Surveying

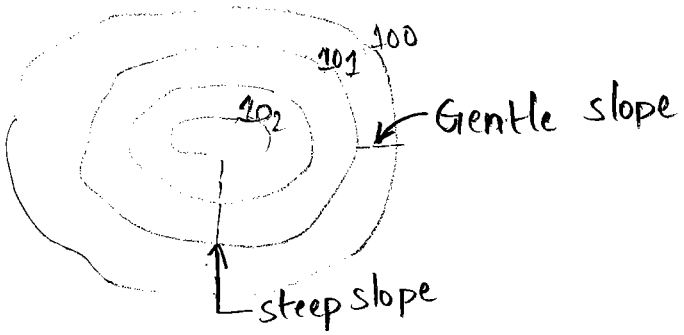
* Explain clearly the difference between prismatic Compass and Surveyor's Compass.

Prismatic Compass	Surveyors Compass
1. The needle is broad needle type but does not act as index.	1. The needle is of edge bar type and also acts as an index.
2. The graduated ring is attached with needle.	2. The graduated ring is attached to box and not to needle.
3. The graduation are in WCB system having 0° to 360°	3. The graduation are in QB system having 0° to 90°.
4. The readings are taken with help of prism provided at eye slit.	4. The reading are taken directly be seeing through the top of glass.
5. Sighting and reading can be done simultaneously from one position of observer.	5. Sighting and reading can not be done simultaneously from one position of observer.
6. The instrument can be used without tripod.	6. The instrument cannot be used without tripod.

* Discuss the characteristics of Contours? Give Suitable sketchs?

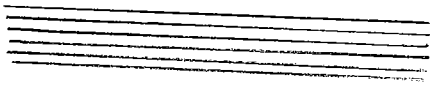
Characteristics of Contours:-

1. The Contour lines are closed curves. However, they may close either on the map itself (or) outside the map, depending upon topography.
2. As the perpendicular distance b/w contour lines is the shortest distance, Contours are always perpendicular to the direction.
3. The spacing b/w contour lines depends upon slope of the ground. In steep slopes, the spacing is small, but for gentle slopes, the spacing is large. As the difference of elevations b/w two Contours is Contour.

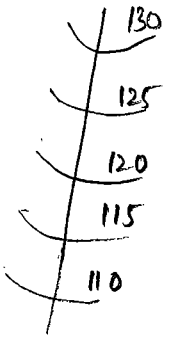


4. If the Contour lines are equally spaced they indicates a uniform slope.

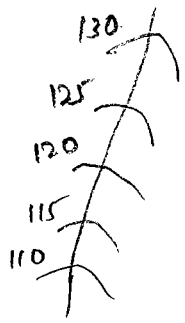
5) If the contour lines are parallel, straight and equally placed they represent a plane surface.



6. A ridge line (water shed line) is indicated when the values inside the bend or loop are higher values where as a valley line is indicated when lower values are inside the bend or loop.

