☆ Compass Survey :->

System of angle measurment :->

(1) Most comly used System

(34)

1 circumference = 360° degree

1 degree = 60 min

1 minute = 60 sec

(2) Hour System

1 circumference = 24 hours.

1 hour = 60 min

1 min = 60 sec.

Note-> 1 circumference is according to the earth rotation.

(3) Centesimal System

1 circumference = 400 grade

1 grade = 100 centigrade.

1 centigrade = 100 centi-centigrade

Important terms:->

(1) Bearing :-> The direction of a line w.r.to a given meridia It is the angle b/w given meridian and the line.

(2) True meridian :-> Line joining true North and true South pole the earth is called True meridian.

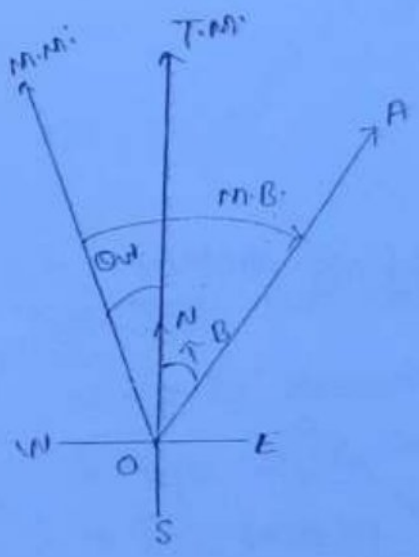
True north or south point are the point about which earth is rotating.

③ True bearing :→ Bearing measured from true meridian.

④ Magnetic Meridian :→ Line joining magnetic North and South poles.

Magnetic bearing :→ Bearing measured from magnetic meridian.

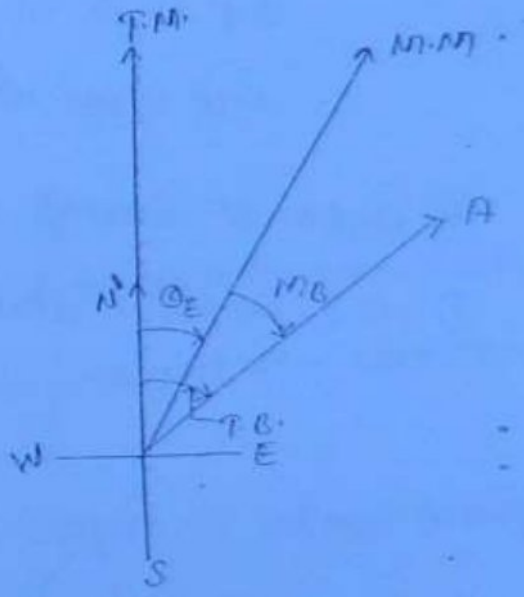
⑤ Magnetic declination :→ Horizontal angle b/w true meridian and magnetic meridian at a particular place is called magnetic declination.



(Western Declination)

$M.B = T.B + \theta_W$

$T.B = MB - \theta_W$



(Eastern declination)

$M.B = T.B - \theta_E$

$T.B = MB + \theta_B$

⑥ Variation in Declination :→

Types :→

① Diurnal variation (Daily)

② Annual variation (Annualy)

③ Secular variation (Due to the moment of moon)

④ Irregular variation.

☆ ⑥ Angle of Dip:→ If a magnet is hanged freely from it's C.G. In a tigh line it sel in the direction of magnetic flux in that area, angle made with horizontal direction of magnet is called dip angle.

