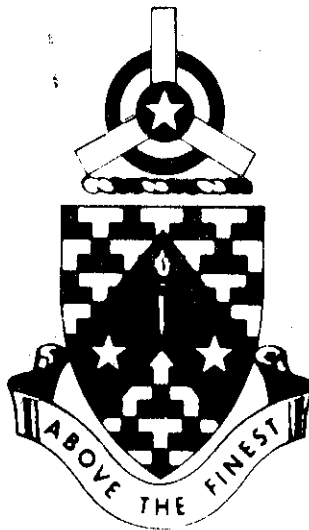


PROGRAMED TEXT

MAP READING
Part IV
TERRAIN FEATURES, ELEVATION

WD-39



AUGUST 1968

UNITED STATES ARMY
PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

PROGRAMED TEXT

PROGRAM TEXT

FILE NO:

WD-39

PROGRAM TITLE

Map Reading
Part IV
Terrain Features,
Elevation

POI SCOPE: Means of indicating elevation and relief, the different types of terrain features.

INSTRUCTOR REFERENCES: FM 21-26

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MAT

15 August 1968

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Map Reading - Part IV

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PREFACE

Knowing what the terrain looks like, from both the air and the ground, is important to all military aviators. Part IV teaches you about terrain features and how to determine their size, shape and height from the information given on a topographic map.

The following materials are essential in answering the frames in this text:

Map of LEAVENWORTH, KANSAS, 1:50,000

Map of GORDON, TEXAS, 1:50,000

Coordinate Scale

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PERFORMANCE OBJECTIVES

Upon completion of this text you will be able to:

- A. Determine the height above mean sea level of any given terrain.
- B. Determine the contour interval.
- C. Determine which contour lines are index, intermediate or supplementary.
- D. Given a terrain feature, determine its shape through the use of contour lines.
- E. Distinguish between a concave and a convex slope.

PART IV

TERRAIN FEATURES, ELEVATION

Section 1.

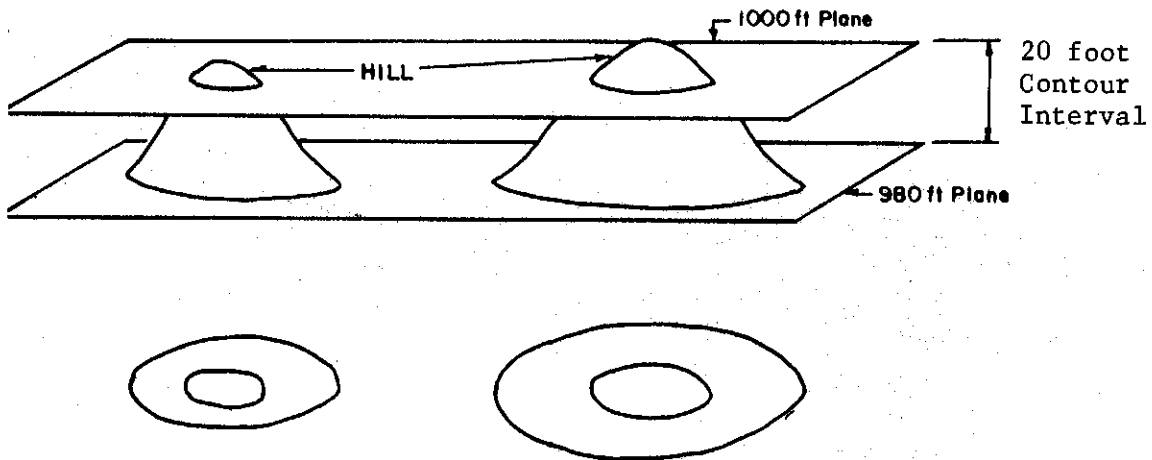
FRAME 1

As you look across the earth's surface you will see relief (changes in elevation) as hills and valleys. On a map relief is shown by symbols called contour lines. Contour lines connect points of equal elevation. Look at coordinate 5171 9950 on your Gordon map. You should see a brown contour line forming a small circle. Close to it you will see a darker line. This is an index contour and will have its elevation on it. What is the elevation of the index contour line near this point?

- a. 500 ft.
- ☒ b. 1,000 ft.
- c. 300 ft.
- d. 400 ft.

(contour) (4)

FRAME 5



Study the illustrations above. When the lines are very close together you know that the terrain is:

- a. very flat.
- ☒ b. very steep.

(20,960) (8)

FRAME 9

Again on your Gordon map, what are the two index contours shown in grid square 5405 and grid square 5396 respectively?

1000 ft 1100 ft

(b) (12)

FRAME 13

Each contour line, whether index, intermediate or supplementary, represents the same elevation wherever it wanders on the map. In other words, all points on a contour line are at the same elevation or level.

The contour interval is the vertical distance represented between one contour and the next one to it. Whatever the horizontal distance between the two contours, the vertical distance between is the same.

(b) (1)

FRAME 2

Refer to grid square 5405 on your Gordon map and you will find another contour with its elevation printed in brown. The elevation of the contour is 1000 feet.

(b. very steep) (5)

FRAME 6

No matter how far apart two adjacent contours are drawn on the map, the contour interval defines the difference in elevation between these two lines.

Refer to the marginal information (bottom center) of the Gordon map. What is the contour interval for this map?

- a. 5 feet
- b. 10 feet
- c. 20 feet

(1000) (1100) (9)

FRAME 10

The contour lines between index contours are called intermediate contours. They are thinner than the index contours. How many intermediate contour lines are there between the index contours?

- a. 5
- b. 6
- ☒ c. 4
- d. 3

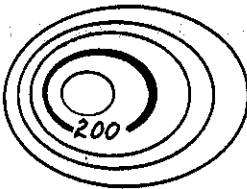
(elevation) (same) (13)

FRAME 14

You can more closely approximate the elevation of a hill top by choosing the elevation of the nearest contour line and adding half of the contour interval.

Example:

Contour Interval 20 feet



200

+20

220

Intermediate Contour

+10

230

Hill Top

What is the elevation of the hill top in grid square 5919 on your Gordon map?

1210 ft.

(1000) (2)

FRAME 3

Refer to grid square 5405 again. You see that there are many contour lines other than the one you found to be 1000 feet in elevation. Each of these contour lines, though not numbered, also represents a specific ground elevation. On the Gordon map each change in elevation of 20 feet is shown by a solid contour line.

This means that any point on a contour line is:

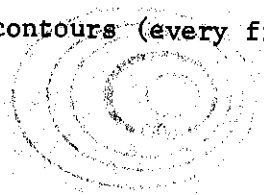
- a. of equal elevation.
- b. of unequal elevation.

(c. 20 feet) (6)

FRAME 7

Contour lines are drawn as brown lines on the map. Every fifth line (starting from zero elevation) is made heavier and is called an index contour. Printing the index contours as heavier lines makes the map easier to read.