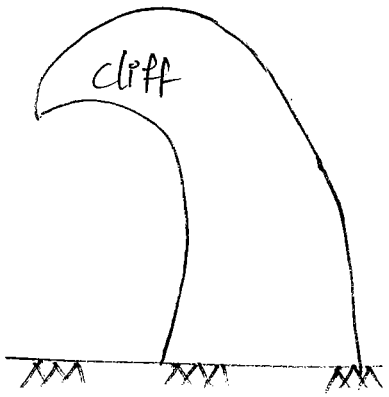


(a) Ridge line



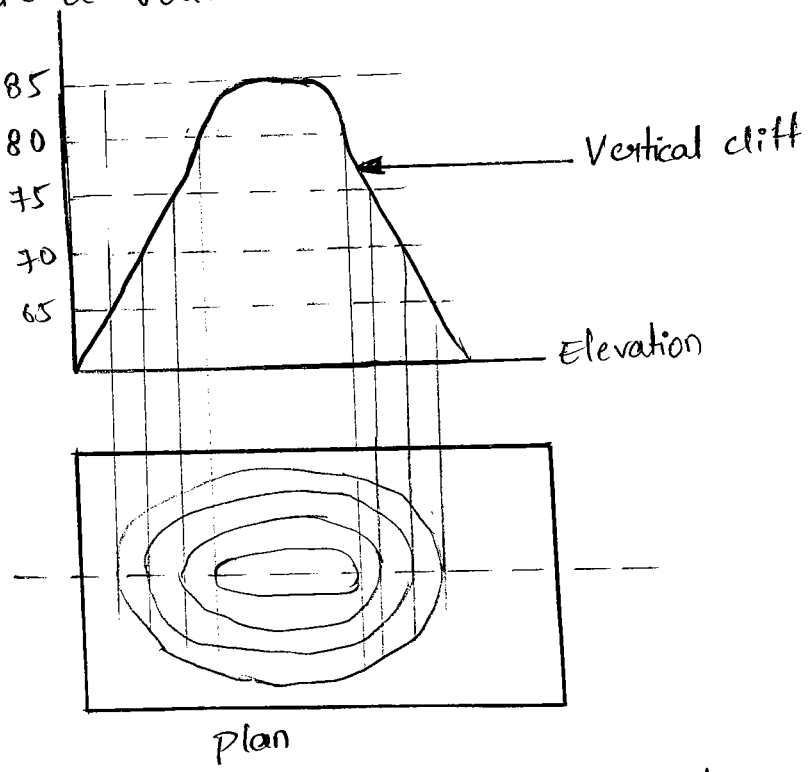
(b) Valley line

7. A Contour line has its own elevation and therefore two contour lines having different elevations will never intersect each other, except in case of an over hanging cliff.

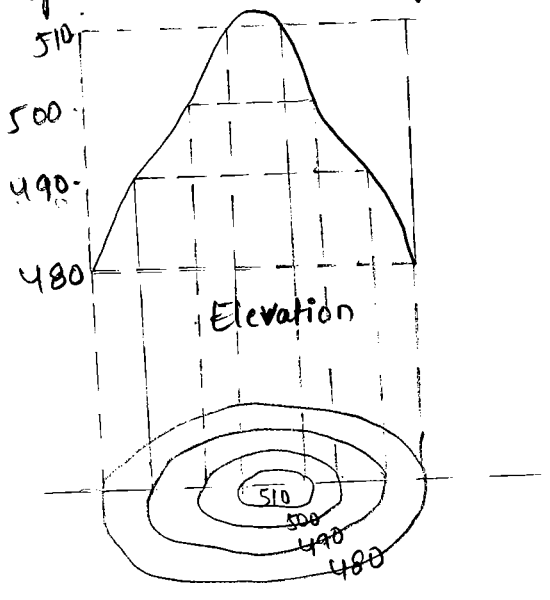


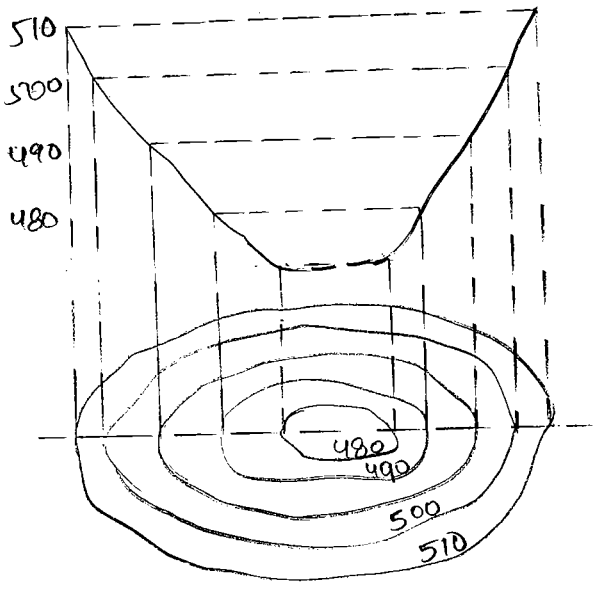
(a) over hanging cliff (elevation)

8. (A ridge) When horizontal equivalent b/w the contour lines is zero they coincide to form a one line and indicate a vertical cliff.

