



- (2) Uniform gentle slopes. Contour lines evenly spaced and wide apart indicate a uniform gentle slope.

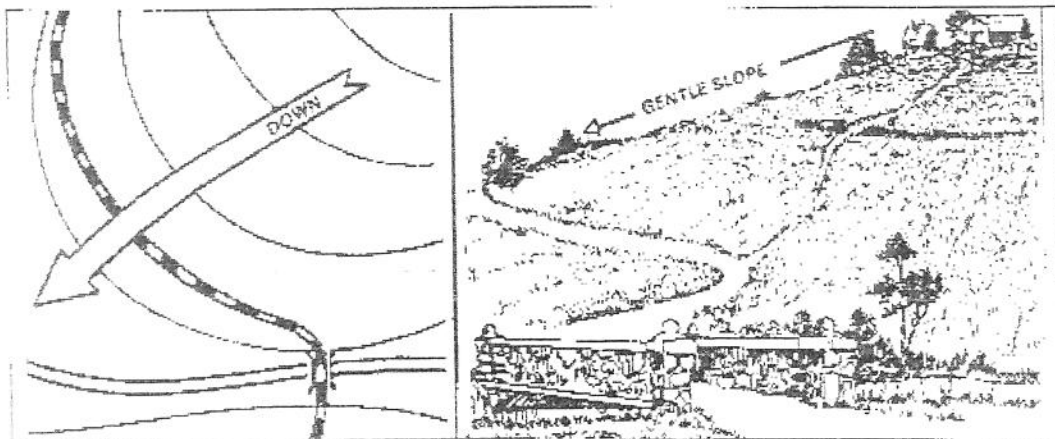
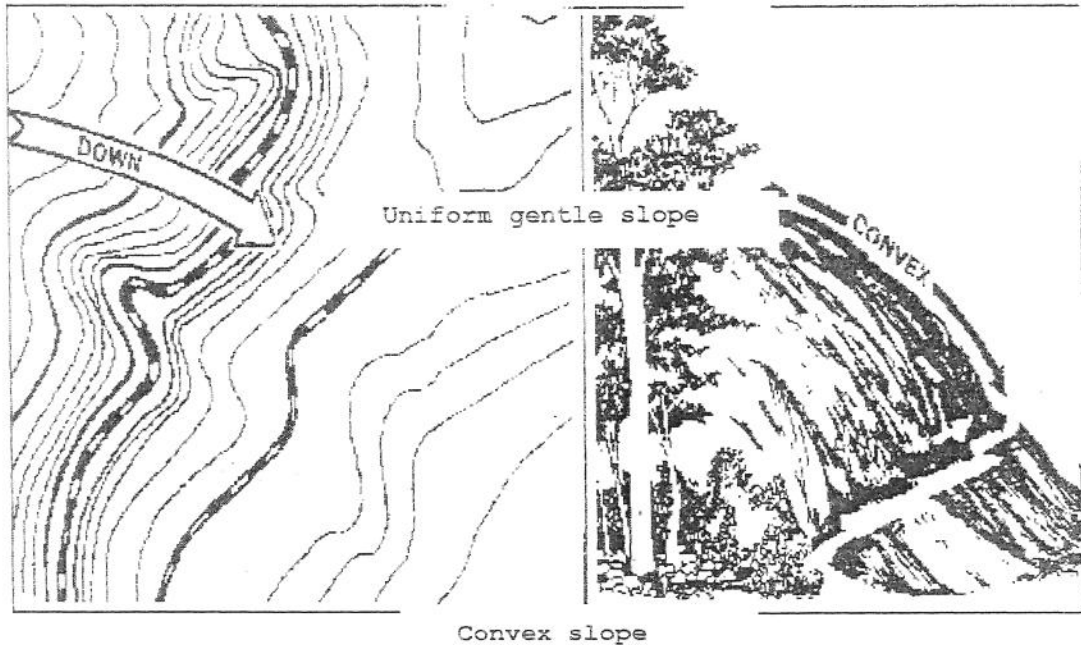


