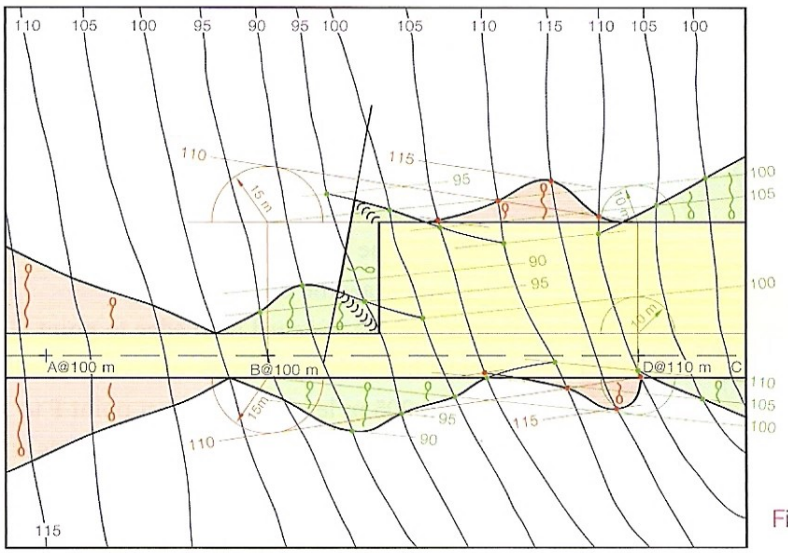


Fig. 19.46c

Fig. 19.47 shows ground contours at 5 m vertical intervals. ABCD is a proposed roadway that widens from C to D. The road has the following specification:

(i) A to C formation width of 12 m.

(ii) Formation level at B is 205 m.

(iii) A to B is 1 in 10 rising, B to D is 1 in 15 rising.

(iv) Side slopes for cutting 1 in 2.

(v) Side slopes for embankment 1 in 1.5.

On the drawing show the earthworks necessary to accommodate the road.

(1) A to B is 1 in 10 rising. B is at 205 m. Measure toward A for 50 m to point E which will be at 200 m.

(2) Draw the cut and fill cones at B and E and deal only with this section of road. The difference in altitude between B and E is 5 m, therefore the cut cone has a radius of 10 m and the fill cone has a radius of 7.5 m.