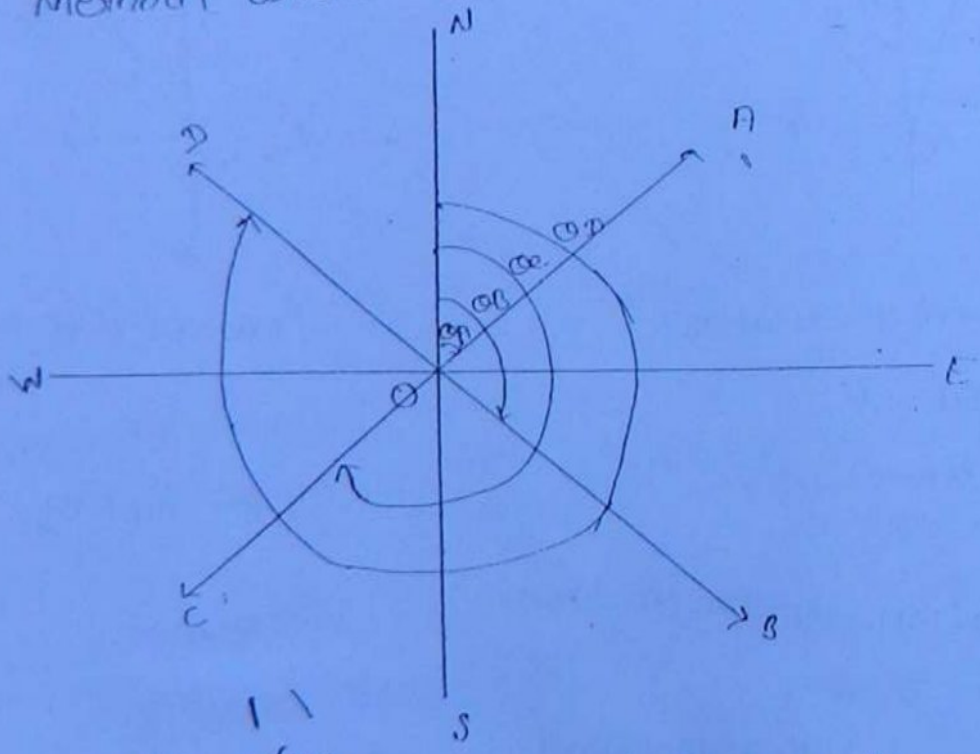
Dip angle at any point on earth is the angle b/w horizontal and direction of magne flux.

Dip angle at equator = 0

Dip angle at poles = 90°

⑦ System of Bearing Measurement:→

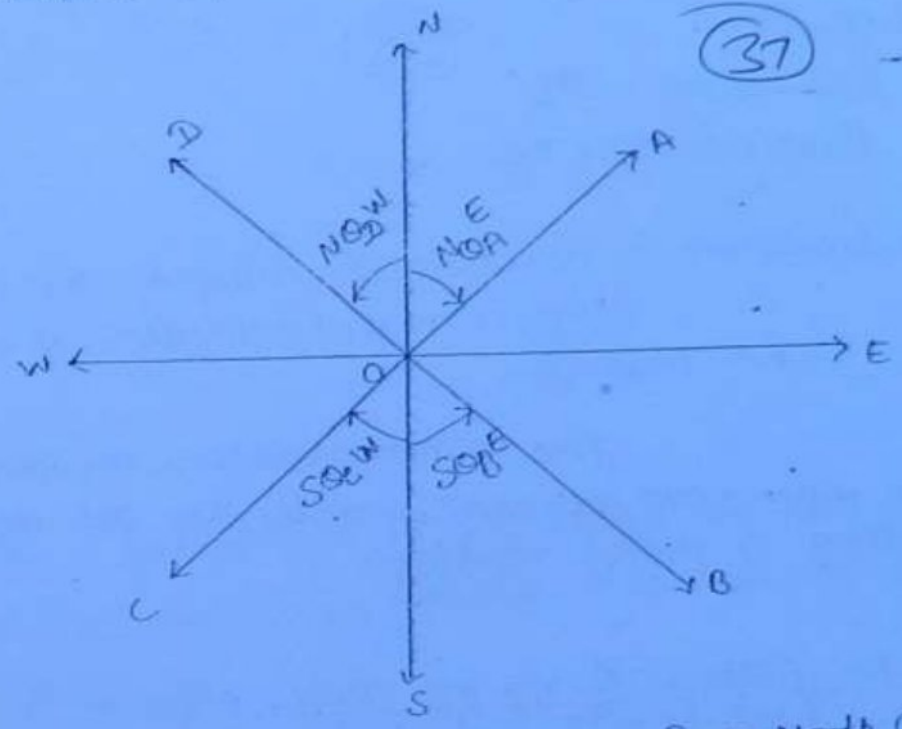
① WCB Method (whole circle bearing Method) :→



→ All angle are measured from north.

→ always in clockwise direction.

② Q.S.B. Method :→
(Quadrantal System of bearing)



→ Angle are measured either from North or from South.
→ Can be measured in clockwise / anticlockwise direction.
→ Angle with direction are shown.
→ This bearing System is also known as reduced bearing

(11) Fore bearing and Back bearing :→

↳ For line AB
↓
Angle at 1st point A = ΘA = Fore bearing.

Angle at 2nd point B = ∠B = Back bearing

→ For line BA

Fore bearing = ∠B

Back bearing = ∠A

* Local Attraction :→ Bearings of different line are measured using a magnetic needle. (In case of magnetic bearing)

Due to the presence of some iron objects near instrument, magnetic needle may get deflected, resulting in wrong readings.