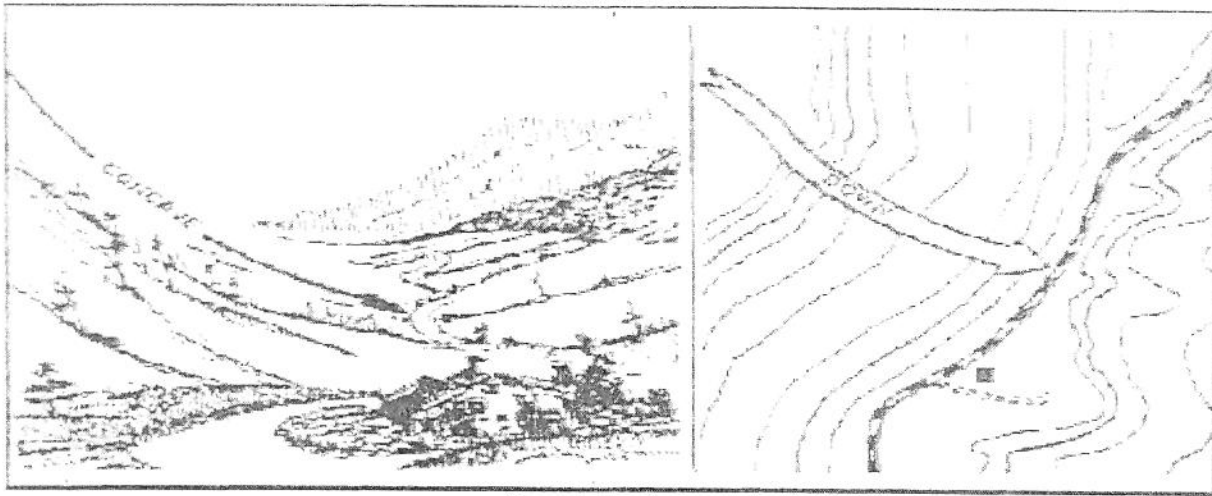
Figure 10-6. Uniform, gentle slope.

- (3) Convex slope. Contour lines widely spaced at the top and closely spaced at the bottom. An observer at the top of a convex slope cannot observe most of the slope, or the terrain at the bottom. The further up the slope, the easier it is to climb.



- (4) Concave slope. Contour lines are closely spaced at top and widely spaced at bottom. An observer at the top of the concave slope can observe the entire slope and the terrain at the bottom. The further up the slope, the more difficult it is to climb.

