Student Handout 3

This student handout contains 46 pages of the Reinforcement Training Package (RTP) and instructions on completing the RTP.

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Map Reading/Land Navigation Reinforcement Training Package (RTP).

1. Overview:

This reinforcement-training package (RTP) is for use by Soldiers planning to attend the Warrior Leader Course (WLC). The purpose of the RTP is to reinforce the Soldier's map reading and land navigation skills in preparation for the training they will receive while attending WLC.

Passing the quizzes in this RTP is not a graduation requirement. The quizzes are for the students to determine how well they understand the tasks and to improve in the areas they are weak.

2. Student Responsibilities:

You will need to acquire the following items in order to complete this training--

a. FM 3-25.26, Map Reading and Land Navigation, dated 18 January 2005.
b. STP 21-1-SMCT, Soldier's Manual of Common Tasks Skill Level 1, dated 11 October 2005.
c. GTA 05-02-012, Coordinate Scale and Protractor.
d. E63317, Lensatic Compass.
e. 7643-01-404-4393, Tenino Map Sheet, 1:50,000, Series V791.
f. Local Area Map Sheet, 1:50,000.

Study the material in this RTP and answer all questions in the quiz answer sheets found in this package. Review your answers with the solution provided to ensure understanding of the tasks. Ask your squad leader or SGL for assistance as required.

3. Recommendation to Students:

USASMA highly recommends you read and study the following with your supervisor prior to arriving at WLC:

a. STP 21-1-SMCT, Soldier's Manual of Common Tasks Skill Level 1, Subject Area 5 Navigate:

(1) 071-329-1006, Navigate From One Point on the Ground to Another Point While Dismounted.
(2) 071-329-1030, Navigate From One Point on the Ground to Another Point While Mounted.

NOTE: The two tasks listed above are trained for sustainment at the unit semi-annually.

b. STP 21-1-SMCT, Soldier's Manual of Common Tasks Skill Level 1, Appendix C:

(1) 071-326-0515, Select a Movement Route Using a Map.
(2) 071-329-1000, Identify Topographic Symbols on a Military Map.
(3) 071-329-1001, Identify Terrain Features on a Map.
(4) 071-329-1002, Determine the Grid Coordinates of a Point on a Military Map.
(5) 071-329-1003, Determine a Magnetic Azimuth Using a Lensatic Compass.
(6) 071-329-1004, Determine the Elevation of a Point on the Ground Using a Map.
(7) 071-329-1005, Determine a Location on the Ground by Terrain Association.
(8) 071-329-1008, Measure Distance on a Map.
(9) 071-329-1009, Convert Azimuths.
(10) 071-329-1011, Orient a Map Using a Lensatic Compass.
(11) 071-329-1012, Orient a Map to the Ground by Map-Terrain Association.

(12) 071-329-1014, Locate an Unknown Point on a Map and on the Ground by Intersection.
(13) 071-329-1015, Locate an Unknown Point on a Map and on the Ground by Resection.
(14) 071-329-1018, Determine Direction without a Compass.
(15) 071-510-0001, Determine Azimuths Using a Protractor.
(16) 071-510-0002, Compute Back Azimuths.

NOTE: The 16 tasks listed above support the two tasks in Subject Area 5 Navigate.

NOTE: The NCOA will not formally teach these skill level one tasks. These skills **must be** mastered prior to attending WLC IAW the Course Management Plan, page 1-1, Course Structure/Conduct of Training, paragraph 3.

c. FM 3-25.26, Map Reading and Land Navigation:

(1) Chapter 3, para 3-1, and 3-3 through 3-5.
(2) Chapter 4, para 4-4 through 4-7.
(3) Chapter 5, para 5-1 and 5-2.
(4) Chapter 9, para 9-2, 9-3, and 9-5
(5) Chapter 10, para 10-2 through 10-6
(6) Chapter 11, para 11-1 through 11-3.

Map Reading/Land Navigation Reinforcement Training Package (RTP)

Purpose

This Reinforcement Training Package (RTP) provides the student with a standardized plan for the reinforcement training of the tasks in STP 21-1-SMCT, Appendix C listed below.

This RTP Contains

Task Number	Task Title	Page
071-329-1000	Identify Topographic Symbols on a Military Map	RTP-4
071-329-1001	Identify Terrain Features on a Map	RTP-6
071-329-1002	Determine the Grid Coordinates of a Point on a Military Map	RTP-13
Student Quiz	Quiz 1	RTP-21
071-329-1003	Determine a Magnetic Azimuth Using a Lensatic Compass	RTP-25
071-329-1008	Measure Distance on a Map	RTP-29
Student Quiz	Quiz 2	RTP-36
071-329-1018	Determine Direction Without a Compass	RTP-37
Student Quiz	Quiz 3	RTP-39
071-329-1012	Orient a Map to the Ground by Map-Terrain Association	RTP-41
071-329-1005	Determine a Location on the Ground by Map-Terrain Association	RTP-42
Quiz Solutions	Quiz Solution Sheet	RTP-43

Identify Topographic Symbols on a Military Map

Task

Task Number:	071-329-1000
Task Title:	Identify Topographic Symbols on a Military Map.
Conditions:	Given a standard 1:50,000-scale map.
Standards:	Identify topographic symbols, colors, and marginal information on a military map with 100 percent accuracy IAW FM 3-25.26 Chapter 3 and STP 21-1-SMCT, Appendix C.

Colors

The ideal situation would be that every mapmaker could show every terrain feature on a map with its true shape and detail. This is impossible however. The amount of detail a map shows is dependent on the size, or scale of the map. The smaller the scale, the less detail can be displayed. Mapmakers use colors as a tool to display additional information. On a standard large-scale topographic map, the colors used and the features they represent are:

1. Black indicates cultural (man-made) features such as buildings, roads, spot elevations, and all labels.
2. Red-Brown combined to identify cultural features, all relief features, nonsurveyed spot elevations, and elevation such as contour lines on red-light readable maps.
3. Blue identifies hydrography or water features such as lakes, swamps, rivers, and drainage.
4. Green identifies vegetation with military significance such as woods, orchards, and vineyards.
5. Brown identifies all relief features and elevation such as contours on older edition maps and cultivated land on red-light readable maps.
6. Red classifies cultural features, such as populated areas, main roads, and boundaries, on older maps.

Symbols

Mapmakers use symbols to represent the natural and man-made features on the earth's surface. These symbols resemble, as closely and logically as possible, the actual feature. Although every effort is made to standardize symbols, each map may have slight differences. Study the legend each time a new map is used. The center of the symbol identifies its true location. Exception: if the feature is adjacent to a major road, then it is offset to preserve its relation to the road.

Military specific symbols (units, phase lines, etc.) are usually not placed on maps due to their temporary nature and security considerations. Military symbols are normally placed on overlays (FM 3-25.26, Chapter 7). Refer to FM 101-5-1 for more information on military symbols.

Marginal Information

The marginal information on a map contains useful information and data about the map. Marginal information is different from map to map so ensure you study the marginal information each time you use a map. Refer to FM 3-25.26, Chapter 3, paragraphs 3-1 and 3-2 for more details on marginal information. Study your map and ensure you can

Marginal Information, continued

identify and explain the following marginal information:

1. Sheet Name.
2. Sheet Number.
3. Series Name.
4. Series Number
5. Declination Diagram.
6. Bar Scales.
7. Contour Interval Note.
8. Grid Reference Box.
9. Legend.
10. Any Special Notes.

Identify Terrain Features on a Map

Task

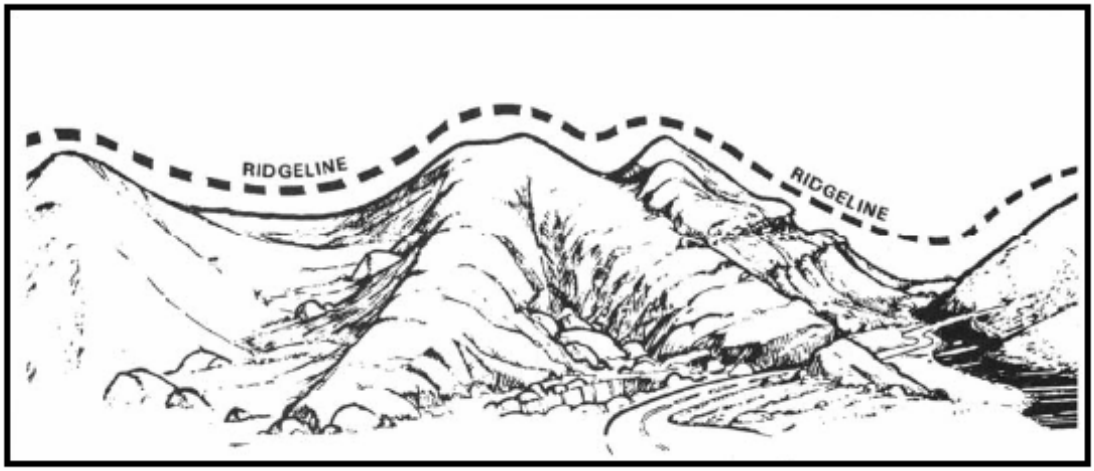
Task Number:	071-329-1001
Task Title:	Identify Terrain Features on a Map.
Conditions:	Given a standard 1:50,000-scale map.
Standards:	Identify the five major and three minor features on the map IAW FM 3-25.26 Chapter 3 and STP 21-1-SMCT, Appendix C.

Identify Terrain Features

You identify terrain features in the same manner on all maps, regardless of the contour interval. However, you must realize that a hill in the Rocky Mountains is much higher and larger than one in Florida. You must be able to identify terrain features in order to locate a point on the ground and to navigate from one point to another.

Terrain Features

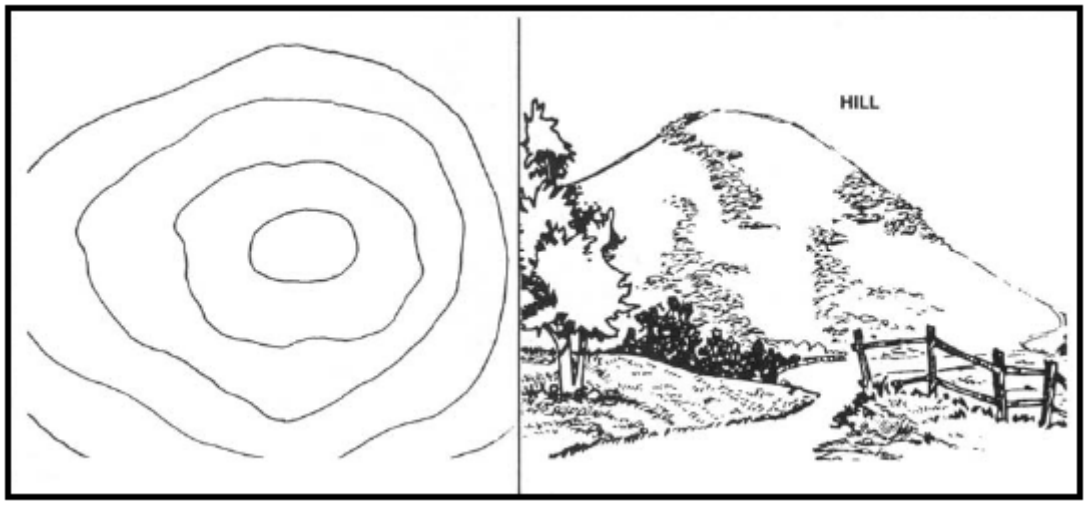
Mapmakers derived all terrain features from a complex landmass known as a mountain or ridgeline. The term ridgeline is not the same as ridge. Do not confuse the two. A ridgeline is a line of high ground, usually with changes in elevation along its top and low ground on all sides. The ridgeline is the basis used to classify ten natural or man-made terrain features.



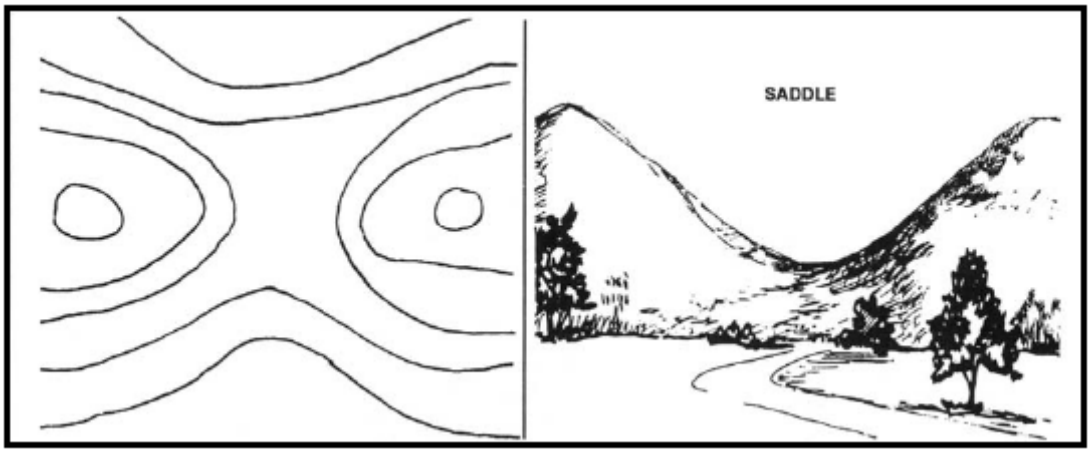
Five Major Terrain Features

There are five major terrain features you must recognize both on a map and on the ground: hill, saddle, valley, ridge, and depression. Let's look at each of these major terrain features.