ES-2002

Problem :→ The following reading were noted in a closed traverse:

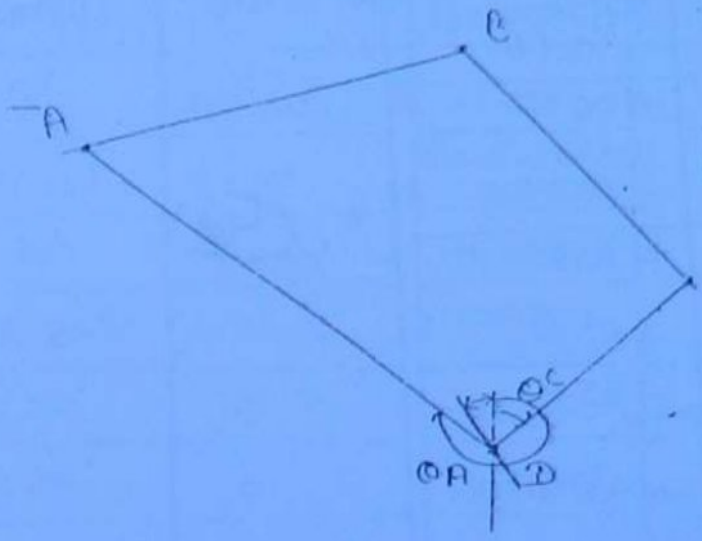
	Fore bearing	Back bearing	
AB	32°	212°	→ 180
BC	77°	262°	→ 185
CD	112°	287°	→ 175
DE	122°	302°	→ 180
EA	265°	85°	→ 180

This station is correct from local attraction

at what station do you suspect local attraction. Find correct bearing of the lines. What will be the true bearings (as reduced bearing is magnetic declination 2°W)

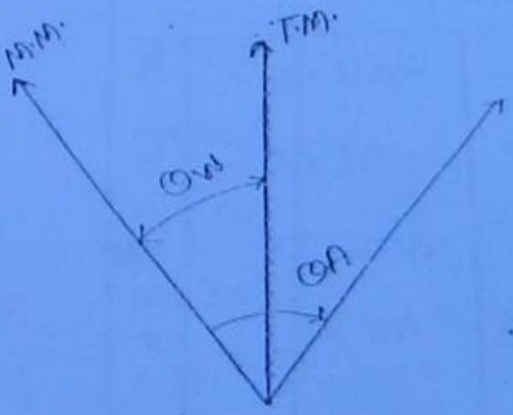
Solution :→

Line	Bearing	Correction	Corrected bearing
AB	32	0	32°
BA	212	0	212°
BC	77	0	77°
CB	262	−5°	77 + 180 = 257°
CD	112	−5°	112 − 5° = 107°
DC	287		
DE	122	0	107 + 180 = 287°
ED	302	0	122°
		0	302°



→ Here all differences of FB/BB are +ve, except for line BC and CD so station 'C' is affected from local attraction.

EA	265°	0	265°
AE	85°	0	85°



T.B = M.B − θ.w.

F.B. in WCB Method	F.B in WCB
20	N20E
200	S20W
65	N65E
245	S65W
95	S85E
275	N85W
110	S70E
290	N70W
253	S73W
73	N73E

(48)

Problem → Following bearing were taken using a compass find out the correct bearing

AB	75°5'	254°20'	x
BC	115°20'	296°35'	x
CD	165°35'	345°35'	180°
DE	224°50'	44°5'	x
EA	300°	125°5'	x

Solution :- when station C and D are free from local attraction

Lines	Bearings	Correction	Corrected bearing
AB	75° 5'	+0° 30' →	75° 35'
BA	254° 20'	+1° 15' ←	(75° 35' + 180°) = 255° 35'
BC	115° 20'	+1° 15' →	116° 35'
CB	296° 35'	0 ←	116° 35' + 180° = 296° 35'
CD	165° 35'	0	165° 35' (Starting point)
DC	345° 35'	0	345° 35'
DE	224° 50'	0	224° 50'
ED	44° 5'	+0° 45' ←	224° 50' − 180° = 44° 50'
EA	304° 50'	+0° 45' →	305° 35'
AE	125° 5'	+0° 30' ←	305° 35' − 180° = 125° 35'

(41)

Problem:→ Following are the bearing of a closed traverse.