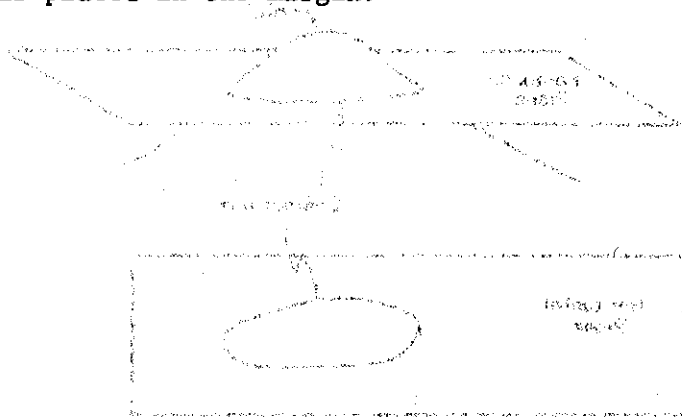
You note from your Gordon map that the index contours (every fifth contour) are the 100 foot contour lines.



(4) (10)

FRAME 11

In relatively flat terrain areas, relief changes are gradual so that the contour interval (20 feet for Gordon map) may be too great to show these changes. Supplementary contours are added in these areas only to show the changes of less than 20 feet. When supplementary contours are used an explanatory note is placed in the margin.



RETURN TO TOP OF PAGE 2 FOR FRAME 12

(1210) (14)

FRAME 15

The same technique also applies to finding stream beds and draws. Just remember to subtract instead of adding.

What is the elevation of the stream bed at coordinate 5862 1177 (Gordon map)?

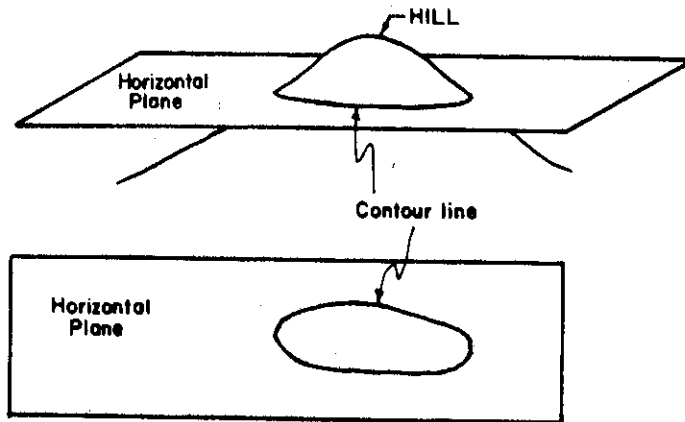
990 ft

RETURN TO TOP OF PAGE 2 FOR FRAME 16

(a) (3)

FRAME 4

Look at the illustration. It shows a horizontal plane cutting through a hill. The line marking all the points where this plane cuts the hill is at the same elevation. It is called a Contour line.



RETURN TO BOTTOM OF PAGE 2 FOR FRAME 5

(100) (7)

FRAME 8

A contour line drawn above or below the first one would be at a different elevation. If 1000-foot and 980-foot contours are adjacent contours on a map, the contour interval is 20 feet. The next lower contour line going down towards a stream or draw would be 960 ft.

RETURN TO TOP OF PAGE 3 FOR FRAME 9

(less, supplementary) (11)

FRAME 12

Supplementary contours are shown by dashed lines on the map. Refer to the marginal information (bottom center) on the Leavenworth map. What is the interval at which supplementary contours are drawn?

- a. 5 foot
- ☒ b. 10 foot
- c. 20 foot

RETURN TO BOTTOM OF PAGE 3 FOR FRAME 13

(990) (15)

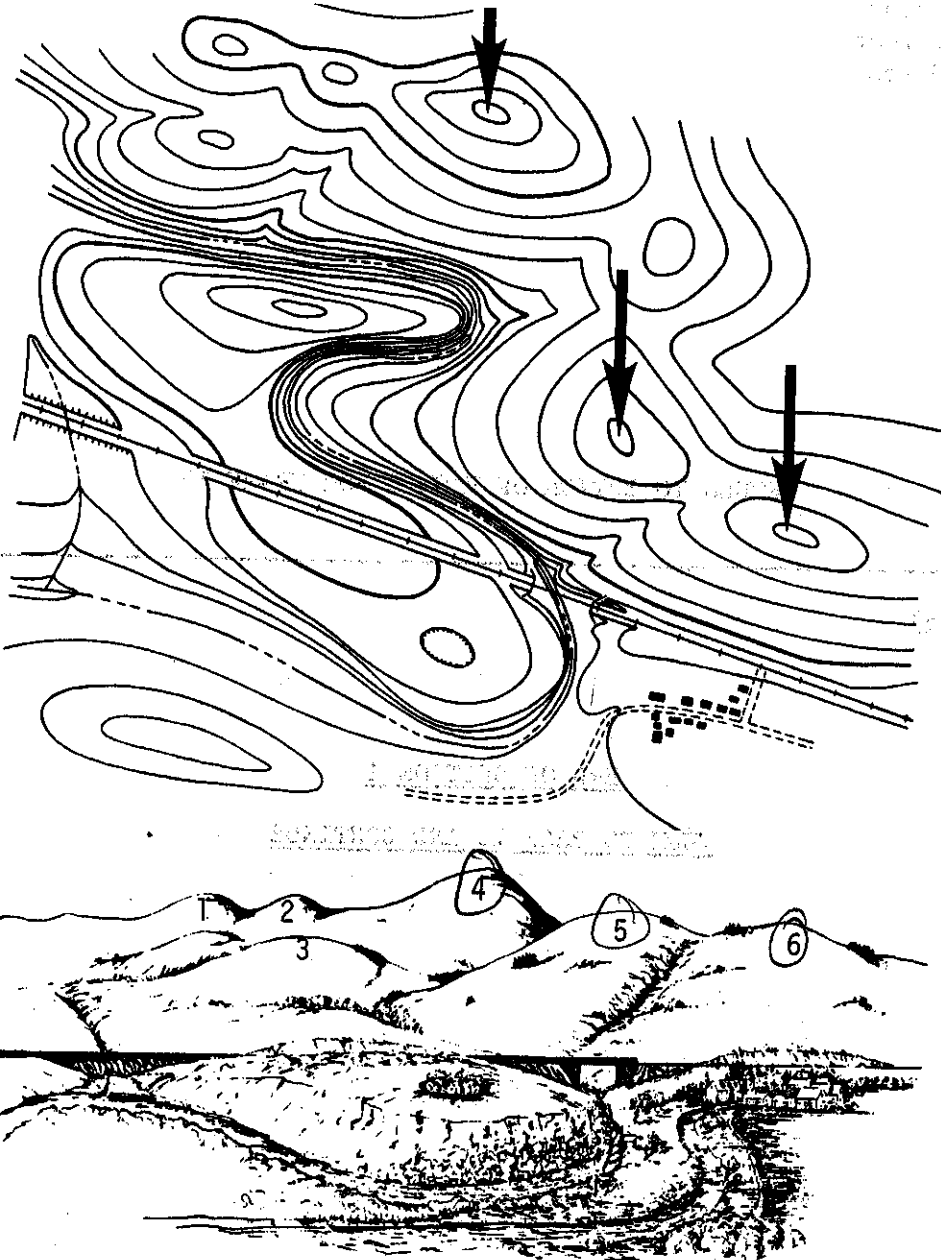
END OF SECTION 1

TURN TO PAGE 10 AND CONTINUE

Section 2

FRAME 1

Peaks or hilltops are easily identified because the contours close to form concentric circles, ovals or loops. Remember, contours forming concentric loops depict hill tops.



