Let l = length of AB, and θ = bearing of AB

Since, in a closed traverse, the algebraic sum of latitude and departures must be equal to zero, therefore

$$-96.24 - 172.32 - 61.55 + l\cos\theta = 0$$

or $$l\cos\theta = 330.11 \quad ...(i)$$

and $$+115.1 - 101.50 - 108.79 + \sin\theta = 0$$

or $$l\sin\theta = 94.58 \quad ...(ii)$$

Since the latitude and departure are both positive, the line AB lies in the NE Quadrant.

From equations (i) and (ii), we get

$$\tan\theta = \frac{94.58}{300.11}$$

or $$\theta = 15\square 59'$$

$\therefore$ Bearing of AB = N 15° 59′ E

Line	Length m (L)	R.B. (0)	Latitude (L cos θ)	Departure (L sin θ)
BQ	150.5	50°15′ SE	150.5 cos 50°15′ = – 96.24	150.5 sin 50°15' = + 115.71
QP	200.0	30°30′ SW	200.0 cos 30°30′ = 72.32	200 sin 30°30' =–101.50
PA	125.0	60°65′ SW	125.0 cos 60°30′ = –61.55	125.0 sin 60°30′ = –108.79
AB	l	θ	l cos θ	l sin θ

Length AB $= \sqrt{330.11^2 + 94.58^2} = \mathbf{343.39\ m}$

$\angle$PAB = BB of AP – FB of AB

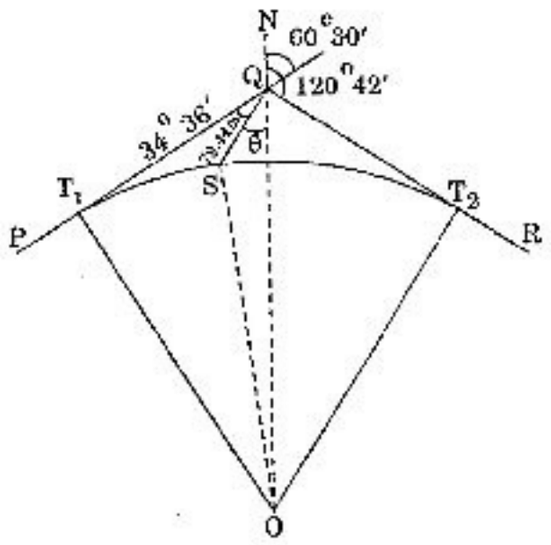
$= 60°30' - 15°59' = \mathbf{44°31'}$

$\angle$QBA = FB of BQ + BB of AB

$= 50°15' + 15°59' = \mathbf{66°14'}$

7. A right hand circular curve is to connect two straights PQ and QR, the bearings of which are 60°30′ and 120°42′ respectively. The curve is to pas through a point S such that QS is 79.44 m and the angle PQS is 34°36′. Determine the radius of the curve.

If the chainge of the intersection point is 2049.20 m, determine the tangential angles required to set out the first two pags on the curve at through chainage of 20 m.



Solution. Let O be the centre of the curve

We know, $(\cos\alpha + \theta) = \cos\dfrac{\dfrac{\alpha+\Delta}{2}}{\dfrac{\cos\Delta}{2}}$

where $\alpha = 34°36'$

Δ = Bearing of QR – Bearing of PQ

$= 120°42' - 60°30' = 60°12'$

θ = angle SQO

$\therefore \quad \cos(34°36' + 0) = \dfrac{\cos(34°36' + 30° + 06')}{\cos 30°06'}$

$= \dfrac{\cos 64°42'}{\cos 30°06'} = 49396926$

or $34°36' + ' = 60°23'54''$

$\therefore \quad \theta = 25°47'24''$

Again, $R = \dfrac{Z\sin\alpha}{1-\cos\theta} = \dfrac{79.44\sin 34°36'}{1-\cos 25°47'54''}$

$= \mathbf{452 - 60\ m}$

$\therefore$ Length of the tangent,

$$T_1Q = R\tan\frac{\Delta}{2}$$

$= 452.60 \tan 30°6' = 262.36$ m

Given, Chainage of point of intersection,

$Q = 2049.20$ m

$\therefore$ Chainage of point of commencement

T_1 = Chainage of Q – Length of tangent T_1Q

$= 2059.200 - 262.36 = 1786.84$ m

$= (89 \times 20 + 6.84)$ m

Trangential angle, $\delta = \dfrac{1718.9}{R} \times c_1$,

where c_1 is chord length

$\therefore \quad \delta_1 = \dfrac{1718.9}{452.6} \times 6.84 = 0°\ 25'58.4''$

and $\delta_2 = \dfrac{1718.9}{453.6} \times 20 = 1°55'\ 57.4''$

Total trangential angles are,

$D_1 = \delta_1 = 0\square 25'58.4''$

and $\Delta_2 = \delta_1 + \delta_2 = 1\square 41'55.8''$

8. A 1.5% gradient meets a – 0.5% gradient at a chainage of 10000 m and reduced level of 75 m. The sight distance is 300 m. Determine the length of the vertical curve and the R.L. of the tangent points. Assume that the eye level of the driver is 1.125 m above the road surface.