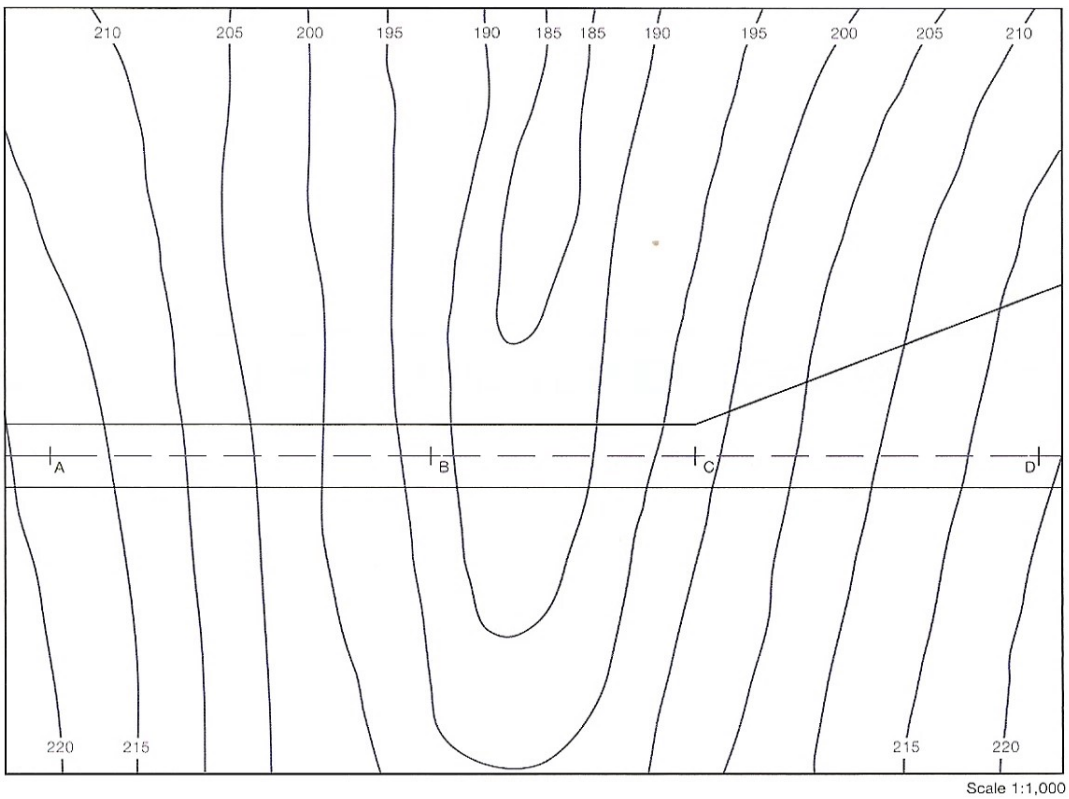


Fig. 19.47

HIGHER LEVEL

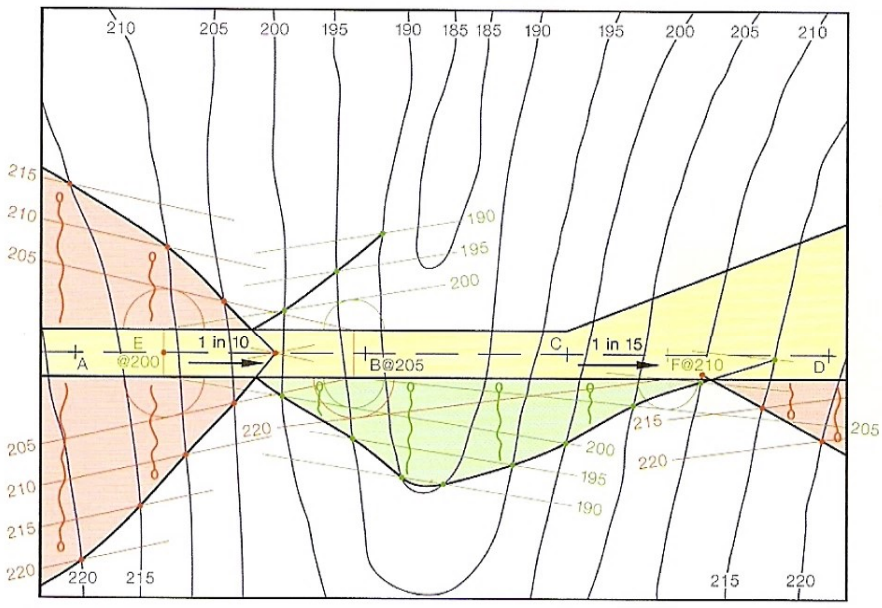


Fig. 19.48

(3) the slope of the road changes at B to 1 in 15 rising. Measure from B to F for 75 m. Point F will be at a 210 m level. Set up the cut and fill cones at B and F. The cut cone has a 10 m radius. The fill cone has a 7.5 m radius.

(4) Ignore the fact that the road widens at C and draw the fill.

(5) Extend the widened road edge to point G which is in line with point B. Point G will be at 205 m level. Also project point F to the side of the widened road at H. H is a 210 m level. Treat GH as a separate road and find the outline of the earthworks.

(6) The cut cone at G will be 10 m radius, the fill cone at H will be at 7.5 m radius. The spacing between the cut contours is 10 m and the spacing between the fill contours is 7.5 m.

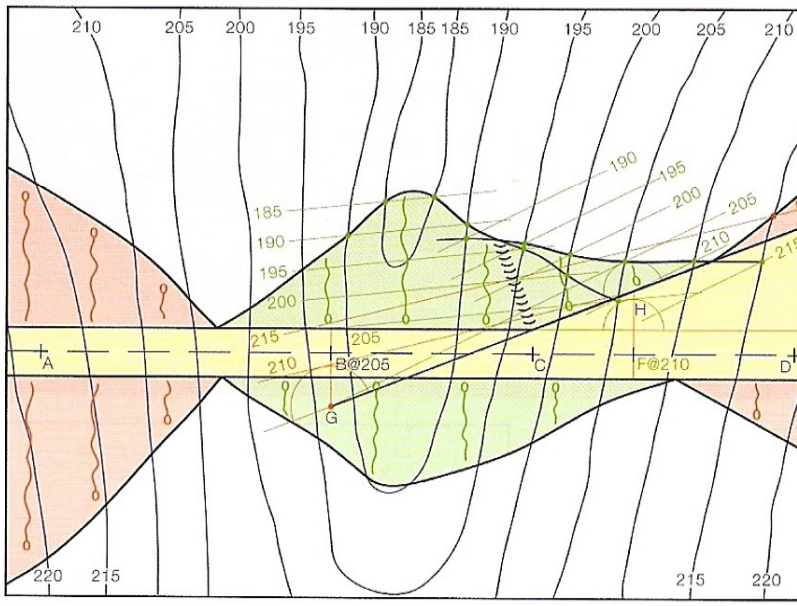


Fig. 19.

Activities

DEFINITIONS

Q1. Explain the following terms:

(i) contour,
(ii) contour interval,
(iii) bearing,
(iv) profile,
(v) gradient.

Q2. Explain the difference between magnetic north and true north.

PROFILES

Q3. To a scale of 1:1,000 redraw the portion of the map shown in Fig. 19.50.

(i) Draw a profile of the line AB.

(ii) Determine the gradient of the slope at C in an easterly direction.

(iii) If a vertical mast 20 m high stands at point A, is it visible from point B on the ground?