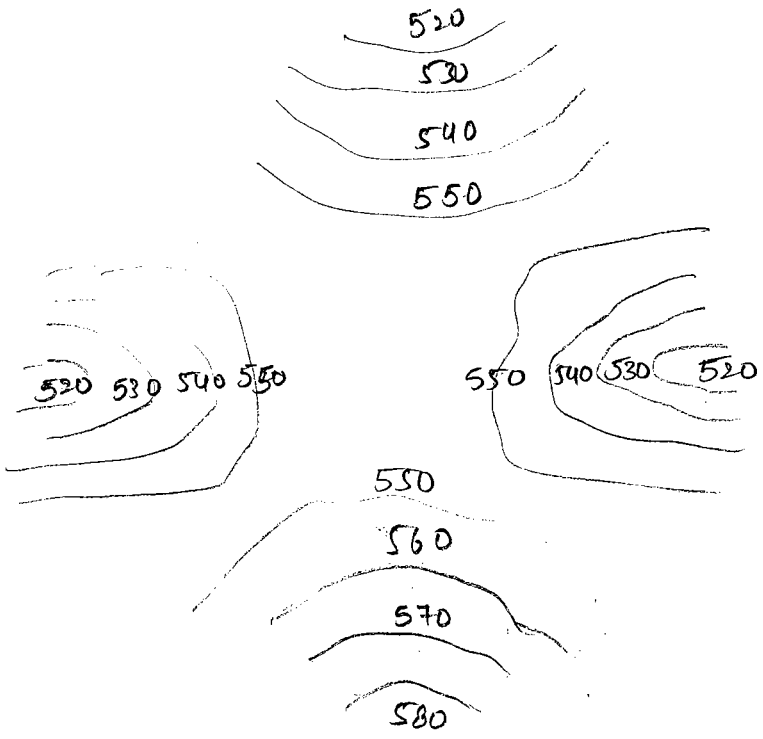


9. A Series of closed contour lines on plan or map indicates either hill or depression. In case of hill the value of elevation go on increasing towards the centre where as in case of depression these values goes on decreasing towards center.





9. The contour lines form fair loops in the case of 'saddles'. In this case, ground is sloping upwards on two sides and sloping downwards on the other 2 sides.



10. Irregular Contours indicates rough rugged terrain where as smooth contour denote gradual slopes and changes.

* Explain the classification of direct levelling?

Ans: 1. Simple levelling:-

This is the easiest method. The method is used for determination the difference of elevations of two points.

2. Differential levelling:-

This method is used when the two points whose difference of elevations is required are situated quite apart or when difference of elevation is high.

3. Check Levelling:-

It is a type of differential levelling done for the purpose of checking of elevation which have already been obtained.

4. Fly levelling:-

This type of differential levelling is used for determination of approximately elevations of different points. The fly levelling is done with rapidity, but low precision is required.

5. Profile levelling:-

This is a type of differential levelling done for the purpose of determining the elevation of ground surface along fixed line.

6. Cross-Sectioning levelling:-

The profile levelling and cross section are similar. This type of differential levelling is to determine the difference of elevation of ground surface along the lines 1^{ar} to center line.

7. Reciprocal levelling. 8. Hypsometric levelling.

* What are different methods of plane surveying? Under what circumstances they are preferred? Also give salient features of this method?

Ans. Methods of plane Surveying:

There are mainly 4 Methods of plane table Surveying

(i) Radiation

(ii) Intersection or triangulation.

iii) Transversing

iv) Resection.

Triangulation Method:- (or) Intersection Method:-

Triangulation surveying is tracking and measurement of series or network of triangles to determine distance and relative positions of points spread over an area, by measuring length of one side of each triangle and deducing its angle and length of other two sides by observation from baseline.

Traversing Method:-

Traversing of survey by the chain angle method or chain transeversing in this method the entire work is done with a chain / tape only and the angle between the successive lines is measured with chain. Angles fixed by measurement are known as chain angles.

1. (i) Radiation plane table surveying is used when all the details are visible and accessible from one instrument station.

(ii) when the ground level is smooth and in level.