	FB	BB
AB	142° 30'	322° 30'
BC	223° 15'	43° 15'
CD	281°	101° 45'
DE	12° 25'	193° 15'
EA	60°	239°

Considered AB value as Correct find out the Correct bearing of all other lines.

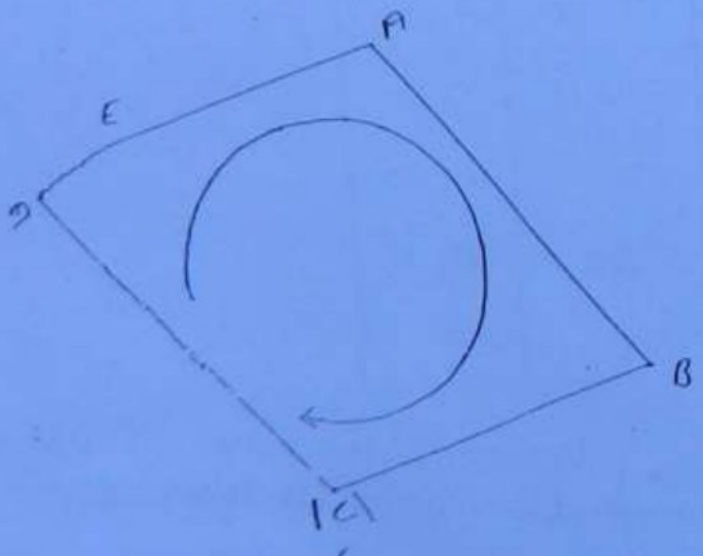
Solution:→

Lines	Bearing	Correction	Correct Bearing
AB	142°30'	0	142°30'
BA	322°30'	0	322°30'
BC	223°15'	0	223°15'
CB	44°15'	-1°0'	(223°15' - 180°) = 43°15'
CD	287°	-1°0'	286°
DC	107°45'	-1°45'	106°
DE	12°45'	-1°45'	11°
ED	193°15'	-2°15'	191°15'
EA	60°	-2°15'	57°45'
AE	239	Not equal	237°45'

(42)

(#) Method of Internal angle :-

① Draw the traverse.



(2) Draw a clock wise circular direction.

(3) Internal angles:

$A = \overset{\text{before}}{AE} - \overset{\text{after}}{AB} = 239 - 142°30' = 96°30'$

$B = BA - BC = 322°30' - 223°15' = 99°15'$

$C = CB - CD = 44°15' - 287 + 360 = 117°015'$

$D = DC - DE = 107°45' - 12°45' = 95'$

$E = ED - EA = 193°15' - 60° = 133°15'$

$541°15'$

(4) If any angle is 360 deduct 360.

(5) If any angle is negative add 360

Sum of all internal angles $= (2n-4) \times 90°$

$= (2 \times 5 - 4) 190°$

$= 540°$

Diffence in sum of all internal angle $= 1°15'$

Corss in each angle $= \frac{1°15'}{5} = 0°15'$

than correction in each angle $= (-) 0°15'$

Corrected internal angle.

$95°15'$

$99°$

$117°$

$194°45'$

$133°$

$540°$

A = AE − AB = 96° 15′ = ∠A

B = BA − BC = 99° = ∠B

(4)

C = CB − CD + 360 = 117°

D = DC − DE = 94° 45′

E = ED − EA = 133′ = ∠E

Corrected bearing of line :→

AB = 142° 30′
+ ∠A = + 96° 15′
AE = 238° 45′
− 180°
EA = 58° 45′
+ ∠E = 133°
ED = 191° 45′
− 180°
DE = 11° 45′
+ ∠D = + 94° 45′
DC = 106° 30′
+ 180°
CD = 286° 30′
+ ∠C = 117°
− 360°
CB = 43° 30′

CB = 43° 30′
+ 180
BC = 223° 30′
+ ∠B = 99°
BA = 322° 30′
− 180°
AB = 142° 30′

Ans

A = AB − AE = 191°30′ − 53° = 138°30′

B = BC − BA = 69°30′ − 13° = 56°30′

C = CD − CB = 32°15′ − 246°30′ = 145°45′
+360°

D = DE − DC = 262°45′ − 210°30′ = 52°15′

E = EA − ED = 230°15′ − 80°45′ = 149°30′

542°30′

(46)

Total error = 2°30′

Error in each angle = $\frac{2°30'}{5}$

= 0°30′

Correction in each angle = (−) 0°30′

Corrected angle

138°
56°
145°15′
51°45′
149°

AB has min error

Corrected bearing AB = 191°30′ − 0°45′ = 190°45′ } this value is wrong than

" " BA = 13° + 0°45′ = "