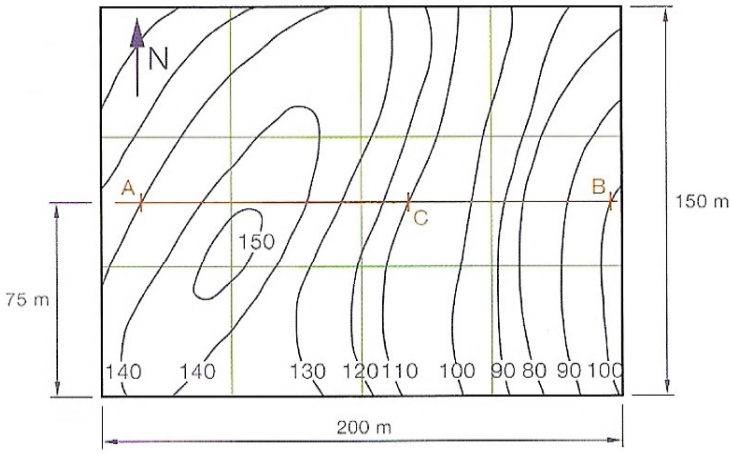


Fig. 19.50

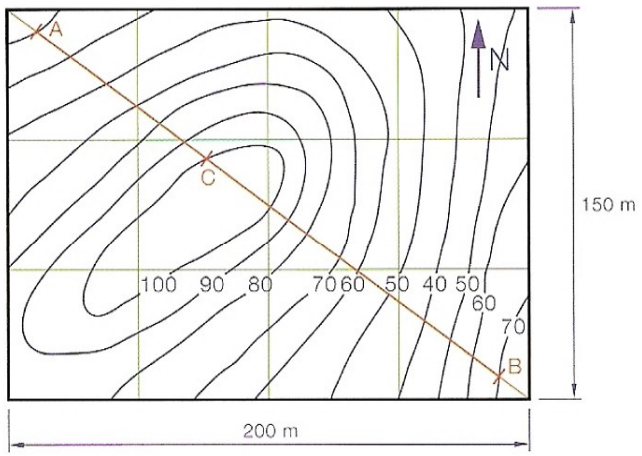


Fig. 19.51

Q4. To a scale of 1:1,000 redraw the portion of the map shown in Fig. 19.51.

(i) Find the profile of the line AB.

(ii) Determine the gradient at point C in the AB direction.

(iii) How tall does a vertical object at C need to stand in order to be seen from point B?

Q5. To a scale of 1:1,000 redraw the portion of the map shown in Fig. 19.52.

(i) Draw a profile along the line AB.

(ii) Determine if a building, standing at C, and having a vertical height of 30 m, is visible from the ground from point D.

(iii) Determine the gradient at E in a westerly direction.

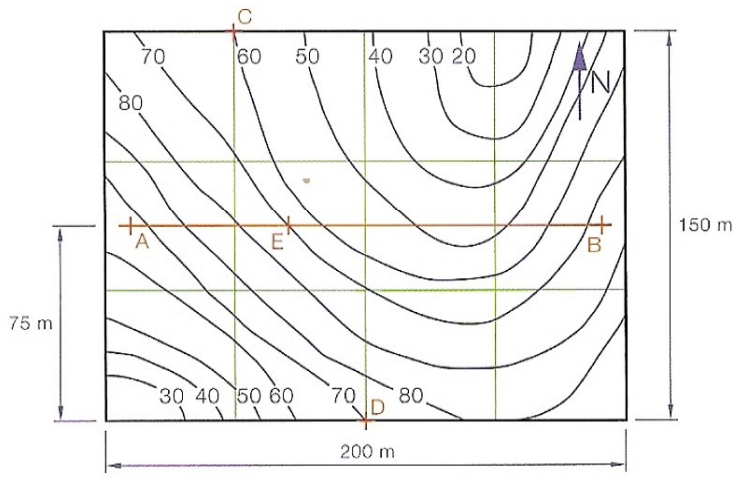
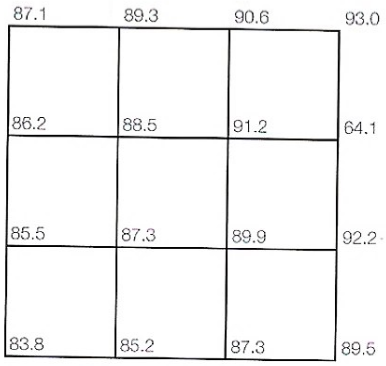


Fig. 19.52

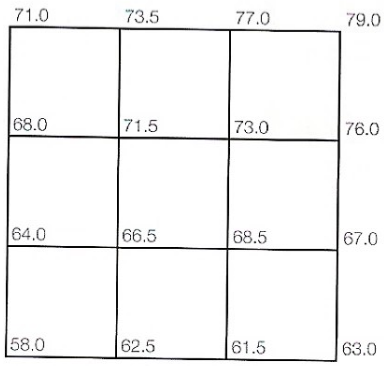
INTERPOLATION OF CONTOURS

Q6. Using the division of lines method plot the contours for the grid levels shown in Figures 19.53a and 19.53b. Scale 1:1,000.



50 m grid squares
Contour interval required = 2 m

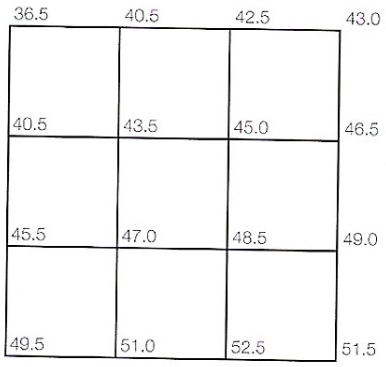
Fig. 19.53a



50 m grid squares
Contour interval required = 5 m

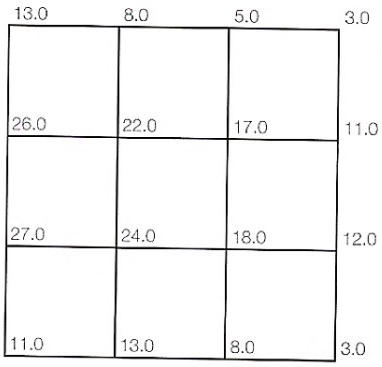
Fig. 19.53b

Q7. Using an interpolation template, plot the contours for the grid layouts shown in Figures 19.54a and 19.54b. Scale 1:1,000.



