COMPASS SURVEY

(#) System of angle & Measurement :-

(1) Most Commonly used :-

1 Circum = 360 degree

1 degree = 60 min.

1 min = 60 sec.

(2) Centesinal system :-

1 Circum = 400 grades

1 grade = 100 centigrade

1 centigrade = 100 centi - centigrade.

(3) Hour system :-

1 Circum = 24 hours

1 hour = 60 min.

1 min = 60 sec.

(#) Relation :

24 hour = 360 degree

1 hour = 15° degree

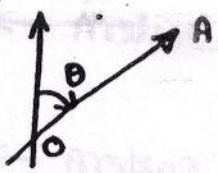
60 minute = 15 X 60 minute

1 minute of time = 15 minute of angle

1 sec. of time = 15 Sec. of angle.

(2) Meridian :- A fixed line w.r.t. which Bearing of line can be measured.

Bearing : Angle measured w.r.t. a fixed meridian.



(3) True Meridian :- The line joining true north & true south on earth surface is called true meridian.

⇒ Axis of rotation of earth meets earth surface at two points, these are true north and true south.

True Bearing : True Bearing is the bearing measured w.r.t. true meridian is called true bearing.

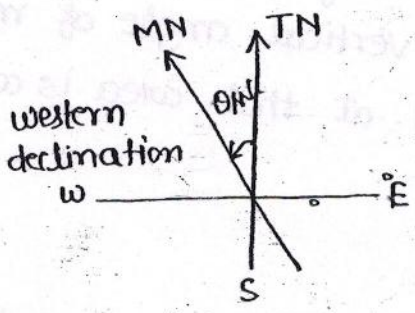
(4) Magnetic Meridian :-

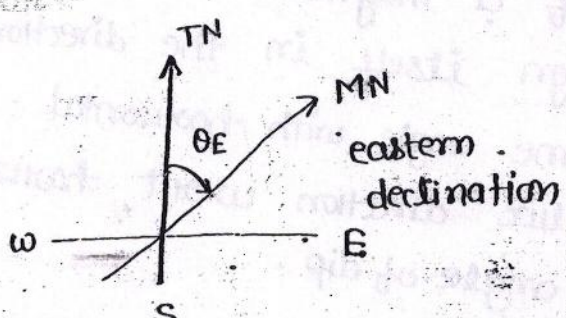
Dirⁿ of magnetic flux in the area show the magnetic meridian.

⇒ A magnetic will show the dirⁿ of magnetic north & south.

Magnetic Bearing : The bearing measured w.r.t. magnetic meridian.

(5) Declination : The difference of angle (horizontal angle) b/w true meridian & magnetic meridian is called declination.

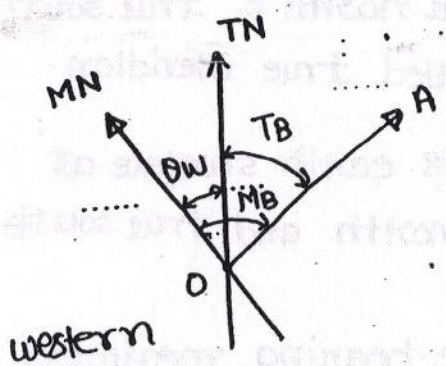




Declination may be –

(i) western → if MM (magnetic meridian) is towards west from T.M.

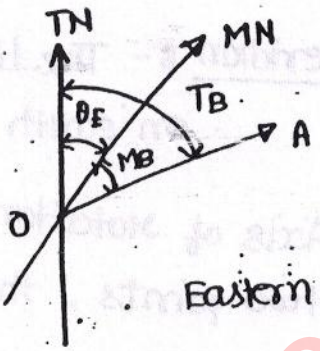
(ii) Eastern → " " " east from T.M.



$T.B. = MB - \theta w$

↓

western declination



$T_B = MB + \theta_E$

↓

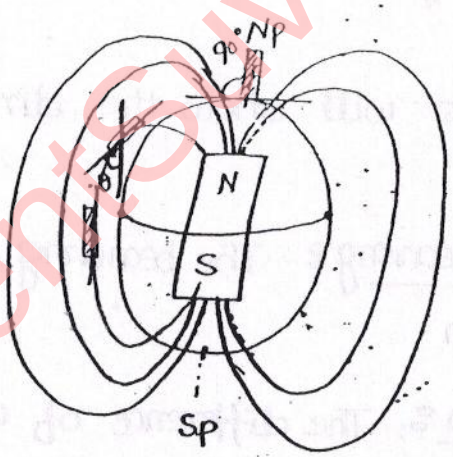
eastern declination

(6) Angle of dip :-

→ Angle of dip –

at equator = 0

At poles = 90°



If a magnetic is hanged freely from its C.G it will align itself in the direction of magnetic flux. It will make some angle with horizontal. The vertical angle of magnetic flux direction w.r.t horizontal at that area is called angle of dip.