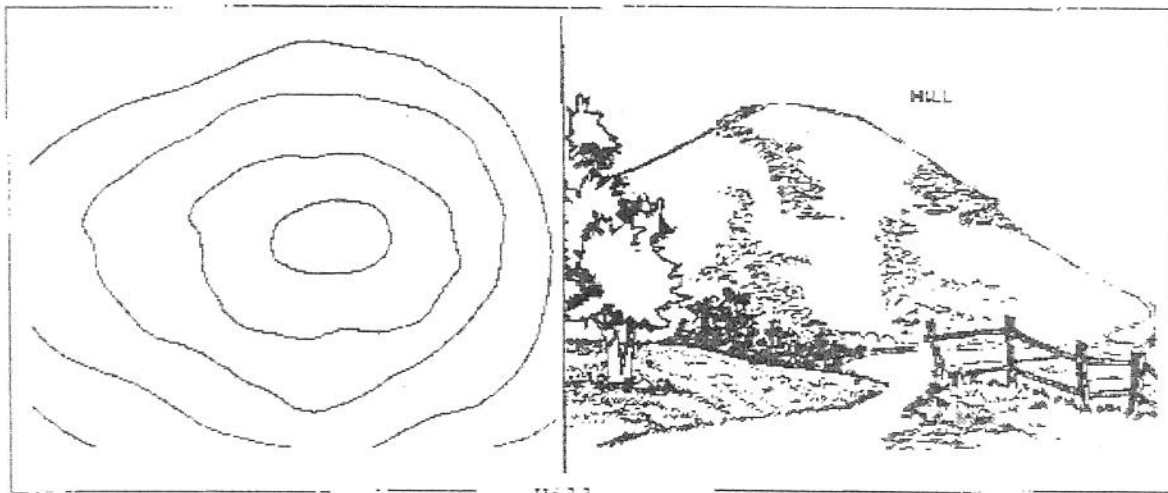
Convex slope



Concave slope

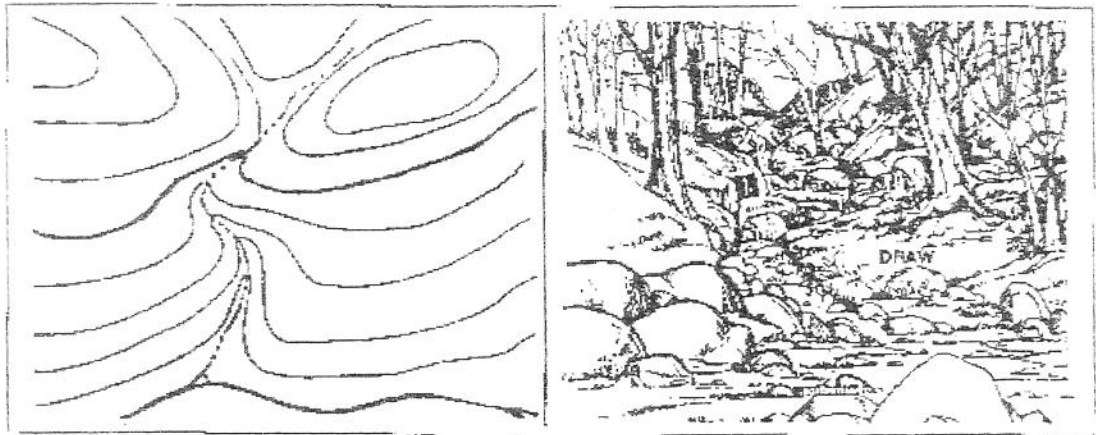
4. TERRAIN FEATURES.

- a. Hill. A point or small area of high ground. Contour lines will represent the hill by being a closed loop within a small area on the map. When you are located on a hilltop the ground slopes down in all directions.



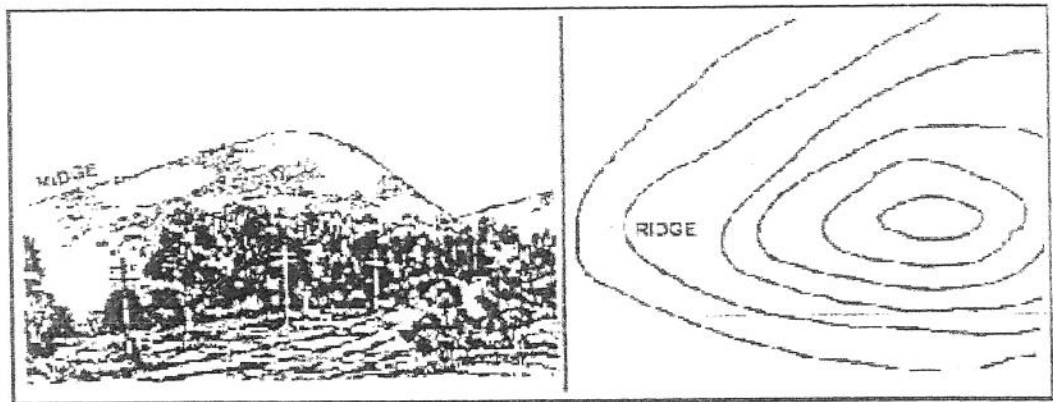
Hill

- b. Draw. A less developed stream course in which there is essentially no level ground, and therefore, little or no maneuver room within its confines. The ground slopes upward on each side and towards the head of the draw. Draws occur frequently along the sides of ridges. Contours indicating a draw are V shaped, with the point of the "V" toward the head of the draw.