50 m grid squares
Contour interval required = 2 m

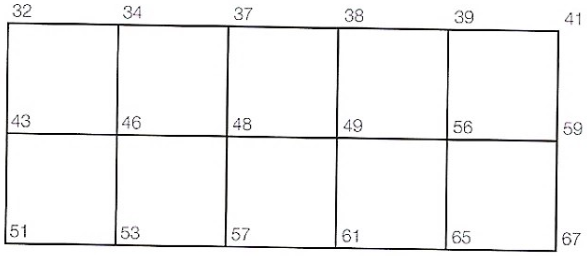
Fig. 19.54a



50 m grid squares
Contour interval required = 5 m

Fig. 19.54b

Q8. Using profiles determine the contours for the grid layout shown in Fig. 19.55. Scale 1:1,000.



50 m grid squares
Contour interval required = 5 m

Fig. 19.55

MINING STRIKE AND DIP

Q9. Explain the following mining terms:

(i) strike, (ii) dip, (iii) stratum, (iv) headwall, (v) footwall, (vi) outcrop, (vii) thickness.

Q10. The maps shown in Figures 19.56a, 19.56b, 19.56c and 19.56d show ground contours at 10 m vertical intervals. Also shown are outcrop points A, B and C on a stratum of ore. Redraw the maps to a scale of 1:1,000 and find the strike and dip of the stratum.

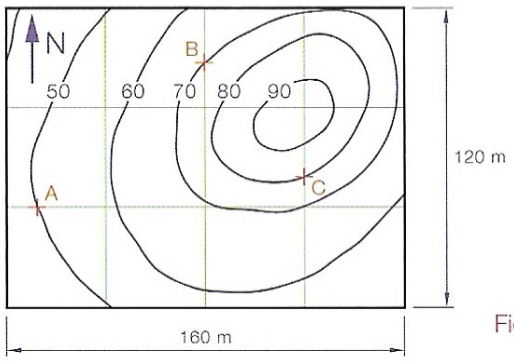


Fig. 19.56a

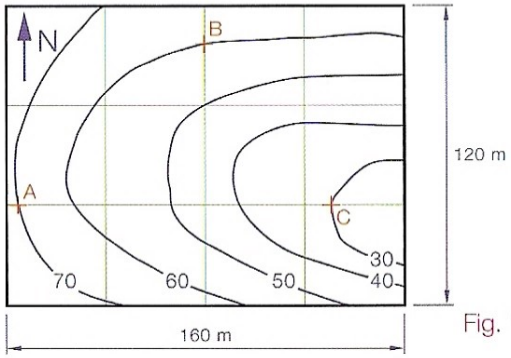


Fig. 19.56b

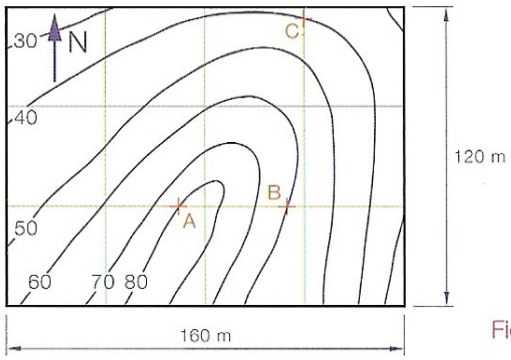


Fig. 19.56c

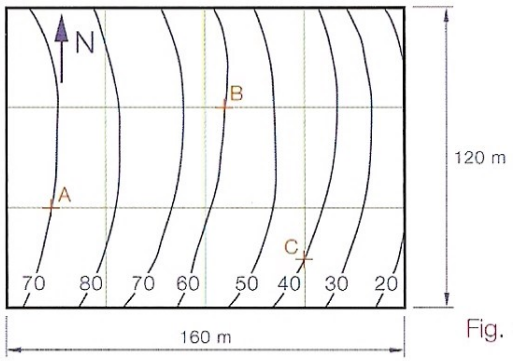


Fig. 19.56d

Q11. Figures 19.57a and 19.57b show ground contours at 10 m vertical intervals. Points A, B and C are outcrop points on a stratum of ore. Redraw the maps to a scale of 1:1,000.

(i) Find the strike and dip of the stratum.

(ii) Determine the outline of the outcrop between A and C and between C and B.

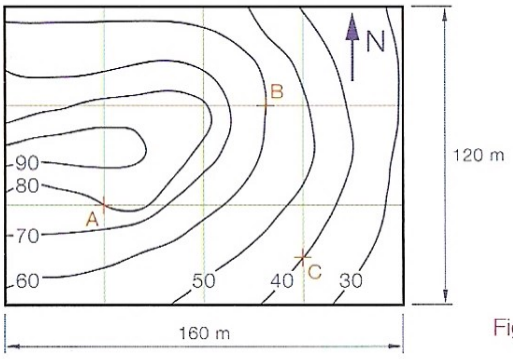


Fig. 19.57a

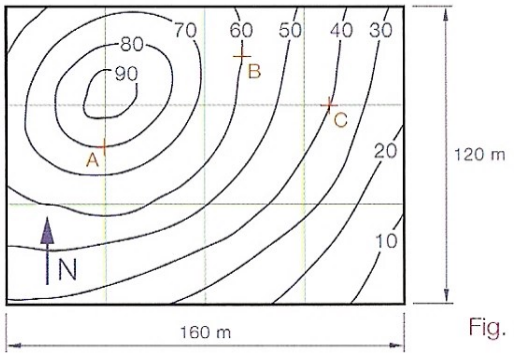


Fig. 19.57b

Q12. The maps shown in Figures 19.58a and 19.58b show ground contours at 10 m vertical intervals. Vertical boreholes at A, B and C strike a stratum at altitudes of 90, 60 and 50 m respectively. Redraw the maps to a scale of 1:1,

(i) Determine the strike and dip of the stratum.