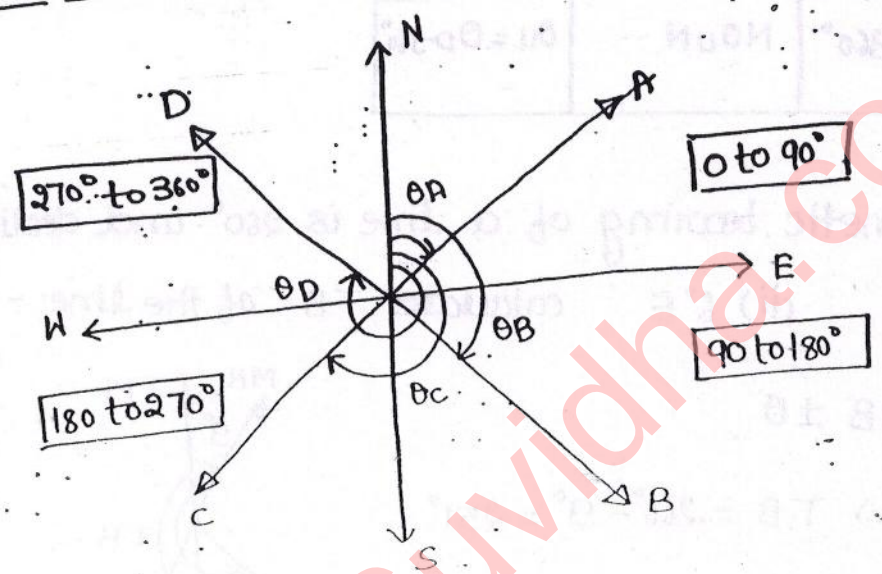
Note :- At equator = dip angle = 0

At pole = 90°

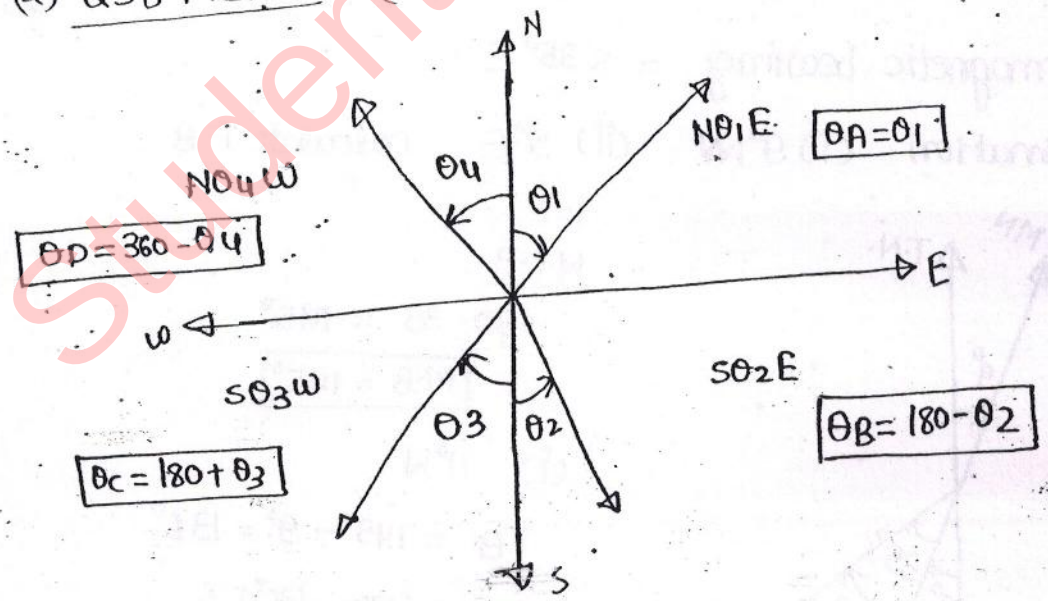
at other place = 0 to 90°

System of Bearing Measurements :-

(1) WCB Method (Whole circle Bearing method)



(2) QSB Method (Quadrantal system of Bearing) Also called Reduced bearing.