Corrected bearing AB = 191°30′ + 0°45′ = 192°15′

" " BA = 13° − 0°45′ = 12°15′

AB = 192° 15'

$\angle A$ = − 130°

AE = 54° 15'

+ 180°

EA = 234° 15'

$\angle E$ = − 149°

ED = 85° 15'

+ 180°

DE = 265° 15'

− $\angle D$ = − 151° 45'

DC = 213° 30'

− 180°

CD = 33° 30'

$\angle C$ = − 145° 15'

+ 360° → Because the value is negative than adt. 360°.

CB = 208° 15'

− 180°

BC = 68° 15'

− $\angle B$ = − 56°

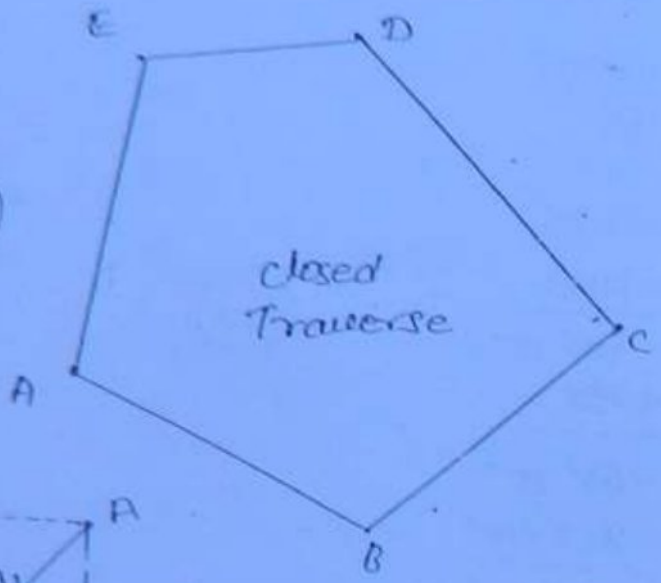
BA = 12° 15'

+ 180°

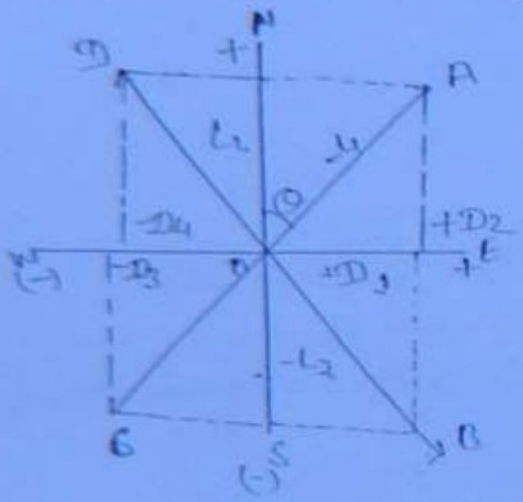
AB = 192° 15'

(47)

Traverse :→ Latitude and departure of different lines of a traverse.



(48)



→ Latitude is the projection of a line on N-S direction

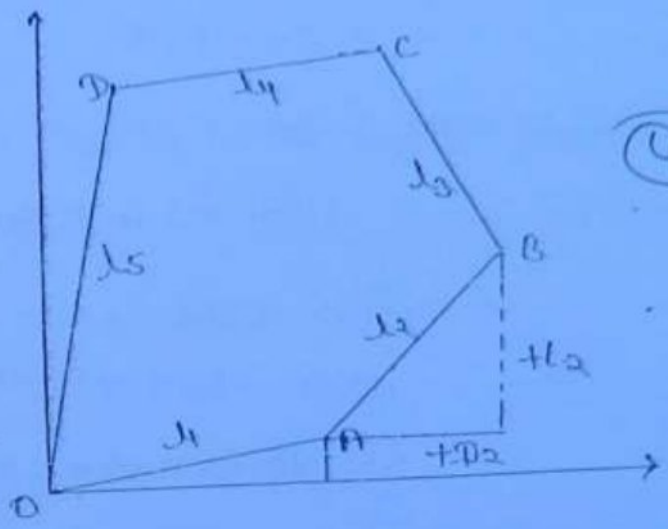
$$l = l\cos\theta$$

→ Departure is the projection of line on E-W direction

$$D = l\sin\theta$$

line	WCB	Latitude		Departure
l_1	$0 < \theta < 90$	$N\theta_1E$	$+l_1\cos\theta_1$	$+l_1 l_1 \sin\theta_2$
l_2		$S\theta_2E$	$-l_2\cos\theta_2$	$+l_2 \sin\theta_2$
l_3		$S\theta_3W$	$-l_3\cos\theta_3$	$-l_3 \sin\theta_3$
l_4		$N\theta_4W$	$+l_4\cos\theta_4$	$-l_4 \sin\theta_4$

(ii) Independent co-ordinate :→



(49)

If co-ordinate of diffient points are measured w.r. to a fixed origin is called independent co-ordinate.