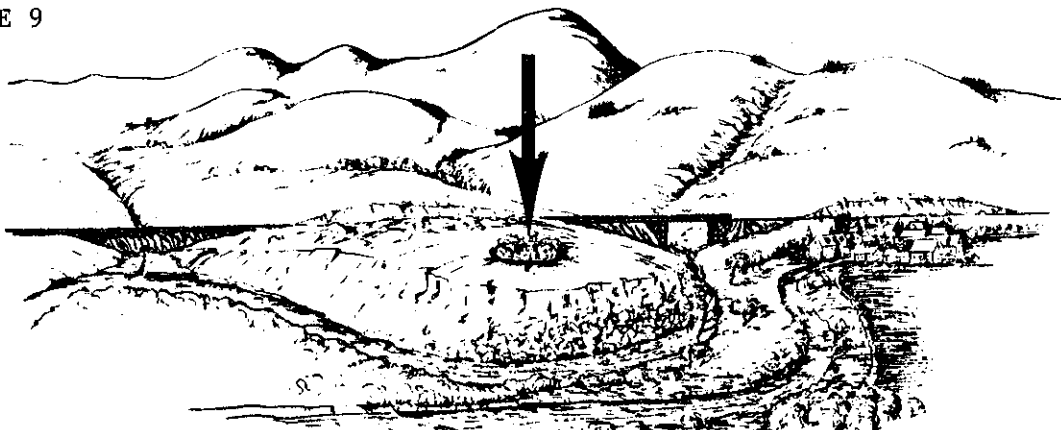
Which numbers are on the hills depicted by the arrows?

TURN TO PAGE 12 FOR FRAME 2

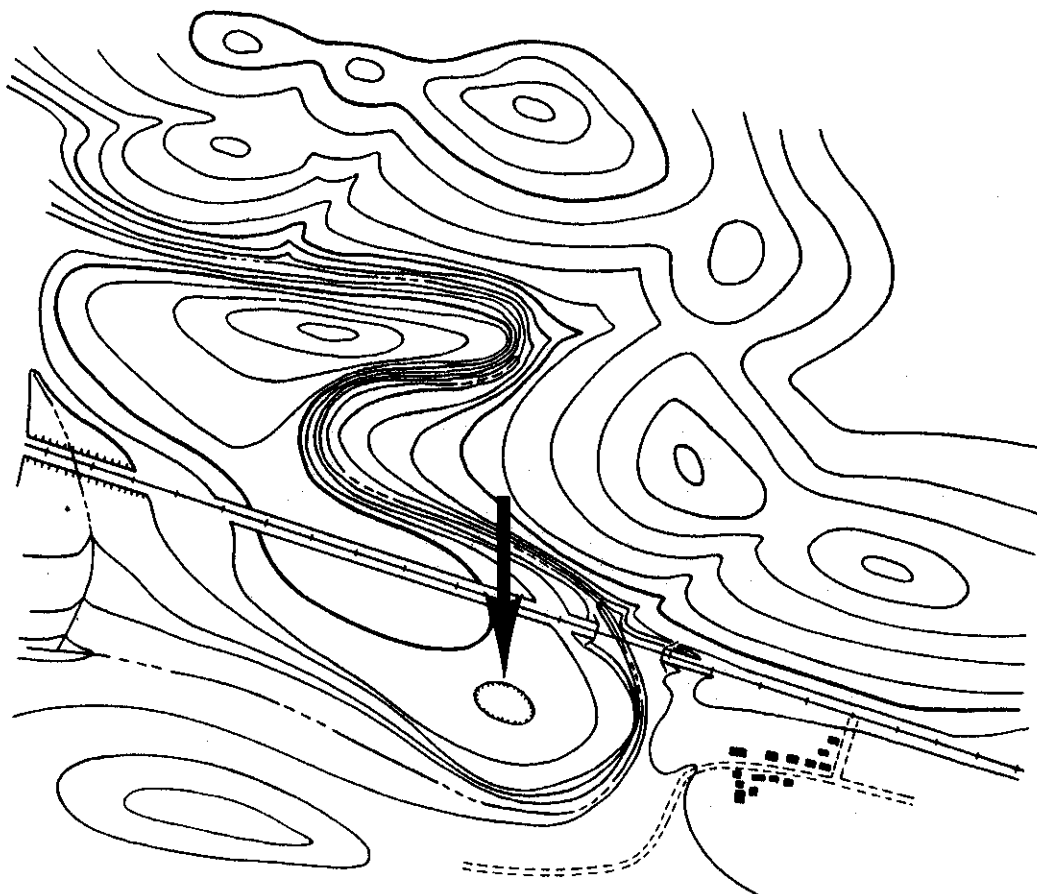
456

(ridge line; a) (8)

FRAME 9



Contour lines making closed loops with ticks indicate a depression. The ticks are always on the downhill side of the contour.

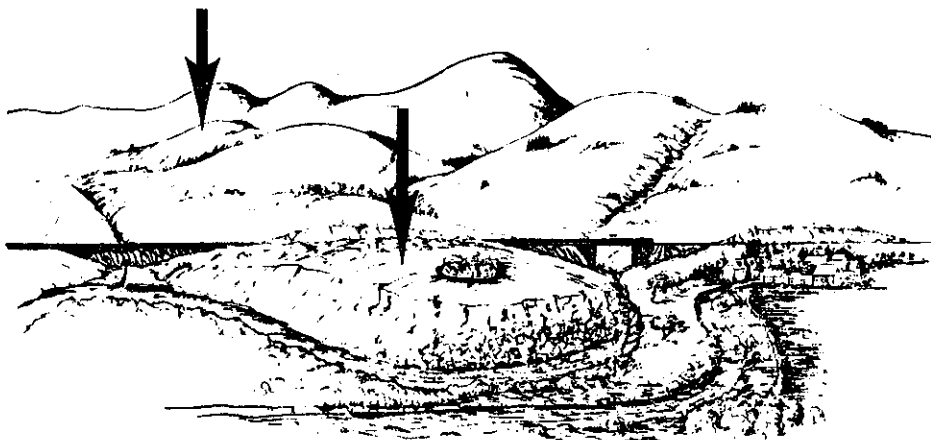


On your Leavenworth map, a depression is located at which of the following coordinates?