1. Hill. A hill is an area of high ground. From a hilltop, the ground slopes down in all directions. A hill is shown on a map by contour lines forming concentric circles. The inside of the smallest closed circle is the hilltop.



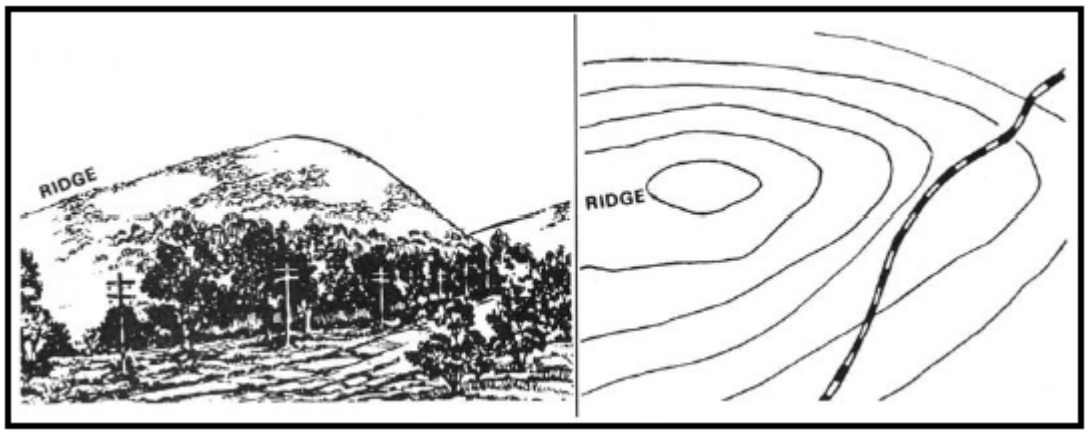
2. Saddle. A saddle is a dip or low point between two areas of higher ground. A saddle is not necessarily the lower ground between two hilltops; it may be simply a dip or break along a level ridge crest. If you are in a saddle, there is high ground in two opposite directions and lower ground in the other two directions.



Five Major Terrain Features, continued

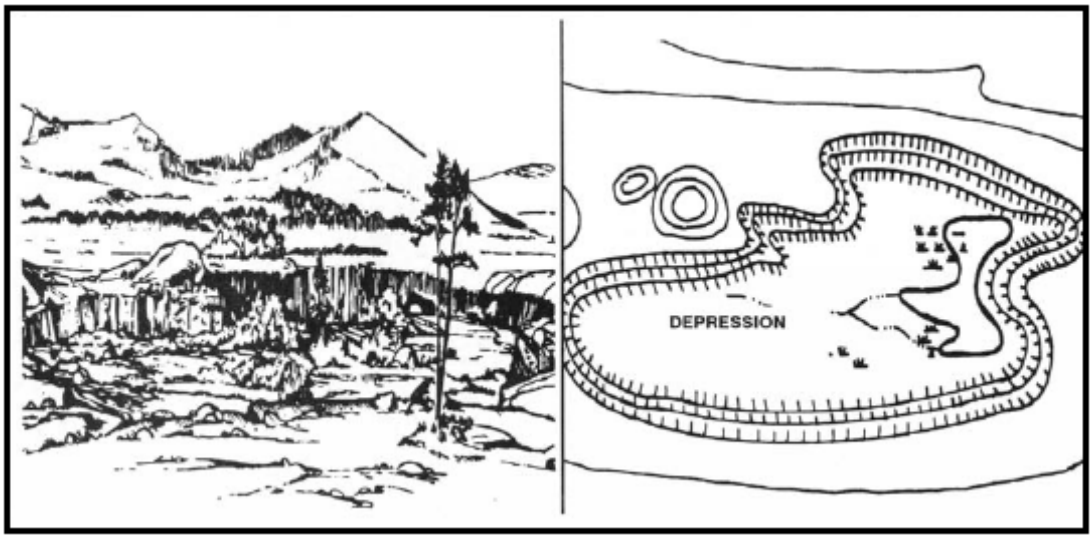
3. Valley. A valley is a stretched out groove in the land, usually formed by streams or rivers. If standing in a valley, three directions offer high ground, while the fourth direction offers low ground. The contour lines forming a valley are either U-shaped or V-shaped. The closed end of the contour line (U or V) always points upstream or toward higher ground.

4. Ridge. A ridge is a sloping line of high ground. If you are standing on the centerline of a ridge, you will normally have low ground in three directions and high ground in one direction with varying degrees of slope. If you cross a ridge at right angles, you will climb steeply to the crest and then descend steeply to the base. Contour lines forming a ridge tend to be U-shaped or V-shaped. The closed end of the contour line points away from high ground



Five Major Terrain Features, continued

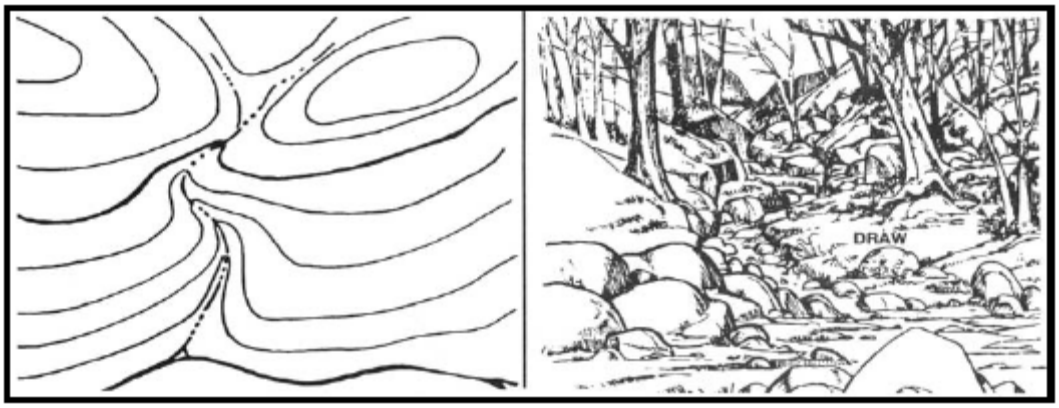
5. Depression. A depression is a low point in the ground or a sinkhole. It could be described as an area of low ground surrounded by higher ground in all directions, or simply a hole in the ground. Usually only depressions that are equal to or greater than the contour interval will be shown. On maps, depressions are represented by closed contour lines that have tick marks pointing toward low ground.



Three Minor Terrain Features

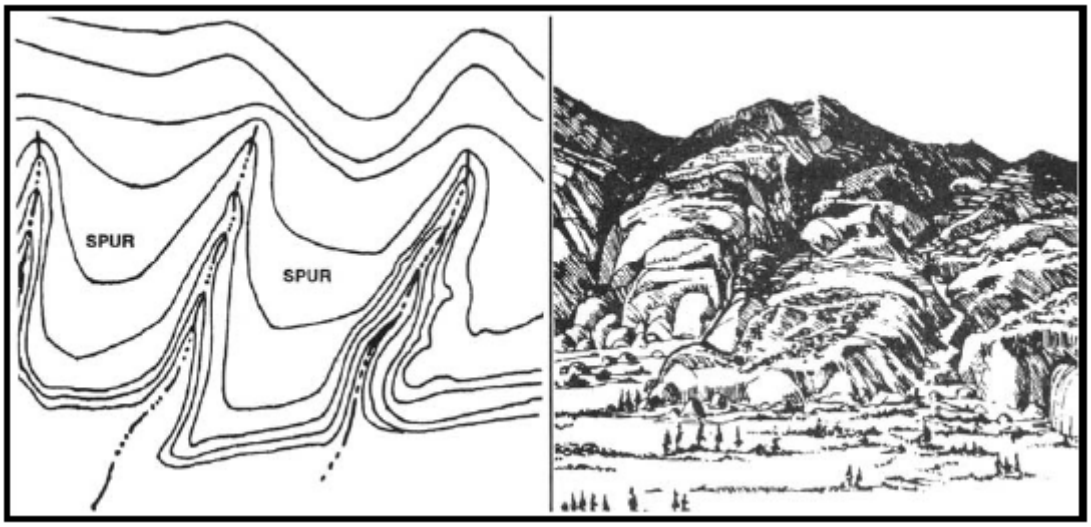
The three minor terrain features include draws, spurs, and cliffs. Your ability to identify these features can greatly aid you when selecting movement routes and possible danger areas.

1. **Draw.** A draw is a stream course that is less developed than a valley. In a draw, there is essentially no level ground and, therefore, little or no maneuver room within its confines. If you are standing in a draw, the ground slopes upward in three directions and downward in the other direction. A draw could be considered as the initial formation of a valley. The contour lines depicting a draw are U-shaped or V-shaped, pointing toward high ground.

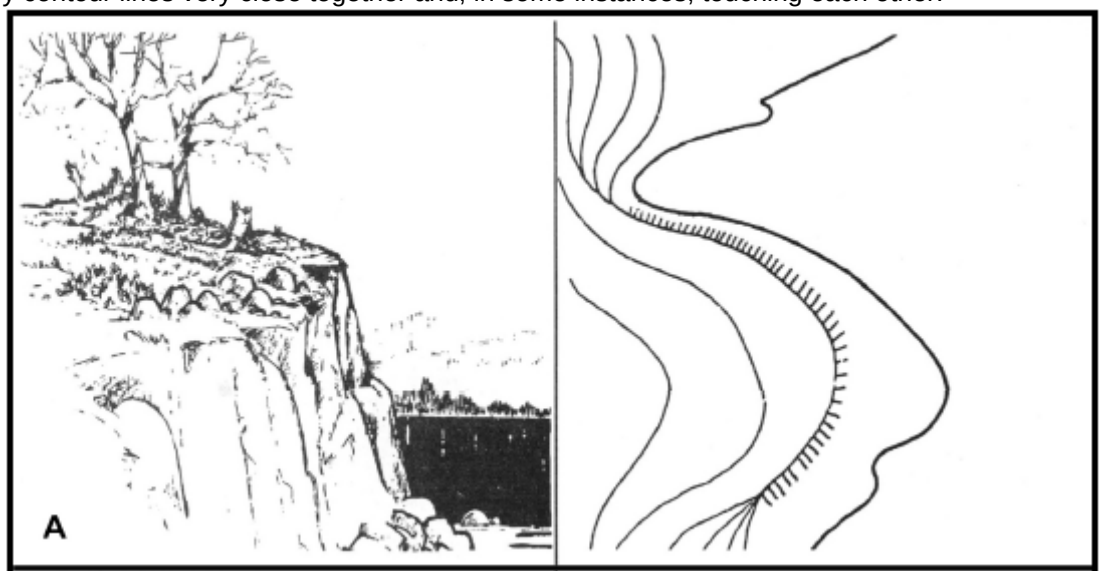


Three Minor Terrain Features, continued

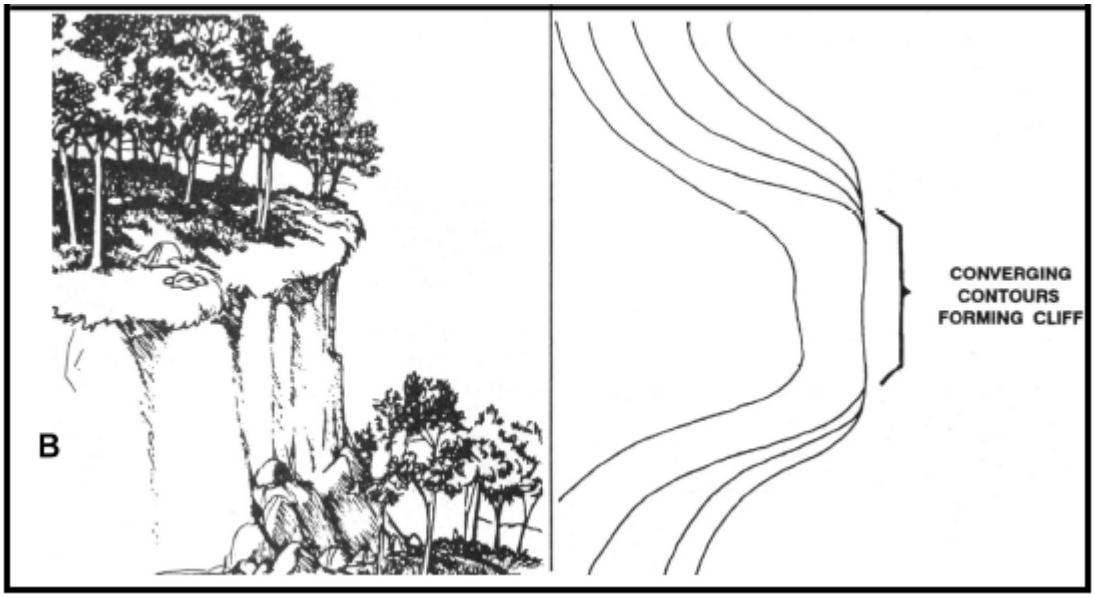
2. **Spur.** A spur is a short, continuous sloping line of higher ground, normally jutting out from the side of a ridge. A spur is often formed by two roughly parallel streams cutting draws down the side of a ridge. The ground will slope down in three directions and up in one. Contour lines on a map depict a spur with the U or V pointing away from high ground.