(ii) Find the complete outline of the outcrop.

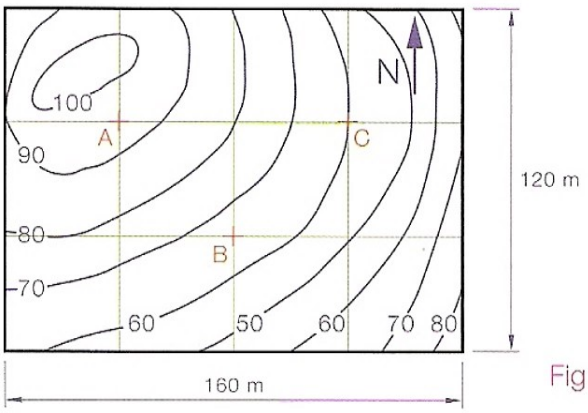
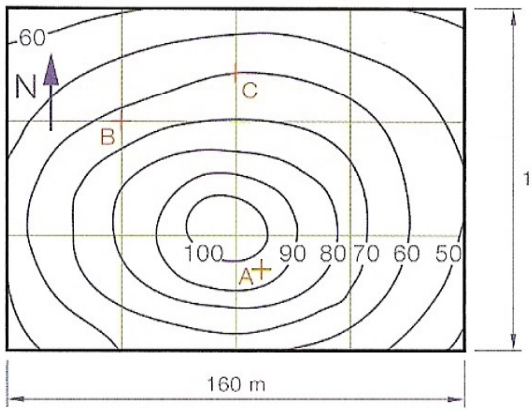


Fig. 19.58a



Fi

Q13. Figures 19.59a and 19.59b show ground contours at 10 m vertical intervals. Points A, B and C are outcrop points on the headwall of a stratum of ore and D is an outcrop point on the footwall. Redraw the diag to a scale of 1:1,000.

(i) Determine the strike, dip and thickness of the stratum.

(ii) Find the outline of the outcrop.

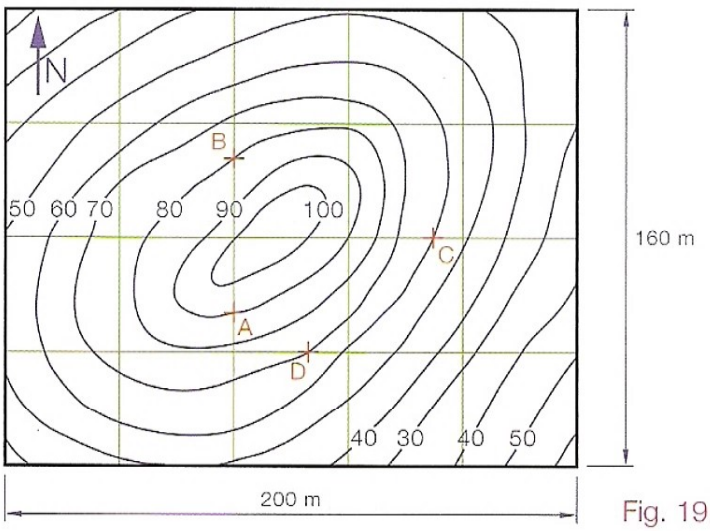
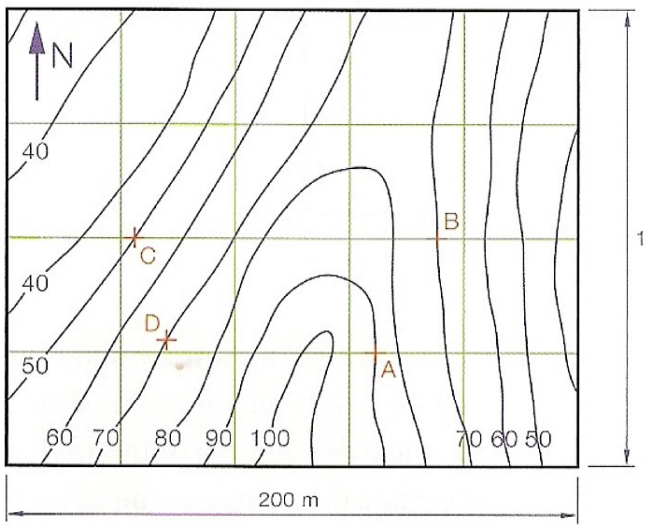


Fig. 19.59a



Fi

EARTHWORKS

Q14. Figures 19.60a and 19.60b, show ground contours at 5 m vertical intervals. AB is the line of a proposed roadway. The road is to have the following specifications. Redraw the maps to a scale of 1:1,000.

(i) Formation width 14 m.

(ii) Formation level 85 m.

(iii) Side slopes for cutting 1:1.5, side slopes for embankment 1:2.

Show the earthworks necessary to accommodate the roadway.