2. Triangulation method is used for plotting the details on maps.

3. Transversing method is used for laying down survey lines of a closed or unclosed traverse.

4. Resection method is for locating station points only one linear measurement is required in this method.

* Problems on leveling (Missing values):

check: $\Sigma B.S - \Sigma F.S$ = Rise − Fall = last R.L − first R.L

* H.I = R.L + B.S * R.L = H.I − I.S / F.S

①

Station	BS	IS	FS	R	F	R.L	Remarks
1.	2.150					450.000	
2.	1.645		?	0.500			
3.		2.345			?		
4.	?		1.965	?			
5.	2.050		1.825		0.400		
6.		?		?		451.73	
7.	-1.690		?	0.120			
8.	?		2.100		?		
9.			?	?		449.100	
	8.445		9.345				

801

Station	B.S	I.S	F.S	R	F	RL	REMARKS
1.	2.150					450.00	
2.	1.645		1.650	0.500		450.50	
3.		2.345			0.700	449.800	
4.	1.425		1.965	0.380		450.180	
5.	2.050		1.825		0.400	449.780	
6.		0.100		1.930		451.730	
7.	-1.690		-0.020	0.120		451.85	
8.	2.863		2.100		3.796	448.060	
9.			1.825	1.040		449.100	
	8.445		9.345	3.990	4.890		
	↓ ΣB.S		↓ ΣF.S	↓ ΣR	↓ ΣF		

Check:

$\Sigma B.S - \Sigma F.S$ = Rise − Fall = last R.L − first R.L

$-0.9 = -0.9 = -0.9$

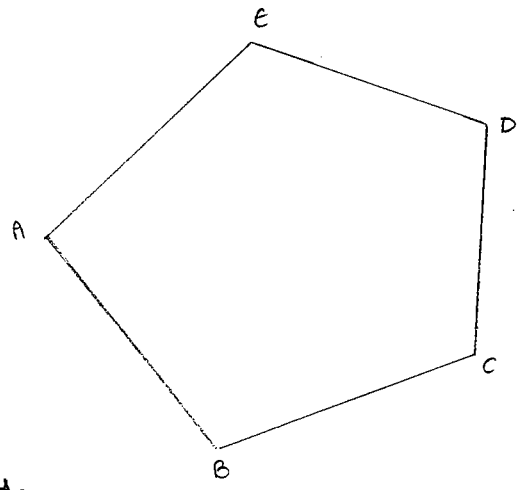
* problems on local attractions:

→ BB = FB + 180° (FB < 180°) → BB = FB − 180° (FB > 180°)

→ If FB of a line is given as QB. BB = FB = Numerically

→ Bearing of a line = Bearing of a preceeding line + Regular angle.

(2) A compan traverse ABCDEA was run anti clock wise & following bearings taken where local attractions were suspect.



line	FB	BB
AB	150° 0'	329° 45'
BC	77° 30'	256° 0'
CD	41° 30'	222° 45'
DE	314° 15'	134° 15'
EA	220° 15'	40° 15'

As FB & BB of EA differ by 180° station E & A are free from local attractions. Therefore, FB of AB & BB of DE are free from local attractions. Determine the local attraction.

Q1:

Correct FB of DE = $134^\circ 45' = 134^\circ 45' + 180^\circ = 314^\circ 45'$

Error at DE $= -314^\circ 45' + 314^\circ 15' = -30'$

correction $= +30'$.

BB of DC $= 222^\circ 45' + 30'$

$= 223^\circ 15'$

Correct FB of CD $= 223^\circ 15' - 180^\circ = 43^\circ 15'$

Error at CD $= 41^\circ 30' - 43^\circ 15' = -1^\circ 45'$

correction $= +1^\circ 45'$

BB of CB $= 256^\circ + 1^\circ 45' = 257^\circ 45'$

Correct FB of BC $= 257^\circ 45' - 180^\circ = 77^\circ 45'$

Error at BC $= 77^\circ 30' - 77^\circ 45' = -15'$

correction $= +15'$

BB of BA $= 329^\circ 45' + 15' = 330^\circ$.

Check:

Correct FB of AB $= 330^\circ - 180^\circ = 150^\circ$.