3. **Cliff.** A cliff is a vertical or near vertical feature; it is an abrupt change of the land. When a slope is so steep that the contour lines converge into one “carrying” contour of contours, this last contour line has tick marks pointing toward low ground. Cliffs are also shown by contour lines very close together and, in some instances, touching each other.



Three Minor Terrain Features, continued

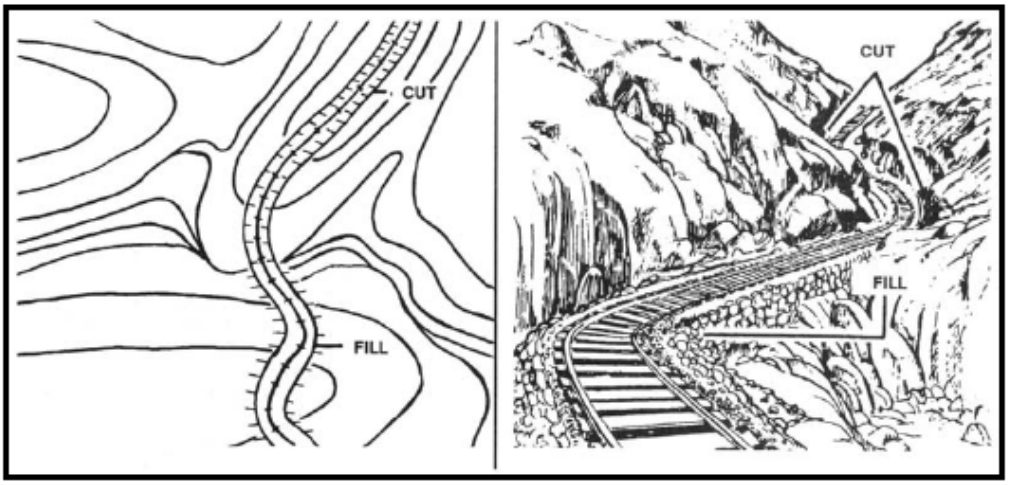


Two Supplementary Terrain Features

Supplementary terrain features include cuts and fills.

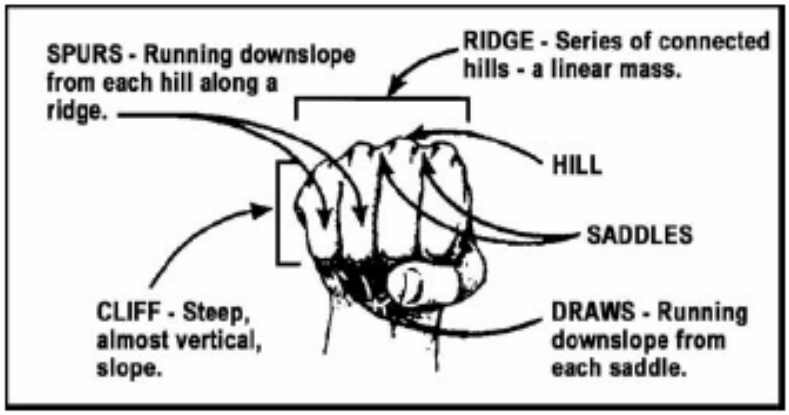
(1) **Cut**. A cut is a man-made feature resulting from cutting through raised ground, usually to form a level bed for a road or railroad track. Cuts are shown on a map when they are at least 10 feet high, and they are drawn with a contour line along the cut line. This contour line extends the length of the cut and has tick marks that extend from the cut line to the roadbed, if the map scale permits this level of detail.

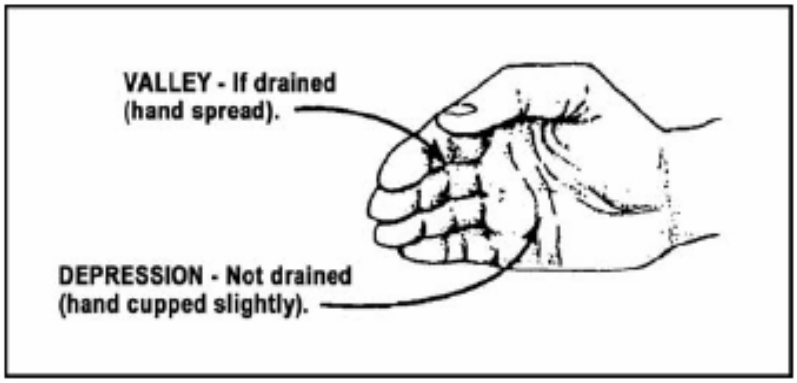
(2) **Fill**. A fill is a man-made feature resulting from filling a low area, usually to form a level bed for a road or railroad track. Fills are shown on a map when they are at least 10 feet high, and they are drawn with a contour line along the fill line. This contour line extends the length of the filled area and has tick marks that point toward lower ground. If the map scale permits, the length of the fill tick marks are drawn to scale and extend from the base line of the fill symbol.



Alternate Method

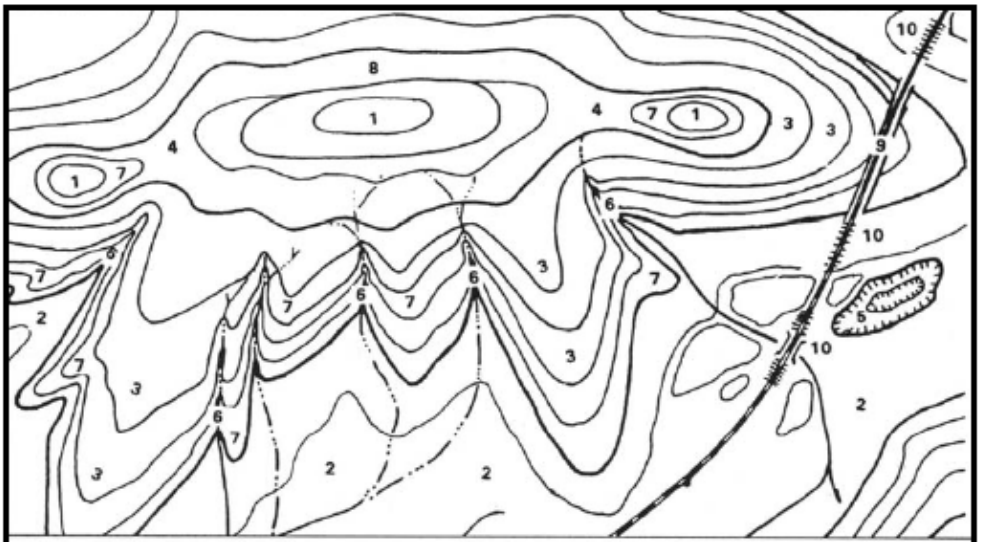
Another method to aid you in recognizing terrain features involves using your hand. Your fist has different features much like the earth's surface, only on a smaller scale. The same concept applies to the palm of your hand. The two diagrams below depict these similarities between your hand and terrain features.





Check On Learning

You have just learned 10 basic terrain features. Look at the diagram below and see if you can identify the numbered terrain features. You can check yourself by viewing the solution key on the next page.



Check On Learning Solution Key

1. HILL	3. RIDGE	5. DEPRESSION	7. SPUR	9. CUT
2. VALLEY	4. SADDLE	6. DRAW	8. CLIFF	10. FILL

Determine the Grid Coordinates of a Point on a Military Map

Task

Task Number:	071-329-1002
Task Title:	Determine the Grid Coordinates of a Point on a Military Map.
Conditions:	Given a standard 1:50,000-scale military map in a field location, a 1:50,000 grid coordinate scale, a pencil, and paper.
Standards:	Determine the six-digit grid coordinate for a point on the map with a 100-meter tolerance. Record the grid coordinates with the correct two-letter 100,000-meter-square identifier IAW FM 3-25.26 Chapter 4 and STP 21-1-SMCT, Appendix C.

NOTES:

To keep from getting lost, you have to know how to find out where you are. There are no street addresses in a combat area, but a military map can spot your location accurately. The map has **vertical lines** (top to bottom) and **horizontal lines** (left to right). These lines form small squares 1,000 meters on each side called **grid squares**.

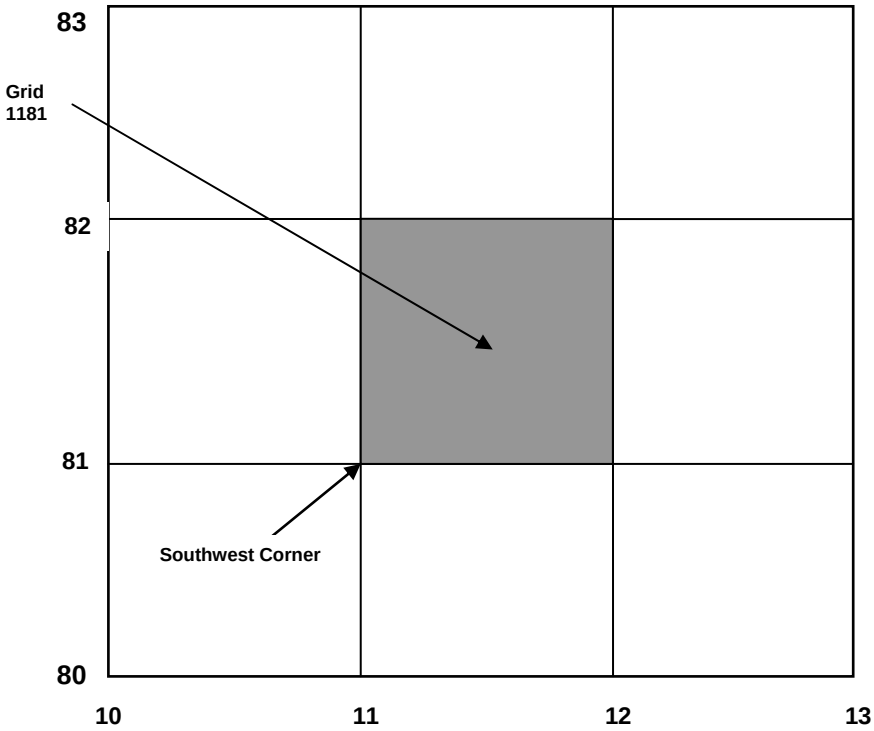
The lines that form the grid squares have numbers along the outside edge of the map picture. No two grid squares will have the same number.

The military uses a digit-coordinate system to locate points on a map. The more digits there are in a coordinate, the more precise the location. Half of the digits of the coordinate designate an east-west line and the other half designates a north-south line. This task will reinforce your skills in determining four-, six-, and eight-digit grid coordinates.

Four-Digit Grid Coordinates

Look at the diagram below. Someone tells you that your location is somewhere in grid square 1181. You may ask yourself, “How do I know where I am?”

To answer the question, you begin by reading LEFT to RIGHT (easterly) until you reach **line number 11**. You have just found the first half of your grid. Next, you read UP (northerly) the map until you reach **line number 81**. You have now found the complete four-digit coordinate. The grid square identified by the grid coordinate **1181** is the area to the RIGHT (east) and UP (north) of the point. Remember, you always read a map RIGHT and UP.



NOTE: Always begin your reading from the southwest corner.

Six-Digit Grid Coordinates

Now we know what grid square we are in. However, a 1000-meter square is a pretty big area. You may need to know a more precise location. A six-digit grid coordinate will determine your location within 100 meters. In order to do this, simply add a digit to the end of the first half (easterly 11) and to the end of the second half (northerly 81) of the four-digit grid coordinate.

To determine the extra numbers, imagine each grid square has ten additional lines running east to west, and ten lines running north to south. This breaks the grid square into 100 smaller squares. You can now determine your location more precisely (within 100 meters) using the same method as you did with the four-digit grid coordinate.

Look at the diagram below. As you can see, grid square 1181 breaks down into 100 meter squares.

Let’s say you are about halfway--500 meters--between grid line 11 and 12. Starting from the southwest corner of grid square 11, you count five lines (500 meters) to the RIGHT (easterly). Since we moved east five lines from the southwest corner, this would make our last digit of the easterly half of the coordinate 5. Our complete easterly coordinate is 115.