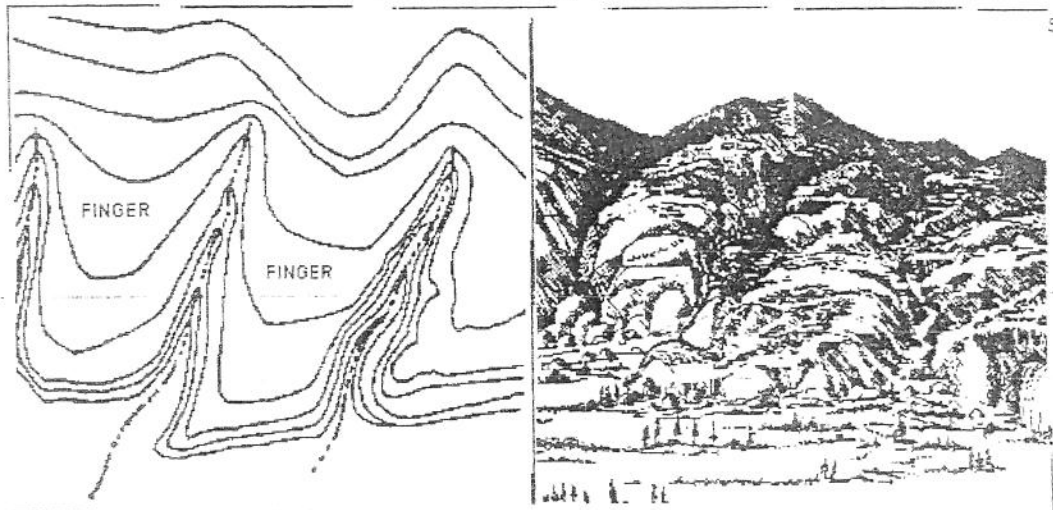
Draw

- c. **Ridge.** A line of high ground, with normally minor variations along its crest. The ridge is not simply a line of hills. All points of the ridge crest are appreciably higher than the ground around it.

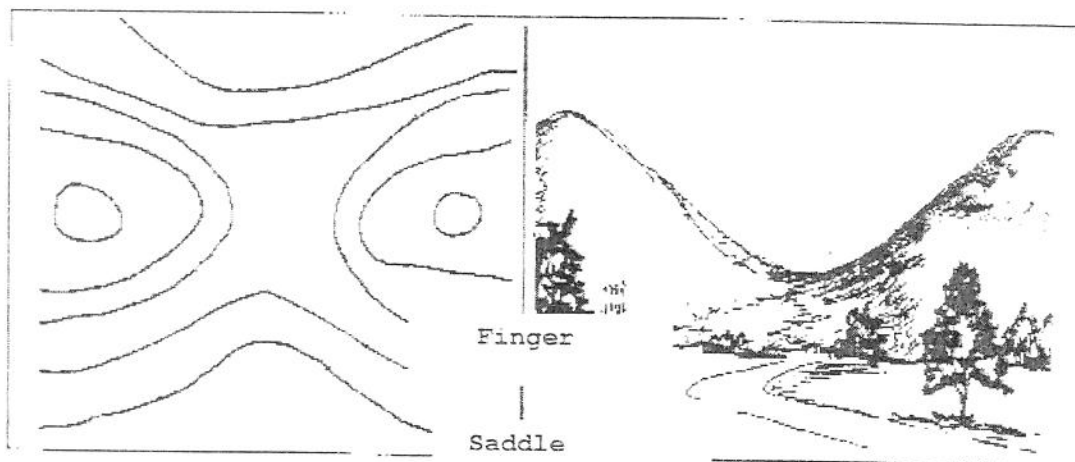


Ridge

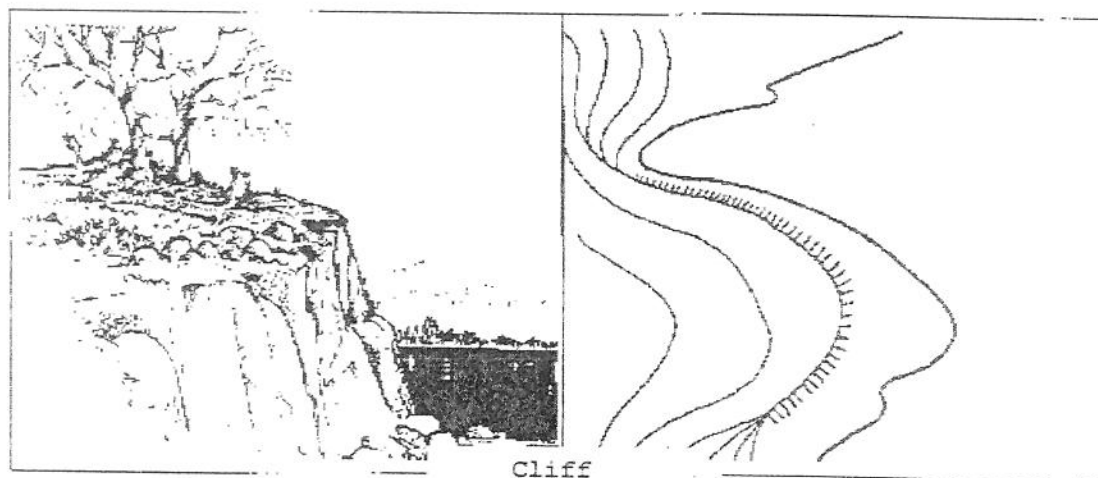
- d. **Finger.** A usually short continuously sloping line of higher ground, normally jutting out from the side of a



- e. Saddle. A dip or low point along the crest of a ridge. A saddle is not necessarily the lower ground between two hilltops. A saddle is simply a dip or break along an otherwise level ridge crest.