③ Explain the broad classification of surveying.

Ans: It is divided into 2types:

(a) primary surveying

(b) secondary surveying

(a) There are two types in primary surveying:-

→ plane surveying (< 250Km)

→ Geodetic surveying (> 250Km)

(b) Secondary surveying

(i) Based on plane:

* land survey
* Hydrological survey
* Topographical survey
* Areal survey
* Cadastral survey
* City survey
* Astronomical survey

(ii) Based on purpose:

* Engineering survey
* Geological survey
* Mine survey
* Defence survey
* Geographical survey
* Route survey
* Archeological survey

(iii) Based on instrument:

* chain surveying
* compan surveying
* Levelling
* plane table surveying
* Theodolite surveying.
* Tacheometric surveying
* photogramatic surveying
* (EDM) Electronic Distance Measurement surveying.

* Problems on chain correction:

④ A steel tape 30m long was standardised with a pull of 65N. If the pull at the time of measurement was 45N, find correction per tape length. Tape weighs 10N.

Take $E = 2 \times 10^5 \text{ N/mm}^2$ & Weight of $1m^3$ of steel as 77.10KN

Sol:

Let A be the cross-sectional area of tape in mm^2

Weight of $1mm^3$ steel $= \frac{77.10 \times 10^3}{10^9} = 77.1 \times 10^{-6} N$

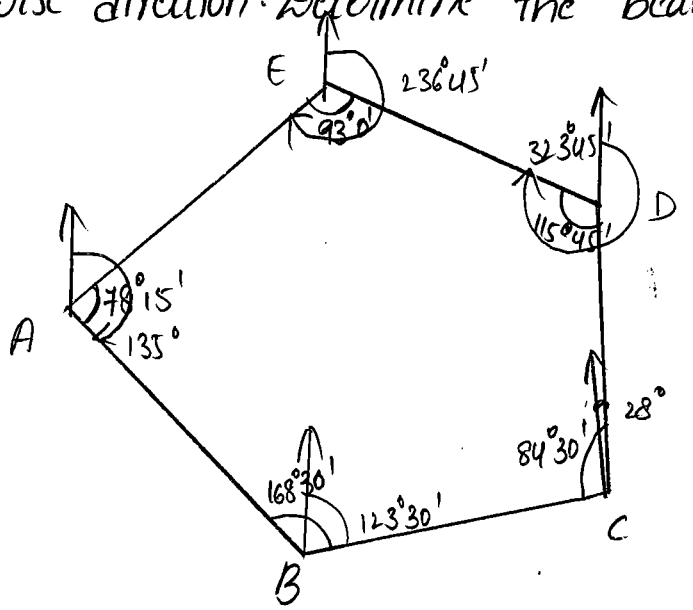
$\therefore A \times (30 \times 10^3) \times 77.1 \times 10^{-6} = 10$

$A = 4.323 mm^2$ $\left[\because C_p = \frac{(P - P_0)L}{AE}\right]$

$C_p = \frac{(45-65)30}{4.323 \times 2 \times 10^5} = -6.93 \times 10^{-4} m$

$\therefore C_p = -0.693 mm$

1. The following are the interior angle of closed traverse A,B,C,D,E $\angle A = 78°15'$, $\angle B = 168°30'$, $\angle C = 84°30'$, $\angle D = 115°45'$, $\angle E = 93°0'$ If the observed bearing of AB is 135° The traverse having beam run counter clock wise direction. Determine the bearing of remaining sides.



$$B \text{ of } BC = B \text{ of } BA + \angle B$$
$$= 315° + 168°30'$$
$$= 483°30' - 360°$$
$$= 123°30'$$

$$B \text{ of } BA = 135° + 180° = 315°$$

$$B \text{ of } CD = B \text{ of } CB + \angle C$$
$$= 303°30' + 84°30'$$
$$= 388° - 360°$$
$$= 28°$$

$$B \text{ of } CB = 123°30' + 180°$$
$$= 303°30'$$

B of DE = B of DC + LD

= 208° 0' + 115° 45'

= 323° 45'

B of DC = 28° + 180°

= 208°

B of EA = B of ED + LE

= 143° 45' + 93°

= 236° 45'

B of ED = 323° 45' - 180°

= 143° 45'

B of AB = B of AE + LA

= 135°

B of AE = 236° 45' - 180°

= 56° 45'

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2. The level values are 1.310, 2.100, 2.245, 1.420, 1.620, 2.150 The station shifted by third station. calculate R.L values if the bench mark is 100.