Solution. Given :

$$g_1 = +1.5\%, g_2 = -1.5\%, s = 300 \text{ m},$$

Driver's eye above the road

$$h_1 = 1.125 \text{ m},$$

Assumed height of obstruction,

$$h_2 = 0.1 \text{ m}$$

Length of vertical curve,

$$L = \frac{s^2(g_1 - g_2)}{200\left(\sqrt{h_2} + \sqrt{h_2}\right)}$$

$$= \frac{300 \times 300\left[(1.5 + 0.5)\right]}{200\left(\sqrt{1.125} + \sqrt{0.1}\right)^2}$$

$$= 474.72 \text{ say } \mathbf{480 \text{ m}}$$

R.L. of point of commencement

$$= \text{R.L. of submit} - \frac{1.5}{100} \times 240$$

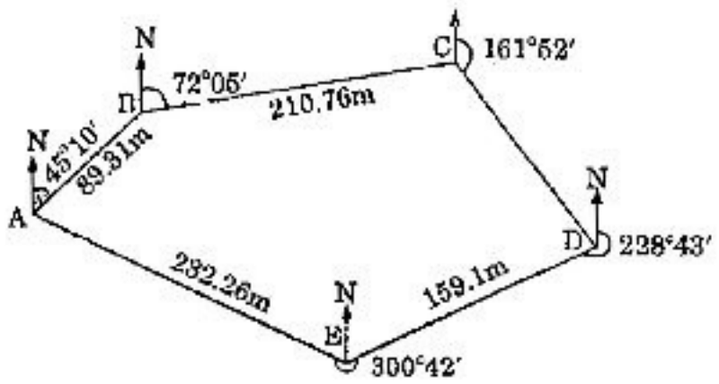
$$= 75.00 - 3.6 = \mathbf{71.4 \text{ m}}$$

$$= \text{R.L. of submit} - \frac{0.5}{100} \times 240$$

$$= 75.00 - 1.2 = \mathbf{73.8 \text{ m}}$$

9. Calculate latitudes, departures, and closing error for the following traverse, and adjust using Bowditch's rule :

Line	Length (m)	Whole circle bearing
AB	89.31	45° 10'
EC	219.76	72°05'
CD	151.18	161° 52'
DE	159.10	228° 43'
EA	232.26	300° 42'



Solution. Let ABCDEA, be the given traverse.

Line	Length	R.B.
AB	89.31	N 45° 10' E
BC	219.76	N 72° 05' E
CD	151.18	S 161° 52' E
DE	159.10	S 228° 43' M
EA	232.26	N 300° 42' W

Latitudes :

Latitude of AB = 89.31 cos 45° 10'
= 62.97 (–ve)

Latitude of BC = 219.76 cos 72° 05'
= 67.61 (+ve)

Latitude of CC = 151.18 cos 18° 08'
= 143.67 (–ve)

Latitude of DE = 159.10 cos 48° 43'
= 104.97 (+ve)

Latitude of EA = 232.26 cos 59° 18'
= 118.58 (+ve)

Algebraic sum = + 0.52

Departures :

Departure of AB = 89.31 sin 45° 10'
= 6.34 (+ve)

Departure of BC = 219.76 sin 72° 05'
= 209.10 (+ve)

Departure of CD = 151.18 sin 18° 08'
= 47.05 (+ve)

Departure of DE = 159.10 cos 48° 43'
= 119.16 (–ve)

Departure of EA = 232.26 sin 59° 18'
= 199.71 (–ve)

Algebraic sum = + 0.22

Let θ be the reduced bearing of closing line A′ A,

hence $\tan \theta = \frac{0.22}{0.52} = 22°55'56''$

Length of the closing error A′

$$A = \sqrt{(0.22)^2 + (0.52)^2}$$

$$= \mathbf{0.565 \text{ m}}$$

Perimeter of the traverse = 89.31 + 219.76 + 151.18
+ 159.10 4– 232.26

$$= \mathbf{851.61 \text{ cm}}$$

Corrections to Latitudes

Correction for AB $= \frac{89.31}{851.61} \times 0.52 = 0.06$

Correction for BC $= \frac{219.76}{851.61} \times 0.52 = 0.13$

Correction for CD $= \frac{151.81}{851.61} \times 0.52 = 0.09$

Correction for DE $= \frac{159.10}{851.61} \times 0.52 = 0.10$

Correction for EA $= \frac{232.26}{851.61} \times 0.52 = 0.14$

Total = 0.52

Corrections to Departures

$$\text{Correction for AB} = \frac{89.31}{851.61} \times 0.22 = 0.22$$

$$\text{Correction for BC} = \frac{219.76}{851.61} \times 0.22 = 0.06$$

$$\text{Correction for CD} = \frac{151.81}{851.61} \times 0.22 = 0.04$$

$$\text{Correction for DE} = \frac{159.10}{851.61} \times 022 = 0.04$$

$$\text{Correction for EA} = \frac{232.26}{851.61} \times 0.22 = 0.06$$

Total = 0.22

As errors of latitudes and departures are positive, their corrections are therefore of negative sign.