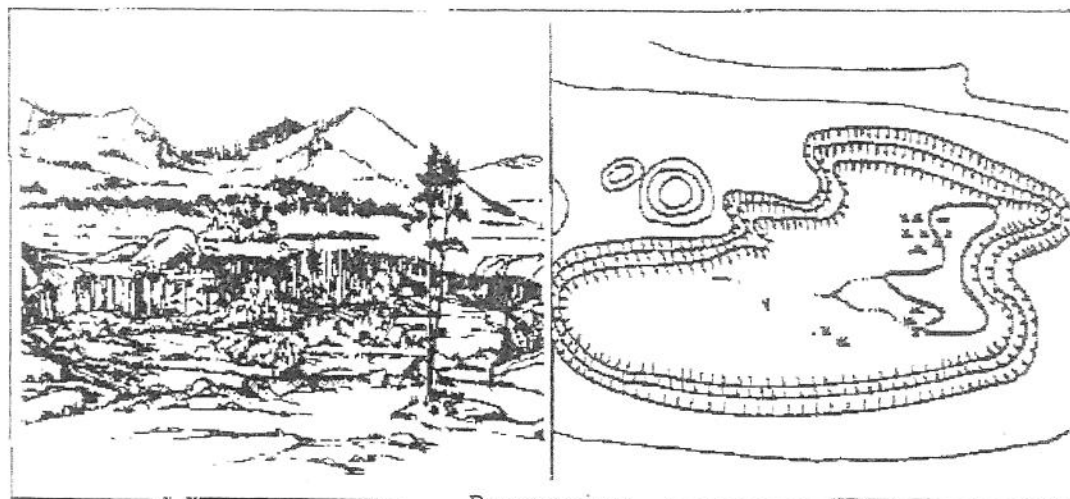


- f. Cliff. A vertical or near vertical slope. When a slope is so steep that it cannot be shown by the contour interval, it is shown by ticked "carrying" contours. The tick marks always point toward lower level of elevation.



- g. Depression. A low point or sinkhole surrounded on all sides by higher ground. Tick marks are used in conjunction with contours to show the lower elevation of

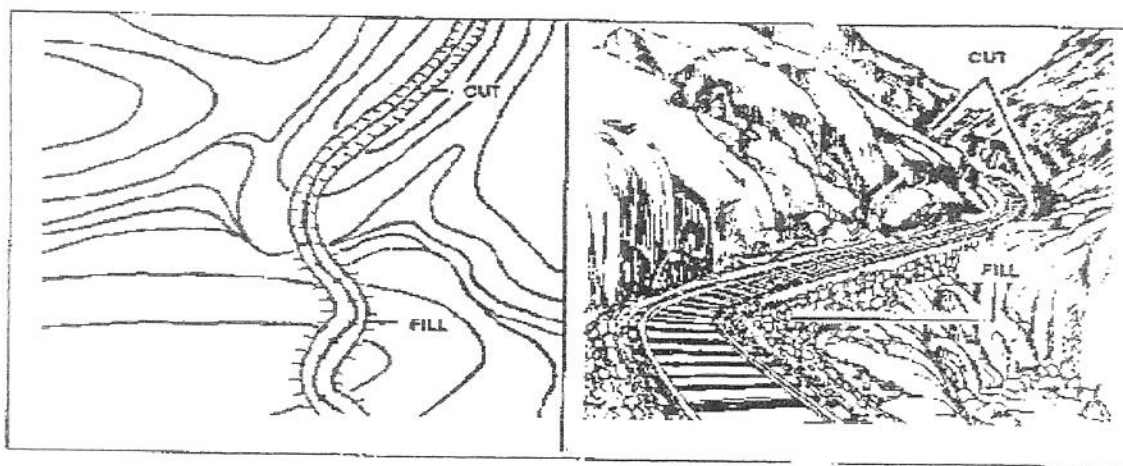
a depression. One additional contour with tick marks will be used for each depth equal to the contour interval of the map.