Ex Properties of a closed traverse :→

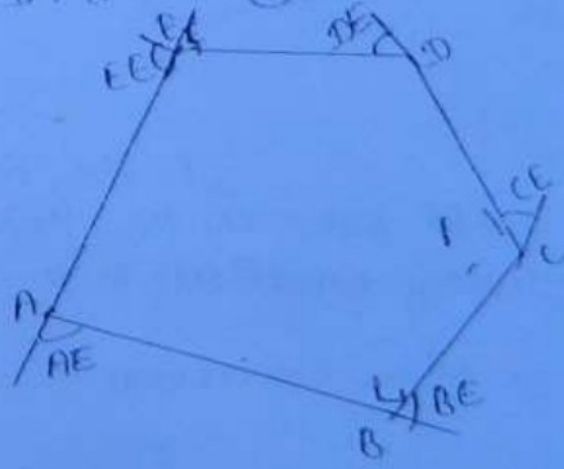
① Sum of all latitude and departure should be zero

$l_1 \cos\theta_1 + l_2 \cos\theta_2 + \cdots$

$\Sigma l = 0$ — (1)

$l_1 \cos\theta_1 + l_2 \cos\theta_2 + \cdots$

$\Sigma D = 0$ — (2)



② Sum of all internal angle of a closed traverse

$= (2n-4)\,90^\circ$

③ Sum of External angle of a closed traverse

$AE + BE + \cdots = (180 - A) + (180 - B) + \cdots$

$= n \times 180 - (A + B + \cdots C$

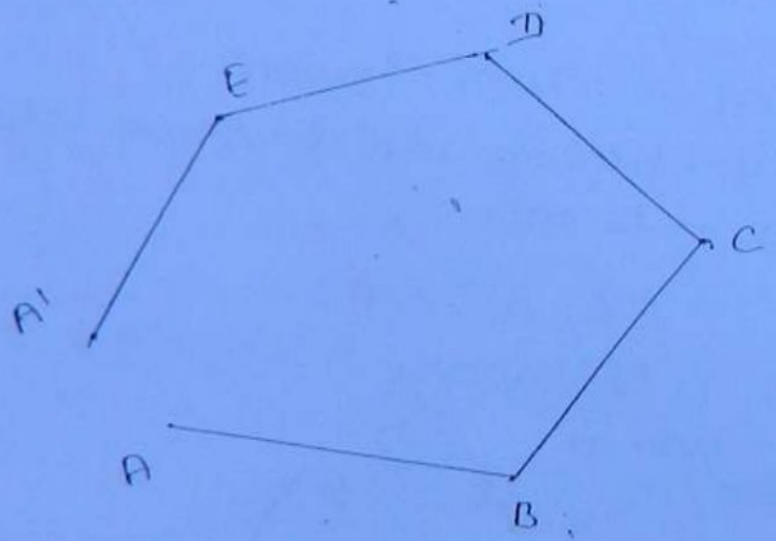
$= 2n \times 90 - (2n-4) \times 90$

$= 2n \times 90 - 2n \times 90 + 4 \times 90$

$= 360^\circ$

(50)

☆ Close Error :→ In case of a closed traverse



If the first point of the closed traverse is not same as the that point the error is called closing error. AA' is the error ... 1

∴ A'A = Correction

L

Adjustment of closing error :→

(1) $\Sigma L = 0$

$\Sigma D = 0$

(2) Sum of all internal angle $= (2n-4) \times 90°$

Method for balancing a closed traverse.

(1) Bowditch method.
(2) Transit method.
(3) Graphical method
(4) Axis method.