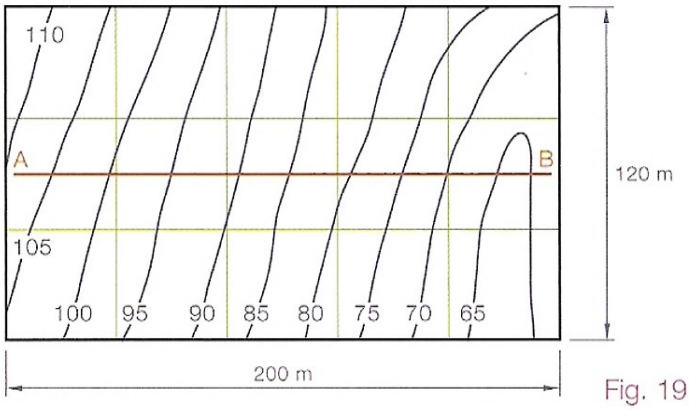


Fig. 19.60a

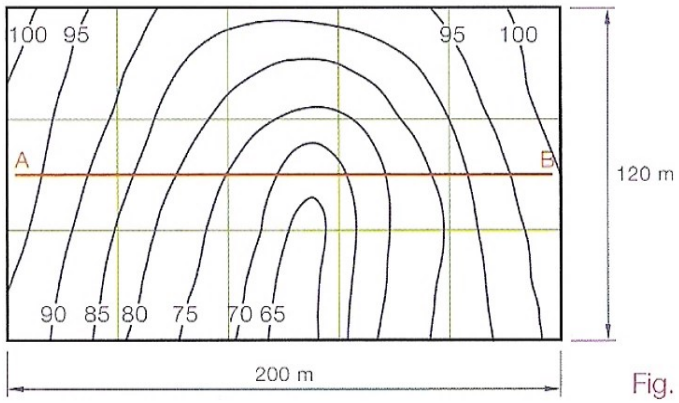


Fig. 19.60b

Q15. Figures 19.61a and 19.61b, show ground contours at 2 m vertical intervals. ABCD is the centre line of a proposed roadway with the centre for the curve at point O. The road is to have the following specifications:

(i) Formation width 14 m.

(ii) Formation level 40 m.

(iii) Side slopes for cutting 1:2, side slopes for embankment 1:2.5.

Redraw the given maps to a scale of 1:1,000 and show the earthworks necessary to accommodate the roadway.

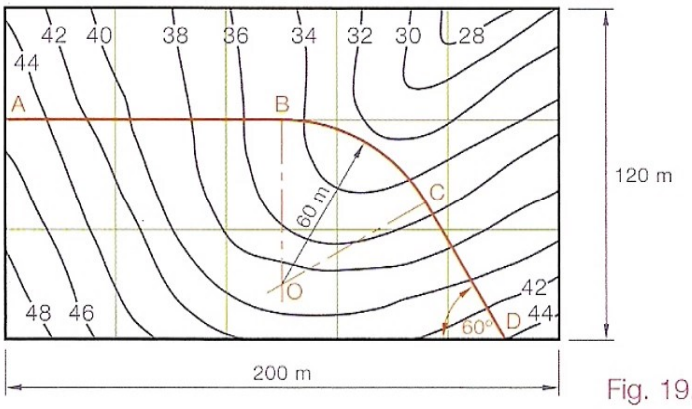


Fig. 19.61a

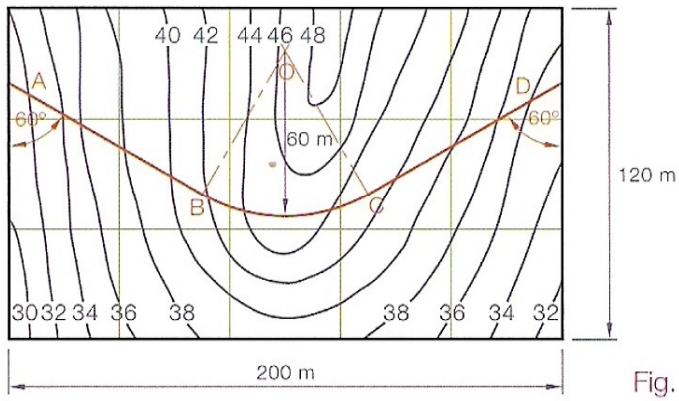


Fig. 19.61b

Q16. The maps shown in Figures 19.62a and 19.62b show ground contours at 4 m vertical intervals. AB shows a proposed roadway with CDEF being a car park. The car park and road are at the same level. The road and car park are to have the following specification:

(i) Formation width 12 m.

(ii) Formation level 100 m.

(iii) Side slopes for cutting 1:1.5, side slopes for embankment 1:1.

Redraw the maps to a scale of 1:1,000 and show the earthworks necessary to accommodate the road and car park.

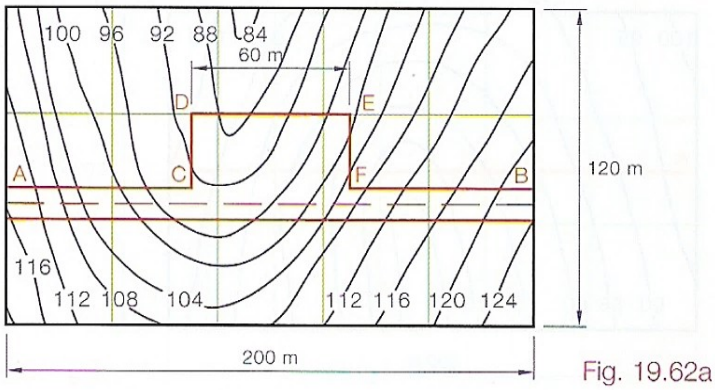


Fig. 19.62a

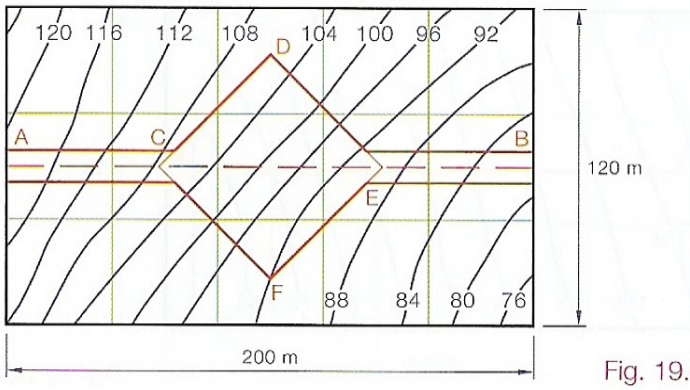


Fig. 19.