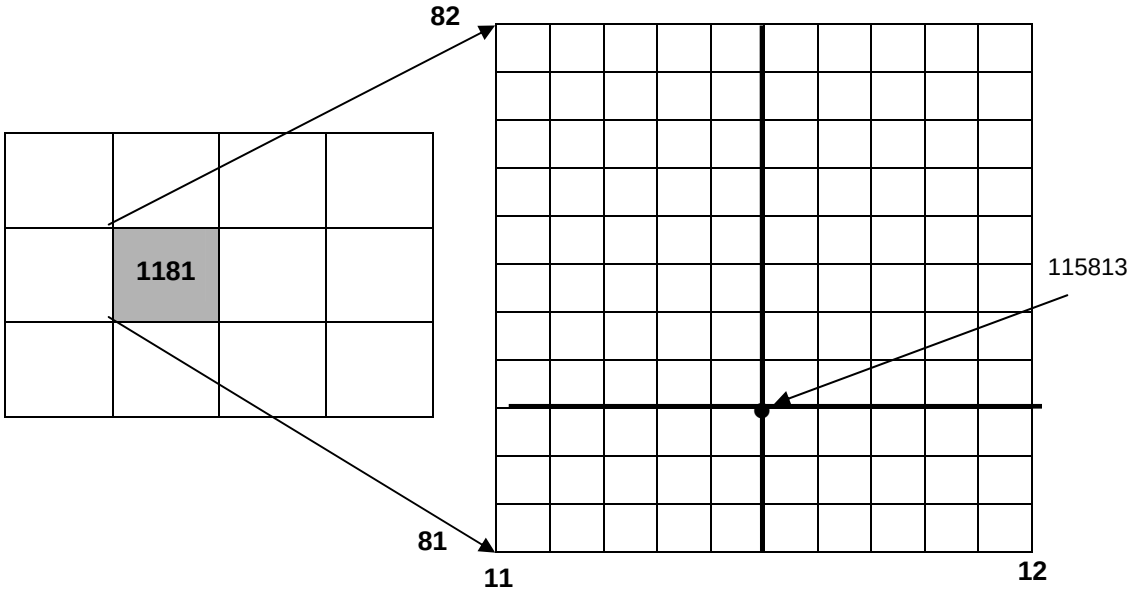
The same process is used for the second half of the grid coordinate. Suppose you are

Six-Digit Grid Coordinates, continued

300 meters north of the southern boundary (line 81). You count three lines UP (northerly) which equals 300 meters. Since you moved north three lines, the northerly half of our grid coordinate is now 813. The above data puts your location at **115813**.

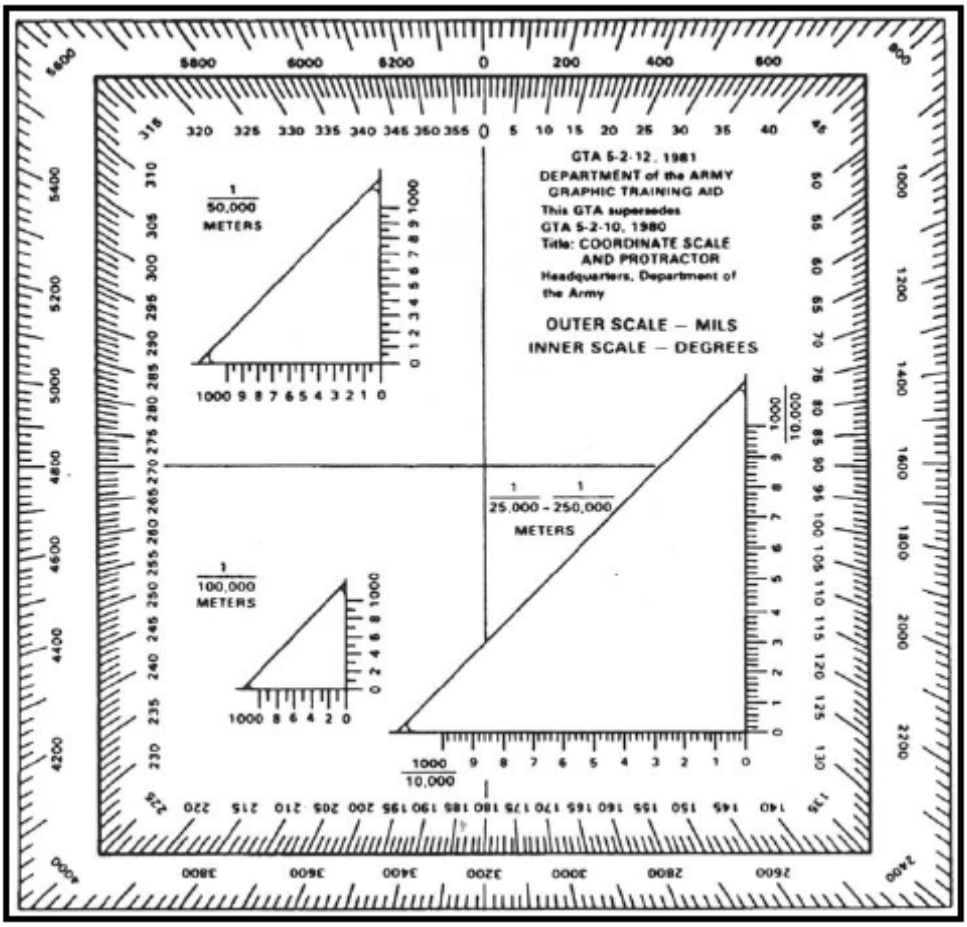
If you were exactly on line 11, the first half of the grid coordinate would be 110. If you were exactly on line 81, the second half of the grid coordinate would be 810. Therefore, the six-digit grid coordinate would be **110810**.

1000-METER GRID SQUARE 1181



Coordinate Scale and Protractor

The most accurate way to determine the coordinate of a point on a map is to use a Coordinate Scale and Protractor, GTA 05-02-012. With the coordinate scale you don't have to use imaginary lines because the coordinate scale has the markings you need to give you the exact coordinates.

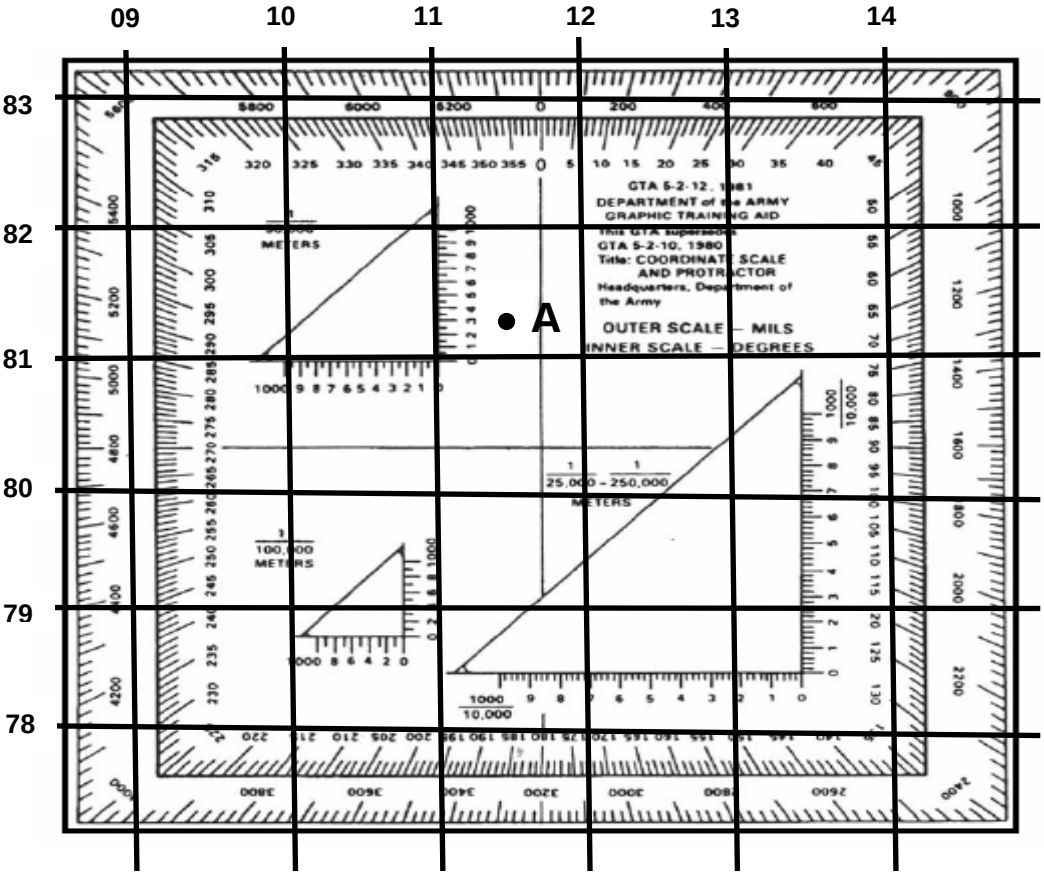


As you can see, the coordinate scale has three different scales: 1:25,000, 1:50,000, and 1:100,000. Make sure you use the proper scale for the specific map you are using. For WLC you will be using 1:50,000-scale maps.

Using the Coordinate Scale to Determine Six-Digit Grid Coordinates

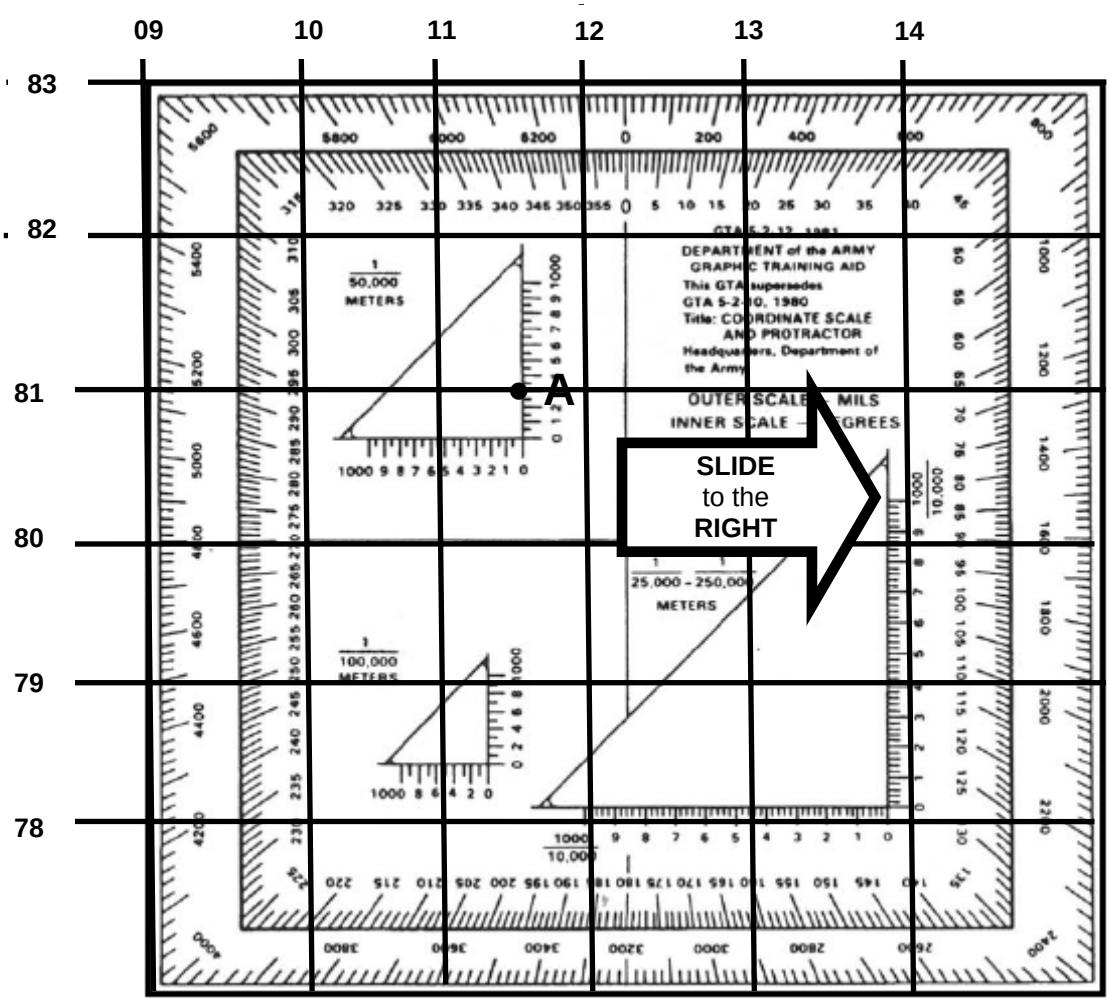
Let's determine the six-digit grid coordinate of a point on a map using your GTA 05-02-012. We'll use the diagram below.

1. Locate the grid square that contains point **A**.
2. Reading RIGHT and UP, you should determine that the four-digit grid square is **1181**.
3. Place the coordinate scale on the bottom horizontal grid line (81) of the grid square containing Point **A** so that the **ZEROS** of the coordinate scale are in the lower left (southwest) corner of grid square **1181**.



Using the Coordinate Scale to Determine Six-Digit Grid Coordinates, continued

4. Slide the scale to the right, keeping the horizontal scale on the bottom grid line (81), until the point is under the vertical scale.