Corrected Latitudes

Side	Latitude	Correction	Corrected latitudes
AB	62.97	–0.06	+ 62.91
BC	67.61	–0.13	+ 67.48
CD	– 143.67	–0.09	– 143.76
DE	– 104.97	–0.10	– 105.07
EA	– 118.51	–0.14	– 118.44
		Algebraic sum = 0.00	

Corrected Departure

Side	Departure	Correction	Corrected Departures
AB	63.34	– 0.02	63.32
BC	209.10	– 0.06	209.04
CD	47.05	– 0.04	47.01
DE	– 119.65	– 0.04	– 119.60
EA	– 199.71	– 0.06	– 199.77
		Algebraic sum = 0.00	

10. Adjust the following angles closing the horizon :

P = 110° 20′48″	weight 4
Q = 92 °30′12″	weight 1
R = 56°12′00″	weight 2
S = 100°57′04″	weights 3

Solution. Σ Angles = 360° 00′ 04″

Total correction = 04″

The error of 04″ will be distributed to the angles in an inverse proportion to their weights. Let c_1, c_2, c_3 and c_4 be the corrections to the observed angles P, Q, R and S respectively.

$$c_1 : c_2 : c_3 : c_4 :: \frac{1}{4} : \frac{1}{1} : \frac{1}{2} : \frac{1}{3}$$

or $$c_1 : c_2 : c_3 : c_4 :: 1 : 4 : 2 : \frac{4}{3}$$

Also $$c_1 + c_2 + c_3 + c_4 = 04''$$

i.e., $$c_1 + 4c_1 + 2c_1 + \frac{4}{3}c_1 = 04''$$

$$\therefore \quad c_1 = 0.48$$

Hence, corrected angles are

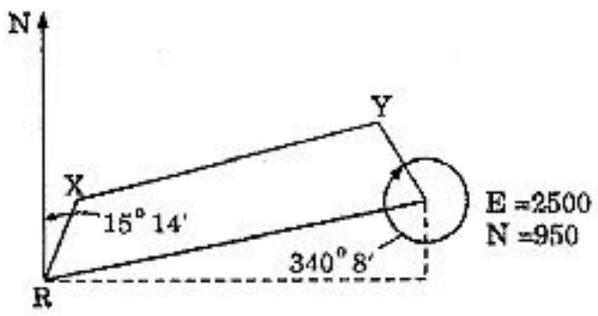
P = 110° 20′ 48″ – (0.48″)
= 110° 20′ 47.52″
Q = 92° 30′ 12″ – (1.92″)
= 92° 30′ 1,0.08″
R = 56° 12′ 00″ – (0.96″)
= 56° 11′ 59.04″
S = 100° 57′04″ – (0.64″)
= 11° 57′ 03.36″
Σ angles = 360°00′00″

11. To determine the distance between two points X and Y and their elevations, the following observations were taken upon vertically held staves from two trovers stations R and S. The techeometer was fitted with an anallatic lens and the instrument constant was 100.

Traverse station	R.L.	Height of Instrument	Co-ordinates		Staff Station	Bearing	Vertical Angle	Staff Reading		
R	1020.60	1.50	800	1800	X	15°14′	+ 8°9′	1.10	1.58	2.60
S	1021.21	1.53	950	1250	Y	340°18′	+ 2°3′	1.32	1.91	2.50

Compute the distance XY, the gradient from X toY and the bearing XY.

Solution. Observations at Station R.



Given : $s_1 = 2.60 - 1.10 = 1.50$ m

$\theta_1 = 8° 9'$

$f_2 = 100$

Horizontal distance, $RX = \frac{f}{i} s_1 \cos^2 \theta_1$

$= 100 \times 1.50 \times \cos^2 8° 9'$

$= 146.99$ m

Vertical component, $V_1 = \frac{f}{i} s_1 \frac{\sin 2\theta}{2}$

$= 100 \times 150 \times \frac{\sin 60°18'}{2}$

$= 21.05$ m

Observation from Station S

Given, $s_2 = 2.50 - 1.32 = 1.18$ m

$\theta_2 = 2° 3'$,

$\frac{f}{i} = 100$

Horizontal distance, $SY = \frac{f}{i} S_2 \cos^2 \theta_2$

$= 100 \times 1.18 \times \cos^2 2° 3'$

$= 117.8$ m

Vertical component, $V_2 = \frac{f}{i} s_1 \frac{\sin 2\theta}{2}$

$= 100 \times 1.18 \times \frac{\sin 4°6'}{2}$

$= 4.22$ m

Consecutive Co-ordinates

Latitude of RX $= 146.99 \cos 15° 14'$

$= 141.83$ m

Departure of RX $= 146.99 \sin 15° 14'$

$= 38.62$ m

Latitude of RY $= 117.85 \cos 19° 42'$

$= 110.95$ m

Departure or RY $= 117.85 \cos 19° 42'$

$= 39.73$ m

Coordinates of X :

Easting of R $= 1800 + 38.62$

$= 183.62$ m

Northing of R $= 800 + 141.83$

$= 941.83$ m

R.L,of X $=$ R.L. of S + H.I. + V_1

$= 1020.60 + 1.50 + 21.50$

$= 1043.15$ m

Co-ordinates of Y :

Easting of S $= 2500 - 39.73$

$= 2460.27$ m

Northing of S $= 950 + 110.95$

$= 1060.95$ m

RL of X $=$ R.L. of s + H.I.+ V

$= 1021.21 + 1.53 + 4.22$

$=$ **1026.96 m**

Distance XY

$= \sqrt{(2400 - 1838.62)^2 + (1060.95 - 941.83)^2}$

$=$ **632.96m**

Difference in elevations of points X and Y

$= 1043.15 - 1026.96 = 16.19$, X being higher

Gradient from X and Y= $\frac{632.96}{16.19} = 1$ in 39.10 falling

Let q be the reduced bearing of XY.