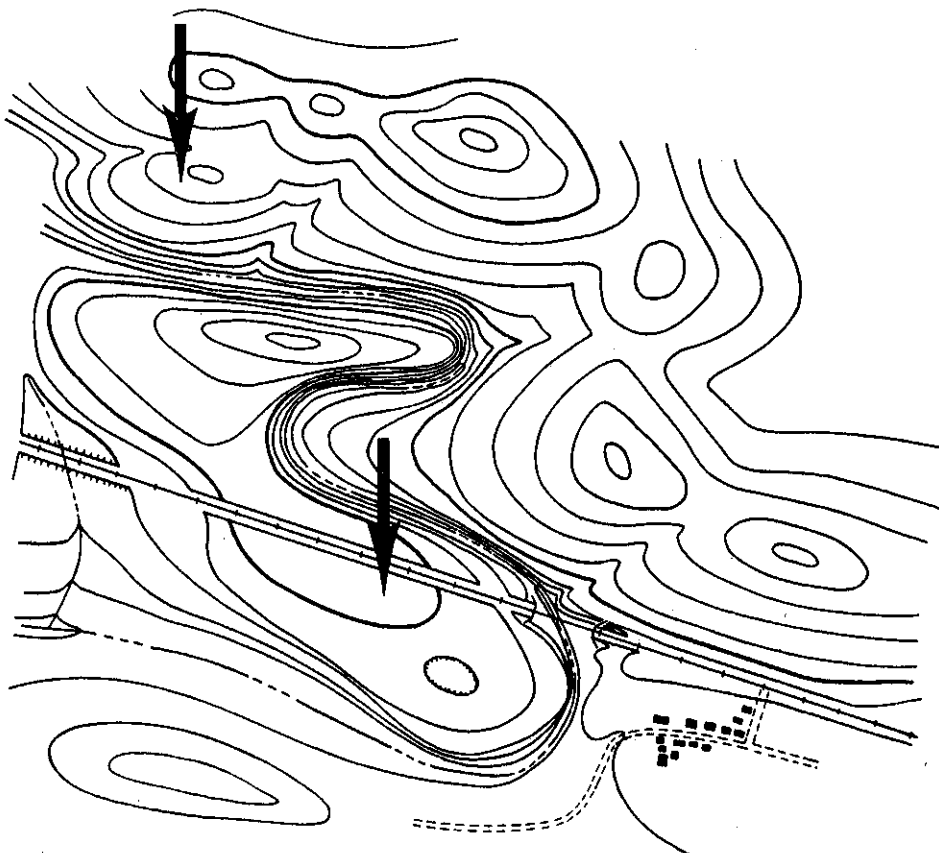
- a. 4030 4960
- b. 4071 4963

(Hilltops; 4, 5, 6) (1)

FRAME 2



Contour lines that form a fingerlike protrusion that extends in a lateral direction from a ridge indicate a spur.



A spur is located at which of the following coordinates? (Gordon Map)

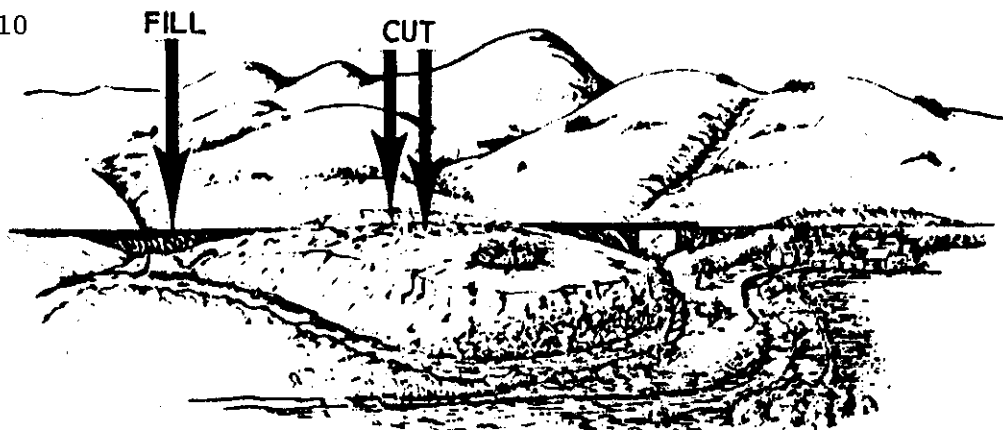
a. 6678 1271 ✓

b. ~~6348~~ 1872

(c.) 6285 1460

(a) (9)

FRAME 10



Contour lines that are straight and are parallel to each other and to adjacent roads, railroads, or other manmade features indicate cuts or fills. Contour lines of cuts pass through hills. Contour lines of fills pass over small streams, gullies, or depressions; the highest contour lines of fills have tick marks.



Remember that tick marks point toward the low ground. On the Leavenworth map at coordinate 4500 5940 the terrain feature found at this point is a

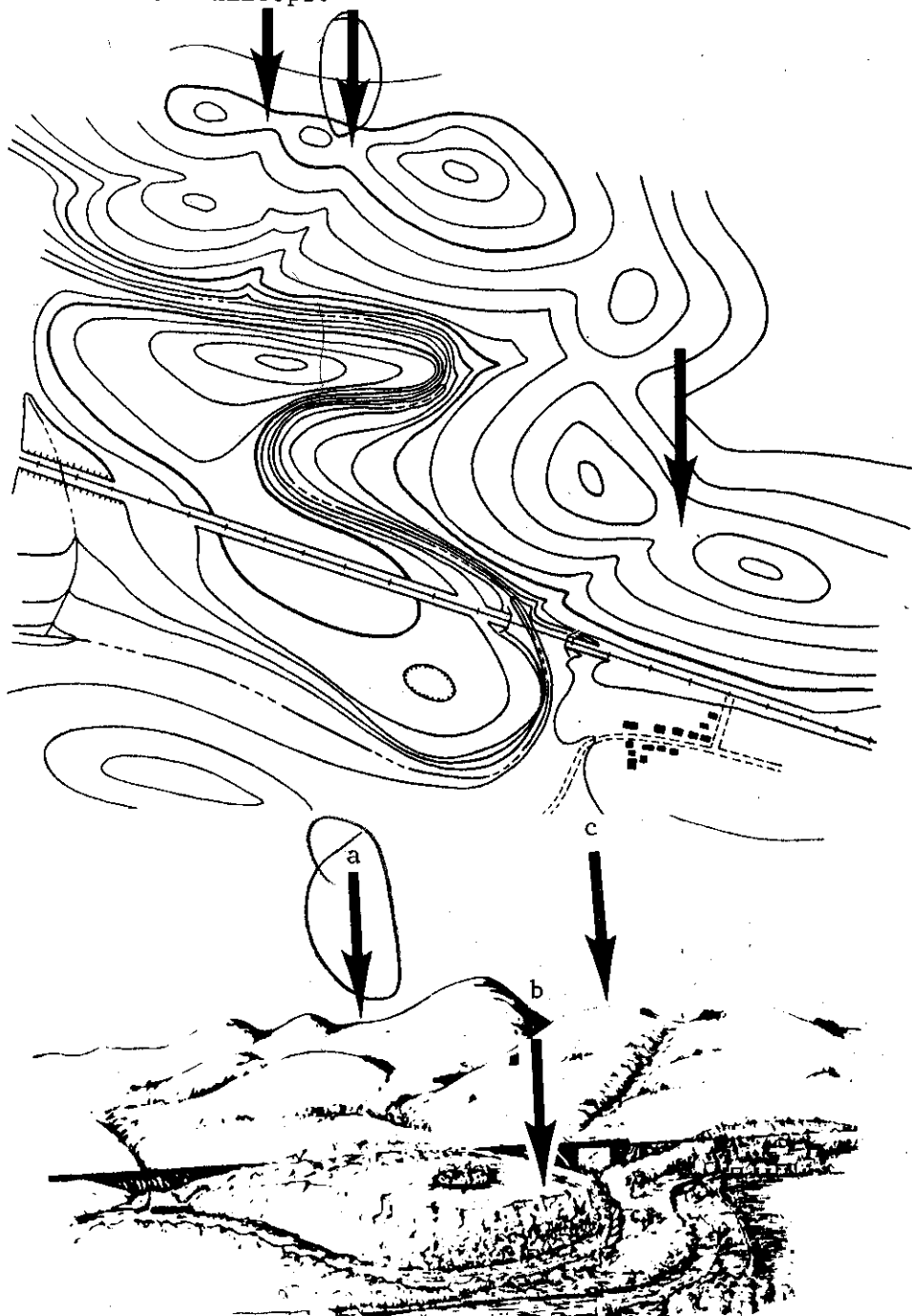
a. cut.

b. fill.