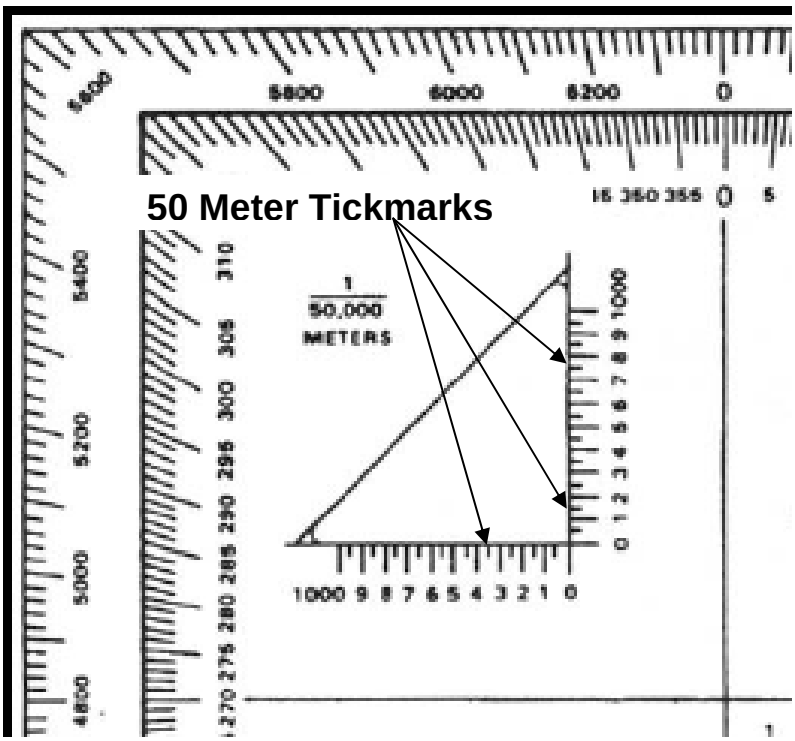
5. To find the third digit for the first half (easterly) grid coordinate, look at grid line **11**. Grid line 11 runs thru the number five on the horizontal line of the coordinate scale. Therefore, **5** becomes your third number for grid 11 easterly. The first half of the six-digit grid coordinate is **115**.

6. To determine the third digit of the second half of the grid coordinate, look at grid line **81**. The point is under the number **3** on the vertical scale. This number is the third number in the second half of the grid coordinate, making the second half of the grid coordinate **813**.

7. You have now determined that your location on the map to within 100 meters is **115813**.

Using the Coordinate Scale to Determine Eight-Digit Grid Coordinates

To determine an eight-digit grid coordinate, which will locate a point on the ground to within 10 meters; you must remember that there are one hundred meters between each 100 meter mark (number) on the coordinate scale's vertical axis. You may have noticed the scale has short tick marks to indicate 50 meters between each 100-meter tick mark.



You use the same procedures as with the six-digit grid coordinate. If the point does not fall directly on one of the numbered lines of the scales, you must interpolate (estimate) the distance or number of imaginary tick marks. This estimated number is the last digit in both halves of the eight-digit grid coordinate.

100,000-Meter Grid Square Identifier

There is only one rule to remember when reading or reporting grid coordinates--always read to the RIGHT and then UP. The first half of the reported set of coordinate digits represents the left-to-right (easting) grid label, and the second half represents the bottom to top (northing). The grid coordinates may represent the location to the nearest 10-, 100-, or 1,000-meter increment.

NOTE: Refer to the diagram below.

Grid Zone. The number 16 locates a point within zone 16, which is an area 6° wide and extends between 80°S latitude and 84°N latitude.

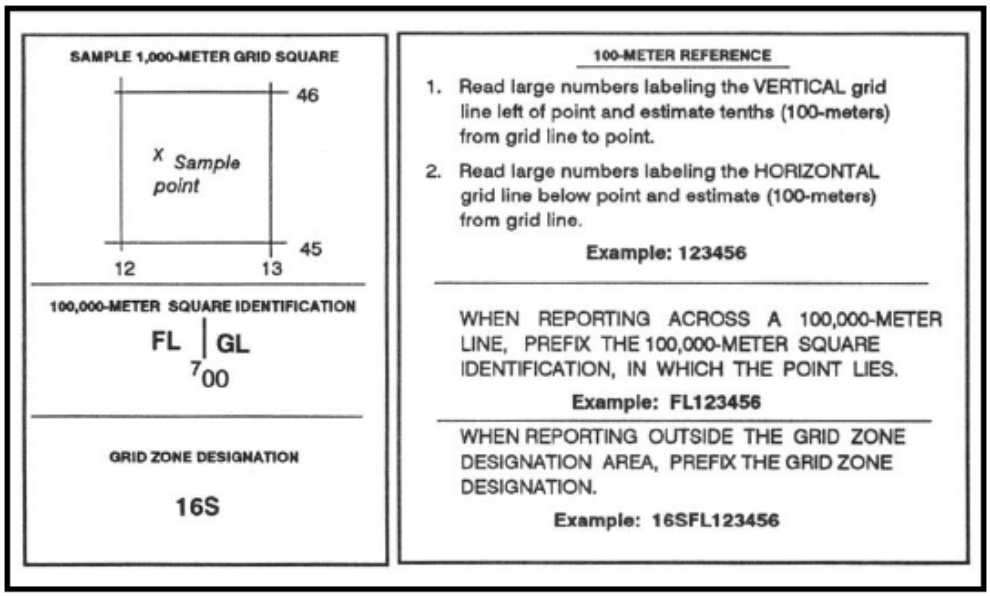
Grid Zone Designation. The number and letter combination, 16S, further locates a point within the grid zone designation 16S, which is a quadrangle 6° wide by 8° high. There are 19 of these quads in zone 16. Quad X, which is located between 72°N and 84°N latitude, is 12° high (Figure 4-8, page 4-11).

The addition of two more letters locates a point within the 100,000-meter grid square. Thus 16SGL locates the point within the 100,000-meter square GL in the grid zone designation 16S. See the instructions in the grid reference box in the diagram below.

A grid reference box appears in the marginal information of each map sheet. It contains step-by-step instructions for using the grid and the U.S. Army military grid reference system. The grid reference box is divided into two parts.

1. The left portion identifies the grid zone designation and the 100,000-meter square. If the sheet falls in more than one 100,000-meter square, the grid lines that separate the squares are shown in the diagram and the letters identifying the 100,000-meter squares are given. **Always use the two-letter grid square identifier when giving coordinates.**

2. The right portion of the grid reference box explains how to use the grid and is keyed on the sample 1,000-meter square of the left side.



QUIZ 1

Quiz 1

Answer the questions below by circling the correct response, filling in the blank, or writing in the space provided. After you finish, check your answers on the Quiz Solution Sheet and study the questions you missed or any other areas you may have questions about.

You will need your Tenino Map, a GTA 05-02-012, and a pen or pencil. If you need additional help, review the references or ask your SGL for assistance.

Question 1

What are the six colors used on a military map?

1. _____ 2. _____ 3. _____

4. _____ 5. _____ 6. _____

Question 2

What do the six colors on a military map represent?

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

Question 3

What portion of a map explains the symbols and features used, and where can you find it?

_____

Question 4

What are the **Map Series Name**, **Scale**, and **Series Number**, of your Tenino Map?

1. Map Series Name: _____

2. Scale: _____

3. Series Number: _____

Question 5 What is the adjoining sheet number directly south of the Tenino Map Sheet?

_____

Question 6 What information is on the map that will tell you the angular relationships of true north, grid north, and magnetic north?

_____

Question 7 Where on the map will you find the declination diagram?

_____

Question 8 The more digits in a coordinate, the _____ _____ the location.

Question 9 Regardless of the scale of a military map, how many meters are normally in a grid square?

_____

Question 10 How do you read a map to find a grid coordinate?

_____

Question 11 How many digits must there be in the grid coordinate of a target to locate the target to within 100 meters?

_____

Question 12 Without the use of a coordinate scale, identify on the Tenino map the topographic symbols at the following six-digit grid coordinates within 100 meters.

A. EG065824 _____ B. EG127841 _____

C. EG032913 _____ D. EH064028 _____

E. EG180903 _____ F. EG177951 _____

Question 13 Using the coordinate scale, identify on the Tenino map the topographic symbols at the following grid coordinates.

A. EG099821 _____ B. EH021005 _____

C. EG086958 _____ D. EG037994 _____

E. EG094847 _____ F. EH123045 _____

Question 14 With the use of a coordinate scale and the Tenino map, determine the eight-digit grid coordinate of the items named in the following four-digit grid squares to within 10 meters.

A. Church of God in EG0385 _____

B. Water tower in EG1088 _____

C. Open pit mine or quarry (active) in EG1095 _____

D. Oil tank in EG0893 _____

E. Road intersection in EH0404 _____

F. Zion Chapel in EH1102 _____

Question 15 What terrain feature is along the unimproved road from the water tower at grid coordinate EG180875 to grid coordinate EG184862 on the Tenino map?

A. Depression.

B. Cliff.

C. Ridge.

D. Valley.

Question 16 What terrain feature runs from grid coordinate EG153841 along the intermittent stream to grid coordinate EG158847 on the Tenino map?

A. Cliff.

B. Draw.

C. Ridge.

D. Saddle.

Question 17 What major terrain feature is in grid coordinate EG1297?

A. Valley.

B. Ridgeline.

C. Hill.

D. Saddle.

Question 18 What minor terrain features are in grid squares EG1786 and EG1785?

_____ and _____

Question 19 What major terrain feature on the Tenino map is at grid coordinate EG16458470?

A. Hilltop.

B. Valley.

C. Depression.

D. Saddle.

Question 20 On what major terrain feature does the city of Tenino sit?

A. Ridgeline.

B. Saddle.

C. Valley.

D. Hill.

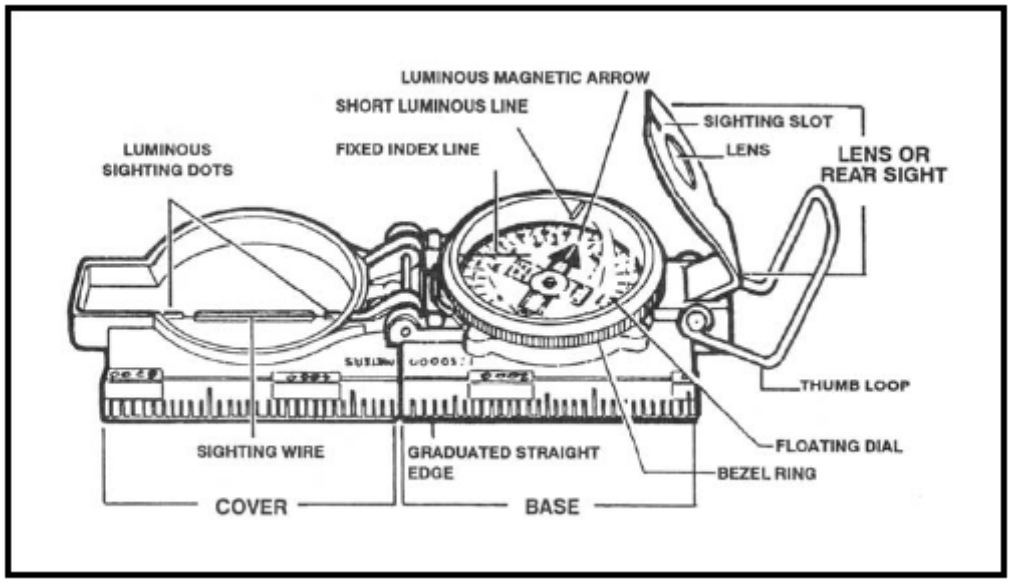
Determine a Magnetic Azimuth Using a Magnetic Compass

Task

Task Number:	071-329-1003
Task Title:	Determine a Magnetic Azimuth Using a Magnetic Compass.
Conditions:	Given a compass and a designated point on the ground.
Standards:	Determine the correct magnetic azimuth to a designated point within 3 degrees using the compass-to-cheek method, and within 10 degrees using the center-hold method IAW FM 3-25.26 and STP 21-1-SMCT, Appendix C.

The Lensatic Compass

The lensatic compass consists of three major parts: the cover, the base, and the lens.



A. **Cover.** The compass cover protects the floating dial. The cover contains the sighting wire (front sight) and two luminous sighting slots or dots used for night navigation.

B. **Base.** The base of the compass contains the following moving parts:

1. The floating dial is mounted on a pivot so it can rotate freely when the compass is held level. Printed on the dial in luminous figures are an arrow and the letters E and W. The arrow always points to magnetic north and the letters fall at east (E) 90 degrees and west (W) 270 degrees. There are two scales; the outer scale denotes mils and the inner scale (normally in red) denotes degrees.
2. Encasing the floating dial is a glass containing a fixed, black index line.

The Lensatic Compass, continued

3. The bezel ring is a ratchet device that clicks when turned. It contains 120 clicks when rotated fully; each click is equal to 3 degrees. A short, luminous line that is used in conjunction with the north-seeking arrow during navigation is contained in the glass face of the bezel ring.

4. The thumb loop is attached to the base of the compass.

C. **Lens.** The lens is used to read the dial, and it contains the rear-sight slot used in conjunction with the front for sighting on objects. The rear sight also serves as a lock and clamps the dial when closed for protection. The rear sight must be opened mare than 45 degrees to allow the dial to float freely.

NOTE: When opened, the straight edge on the left side of the compass has a coordinate scale; the scale is 1:50,000 in newer compasses.

Care of the compass

Compasses are delicate instruments and one treats them accordingly. Do not drop the compass or use for a purpose other than the one intended. As soon as you get your compass, inspect it in detail. One of the most important parts is the floating dial that contains the magnetic needle. Make sure that the dial floats freely and DOES NOT STICK. Also, make sure the sighting wire is straight, the glass and crystal parts are not broken, and you can read all the numbers on the dial.