Difference in eastings of X and Y.

$\Delta E = 2460 - 941.83 = 119.12$

$\tan q = \frac{\Delta E}{\Delta N} = \frac{621.65}{119.12}$

$= 5.18687$

$\therefore \quad \theta = 79° 09' 9''$

Bearing of XY $= 79° 09'9''$

Distance XY $= 632.96$ m

RL of X $= 1043.15$ m

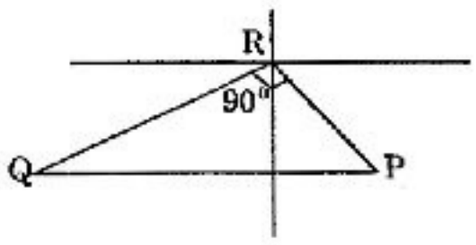
R.L. of Y $= 1026.96$ m

Gradient from X to Y $=$ 1 in 39.10 falling

12. Determine the gradient from a point P, to another point Q from the following observations made with a techeometer fitted with an anallatic lens. The constant of the instrument was 100 and the staff held vertically.

Traverse Station	Staff station	Bearing	Vertical Angle	Staff Readings
R	P	130°	+ 10□32′	1.255, 1.810, 2.365
	Q	120°	+ 05□06′	1.300, 2.120, 2940

Solution. At station P



s = staff intercept = $(2.356 - 1.255)$

$= 1.110$ m

V = vertical intercept

$= ks \frac{\sin 2\theta}{2} + c \sin \theta$

$$= 100 \times 1.110 \times \frac{\sin 21°04'}{2} + 0(\sin\theta)$$

$$= 20.49 \text{ m}$$

D = Horizontal distance

$= ks \cos^2\theta + c \cos\theta$

$= 100 \times 1.110 \times \cos^2 10° 32'$

$= 107.337 = \text{RP}$

At station Q

$s = (2.940 - 1.300) = 1.64\text{m},$

$c = 0, \quad \theta = 5° 06' = 5.10°$

$$V = ks\frac{\sin 2\theta}{2} + 2\sin\theta$$

$$= 100 \times 1.64 \times \frac{\sin 10.2°}{2} + 0$$

$$= 29.042 \text{ m}$$

$D = ks \cos^2\theta + c \cos\theta$

$= 100 \times 1.64 \cos 2 (5.1°) + 0$

$= 161.418 \text{ m} = \text{RQ}$

Difference in height between stations P and Q

$= (29.042\ 20.49) = 8.552 \text{ m}$

P is at higher and $QP = \sqrt{RP^2 RQ^2}$

$$= \sqrt{107.337^2 + 161.418^2}$$

$= 193.65 \text{ m}$

Gradient P towards Q

$$= \frac{\text{Difference in height between P and Q}}{\text{Rising P towards Q}}$$

$$= \frac{8.552}{193.65} = \mathbf{0.044}$$

13. From a satellite station S, 5.8 metres from the main triangulation station A, the following directions were observed :

A	0°	0′	0″
B	132°	18′	0″
C	232°	24′	0″
D	296°	6′	11″

The length AB, AC and AD were computed to be 3265.5 m, 4020.2 m and 3086.4 m respectively. Determine the directions ofAB, AC and AD.

Solution. The correction to any direction is given by,

$$\beta = \frac{d\sin\theta}{\Delta \sin 1''} \text{ seconds}$$

(*i*) For the line AB

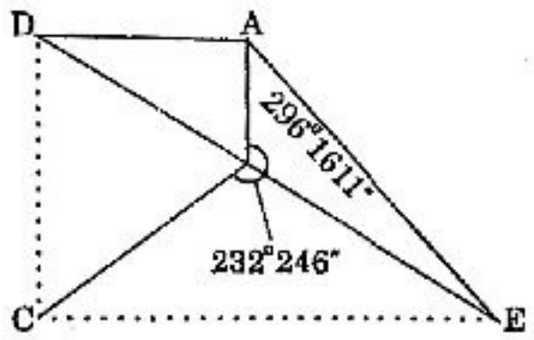
θ = angle reduced to the direction

SA = 132° 18′ 30″

d = AS = 5.8m

D = AB = 3265.5

$$\therefore \quad \beta = \frac{5.8\sin 132°18'30''}{3265.6} \times 206265 \text{ seconds}$$



$= + 270.9''$

$= + 4' 30.9''$

$\therefore$ Direction on AB = direction of SB

$= \beta$

$= 132° 18' 30.0''$

$= 132° 23' 0.9''$

(*ii*) For the line AC

θ angle reduced to the direction

S = 232° 24′6″

D = AC

= 4022.2m

$$\therefore \quad \beta = \frac{5.8\sin 232°24'6''}{4022.2} \times 206205 \text{ seconds}$$