(c) (2)

FRAME 3

Contour lines that show two hilltops within a larger contour line indicate a saddle. As a general rule a saddle is a noticeably low point between higher elevations or hilltops.



The arrows in the top illustration all point to saddles. Circle the arrow in the bottom illustration that points to a saddle.

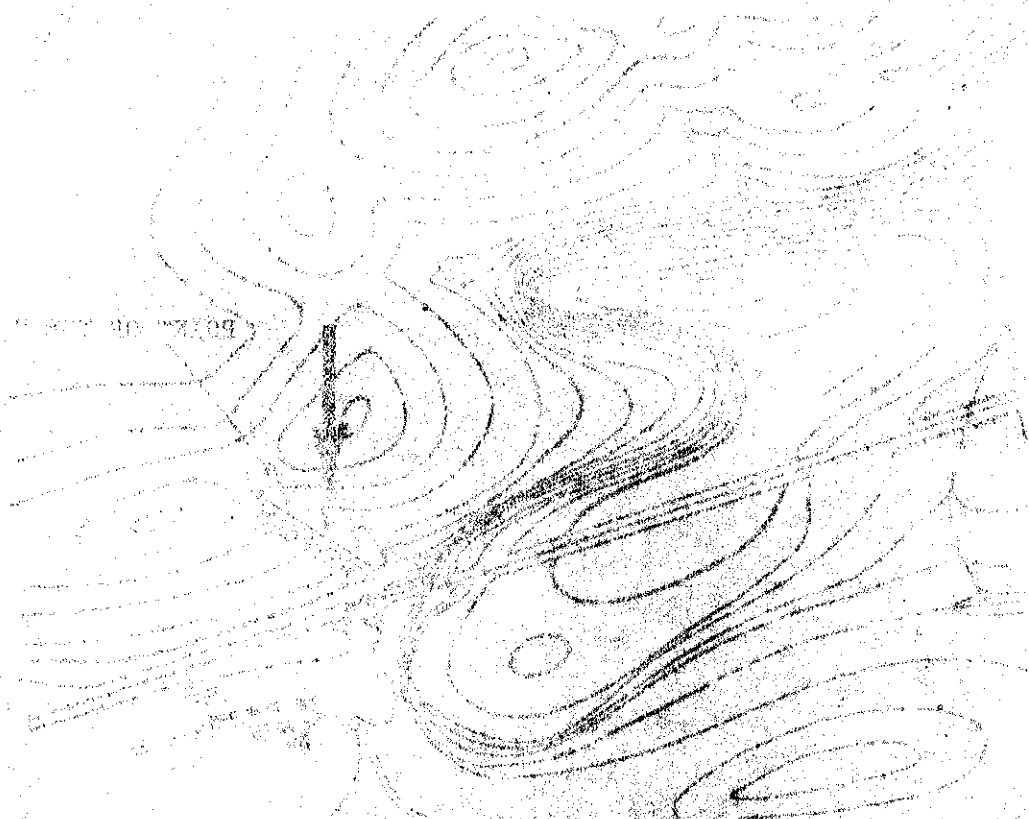
(b) (10)

FRAME 11

Find each of the following coordinates on your Leavenworth map and match each one with the terrain feature that is found there.

- a. 3377 6049 3
b. 3506 6521 1
c. 4300 4895 2

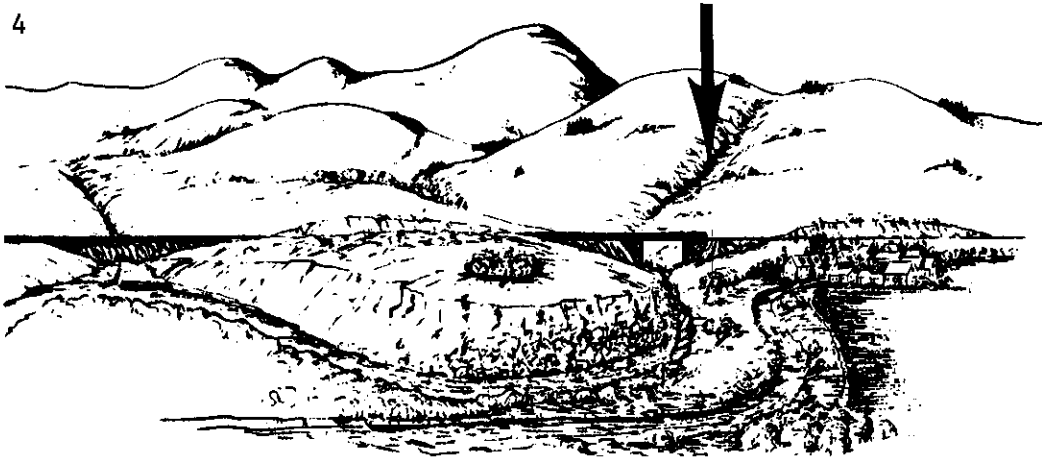
1. Cliff
2. Depression
3. Fill



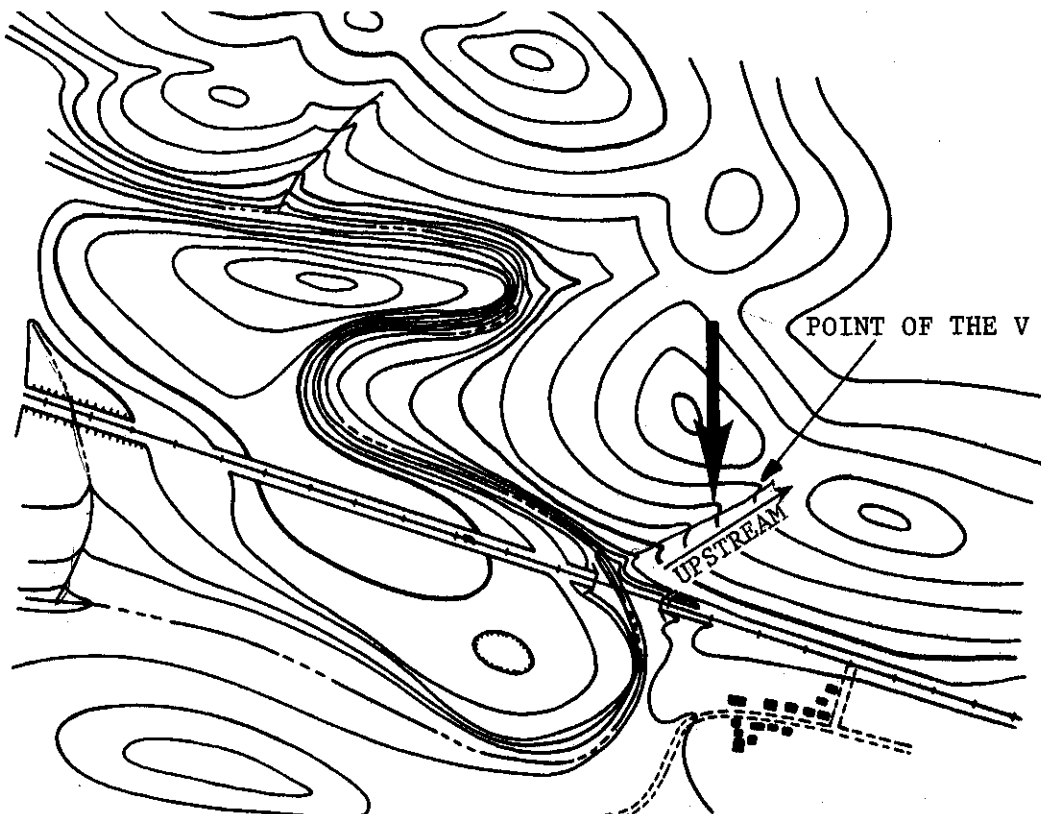
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98
99
100