Depression

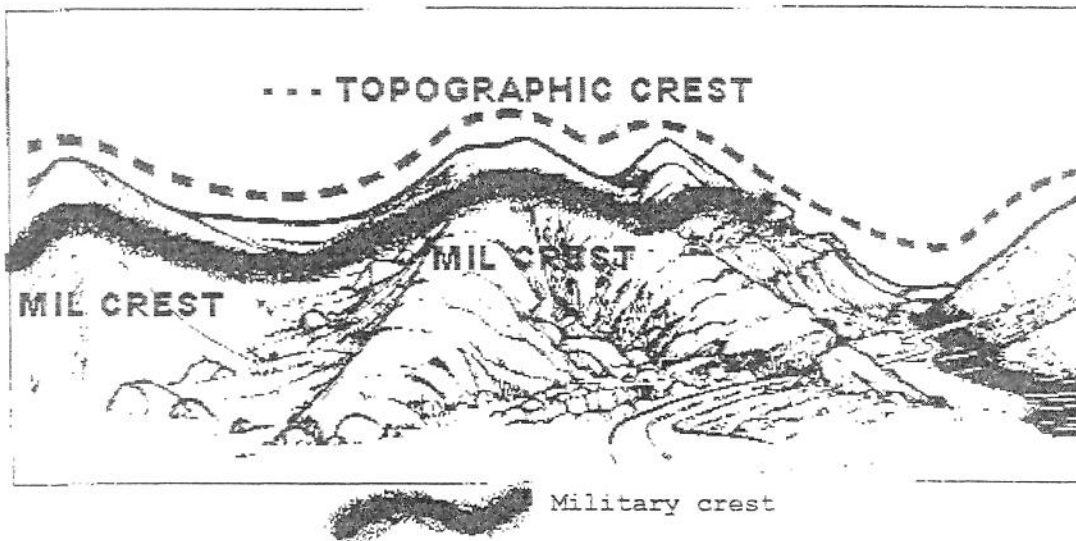
- h. Cuts And Fills. Man made features by which the bed of a road or railroad is graded or leveled off by cutting through high areas and filling low areas along the right of way. Tick marks are used on a fill to show the lower

elevation. The tick marks will point away from linear features such as roads, railroad tracks, and trails. The contours on a cut are parallel to the linear feature. Cuts are formed by removing the high areas along the linear features path.

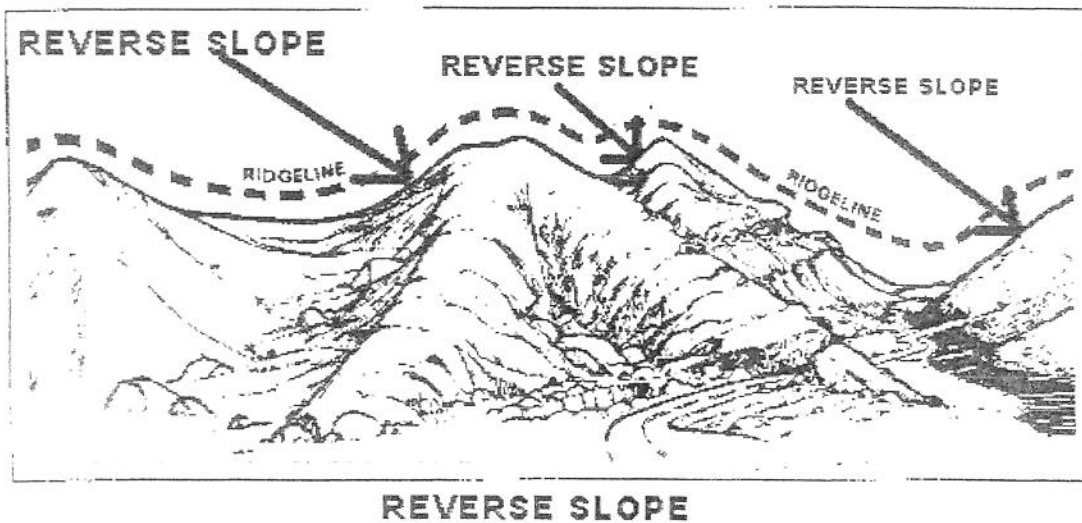


Cut and fill

- i. Military Crest. An area on the slope of a hill or ridge just below the topographic crest from which maximum observation and direct fire can be obtained. Using the military crest reduces the chances of a unit skylining itself.