$= - 3' 55.7''$

$\therefore$ Direction of AC = Direction of SC + β

$= 232° 24' 6'' - 3' 55.7''$

$= 232° 20' 4.3''$

(*iii*) For the line AD

θ = angle reduced to the direction

SA = 269. 6′ 11″

D = Ad

$= 3086.4 \text{ m}$

$$\therefore \quad \beta = \frac{5.8\sin 296°16'11''}{3086.4} \times 206265 \text{ seconds}$$

$= - 348.1$ seconds

$= - 5' 48.1''$

$\therefore$ Direction of AD = Direction of SD = π

$= 296° 6' - 5\ 48.1''$

$= 296° 0' 22.9''$

EXERCISE - I

1. Principle of surveying followed to prevent accumulation of errors is
(*a*) to work from whole to a part
(*b*) to work from part to whole
(*c*) both (*a*) and (*b*) above
(*d*) none of the above

2. Geodetic survey is different from plane surveying because of
(*a*) very large area is covered.
(*b*) the curvature of the earth is considered.
(*c*) undulations of the topography.
(*d*) the large difference of elevations

3. Difference in the length of an arc and its subtended chord on earth's surface for a distance of 18.5 km is
(*a*) 10 mm (*b*) 15 mm
(*c*) 22 mm (*d*) 100 mm

4. For a survey to be classed as plane, difference between the sum of angles of spherical triangle and that of plane triangle is only one second at the earth's mean surface for an area of
(*a*) 160 km^2 (*b*) 195.5 km^2
(*c*) 260 km^2 (*d*) 282.5 km^2

5. Chain surveying is most suitable when
(*a*) the ground is fairly level and open with simple details.
(*b*) the area is small in extent.
(*c*) plans are required on a large scale.
(*d*) All of the above

6. If s is the value of one smallest division on main scale, v is the value of one smallest divisioin on the vernier and n is the number of divisions on the vernier, then least count is given by
(*a*) $\frac{s}{n}$ (*b*) $\frac{s}{n-1}$
(*c*) $\frac{(s+1)}{n}$ (*d*) $\frac{(n-1)}{n}s$

7. A discrepancy is the difference between
(*a*) true value and error
(*b*) measured value and actual value
(*c*) two measured values of the same quantity
(*d*) None of the above.

8. Every 20 m chain should be accurate to within
(*a*) ± 2 mm (*b*) ± 5 mm
(*c*) ± 8 mm (*d*) None of the above

9. Off sets are
(*a*) chain lines out of alignment
(*b*) small measurements from chain line
(*c*) measurements taken in chain surveying
(*d*) none of the above.

10. Compensating errors in chaining are
(*a*) proportional to the length of the line
(*b*) proportional to the square root of the length of the line
(*c*) inversely proportional to the square root of the length of the line.
(*d*) inversely proportional to the length of the line.

11. An error under the same conditions always of the same size and sign, is called as
(*a*) Uniform error
(*b*) Systematic error
(*c*) Cumulative error
(*d*) Any of (*b*) and (*c*) above

12. Most probable value of an observed quantity available from a given set of observation is the one for which the sum of the square of errors is a minimum. This statement is called as
(*a*) Principal of least square.
(*b*) Law of errors.
(*c*) Principle of square errors.
(*d*) None of the above.

13. A 30 m chain was found to be 20 cm too long after chaining 1500 m. The correct length of the total distance chained will be
(*a*) 1495 m (*b*) 1500 m
(*c*) 1505 m (*d*) None of the above

14. Ranging is the process of
(*a*) marking some intermediate points in a straight line, joining the two end points in the field
(*b*) fixing ranging rods on the extremities of the area.
(*c*) taking offsets from a chain line
(*d*) none of the above.

15. The longest chain line passing through the centre of the area is known as
(*a*) Baseline
(*b*) Tie line
(*c*) Check line
(*d*) All the above.

16. The tie line is run throught the survey to
(*a*) take offsets for detailed surveying
(*b*) take details of nearby objects
(*c*) check accuracy of work
(*d*) none of the above.

17. Permissible limits of error in chaining for measurement on rough or hilly ground is
(*a*) 1 : 2000 (*b*) 1 : 1000
(*c*) 1 : 500 (*d*) 1 : 250

18. Positive error is caused if
(*a*) length of chain is shorter than the standard.
(*b*) slope and sag corrections is not applied.
(*c*) measurements are made along the - incorrectly aligned line.
(*d*) all of the above.

19. The base line is measured with
(*a*) metallic tape (*b*) steel tape
(*c*) Invar tape (*d*) chain.

20. Metallic tapes are made of
(*a*) Steel (*b*) Invar
(*c*) Cloth and wires (*d*) Nickel.

21. For accurate work, in comparison to chain, the steel band is used because it is
(*a*) light in weight
(*b*) easy to handle
(*c*) practically inextensible.
(*d*) all of the above.