R.L = H.I - I.S

H.I = R.L + B.S

S.NO	B.S	I.S	F.S	H.I	R.L	Remarks
1	1.310			101.310	100	BM = 100
2		2.100			99.210	
3	1.420		2.245	100.485	99.065	T.P = 1
4		1.620			98.865	
5			2.150		98.335	
	2.730		4.395			

$\Sigma B.S - \Sigma F.S$ = Last R.L − First R.L

$2.730 - 4.395 = 98.335 - 100$

$-1.665 = -1.665$

Rise and fall method

S.NO	B.S	I.S	F.S	R	f	R.I	Remark.
1	1.310					100	BM=100
2		2.100			0.790	99.210	
3	1.420		2.245		0.145	99.065	
4		1.620			0.200	98.865	
5			2.150		0.530	98.335	
	2.730		4.395		1.665		

$\Sigma BS - \Sigma FS = 2.730 - 4.395 = -1.665$

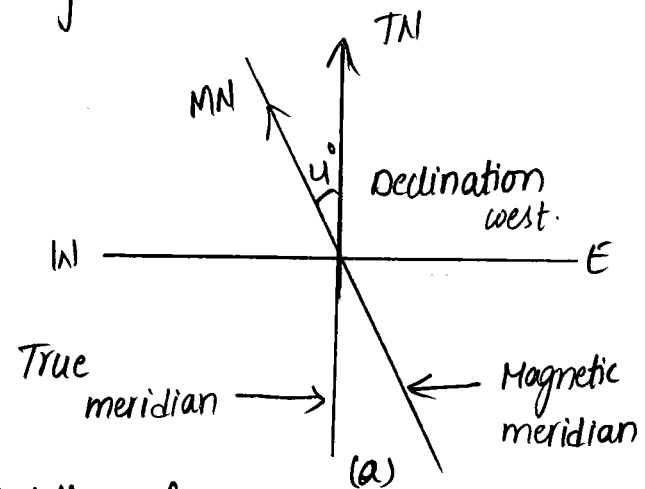
Last R.L − First R.L = $98.335 - 100 = -1.665$

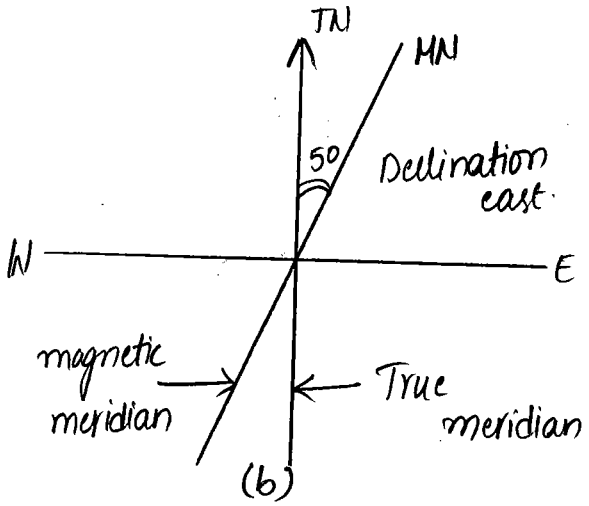
rise − fall = $0 - 1.665 = -1.665$

3). What is declination what are different types of variations in declination.

The magnetic meridian and the true meridian at a place generally do not coincide. The horizontal angle which the magnetic meridian makes with the true meridians is called the magnetic declination (or) simply declination.

1. The declination varies from one place to the other.
2. It also varies at the same place from time to time.
3. The variation of declination at various place is shown by isogonic lines.
4. The Isogonic lines do not form complete great circles.
5. Isogonic charts are maps showing, the isogonic lines of the region.
6. Agonic lines are special isogonic lines which pass through the point having declination.