MINING: SKEW BOREHOLES

Q17. On a contour map A and B are two points whose altitudes are 105 m and 80 m respectively. On the map B is located 120 m north-east of A. A skew borehole at A is drilled in a south-westerly direction in plan and has an actual inclination of 60° to the horizontal plane. It reveals the top and bottom surfaces of the stratum at distances of 30 m and 65 m respectively from A.

A skew borehole at B is drilled in a southerly direction in plan and has an actual inclination of 50° to the horizontal plane. It reveals the top and bottom surfaces of the stratum at altitudes of 50 m and 35 m respectively.

(i) Determine the dip, strike and thickness of the stratum.

(ii) Another skew borehole at B is drilled in a south-westerly direction in plan and meets the bottom surface of the stratum at a distance of 110 m from B. Determine the inclination of this borehole to the horizontal plane.

Scale 1:1,000.

Q18. On a contour map, A and B are two points whose altitudes are 115 m and 120 m respectively. On the map, B is located 125 m north-east of A. A skew borehole at A is drilled in a northerly direction in plan and has an actual inclination of 60° to the horizontal plane. It reveals the top and bottom surfaces of the stratum at altitudes of 105 m and 40 m respectively.

A skew borehole at B is drilled in a south-westerly direction in plan and has a true inclination of 50° to the horizontal plane. It reveals the top and bottom surfaces of the stratum at altitudes of 85 m and 65 m respectively.

(i) Determine the strike, dip and thickness of the stratum.

(ii) Another skew borehole at B is drilled in a southerly direction in plan. The length of the borehole as it goes through the stratum is 20 m. Determine the altitude at which this borehole hits the bottom surface of the stratum.

Scale 1:1,000.

HIGHER LEVEL

Q19. On a contour map, A and B are two points whose altitudes are 80 m and 95 m respectively. On the map, A is located 100 m south-east of B. A skew borehole at A is drilled in a northerly direction in plan and has an actual inclination of 45° to the horizontal plane. It reveals the top and bottom surfaces of the stratum at altitudes of 20 m and 90 m respectively.

A skew borehole at B is drilled in a south-westerly direction in plan and has a true inclination of 60° to the horizontal plane. It reveals the top and bottom surfaces of the stratum at altitudes of 60 m and 45 m respectively.

(i) Determine the strike, dip and thickness of the stratum.

(ii) Another skew borehole from B is drilled in a southerly direction in plan and has an actual inclination of 60° to the top surface of the stratum. Determine the altitude at which this borehole reaches the bottom surface of the stratum.

Scale 1:1,000.

APPARENT DIP

Q20. On a contour map, A and B are two points whose altitudes are 95 m and 105 m respectively. On the map, A is located 65 m north of B. A skew borehole at A is drilled in a north-easterly direction in plan and has an actual inclination of 60° to the horizontal plane. It reveals the top and bottom surfaces of the stratum at altitudes of 65 m and 35 m respectively.

A skew borehole at B is drilled in a north-westerly direction in plan and has a true inclination of 40° to the horizontal plane. It reveals the top and bottom surfaces of the stratum at altitudes of 85 m and 15 m respectively.

(i) Determine the strike, dip and thickness of the stratum.

(ii) Determine the apparent dip of the stratum in a westerly direction.

Scale 1:1,000.

Q21. On a contour map, A and B are two points whose altitudes are 110 m and 115 m respectively. On the map, A is located 120 m west of B. A skew borehole at A is drilled in a north-easterly direction in plan and has an actual inclination of 65° to the horizontal plane. It reveals the top and bottom surfaces of a stratum at altitudes of 90 m and 25 m respectively.

A skew borehole at B is drilled in a south-westerly direction in plan and has an actual inclination of 50° to the horizontal plane. It reveals the top and bottom surfaces of the stratum at altitudes of 70 m and 55 m respectively.

(i) Determine the strike, dip and thickness of the stratum.

(ii) Determine the apparent dip of the stratum in a south-easterly direction.

Scale 1:1,000

Q22. On a contour map, A and B are two points whose altitudes are 100 m and 80 m respectively. On the map, B is located 120 m north-west of A. A skew borehole at A is drilled in a north-easterly direction in plan and has an actual inclination of 60° to the horizontal plane. It reveals the top and bottom surfaces of the stratum at altitudes of 80 m and 35 m respectively.

A skew borehole at B is drilled in a southerly direction in plan and has a true inclination of 50° to the horizontal plane. It reveals the top and bottom surfaces of the stratum at altitudes of 55 m and 30 m respectively.