22. If W is weight of the chain, L is the span and P is the tension or pull, the sag correction for chain line will be
(*a*) $\frac{W^2L^2}{24P^2}$ (*b*) $\frac{W^2L}{24P}$
(*c*) $\frac{W^2L}{24P^2}$ (*d*) $\frac{W^2L^2}{24P}$

23. If θ is the angle of slope, L is length of slope and His the difference in elevation between the two ends of the line, then slope correction will be
(*a*) L sin θ (*b*) 2L sin $\theta/2$
(*c*) L sin $\theta/2$ (*d*) 2L sin 2θ

24. The angle that can be set by French cross staff is
(*a*) 45° (*b*) 90°
(*c*) 45° or 90° (*d*) none of the above.

25. The method of offset laying involving minimum measurement on the ground is
(*a*) perpendicular off set method
(*b*) oblique offset method
(*c*) tie offset method
(*d*) none of the above.

26. The sag correction is always
(*a*) positive (*b*) negative
(*c*) zero (*d*) none of above.

27. Open cross staff is used for setting out
(*a*) long offsets (*b*) short offsets
(*c*) oblique offsets (*d*) none of the above.

28. The angle of intersection of horizon mirror and index mirror of an optical square is
(*a*) 30° (*b*) 45°
(*c*) 105° (*d*) 120°

29. A river is an obstacle to
(*a*) chaining but not ranging
(*b*) ranging but not chaining
(*c*) both chaining and ranging
(*d*) none of the above.

30. A building is an obstacle to
(*a*) chaining but not ranging
(*b*) ranging but not chaining
(*c*) both chaining and raning
(*d*) none of the above.

31. Angles of 45° with chain line may be set out with
(*a*) optical square (*b*) prismatic square
(*c*) open cross staff (*d*) French cross staff

32. In compass surveying
(*a*) the direction and lengths of survey line is measured by compass
(*b*) the direction is measured by compass
(*c*) length is measured by the chain or tape
(*d*) both (*b*) and (*c*) above

33. Graduations in a prismatic compass are
(*a*) inverted and run clockewise having 0° at north
(*b*) inverted and run clockwise having 0° at south
(*c*) erect
(*d*) none of the above.

34. In a prismatic compass
(*a*) magnetic needle moves with the box
(*b*) magnetic needle and graduated circle do not move with the box
(*c*) line of sight does not move with box
(*d*) graduated circle is fixed to the box and the magnetic needle always remains in the N – S direction

35. True meridians
(*a*) are parallel to each other
(*b*) converge at a point called pole
(*c*) converge near equator
(*d*) none of the above.

36. A negative declination shows the magnetic meridian to the

(*a*) eastern side of the true meridian

(*b*) western side of the true meridian

(*c*) southern side of the true meridian

(*d*) none of the above.

37. Isogonic lines are

(*a*) lines passing through points having same declination at a given point

(*b*) line passing through point of zero declination

(*c*) line passing through point having same dip

(*d*) line passing through point having zero dip.

38. In survey works declinations varies from time to time andplace to place. The most important variation is

(*a*) Secular variation (*b*) Annual variation

(*c*) Duirnal variation (*d*) Irregular variation

39. Angle of dip at pole is

(*a*) 0° (*b*) 90°

(*c*) 45° (*d*) 30°

40. The true bearing of a line can be calculated as

(*a*) True bearing = magnetic bearing + magnetic declination

(*b*) True bearing = magnetic bearing - magnetic declination

(*c*) True bearing = magnetic declination - magnetic bearing

(*d*) None of the above

where the declination is to the east

41. If the magnetic declination is (–) 6 Wand the reduced bearing of a line is S 40°0′E the true bearing of the line is

(*a*) S 134° 0′ E (*b*) S 146°0′ E

(*c*) S 46°0′ E (*d*) S 34°0′ E

42. With regards to traversing

1. South coordinate is an example of negative coordinate.
2. Plotting by consecutive coordinates is better than by independent coordinates.
3. In an open traverse the angular error is determined by astronomical observations.

Select the correct answer using the cods given below :

(*a*) 1 and 2

(*b*) 2 and 3

(*c*) 3 and 1

(*d*) 1, 2 and 3

43. In Bowditch rule of traverse adjustment it is assumed that the errors in the linear measurements are

(*a*) proportional to $\sqrt{L}$

(*b*) proportional to L

(*c*) inversely proportional to $\sqrt{L}$

(*d*) inversely proportional to L

44. A bearing noted 45°NE represents

(*a*) Quadrantal system

(*b*) Whole circle system

(*c*) Reduced bearing system

(*d*) None of the above

45. The prismatic compass and surveyor's compass respectively give

(*a*) whole circle bearing of a line and quadrantal bearing of a line.

(*b*) both quadrantal bearing of a line

(*c*) both whole circle bearing of a line

(*d*) quandrantal and whole circle bearing of a line

46. Local attraction in a compass surveying may be due to

(*a*) faulty adjustment in compass

(*b*) due to presence of magnetic materials

(*c*) loss of magnetism in the needle

(*d*) friction of the needle at the point.

47. The closing error in a traverse is adjusted by

(*a*) elimination the error and modifying the shape

(*b*) the error is distributed to all stations proportionately by shifting the station parallel to the direction of closing error

(*c*) the error is distributed to all stations proportionately by shifting the stations perpndicular to the direction of closing error.