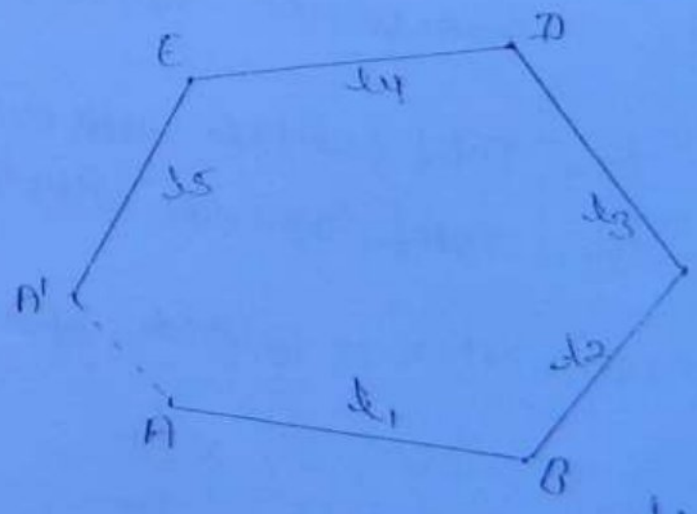
(51)

(1) Bowditch method :→ This method is suitable when linear and angular measurements having been measured with equal precision. Changes of error are done in linear/angular measurements.

As per bowditch

(1) Error in linear measurement $\propto \sqrt{L}$.

(2) Error in angular measurement $\propto \sqrt{L}$



If

ΣL = Total error in latitude.
(Sum of all latitude with Singe)

ΣD = Total error in Depertude
(Sum of all depeorture with singe)

Σl = Sum of all length of diffrent line

Correcton in latitude of a paticular line

$$C_L = \Sigma l \times \frac{l_1}{\Sigma l} \quad \text{—(1)}$$

Correction in Departure

$$C_D = \Sigma D \times \frac{l_1}{\Sigma l} \quad \text{—(2)}$$

② Transit Method :→ This Method is Suitable when angular measurement are more prease than linear measurement.

Error
- ΣL = Sum of all latitudes (with Sing)
- ΣD = Sum of all departure (with sing

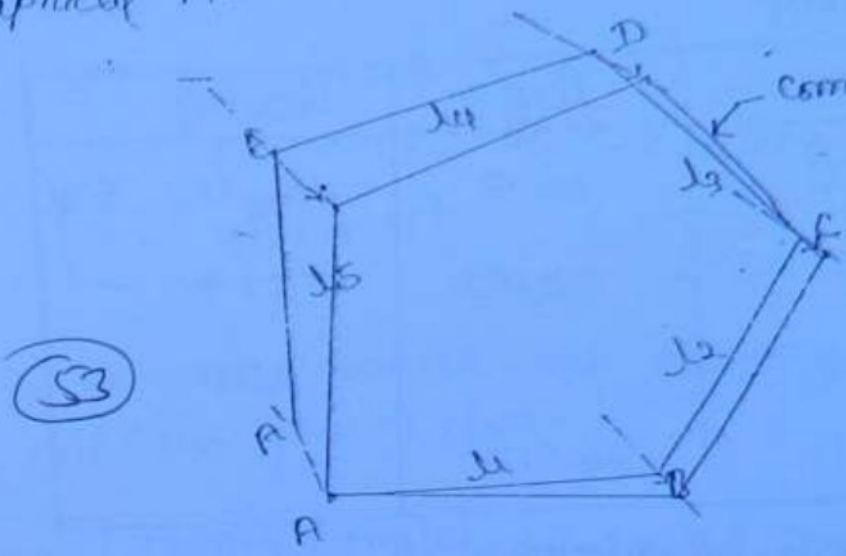
L_T = Total latitude with out sng
D_T = Total Departure with outsng

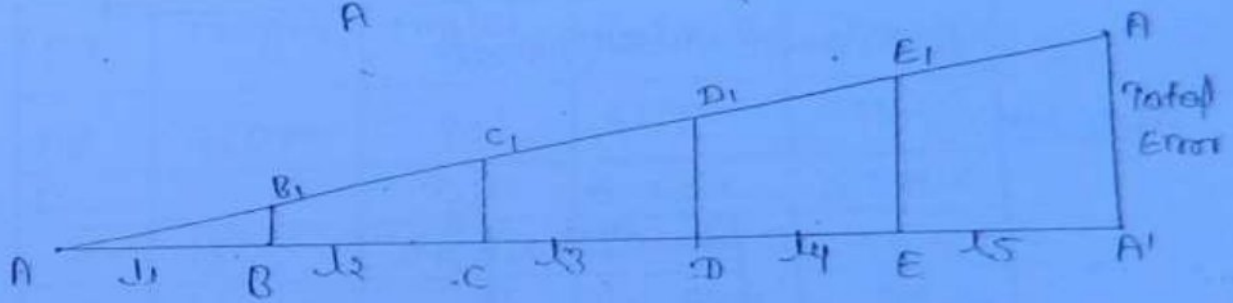
than correcton in latitude of a par line

$$C_L = \Sigma_L \times \frac{L_1}{L_T}$$

$$\text{—} C_D = \Sigma_D \times \frac{D_1}{D_T}$$

(2) Graphical method :→





all this correction is makerd and the mark point is same direction.