Metal objects and electrical sources have an effect on the performance of the compass. However, nonmagnetic metals and alloys do not affect compass readings. Maintain the following separation distances when using a compass:

High-tension power line……..55 meters.
Field gun, truck, or tank……..……18 meters.
Telegraph or telephone wire or barbed wire …..10 meters.
Machine gun……..……2 meters.
Steel helmet or rifle……..……..1/2 meter.

Your compass, if in good working condition, is very accurate. However, you must check your compass periodically to ensure it works properly. Check it by using it on a known line of direction such as a surveyed azimuth using a declination station. Do not use a compass with more than a 3 degree variation.

NOTE: Check with your supervisor to determine if your duty station has surveyed points to check the accuracy of your compass.

When you travel with the compass unfolded, make sure you fold the rear sight down all the way to the bezel ring. This will lock the floating dial and prevent vibration, as well as protect the crystal and rear sight from damage.

Reading Your Compass

1. Use the floating dial to determine the direction in which you are pointing the compass.
2. Use the outer black ring of numbers and tick marks for finding direction in mils. Use the inner red ring of numbers and tick marks for finding direction in degrees.

   a. There are 360 degrees and 6,400 mils in a circle. The compass depicts the degrees at 5 degree intervals and mils at 20 mil intervals. For lines in degrees and mils that do not have a number, you determine the line's number by using the numbers given on the dial.

Reading Your Compass, continued

NOTE: You will use the degree ring for WLC.

b. To read direction, point the compass in the direction you want to go or want to determine.

c. Look beneath the index line on the outer glass cover and estimate, to the nearest degree, the position of the index line over the RED degree scale.

d. Be careful to hold the compass still so that the dial remains stationary while you red the scale.

3. Use the compass to follow or determine an azimuth. The arrow on the compass points to magnetic north. The arrow is also attracted by any mass of metal or electromagnetic field; e.g., a truck, your rifle, power lines, or radio signal amplifiers.

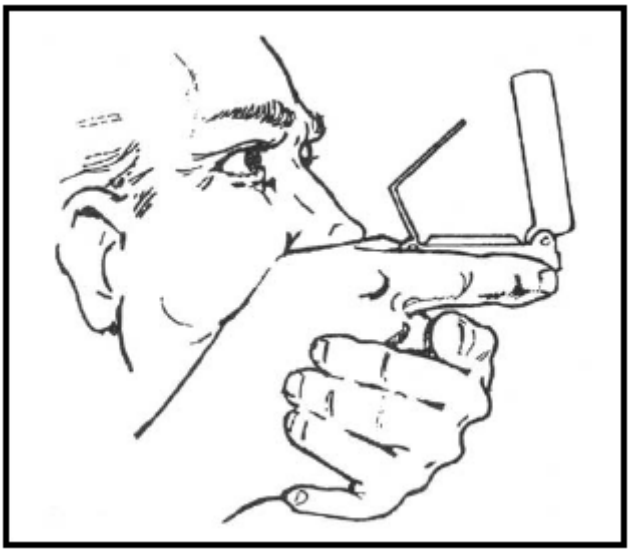
4. Always hold the compass level and firm when sighting on an object and reading an azimuth.

Compass Holding Methods

There are two methods of holding and reading a compass. Have your compass available to use during this portion of the lesson. The two methods are:

1. Compass-to-Cheek Method.

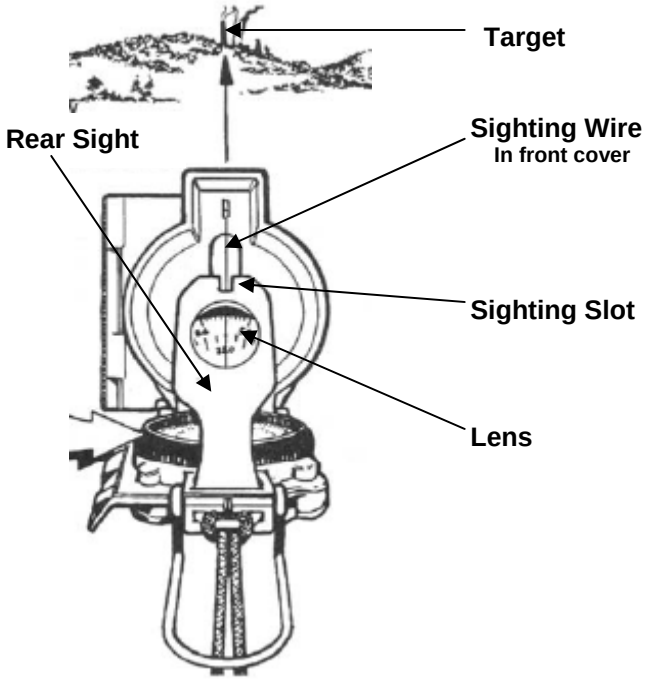
a. Open the cover to a 90 degree angle to the base. Position the eyepiece at a 45 degree angle to the base.
b. Place your thumb through the thumb loop, form a steady base with your third and fourth fingers, and extend your index finger along the side of the compass base.
c. Place the hand holding the compass into the palm of the other hand.
d. Bring both hands up to your face and position the thumb that is through the loop against your cheekbone.



e. Look through the lens of the eyepiece. If the dial is not in focus, move the eyepiece up or down slightly until you see clearly. Don't forget that the lens/rear sight must be at a 45 degree angle to ensure the dial floats freely.

f. Align the sighting slot of the eyepiece with the sighting wire in the cover on the point for which you trying to determine the azimuth.

g. Glance down at the dial through the eye lens to read the azimuth. (See diagram on the next page.)



2. Center-Hold Method.

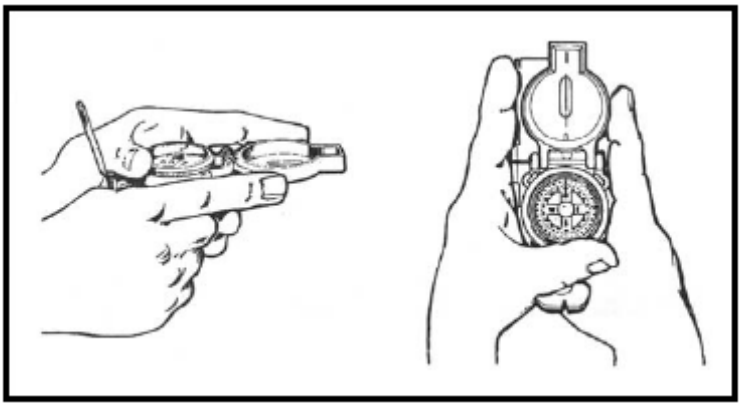
NOTE: Use this method only when a precise azimuth is not required.

a. Open the compass so that the cover forms a straight edge with the base. Move the lens/rear sight to the rear as far as it will move.

b. Place your thumb through the thumb loop, form a steady base with your third and fourth fingers, and extend your index finger along side the base of the compass.

c. Place the thumb of your other hand between the eyepiece and the lens, extend the index finger along the remaining side of the compass, wrap the remaining fingers around the fingers of the other hand, and pull your elbows firmly into your sides. This will place the compass between your chin and your belt.

Compass Holding Methods, continued



d. To measure an azimuth, you must turn your entire body toward the object and point the compass cover directly at the object. Look down and read the azimuth from beneath the fixed black index line. You may use this method at night.

e. To keep from going in circles when you are land navigating, stop occasionally to check the azimuth along which you are moving. Also, you can move from object to object along your path by shooting an azimuth to each object and then moving to that object. Repeating this process while you navigate should keep you straight.

Measure Distance on a Map

Task

Task Number:	071-329-1008
Task Title:	Measure Distance on a Map.
Conditions:	Given a standard 1:50,000-scale military map, a strip of paper with a straight edge, and a pencil.
Standards:	Determine the: 1. Straight-line distance between two points in meters, with no more than 5 percent error. 2. Road (curved line) distance between two points in meters, with no more than 10 percent error. IAW FM 3-25.26, Chapter 5, and STP 21-1-SMCT Appendix C.

Determining Distance on a Map

If you were to plot the coordinates to two points, one inch apart on your 1:50,000-scale map, your first thought might be--this isn't very far. However, once you convert the one-inch of map distance to the actual distance you must travel on the ground, you'll discover that your trip, at a minimum, is 1,270 meters long!

A definite relationship exists between the distance of points on the map and the distance between the same points on the ground. Normally, we express this relationship in one of two ways: by a representative fraction or by a graphic scale.

A representative fraction (RF) is the numerical scale of a map. On your Tenino map, the RF is 1:50,000. Keep in mind, RF expresses the ratio of horizontal distance on the map to the corresponding horizontal distance on the ground. You always write the RF with the map distance as one (1) and in either linear form (1:50,000) or fraction form (1/50,000).

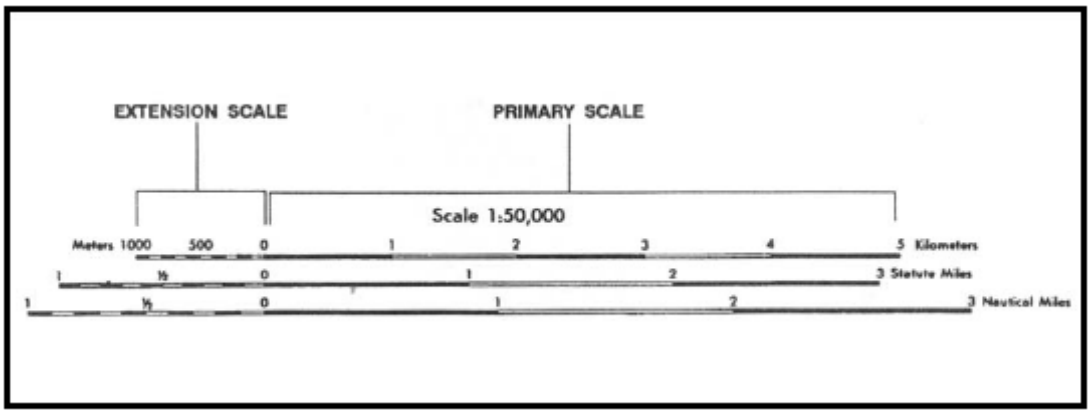
An RF written in either form simply means that one unit of measure on the map is equal to 50,000 (on your Tenino map) of the same units on the ground. For example, one-inch (1") map distance (MD) measured on a map scaled at 1:50,000 is equal to 50,000 inches of ground distance (GD).

If you don't like working with inches, you can convert to other units of measure by dividing the 50,000 by the appropriate divisor. The following are examples to convert to feet and meters.

Feet: 50,000 inches divided by 12 inches (1 foot) = 4,166.7 feet.

Meters: 50,000 inches divided by 39.37 inches (1 meter) = 1270 meters.

A bar scale is a graphic representation of ground distance drawn to the scale of the map. These scales appear on most military maps in the bottom-center of the margin. Look at your Tenino map and you will see that your map has a bar scale. The unit of measure for an individual scale appears to the right or above the scale.



The bar scale shows the **primary scale** in full units of measure to the right of zero (0), and the **extension scale** left of zero shows the unit divided into tenths.

The number and types of measurement found on bar scales will vary. The most commonly used units of measure are meters, yards, statute miles, and nautical miles. As you can see on your Tenino map, the bar scale provides all four of these measurements.

Types of Distance Measuring

The two types of distances you can measure on a map are **straight-line distance** and **curved** (or road) **distance**. In order to measure them on a map, you will need:

1. A straight edged piece of paper long enough to cover your selected points on the map.
2. A sharp pencil used for making tick marks between map points.

Straight-Line Distance

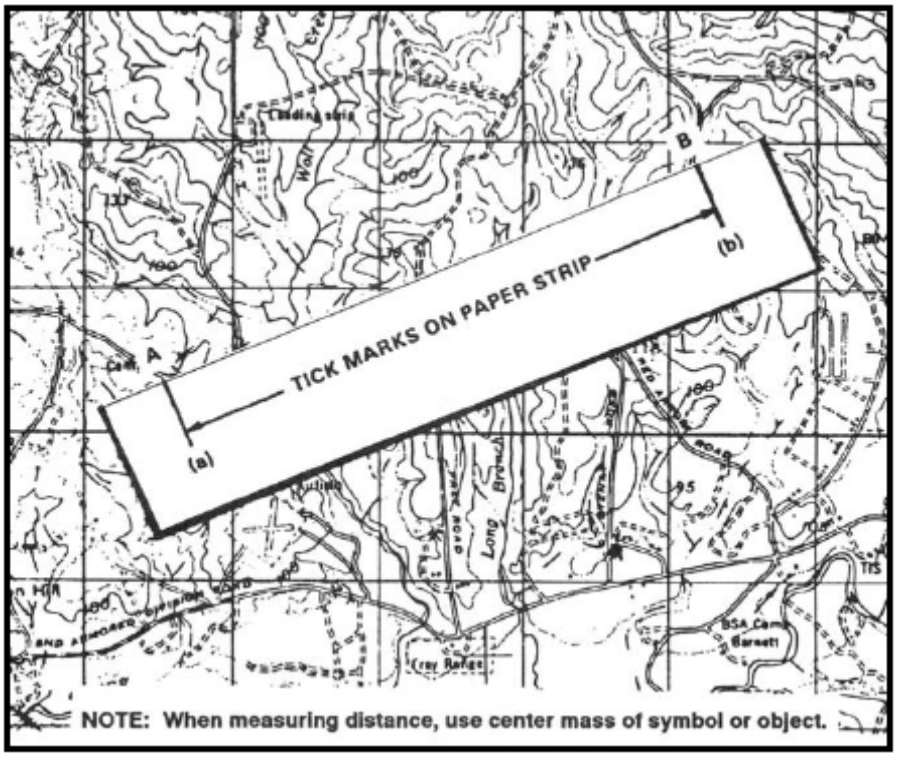
NOTE: You will now review the method to determine the straight-line distance between two points. As you follow the steps below, you will use the figure given below and the Tenino map.