(*d*) none of the above.

48. Inclination of the needle to the horizontal towards the pole is called

(*a*) Dip

(*b*) Declination

(*c*) Azimuth

(*d*) Bearing

49. The dip of the needle

(*a*) is constant

(*b*) varies from place to place & is zero at the equator and maximum at the poles

(*c*) is zero at the equator and poles

(*d*) none of the above.

50. Magnetic declination
(*a*) remains same at different places
(*b*) varies from place to place
(*c*) does not vary with temperature
(*d*) none of the above.

51. The foremost work to be executed while traversing with a compass is
(*a*) marking and referencing of stations
(*b*) running survey lines
(*c*) picking up of details
(*d*) reconnaissance

52. If the needle of the compass is sluggish, the type of error will be
(*a*) Instrumental error (*b*) Personal error
(*c*) Natural error (*d*) None of the above.

53. For a station to be free of local attraction
(*a*) the fore and back bearings of line should be measured accurately
(*b*) the fore and back bearings of line should differ by exactly 180°
(*c*) the fore and back bearing of the line should be exactly same but with opposite signs
(*d*) None of the above.

54. The maximum prmissible differnce allowed while taking down the fore bearing and back bearing of a line is
(*a*) 15′ (*b*) 15″
(*c*) no such limit (*d*) 1°

55. If the sights are vertical
(*a*) the eye vane and object vane will be ir same live
(*b*) the eye vane, object vane and string w be parallel and in same line
(*c*) there will be no local attraction
(*d*) none of the above

56. The temporary adjustment of a prismatic compass are
(*a*) centring (*b*) adjustment of levels
(*c*) adjustment of needle (*d*) adjustment of van.

57. The process of establishing intermediate points, betwen two end ponints which are not intervisible, with the help of a theodolite is known as
(*a*) ranging (*b*) interpolation
(*c*) lining-in (*d*) balancing-in

58. Spire test is used for adjustment of
(*a*) line of sight
(*b*) horizontal axis
(*c*) vertical axis
(*d*) adjustment of altitude bubble

59. In theodolites
(*a*) A telescop is said to normal when its vertical circle is to the left of the observer and bubble is down.
(*b*) The levelling is quicker if the levelling head is provided with thre foot screws than that with four foot screws.
(*c*) Error due to line of collimation not being perpendicular to vertical axis of a theodolite is eliminated by changing face.
(*d*) The repetition method of angle measurement eliminates the error due to displacement of station signals.

60. Difference between a level line and a horizontal line is that
(*a*) level line is normal to plumb line while horizontal line is not necessarily.
(*b*) level line is curved but horizontal line is a straight line
(*c*) both lines are same lines
(*d*) none of the above.

61. A staff reading taken on a bench mark or change point is known as
(*a*) Backsight (*b*) Fore sight
(*c*) Intermediate sight (*d*) None of the above.

62. The observation is taken on a turning point is
(*a*) Fore sight
(*b*) Backsight
(*c*) Both fore sight and back sight
(*d*) None of the above.

63. Are operation for determining the relative elevations of diffrentpoints on the surface of the earth is known as
(*a*) levelling
(*b*) simple levelling
(*c*) Differential levelling
(*d*) longitudinal levelling.

64. In a dumpy level, the objective and eyepiece lenses are made of two or more small lenses to obtain
(*a*) distinct image
(*b*) shorter focal length
(*c*) reading even in less light
(*d*) all of the above.

65. The absence of spherical aberration in a telescope is known as
(*a*) Achromation (*b*) Chromitation
(*c*) Aplanation (*d*) Ablation

66. In an interfocussing type of telescope, the Ins provided is
(*a*) convex lens (*b*) concave lens
(*c*) plano concave lens (*d*) convex concave lens.

67. In a constant level tube, size of the bubble remains constant because upper wall of tube has
(*a*) relatively small radius
(*b*) relatively large radius
(*c*) flat
(*d*) none of the above.

68. Sensitivity of a level tube is expressed by
(*a*) length of level tube
(*b*) radius of level tube
(*c*) length of bubble of level tube
(*d*) all of the above.

69. Dummpy level is used when
(*a*) number of observations to be taken are large from one level position
(*b*) number of observations to be taken are small from one level position
(*c*) fly levelling is to be done
(*d*) none of the above.

70. In levelling height of instrument is
(*a*) the height of telescope above the ground at the time of observation
(*b*) the height of levelling staff
(*c*) the elevation of plant of collimation
(*d*) sum of the reduced level of B.M. and foresight.

71. Sensitivity of the bubble tube increases with
1. decreases in radius of curvature of bubble tube
2. increase in length of the vapour bubble
3. increase in diameter of bubble tube

Of the above statements
(*a*) 1 and 2 are correct
(*b*) 2 and 3 are correct
(*c*) 3 and 1 are correct
(*d*) 1, 2 and 3 are correct

72. Height of instrument method of levelling as compared to rise and fall method is
(*a*) more accurate
(*b*) less accurate.
(*c*) quicker and less tedious
(*d*) none of the above.