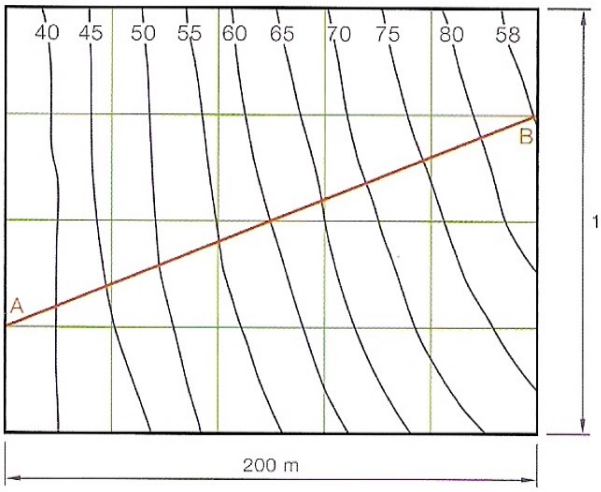
(i) Determine the strike, dip and thickness of the stratum.

(ii) Determine the apparent dip of the stratum along a south-easterly section.

Scale 1:1,000.

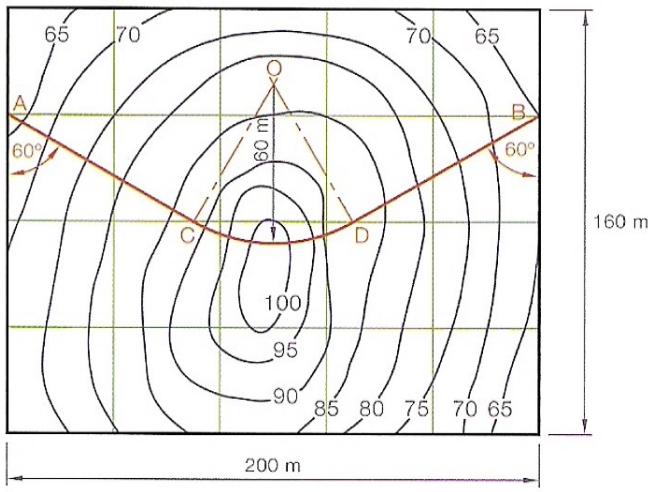
EARTHWORKS

Q23. Figures 19.63a and 19.63b, show ground contours at 5 m vertical intervals. AB is the line of a proposed roadway. To a scale of 1:1,000, redraw the maps and show the earthworks necessary to accommodate the roadway.



Formation width 12 m
Formation level at A 70 m
Gradient A to B is 1 in 15 falling
Side slopes for cutting 1 in 1.5
Side slopes for embankment 1 in 1

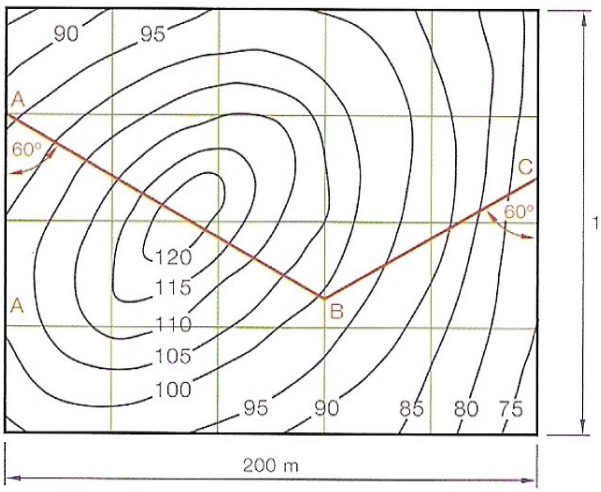
Fig. 19.63a



Formation width 12 m
Formation level at A 85 m
C to D level
Gradient A to C 1 in 10 rising
Gradient D to B 1 in 15 falling
Side slopes for cutting 1 in 1.5
Side slopes for embankment 1 in 2

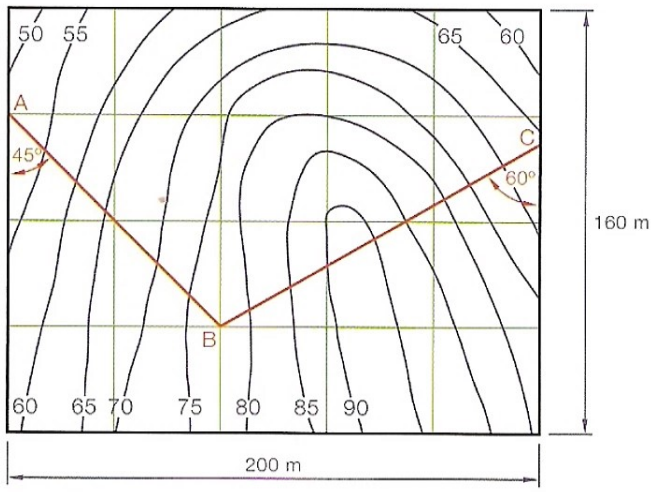
Fig. 19

Q24. Figures 19.64a and 19.64b, show ground contours at 5 m vertical intervals. ABC is the line of a proposed roadway. To a scale of 1:1,000, redraw each map and show the earthworks necessary to accommodate the roadway.



Formation width 12 m
Formation level at A 100 m
Gradient A to B to C 1 in 15 falling
Side slopes for cutting 1 in 1.5
Side slopes for embankment 1 in 2

Fig. 19.64a



Formation width 12 m
Formation level at A 70 m
Gradient A to B to C 1 in 15 rising
Side slopes for cutting 1 in 1.5
Side slopes for embankment 1 in 2

Fig. 19

HIGHER LEVEL