Variation of magnetic declination :-

1. Secular variation
2. Annual variation
3. Diurnal variation
4. Irregular variation

1. Secural variation : Secular variation of declination occurs continuously over a long period of time.

Ex:- In London the declination was 11°E in 1580 and 24°W in 1820

2. Annual variation; The variation of declination in a year from the mean position of the year is called the annual variation.

3. Diurnal variation : The variation of the declination in one day from the mean position is called diurnal variation. The diurnal variation mainly depend upon the following factors

(i) Locality : It is greater at places near the poles than those near the equator. In generally as the latitude of the place increases, the diurnal variation also increases.

(ii) Season : It is greater in Summer than in winter.

iii Time: It is greater in day time and smaller during night hours. However, the rate of variation in 24 hrs of the day is quite irregular.

iv Year : The [diurnal] diurnal variation also changes from year to year.

4. Irregular variation ; Magnetic disturbances or magnetic storms in the earth's magnetic field cause irregular variation of the declination at a place.

Natural phenomena, such as Aurora Borealis, earth quakes, volcanic eruptions, also cause irregular variation of declination.

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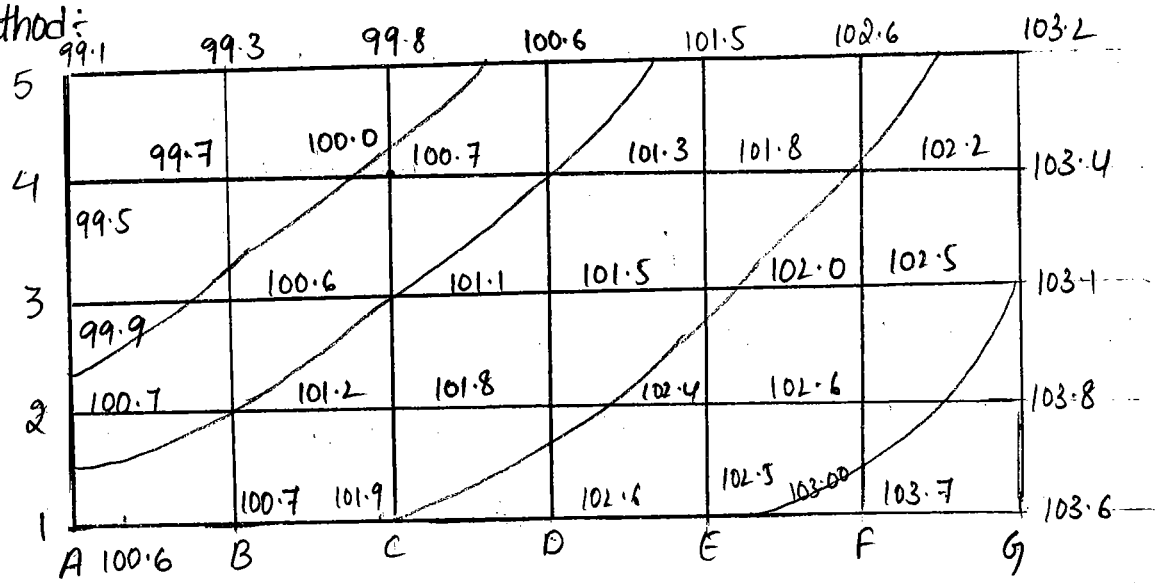
4 What are the indirect methods of locating in a contour write about any one method?

Ans: i Grid method

ii cross section method

3. Radial line method.

i Grid method:



1. The grid method is used when the area to be contoured is not very large and the ground is not much undulating.

2. If the area is not large, It is divided into a grid (or) series squares. The grid size may vary from 5m x 5m x 25m x 25m depending upon the nature of the ground, the contour interval and scale of the map.

The grid corner are marked on ground and spot levels of these corners are determined.

3. The grid is plotted to the scale of the map and the spot levels of the grid corners are entered, the contours of desired values are then locked by interpolation.

4. Theodolite is used to layout the lines at right angles to each other.

5. Tape (or) cross staff may also be used if theodolite is not available.