(a) (3)

FRAME 4



Contour lines that form a series of successive "V" shapes indicate a draw. A draw is a stream course that has not developed a valley floor. The distinction between the valley and the draw is in terms of troop movement. A valley has enough reasonably level ground to permit deployment of a military unit; the draw does not.



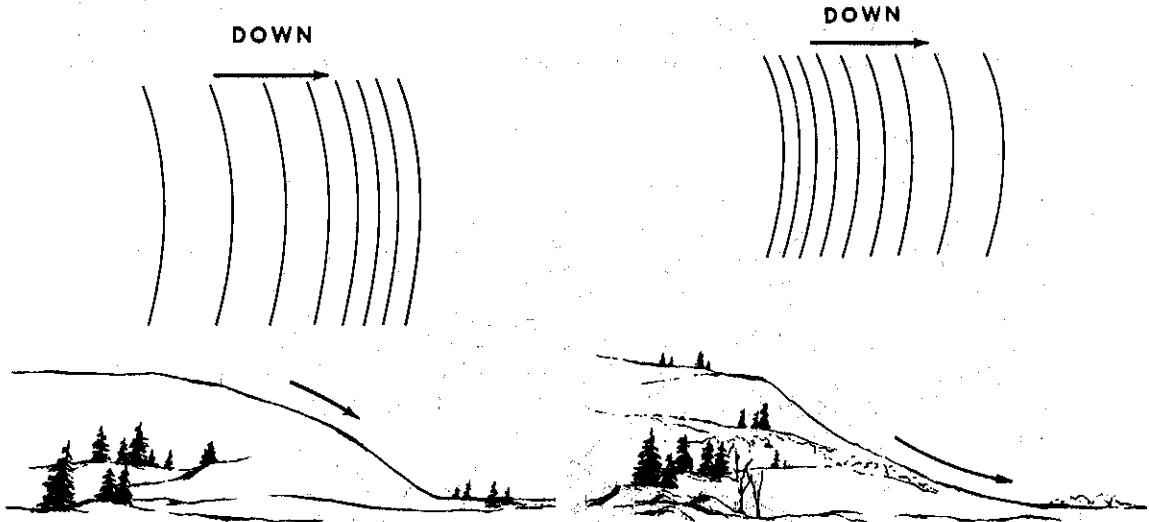
A draw is located at which of the following coordinates? (Gordon Map)

- a. 6736 2038
- ☒ b. 6167 1265
- c. 6624 1730

(a-3; b-1; c-2) (11)

FRAME 12

A convex slope will start with a gentle slope that increases as it goes down. A concave slope will be steep at the top and shallow at the bottom.



a. Convex

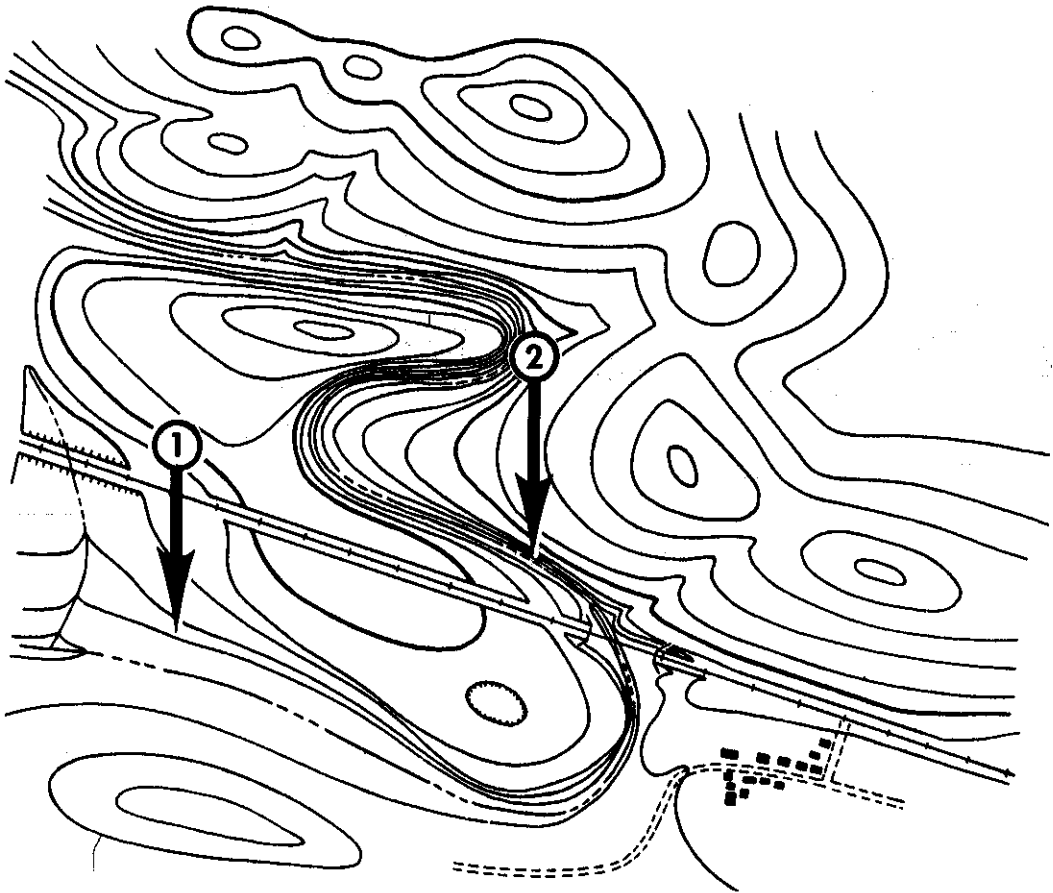
b. Concave

LABEL THE ABOVE SLOPES.

(b) (4)

FRAME 5

Contour lines that roughly parallel a stream and represent elevations definitely lower than those farther from the stream indicate a valley. When these contours are located away from the stream (see point 1, below) they indicate level ground which will permit limited maneuver of a military unit. Contours closely spaced, adjacent to a stream (see point 2, below) indicate a deep gorge or inclosed stream with steep banks, an impediment to troop movement.