Straight-Line Distance. A straight-line distance is the shortest route between two points. To convert straight-line map distance to miles, meters, or yards, perform the following:

Step 1. Determine the two points between which you want to find the straight-line distance.

Step 2. Align a straight edged piece of paper on the map so that the edge of the paper touches both points on the map.

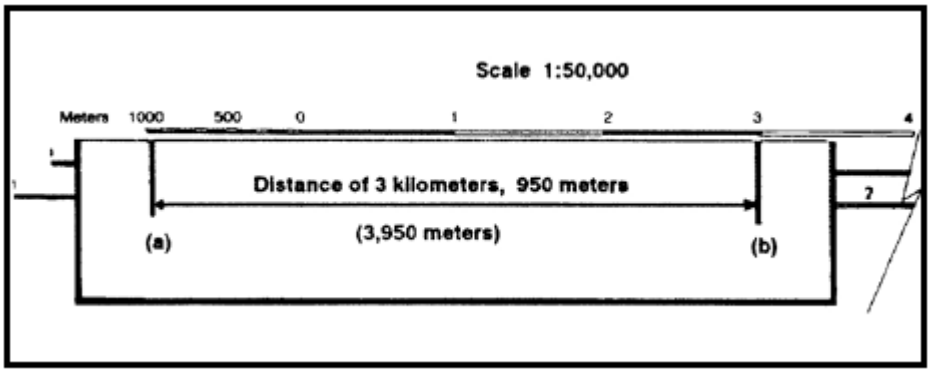
Step 3. Place a tick mark on the paper where your selected points touch the edge of the paper. (See the example below.)



NOTE: At this time, go to your Tenino map and find grid coordinate EG079874. At this coordinate you should see BM 83. This is **point A**. Next, find the TV Relay Tower at EG126877. This is **point B**. Once you have marked these two points, conduct steps 2 and 3.

Straight-Line Distance Continued

Step 4. Align the piece of paper on the bar scale for the ground unit measure that you need and read the distance from the graphic scale to the nearest tenth of a unit. (See example below.)



Step 5. Since the military measures distance in meters, lay your straight edged piece of paper on the meter bar of your Tenino map. You line up the tick marks so that the right end is on a full 1000-meter increment in the primary scale, and the other tick mark is on the inside of the extension scale. The only time your left tick mark does not fall in the extension scale is when you have a distance that is a full 1000-meter increment. In that case, the left tick mark will fall on zero (0).

Step 6. You obtain the total distance by adding the 600 meters from the extension scale to the 4000 meters from the primary scale. Therefore, you have a total straight-line distance of 4600 meters from BM 86 to the TV Relay Tower.

Now you will find another straight-line distance. This time however, you will have to break down the extension scale into tenths in order to interpolate (estimate) the distance between the 100-meter marks on the extension scale.

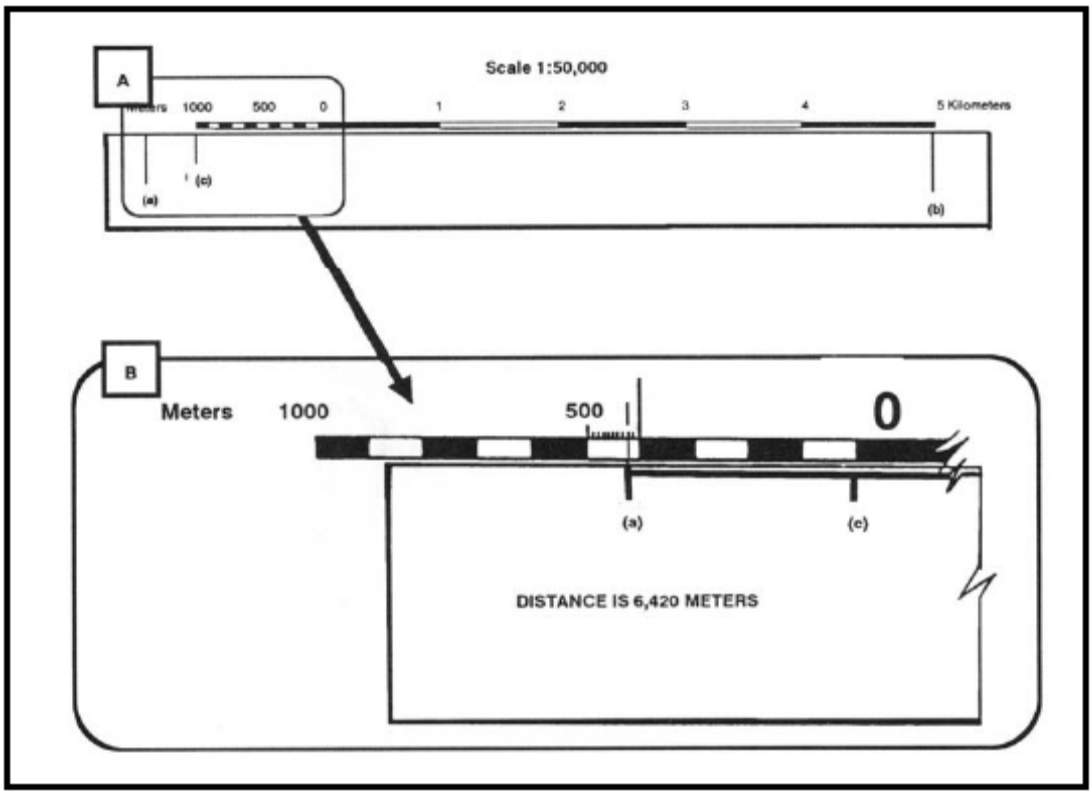
Go to your Tenino map and find the distance in meters between the water towers in grid squares EG0982 and EG 1185.

NOTE: Make sure your pencil is sharp. You must be as precise as possible.

If you followed the step correctly, the distance between the two water towers is 3,450 meters. In this instance, the right tick mark lined up on 3,000 meters on the primary scale, and the left tick mark fell halfway between the 400- and 500-meter marks on the extension scale. You must interpolate and came to an estimate of 50 meters. 3000 meters plus 450 meters equals 3.450 meters.

Now you will work a straight-line distance where the measured (a) to (b) is longer than the bar scale. This is simple to do following the steps above with one additional step. Simply place the right tick mark on the largest number in the primary scale, and place a tick mark under the highest number of the extension scale (c) so you will know how much distance you have already measured. (See example below.)

Straight-Line Distance, continued



Take your Tenino map and mark your straight-line measurement between the horizontal control point “Skook” in grid square EG1682 and the water tower in grid square EG1088. Mark your points (a) and (b) respectively, then place your measurement on the meter bar scale and mark your point (c) on the piece of paper.

Once you mark the distance point (c) between points (a) and (b) slide the paper where the new point (c) is lined up in the primary scale on one of the 1000-meter tick marks and point (a) lining up somewhere in the extension scale.

Your point (c) lines up under the 2000-meter mark in the primary scale and point (a) falls in the extension scale between the 600-meter mark and the 700-meter mark.

Now you must add everything as follows:

Distance between points (b) and (c):	6,000 meters
Distance between points (c) and zero:	2,000 meters
Distance between zero and point (b):	640 meters
TOTAL:	8,640 meters

NOTE: Do not forget--when a tick mark falls between two 100-meter marks, you must interpolate (estimate) the distance. The estimated distance between the 600-meter mark and the 700-meter mark is 40 meters. With a 5 percent margin of error, your distance should range from 8208 and 9072 meters.

Curved or Road Distance

The bar scales are simple to use and there is a need for very precise work. However many map users may find or arrive at different results. Did you come up with 8640 meters as we did in the previous straight-line distance exercise? Hopefully you were no more than 5 percent off. The sharpness of your pencil alone can make a difference. As you will see, when measuring curved or road distances, the variation of measurements will increase.

To measure curved distances, you will also use a straight-edged piece of paper to measure the distance along a winding road, stream, or any other route following an irregular course. For the rest of this lesson we will use roads, but remember you use the same process for any route that is irregular.

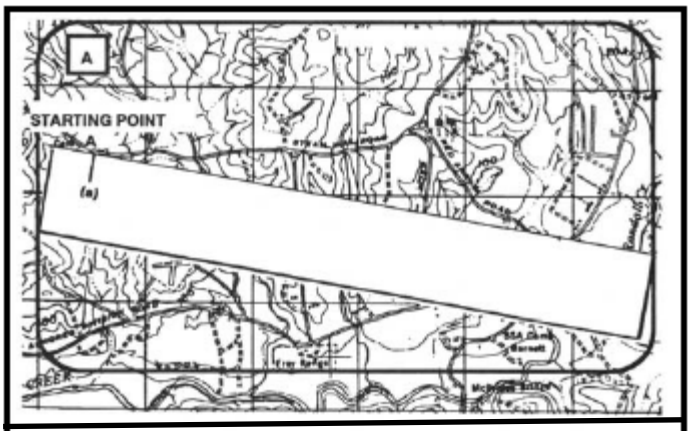
NOTE: Before starting, make sure your pencil is sharp and you have a clean piece of paper with a straight edge. You will use the figures below as well as your Tenino map.

NOTE: It does not matter if you measure from point A to point B or vice versa. It also does not matter if you place your paper above, below, left, or right of the road as long as you **always measure along the same side and do not cross the road.**

Step 1. Mark on your map starting point **A** and finishing point **B**.

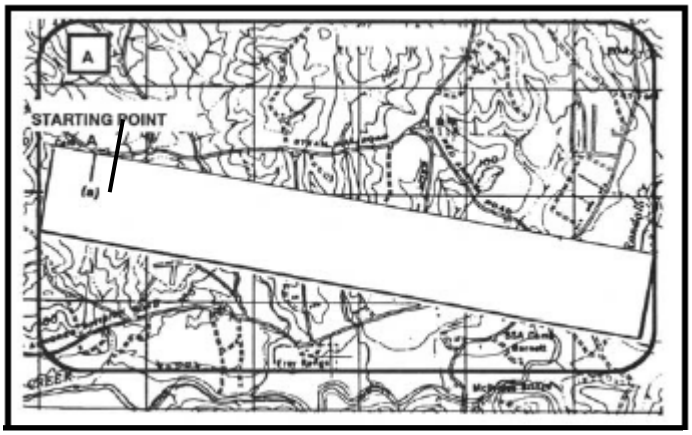
Step 2. Place a tick mark near one edge of the straight-edged piece of paper.

Step 3. Align the straight edge of the paper with the road on the map so that the tick mark is on one of the points (start point for example) and the edge of the paper extends along the route to a point where the route changes direction. (See example below.)



Step 4. At the point where the road changes direction and does not follow the edge of the paper, place a tick mark on the edge of the paper **<u>and</u>** the map as shown below.

Curved or Road Distance, continued



NOTE: On your Tenino map, find and mark the horizontal control station “Skook” at coordinate EG16108255 as point **A** and the bridge at coordinate EG13558355 as point **B**. Don’t forget to measure from the center mass of the object or symbol.

Step 5. Rotate the paper so that the tick mark you just made on the paper and the map are aligned and the straight edge follows the road until the road changes direction again. As before, place a tick mark on the piece of paper and the map at the location where the road changes direction. Continue this process until you reach point B.

NOTE: Continue with Step 5 on your Tenino map until you reach point B. Once you reach point B, you have successfully taken the curved road or route and converted it into a straight-line distance on your straight-edged piece of paper.

Step 6. Now that you have a straight-line measurement, determine the distance on the bar scale the same way as you previously learned.

NOTE: After determining the distance on your meter bar scale on the Tenino map, your distance should be 3240 meters. With a 10 percent error margin, your distance should read between 2916 meters and 3564 meters.

Now let’s take time out to check your proficiency in determining distances on a map by measuring straight-line distances and curved distances. Complete Quiz 2 on the next page.

QUIZ 2

Quiz 2

Take a few moments now to complete Quiz 2. You will need your Tenino map, a few straight-edged pieces of paper, and a sharp pencil. After you finish, check your answers with the answer key to ensure you understand and can execute the task correctly.

Question 1

What is the straight-line distance in meters from the road junction located at EG11159339 to the road junction at EG 13558919?

ANSWER:

Question 2

What is the straight-line distance in meters from the water tank in grid square EG1088 and the Deschutes Fire Tower in grid square EG1795?