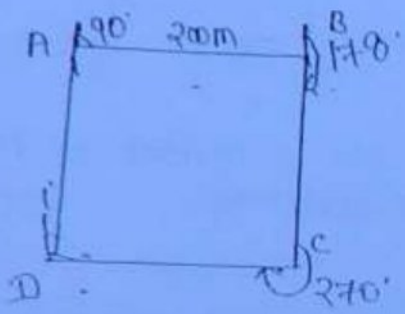
Que:→ A closed traverse has the following length and bearing

Line	length	bearing
AB	200 m	Rightly East
BC	99 m	178°
CD	—	270°
DA	84.6 m	1°

(54)

find out missing data

Solution:→



Bearing Rightly	Latitude	Departure
Rightly	200 cos θ = −97.94	200 sin θ = 3.42
178°	x cos 270 = 0	x sin 270 = −x
270		
84.6	86.39	= 1.500
	ΣL = 0	ΣD = 0

From ΣL = 0

200 cos θ = 11.55

cos θ = 0.05775 ⇒ θ = 86° 41' 22" Ans.

$\Sigma D = 0$

$200.8\sin\theta + 3.42 + 1.508 - x = 0$

$x = 8.200\sin 86^\circ 01'22'' + 4.928$

$\boxed{x = 204.60\,m}$ Ans (55)

Problem:→ A closed traverse has following readings. Find out the missing data.

Line	Length	Angles with	Latitude	Departure
AB	250m	85°	21.79	249.05
BC	$= x$	40°	$0.766x$	$0.643x$
CD	150	320°	114.907	−96.418
DE	220	295°	92.976	−199.39
EF	140	θ − 160°	$140\cos\theta$	$140\sin\theta$
FA	200		−187.94	68.400

Solution:→

$\Sigma L = 0$

$\Rightarrow 0.766x + 140\cos\theta + 41.733 = 0$ — (1)

$\Sigma D = 0$

$0.643x + 140\sin\theta + 21.646 = 0$ — (2)

From eq (1)

$\Rightarrow 140\cos\theta = -0.766x - 41.733$ — (3)

From eq (2)

$\Rightarrow 140\sin\theta = -0.643x - 21.646$ — (4)

$$\Rightarrow 140^2(\cos^2\theta + \sin^2\theta) = (0.766x + 41.733)^2 + (0.6432x + 21.646)^2$$

$$\Rightarrow 19600 = x^2 + 91.77x + 2210.192 = 0$$

$$\Rightarrow x^2 + 91.77x - 17389.8 = 0$$

$$\boxed{x = 93.74\ m}$$ (56)

Ans

From eq. (3)

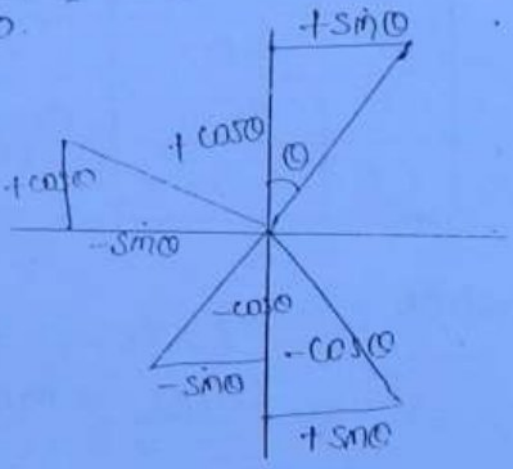
$$\cos\theta = -\frac{173.54}{140} = -0.81098$$

From eq (1)

$$\sin\theta = -\frac{81.92}{140} = -0.58515$$

$$\tan\theta = \frac{\sin\theta}{\cos\theta} = 0.7215$$

$$\theta = 35^\circ 45' 52''$$



Bearing of line (line is in 3rd Q)

$$= 180 + \theta$$

$$= 180 + 35^\circ 45' 41.52''$$

$$\boxed{= 215^\circ 45' 41.52''}$$ Ans