- j. Reverse Slope. Any slope, which descends away from the enemy. A reverse slope defense reduces the chance of enemy observation and thus the effects of direct and indirect fire.



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APR 2009

LAND NAVIGATION 4

ENABLING LEARNING OBJECTIVES.

(1) Given a military topographic map, protractor, and objective, determine a grid azimuth between two points on a map, in accordance with Chapter 6 of FM 3-25.26. (0300-PAT-1002p)

(2) Given a military topographic map with marginal information, protractor, and objective, convert the grid azimuth to a magnetic azimuth in accordance with Chapter 6 of FM 3-25.26. (0300-PAT-1002p)

(3) Given a military topographic map with marginal information, protractor, and objective, convert a magnetic azimuth to a grid azimuth in accordance with Chapter 6 of FM 3-25.26. (0300-PAT-1002q)

1. GM ANGLE.

a. The GM angle will allow you to take an azimuth from a map and convert it to a bearing which can be used with a compass.

(1) Direction is defined as the position of one point in relation to another.

(2) Two essential elements are necessary to determine direction.

(a) An understood and universal base direction or reference line.

(b) An angle measured with respect to that line.

2. BASE DIRECTIONS.

a. There are three universal base directions in common

usage: True North, Magnetic North, and Grid North.

(1) True north is at the North Pole. Lines of longitude on a globe indicate this baseline direction. It is usually used in celestial navigation.

(2) Magnetic north is the direction the compass points. There are no magnetic lines shown on the map. The magnetic north pole is located just north of the Hudson Bay in Canada.

(3) Grid north lines are a device of mapmakers and enable us to plot direction on the map. They are indicated by the vertical, parallel lines on the map. When the mapmaker interprets the rounded earth surface on a flat map sheet, it is necessary to create this artificial base direction.

b. Magnetic north and grid north lines are used to determine the GM angle.

c. The declination diagram shows the angular relationship between the three north(s).

3. AZIMUTH.

a. Azimuth - A horizontal angle measured clockwise from a base line.

b. Grid Azimuth - A horizontal angle measured clockwise from a grid north line. A grid azimuth can be measured directly from a map showing grid north lines.

b. Magnetic Azimuth - A horizontal angle measured clockwise from magnetic north. A magnetic azimuth can be read directly from a compass but not from a map.

4. TO MEASURE A GRID AZIMUTH.

a. Instruction.

(1) Plot two eight digit grid coordinates.

(2) Connect them with a straight line.

(3) Place the index point of the protractor on the point from which you want to measure the azimuth.

(4) Ensure the grid alignment lines are parallel to the north and south grid lines on the map.

(5) Ensure the square edges of the protractor are aligned with the east or west horizontal gridlines.

(6) Read the value off the protractor where the line crosses the rounded edge. Make sure to read the proper scale.

4. CONVERTING AZIMUTHS.

a. The **GM Angle** is the key to converting azimuths back and forth between grid and magnetic.

c. On newer maps, the instructions are written out next to the declination diagram.

d. If the map does not contain instructions, there are two simple methods to determine whether the GM Angle should be added or subtracted.

(1) Look at the declination diagram and determine the direction between the line representing grid north and the line representing magnetic north.

(2) Put your finger on the grid north line, now move it to the magnetic north line. If you moved left you should add the angle between grid and magnetic; if you moved right, you should subtract. This concept of **LEFT ADD, RIGHT SUBTRACT** is known as the LARS Rule.