Match the features in the following grid squares with the type of movement they will allow. (Gordon Map)

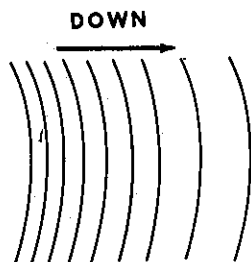
- a. 6418
- b. 6417
- c. 6516

- 1. Limited movement
- 2. Impediment to movement
- 3. Maximum movement

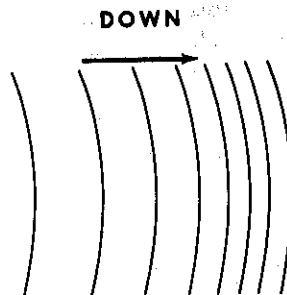
(a. convex; b. concave) (12)

FRAME 13

A concave slope always slopes in; a convex slopes out. This means that on a topographic map a concave slope will have the contour lines close together at the top of the slope and increasing in distance down the slope. A convex will have the contour lines closer at the bottom.



a.



b.

What kind of slopes are the ones above?

a. concave

b. convex

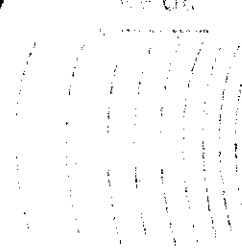
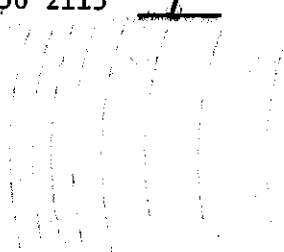
(a-2; b-1; c-3) (5)

FRAME 6

Find each of the following coordinates on your Gordon map and match each with the terrain feature that is found there.

- a. 6411 1408 3
- b. 6860 2265 2
- c. 6674 2044 4
- d. 6759 1986 5
- e. 6556 2115 1

- 1. Hill
- 2. Spur
- 3. Saddle
- 4. Draw
- 5. Valley



What kind of slopes are the ones above?

Look on your Gordon map that it is a hill. Look at the contour lines.

(a. concave; b. convex) (13)

FRAME 14

A. If you were walking toward the hard surfaced road from coordinate 4585 5155 on your Leavenworth map, what type of slope would you be walking on?

- ☒ a. Convex
- b. Concave

B. If you were walking toward the military reservation from the hill at coordinate 2923 6135 on your Leavenworth map, what type of slope would you be walking on?

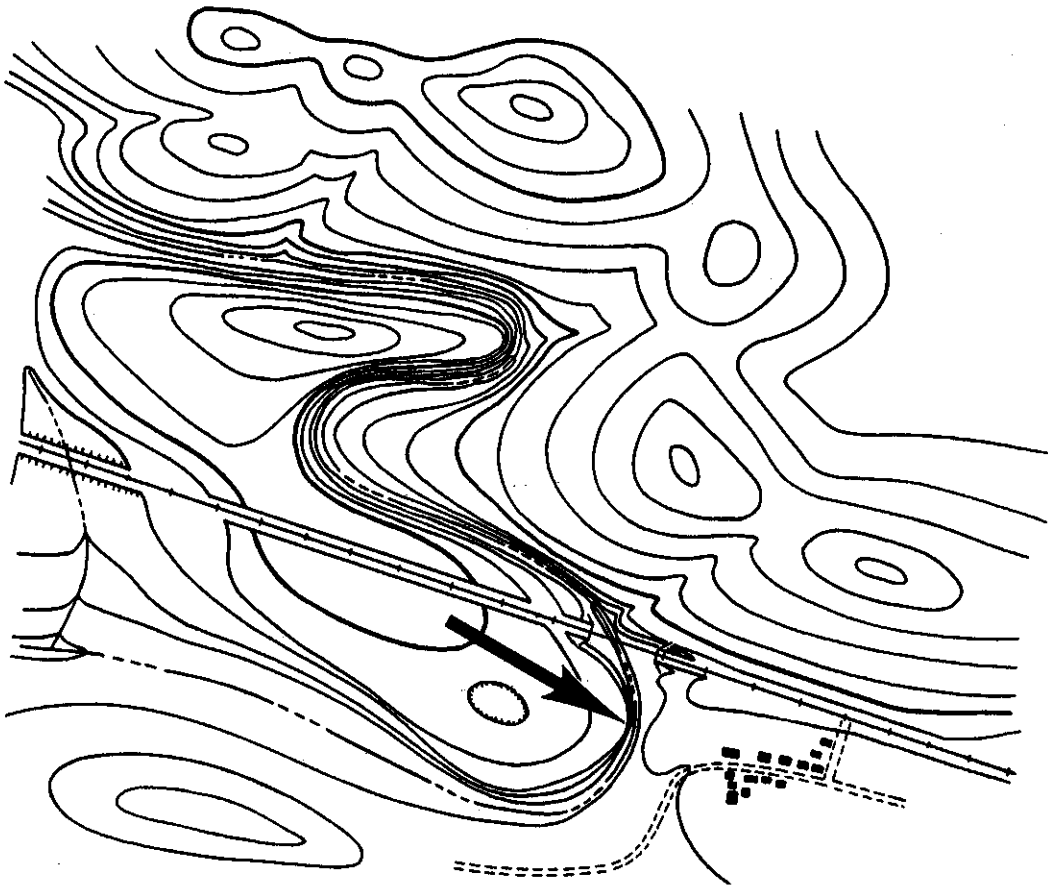
- a. Convex
- ☒ b. Concave

(a-3; b-2; c-4; d-5; e-1) (6)

FRAME 7



Contour lines that converge into one line indicate a cliff. In areas of steep uniform slope, contours are often broken just short of the point where they would touch, so as not to form a confusing pattern.



A cliff is located in which of the following grid squares on your Gordon map?