ANSWER:

Question 3

What is the road distance in meters from the bridge in grid square EG1198 to the road junction at EG12750111?

ANSWER:

Question 4

What is the road distance in meters from the road junction at EG149884 to the road junction at EG168884?

ANSWER:

Question 5

What is the shortest road distance in meters from the bridge in grid square EG0385 to the church in grid square EG0687?

ANSWER:

Determine Direction Without a Compass

Task

Task Number:	071-329-1018
Task Title:	Determine Direction Without a Compass.
Conditions:	During daylight and at night (with a clear view of the Big Dipper), given a wrist watch (not digital), and natural vegetation in a field environment.
Standards:	Identify north and east within 15 degrees IAW FM 3-25.26, Chapter 9, and STP 21-1-SMCT Appendix C.

Shadow-Tip Method

The shadow-tip method is a simple and accurate method of finding direction by the sun. You can use it to find the four cardinal directions (north, south, east, and west).

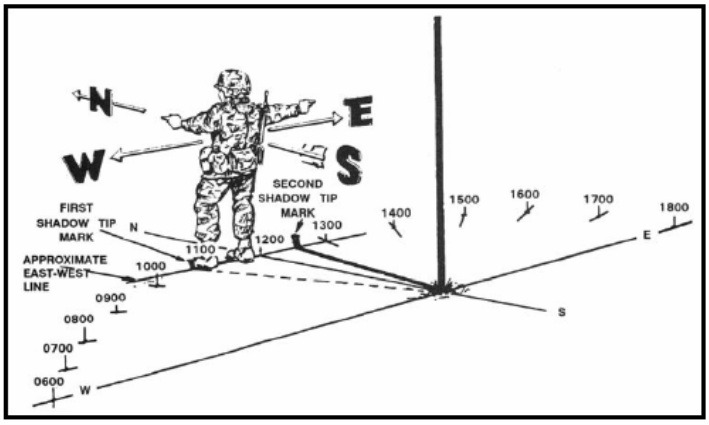
Step 1. Place a stick or branch into the ground at a level spot where the sun will cast a distinct shadow. Place an object (stone, stick, coin, etc.) at the tip of the shadow. This first shadow mark is always the westerly direction.

Step 2. Wait 10 to 15 minutes until the shadow tip moves. Mark the second shadow tip as you did the first. This is your easterly direction.

NOTE: Since the sun rises in the east and sets in the west, the first shadow mark is always to the west, and second shadow mark is always to the east.

Step 3. Draw a line through the two points you made from the shadow tips to determine the approximate east-west line.

Step 4. Standing at the shadow casting stick, facing perpendicular to the line, the first mark is west. Determining the other directions is simple. You are facing north, east is to the right, and south is toward the rear.



Watch Method

You can also use a watch to determine the approximate true north and true south. The watch must have hands--not digital.

Northern Temperate Zone. For standard time, point the hour hand toward the sun. South is half way between the hour hand and 1200 hours. For daylight saving time, south is half way between the hour hand and 1300 hours.

NOTE: If there is any doubt as to which end of the line is north, remember that the sun is in the east before noon, and in the west after noon.

Southern Temperate Zone. Refer to FM 3-25.26, Chapter 9, page 9-8 for instructions on this method.

Star Method at Night--Northern Hemisphere

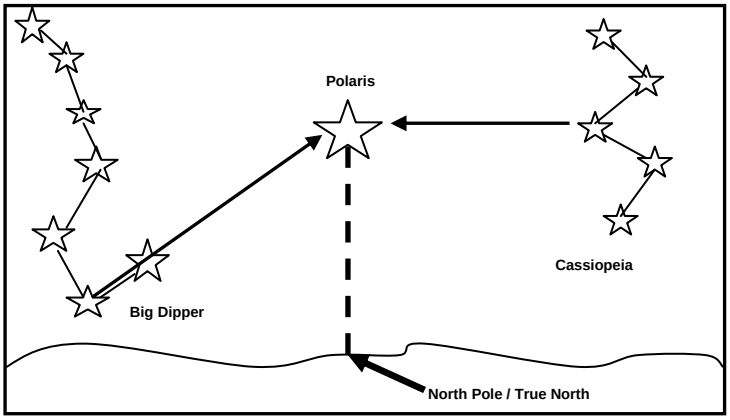
The main constellations to learn are Ursa Major (the Big Dipper) and Cassiopeia. Neither of these constellations ever set. They are always visible on a clear night. Use them to locate the North Star, also known as Polaris or Polar Star. The North Star forms part of the Little Dipper--Ursa Minor--handle and could cause confusion with the Big Dipper. Prevent confusion by using both the Big Dipper and Cassiopeia together. The Big Dipper and Cassiopeia are always directly opposite of each other with the North Star between them. They rotate in a counterclockwise direction around the North Star. The North Star appears stationary in the night sky.

The **Big Dipper** is a seven-star constellation in the shape of a dipper. The two stars forming the outer lip of the dipper are **pointer stars**.

Mentally draw a line using the two pointer stars at the closed end (bottom) of the Big Dipper. Along the imaginary line, at a distance of approximately five times that of the distance between the two pointer stars, you will find the **North Star**.

Cassiopeia has five stars that form a shape like a “W” or a side-ways “M.” The North star is straight out from Cassiopeia’s center star.

Once you find the North Star, you can locate the North Pole or True North by drawing an imaginary line directly to the earth from the North Star. The North Star is less than one degree off True North and does not move from its place in the sky because the axis of the earth points directly toward it. This is why the Big Dipper and Cassiopeia appear to rotate around the North Star.



Quiz 3

Quiz 3

Complete the quiz below. When you finish, check your answers with the answer key in the back of this RTP. Review any questions you missed or are not sure of to ensure understanding of this lesson.

This evening, or on the next clear evening in your location, go outside. Trying to stay away from lighted areas, find the Big Dipper, Cassiopeia, and the north Star.

Question 1

When using the shadow-tip method to determine direction, where on the shadow do you place the object (stone, stick, coin, etc.)?

Question 2

When you place an object (stone, stick, coin, etc.) to mark your first shadow, which directional setting have you made?

Question 3

What line do you create by drawing a line from the first shadow mark to the second shadow mark?

Question 4

If you draw a perpendicular line anywhere on the approximate east-west line, what line have you made?

Question 5

Once you establish your approximate east-west line using the shadow-tip method, how do you position yourself on the line to determine north, south, east, and west?

Question 6

In the northern temperate zone, what part of the watch do you point toward the sun?

Question 7 What is the difference between determining direction in the northern temperate zone during daylight saving time and standard time?

Question 8 Which two constellations can direct you to the North Star?

_____ and _____

Question 9 Which two stars on the Big Dipper point to the North Star and what are they called?

Question 10 How far out from the Big Dipper do you draw an imaginary line to the North Star?

Question 11 When you have found the North Star, which north have you found? (Circle one.)

a. True North.
b. Grid North.
c. Magnetic North.
d. Zodiacal North.

Question 12 In which direction do Cassiopeia and the Big Dipper rotate around the North Star? (Circle one.)

a. Clockwise.
b. Counterclockwise.
c. North to south.
d. They do not rotate.

Orient a Map to the Ground by Map-Terrain Association

Task

Task Number:	071-329-1012
Task Title:	Orient a Map to the Ground by Map-Terrain Association.
Conditions:	Given a standard 1:50,000-scale military map in the field in daylight.
Standards:	Orient the map to within 30 degrees of north IAW FM 3-25.26, Chapter 11 and STP 21-1-SMCT, Appendix C.

Terrain Association

You can orient your map by terrain association when you don't have a compass, or you want to make a quick reference as you move across the terrain.

Using this method requires a careful examination of the map and the ground. You must know your approximate location and have a good knowledge of the terrain features appearing on your map so you can compare them with the physical features on the ground.

Hold the map in a horizontal position and line up the features you see on the ground with those on the map. If you have a compass, you can check your orientation by:

1. Placing a compass along one of the north-south grid lines to keep from orienting the map in the wrong direction (180 degrees out).
2. Aligning two or more features, e.g., a swamp to the left and a water tower near a known city.

Determine a Location on the Ground by Map-Terrain Association

Task

Task Number:	071-329-1005
Task Title:	Determine a Location on the Ground by Map-Terrain Association.
Conditions:	In the field during daylight, while at an unknown location on the ground, given a standard 1:50,000-scale military map of the area, pencil, paper, a coordinate scale and protractor (GTA 05-02-012), and a known point on the ground.
Standards:	Within seven minutes, determine the six-digit grid coordinate of your location with a 100-meter tolerance IAW STP 21-1-SMCT, Appendix C.

Determine Location by Terrain Association

First, you must determine the terrain features of your location and their position relative to you. You must also have knowledge of the terrain features that appear on your map so you can compare them to the physical features on the ground.

Orient the map to the ground by terrain association and then determine your four cardinal directions (north, south, east, and west). Remember, you can determine the directions by by lining up known terrain features on the ground with those on your map. Also, you can use the shadow-tip method to determine direction.

To find your location, you must relate the terrain features on the ground to those shown on the map. After determining where the terrain features on the ground and those on your map coincide, determine the six-digit grid coordinate of your location using the coordinate scale and protractor (GTA 05-02-012).

This completes the working portion of the RTP.

Quiz 1 Solution Sheet

Question 1

1-Black. 2-Blue. 3-Brown. 4-Green. 5-Red. 6-Red-Brown.

Ref: Page RTP-4

Question 2

1. Black: Cultural (man-made) features other than roads.
2. Blue: Water.
3. Brown: All relief features--contour lines on old maps--cultivated land on red-light readable maps.
4. Green: Vegetation.
5. Red: Major roads, built-up areas, special features on old maps.
6. Red-Brown: All relief features and main roads on red-light readable maps.

Ref: Page RTP-4

Question 3

In the **LEGEND**, located in the **LOWER LEFT MARGIN**.

Ref: Pages RTP-4 and RTP-5.

Question 4

1. Map Series Name: Washington
2. Scale: 1:50,000.
3. Series Number: V791

Ref: Tenino Map and pages RTP-4 and RTP-5.

Question 5

1477 III.

Ref: Tenino map and pages RTP-4 and RTP-5.

Question 6

The declination diagram.

Ref: Page RTP-5.

Question 7

Lower Margin of large-scale maps.

Ref: Page RTP-5.

Question 8

… <u>more</u> <u>precise</u> …

Ref: Page RTP-12.

Question 9

1,000 meters.

Ref: Page RTP-12.

Question 10

Left to right, then up.

Ref: Pages RTP-13 and RTP-19.

Question 11

Six-digits.

Ref: Page RTP-13.

Question 12

A. Swamp.
B. Road intersection.
C. Lake.
D. Tanks.
E. McIntosh Lake.
F. Deschuters Fire Tower.

Ref: Tenino map.

Question 13

A. Water tower.
B. Road intersection.
C. Pitman Lake.
D. Building.
E. Road loop/turnaround.
F. Open pit, mine, or quarry--active.

Ref: Tenino Map.

Question 14

A. EG03148523.
B. EG10258885.
C. EG10659576.
D. EG80349357.
E. EH0445o433.
F. EH11300291.

Ref: Tenino map.

Question 15

C. Ridge.

Ref: Page RTP-7.

Question 16

B. Draw.

Ref: Page RTP-8.

Question 17

C. Hill.

Ref: Page RTP-6.

Question 18

Draws and spurs.

Ref: Pages RTP-8 and RTP-9.

Question 19

D. Saddle.

Ref: Page RTP-6.

Question 20

D. Valley.

Ref: Page RTP-8.

Quiz 2 Solution Sheet

Question 1	4885 meters, with a 5 percent margin of error, between 4641 and 5129 meters. Ref: Tenino map.
Question 2	9750 meters, with a 5 percent margin of error, between 9263 and 10,237. Ref: Tenino map.
Question 3	3150 meters, with a 10 percent margin of error, between 2835 and 3465 meters. Ref: Tenino map.
Question 4	2250 meters, with a 10 percent margin of error, between 2025 and 2475 meters. Ref: Tenino map.
Question 5	3960 meters, with a 10 percent margin of error, between 3564 and 4356 meters. Ref: Tenino map.

Quiz 3 Solution Sheet

Question 1 At the tip of the shadow.

Ref: Page RTP-36.

Question 2 West.

Ref: Page RTP-36.

Question 3 The approximate east-west line.

Ref: Page RTP-36.

Question 4 The approximate north-south line.

Ref: Page RTP-36.

Question 5 Stand with the first mark (west) to your left, meaning you are facing north, east is to the right and south to the rear.

Ref: Page RTP-36.

Question 6 The hour hand.

Ref: Page RTP-37.

Question 7 For standard time, south is half way between the hour hand and 1200 hours. For daylight saving time, south is half way between the hour hand and 1300 hours.

Ref: Page RTP-37.

Question 8 Ursa Major (big Dipper) and Cassiopeia

Ref: Page RTP-37.

Question 9 The two stars that form the outer lip of the dipper. We call them **pointer stars**.

Ref: Page RTP-37.

Question 10 A distance approximately five times the distance between the pointer stars.

Ref: Page RTP-37.

Question 11 True north.

Ref: Page RTP-37.

Question 12 C. Counterclockwise.

Ref: Page RTP-37.