73. The rise and fall method
(*a*) provides a check on the intermediate
(*b*) is preferable for differential and check levelling.
(*c*) suitable for important works
(*d*) all of the above.

74. The levelling of instrument is done such that
(*a*) line of sight is truly horizontal
(*b*) optical axis is truly horizontal
(*c*) vertical axis is truly vertical
(*d*) line of collimation is truly horizontal.

75. Natural error in levelling is caused due to
(*a*) wind vibration
(*b*) atmospheric refraction
(*c*) temperature variation
(*d*) all of the above.

76. Permanent adjustments are carried out to
(*a*) set up of the level
(*b*) establish a fixed relatinoship between its fundamental axes
(*c*) focus the eyepiece
(*d*) focus the object glass.

77. The line of collimation should be parallel to
(*a*) vertical axis
(*b*) bubble axis
(*c*) both (*a*) and (*b*) above
(*d*) none of the above.

78. Which is an odd instrument with regards to levelling ?
(*a*) Altimeter (*b*) Clinometer
(*c*) Abney hand level (*d*) Planimeter

79. When it is not possible to set up the level, midway between the two points, then the difference in elevation between them is measured by
(*a*) Fly levelling (*b*) Precise levelling
(*c*) Differential levelling (*d*) Reciprocal levelling

80. The accuracy required in precise levelling is of the order of
(*a*) $\sqrt{K}$ mm (*b*) $1\sqrt{K}$ mm
(*c*) $5\sqrt{K}$ mm (*d*) None of the above
Where K is the distance levelled in km

81. If the formation level is less than the ground level, the difference between them at anypont will give the
(*a*) height of embankement
(*b*) depth of cutting
(*c*) proposed gradient
(*d*) none of the above.

82. The reciprocal levelling eliminates
(*a*) the error due to curvature and refraction
(*b*) collimation error
(*c*) both (*a*) and (*b*) above
(*d*) none of the above.

83. Sensitivity of the bubble tube expressed is terms of angular value of one division of the bubble is given by

(*a*) S/D radians (*b*) P/S

(*c*) S/D seconds (*d*) None of the above.

where

S = difference between the two staff readings

D = distance between the staff and the instrument

84. Levelling across a river is done by

(*a*) Fly levelling

(*b*) Reciprocal levelling

(*c*) Trigonometrical levelling

(*d*) Cross levelling.

85. Bench marks are fixed by

(*a*) trigonometric levelling

(*b*) barometric levelling

(*c*) spririt levelling

(*d*) profile levelling.

86. In levelling, a station is a point where

(*a*) staff is placed

(*b*) instrument is set up

(*c*) bench mark is marked

(*d*) none of the above.

87. The correction for refraction as applied to staff reading is

(*a*) $\frac{1}{7}\left(\frac{d^2}{R}\right)$ (*b*) $\frac{1}{7}\left(\frac{d^2}{2R}\right)$

(*c*) $-\frac{1}{7}\left(\frac{d^2}{2R}\right)$ (*d*) $-\frac{1}{7}\left(\frac{d^2}{R}\right)$

88. The curvature and refraction corretion applied to staff readings respectively are

(*a*) both + ve (*b*) both – ve

(*c*) + and – ve (*d*) – ve and + ve

89. Glass wedge is used in

(*a*) Double image tacheometer

(*b*) Szepessy tacheometer

(*c*) Jeffcott tacheometer

(*d*) Auto reduction tacheometer

90. An imaginary line connecting the points of equal elevation on the ground surface is known as

(*a*) contour line

(*b*) contour interval

(*c*) horizontal equivalent

(*d*) contour gradient.

91. The contour interval depends upon

(*a*) Nature of the ground

(*b*) Scale of the map

(*c*) Purpose and extent of survey

(*d*) All of the above.

92. An imaginary line lying throughout the surface of gound having a constant inclination to the horizontal is known as

(*a*) Contour line (*b*) Contour gradient

(*c*) Contour interval (*d*) Horizontal equivalent

93. The contour lines merge or cross one another on the map in case of

(*a*) vertical surfaces

(*b*) overhang ground surfaces

(*c*) cave

(*d*) all of the above.

94. The tacheometric method is more suitable method for preparing the contour map of a

(*a*) valley (*b*) hill

(*c*) ridge (*d*) plain surface.

95. In direct method of coutouring, the process of locating points lying on a contour is known as

(*a*) horizontal control (*b*) vertical control

(*c*) ranging (*d*) none of the above.

96. Contours are used to determine

(*a*) intervisibility of points on a contour map

(*b*) area of the drainage basin and capacity of the reservoir

(*c*) quantities of earth work

(*d*) all of the above

97. A series of straight parallel and widely spaced contours on a map represents a

(*a*) valley (*b*) ridge

(*c*) curved surface (*d*) inclined plane surface

98. The best method of interpolation of contours in Direct method of contouring is by

(*a*) Computations (*b*) Interpolation

(*c*) Estimation (*d*) None of the above

99. In double line river, contours are

(*a*) stopped at the banks of the river

(*b*) stopped at the edge of the river

(*c*) drawn across the water

(*d*) none of the above

100. For any point on the surface with a given inclination, contour gradient possible is

(*a*) One (*b*) Two

(*c*) Infinite (*d*) None of above