LAND NAVIGATION QUIZ

1. WHAT ARE THE THREE MAIN PARTS OF THE LENSATIC COMPASS?
2. WHAT ARE THE EIGHT INDIVIDUAL PARTS OF THE LENSATIC COMPASS?
3. WHAT ARE THE TWO SYSTEMS OF MEASUREMENT USED BY THE MILITARY?
4. DEFINE WHAT AN AZIMUTH IS.
5. DEFINE WHAT A BACK AZIMUTH IS?
6. WHAT IS THE BACK AZIMUTH OF 245 DEGREES?
7. WHAT IS THE BACK AZIMUTH OF 70 DEGREES?
8. WHAT DOES THE ACRONYM LAMS STAND FOR?
9. WHAT ARE THE TWO METHODS IN SHOOTING AN AZIMUTH?
10. COMPASS READINGS SHOULD NEVER BE TAKEN NEAR _____ OR _____ (FILL IN THE BLANK).
11. WHAT IS THE SUGGESTED DISTANCE FOR USING A COMPASS NEAR A METAL HELMET OR A RIFLE?
12. WHAT IS THE SUGGESTED DISTANCE FOR USING A COMPASS NEAR A MACHINE GUN?
13. WHAT IS THE SUGGESTED DISTANCE FOR USING A COMPASS NEAR TELEPHONE WIRES AND BARBED WIRES?
14. WHAT IS THE SUGGESTED DISTANCE FOR USING A COMPASS NEAR POWER LINES?
15. WHAT ARE THE SIX UNCONTROLLABLE CONDITIONS IN WHICH YOUR PACE COUNT MAY HAVE TO BE ADJUSTED?
16. WHAT ARE THE 2 METHODS IN WHICH YOU WOULD USE TO ORIENTATE A MAP?
17. WHAT DOES THE DECLINATION DIAGRAM INDICATE?
18. WHAT ARE THE THREE TYPES OF NORTH?

19. WHAT ARE THE THREE MAP SCALES?
20. WHAT ARE THE SIX COLORS ON A MAP AND WHAT DO THEY REPRESENT?
21. DEFINE WHAT A GRID LINE IS?
22. ON MOST MILITARY MAPS A GRID SQUARE IS _____ BY _____ METERS? (FILL IN THE BLANK).
23. HOW DO YOU READ A MAP?
24. A FOUR-DIGIT GRID COORDINATE LOCATES A POINT TO WITHIN _____ METERS? (FILL IN THE BLANK).
25. A SIX-DIGIT GRID COORDINATE LOCATES A POINT TO WITHIN _____ METERS? (FILL IN THE BLANK).
26. A EIGHT-DIGIT GRID COORDINATE LOCATES A POINT TO WITHIN _____ METERS? (FILL IN THE BLANK).
27. A TEN-DIGIT GRID COORDINATE LOCATES A POINT TO WITHIN _____ METERS? (FILL IN THE BLANK).
28. LIST THE TWO METHODS IN WHICH WOULD BE USED TO MEASURE DISTANCE.

LAND NAVIGATION ANSWER KEY

1. BASE, COVER, EYEPIECE
2. THUMB LOOP, COVER, SIGHTING WIRE, EYEPIECE, SIGHTING SLOT, BEZEL RING, BLACK INDEX LINE, COMPASS DIAL
3. DEGREES AND MILS
4. A HORIZONTAL ANGLE, MEASURED IN A CLOCKWISE MANNER FROM A NORTH BASE LINE
5. IS THE OPPOSITE DIRECTION OF AN AZIMUTH
6. 65 DEGREES
7. 250 DEGREES
8. LESSM ADD MORE SUBTRACT
9. COMPASS TO CHEEK METHOD, THE CENTER HOLD METHOD
10. VISIBLE MASSES OR IRON OR ELECTRICAL CIRCUITS
- 11.0.5 METERS
- 12.2 METERS
- 13.10 METERS
- 14.18 METERS
- 15.SLOPES, WINDS, SURFACES, ELEMENTS, CLOTHING, STAMINA
- 16.INSPECTION METHOD, COMPASS METHOD
- 17.IT INDICATES THE ANGULAR RELATIONSHIP OF THE THREE NORTHS
- 18.TRUE NORTH, GRID NORTH, MAGNETIC NORTH
- 19.SMALL MAP SCALE, MEDIUM MAP SCALE, LARGE MAP SCALE
- 20.BLACK- MAN MADE FEATURES; BLUE- WATER FEATURES; GREEN- VEGITATION; BROWN- ALL RELIEF FEATURES; RED- MAIN ROADS BUILT UP AREAS ANS SPECIAL FEATURES; REDDISH-BROWN - THE TWO COLORS AND COMBINED TO IDENTIFY CULTURAL FEATURES, ALL RELIEF FEATURES, AND ELEVATION.
- 21.A SERIES OF STRAIGHT LINES INTERSECTING AT RIGHT ANGLES AND FORMING A SERIES OF SQUARES.
- 22.1000 BY 1000
- 23.RIGHT AND UP
- 24.1000
- 25.100
- 26.10
- 27.1
- 28.STRAIGHT LNE DISTANCE AND TRREGULAR DISTANCE