a. 6522

b. 6922

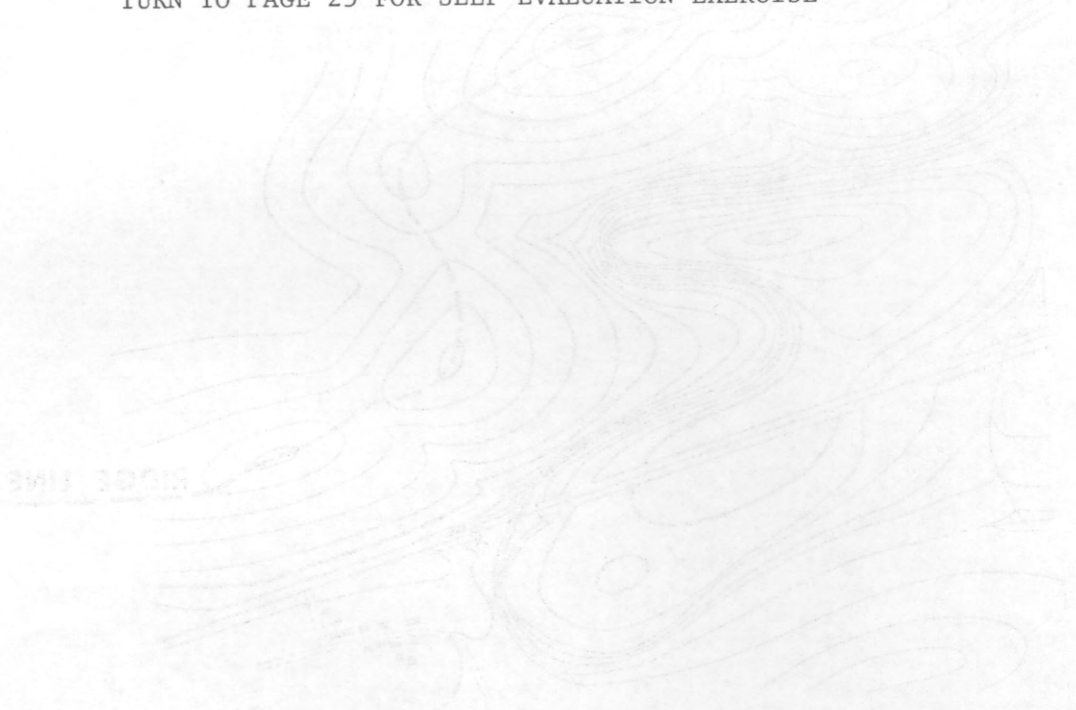
c. 6519

...as a series of peaks and valleys. The ridge line follows the
line of highest points through the formation. Contour lines are
drawn at 100-foot intervals and are labeled with their
elevation. The map also shows the location of the ridge line
and the points along the top of the ridge.



END OF PART IV

TURN TO PAGE 25 FOR SELF EVALUATION EXERCISE



...of the following best describes a ridge line?
...the high ground
...points of equal elevation

RETURN TO PAGE 11 FOR PART 3

(b) (7)

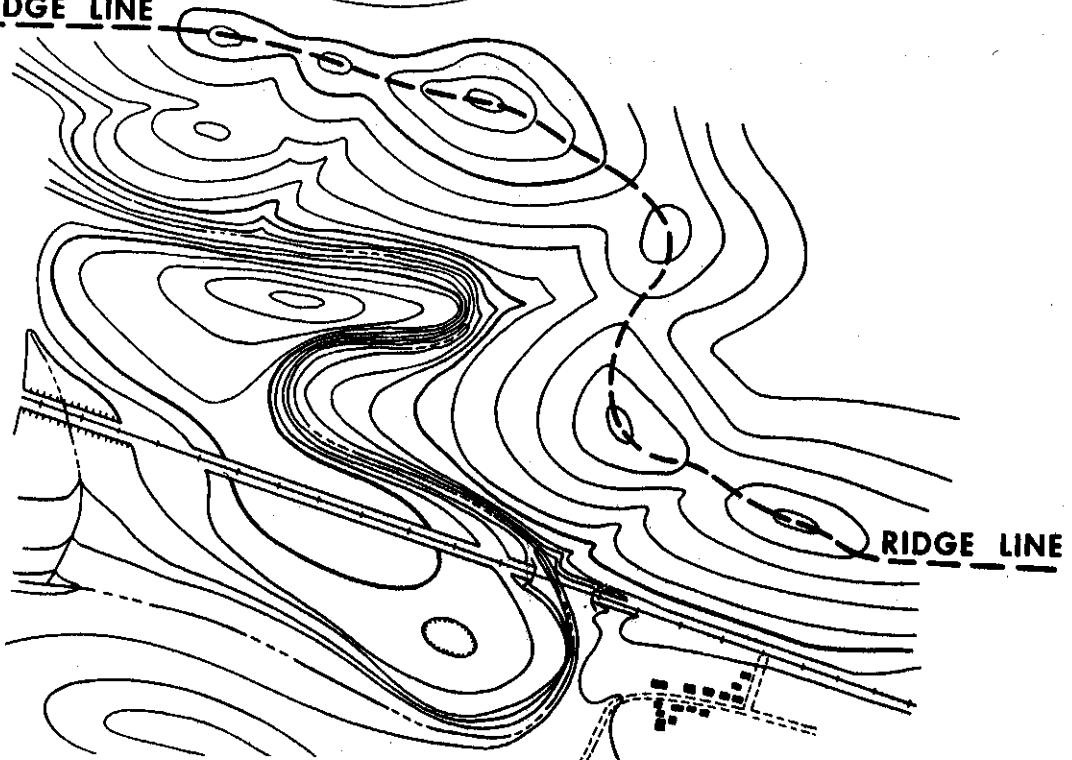
FRAME 8

A ridge is a series of peaks and saddles. The ridge "line" follows the backbone or highest points through the formation. Contours cross the imaginary ridge "line" at right angles and turn back to parallel the ridge line. The high and low points along the top elevations of a ground formation define a hilltop or saddle ridge line.

RIDGE LINE



RIDGE LINE



Which of the following best describes a ridge line?

- ☒ a. Follows the high ground
- ☐ b. Follows points of equal elevation

RETURN TO PAGE 11 FOR FRAME 9

SELF EVALUATION EXERCISE
PART IV

This exercise will test what you have learned from this programed text. Read each question carefully and select the correct answer.

Use Leavenworth map.

1. What is the terrain feature found at coordinate 4565 5445?
 - a. Valley
 - b. Draw
 - ☒ c. Hill
 - d. Spur

2. What is the terrain feature located from coordinate 3322 6758 to 3351 6719?
 - a. Hill
 - ☒ b. Draw
 - c. Valley
 - d. Spur

3. What terrain feature is found from coordinate 2911 5357 to 2993 5246?
 - a. Hill
 - b. Ridge
 - ☒ c. Valley
 - d. Spur ?

4. What is the terrain feature found at coordinate 4522 5270 running to the north?
 - a. Hill
 - ☒ b. Draw ✓
 - c. Ridge
 - d. Spur

5. If you were walking from coordinate 4110 5250 toward the Platte River, you would be walking
 - ☒ a. downhill.
 - b. uphill.
 - c. on level ground.

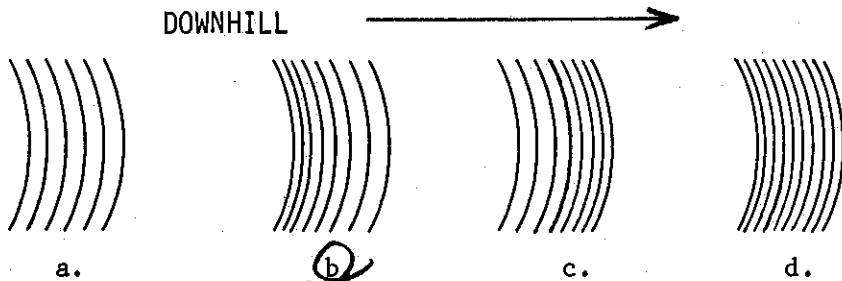
6. What is the elevation of the hilltop at coordinate 4835 5270?

- a. 900
- b. 800
- c. 920
- ☒ d. 930

7. What is the elevation of the stream bed at coordinates 472 545?

- a. 800
- b. 820
- ☒ c. 790
- d. 780

8. Which of the following is a concave slope?



9. If you were walking east from the hilltop at 305 502, you would be on

- ☒ a. a concave slope.
- ☐ b. a convex slope.
- ☐ c. both of the above.

10. What type of contour lines are found in grid square 3657?

- ☒ a. Intermediate
- ☒ b. Supplemental
- ☒ c. Depression
- ☒ d. All of the above

ANSWERS - SELF EVALUATION EXERCISE PART IV

1. c
2. b
3. c
4. b
5. a
6. d
7. c
8. b
9. c
10. d