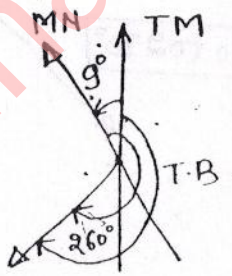
WCB		QSB	
θ_A	0 to 90°	NO_1E	$\theta_1 = \theta_A$
θ_B	90° to 180°	SO_2E	$\theta_2 = \theta_B - 180°$
θ_C	180° to 270°	SO_3W	$\theta_3 = \theta_C - 180°$
θ_D	270° to 360°	NO_4N	$\theta_4 = \theta_D - 360°$

Ques: (1) If magnetic bearing of a line is 260° and declination is (i) 9° W (ii) 6° E calculate T.B. of the line -

T.B = MB ± θ

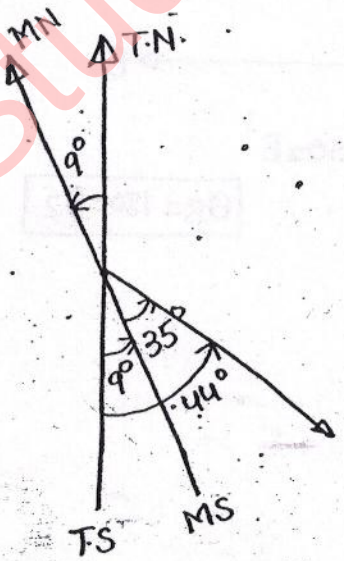
(i) 9° W ⇒ T.B = 266° − 9° = 251°

(ii) 6° W ⇒ T.B = 260° + 6° = 266°



Ques: (2) If magnetic bearing = S 35° E

declination (i) 9° NW (ii) 5° E calculate T.B.



W.C.B

180 − 35 = 145°

M.B = 145°

(i) 9° W

T.B = 145° − 9° = 136°

S (180 − 136°) E

T.B. = S 44 E

(ii) $5^\circ E$

$T.B = 145^\circ + 5^\circ$

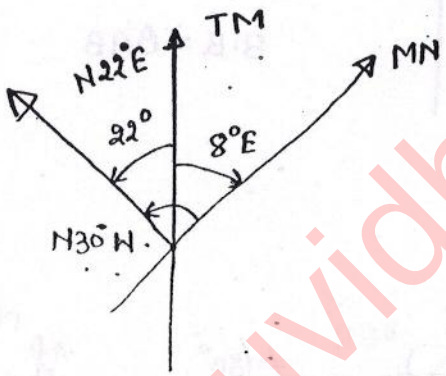
$= 150^\circ$

$= S(180-150)E$

$= S\,30^\circ E$

27/12/2013

Ques 8(2) If magnetic bearing of a line is N 30° W, and declination is 8°E. Calculate the true bearing of line.



Mag. Bearing of line = N 30° W

$= 360^\circ - 30^\circ$

$= 330^\circ$ (∵WCB)

(ii) True Bearing of line

$T.B = MB + 0E$

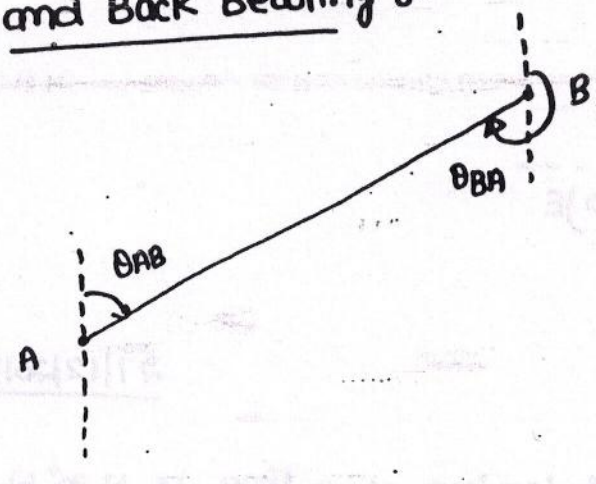
$= 330^\circ + 8^\circ$

$= 338^\circ$

$= N(360-338^\circ)W$

$= N\,22^\circ W$

Fore Bearing and Back Bearing :-



For line AB

F.B = θAB

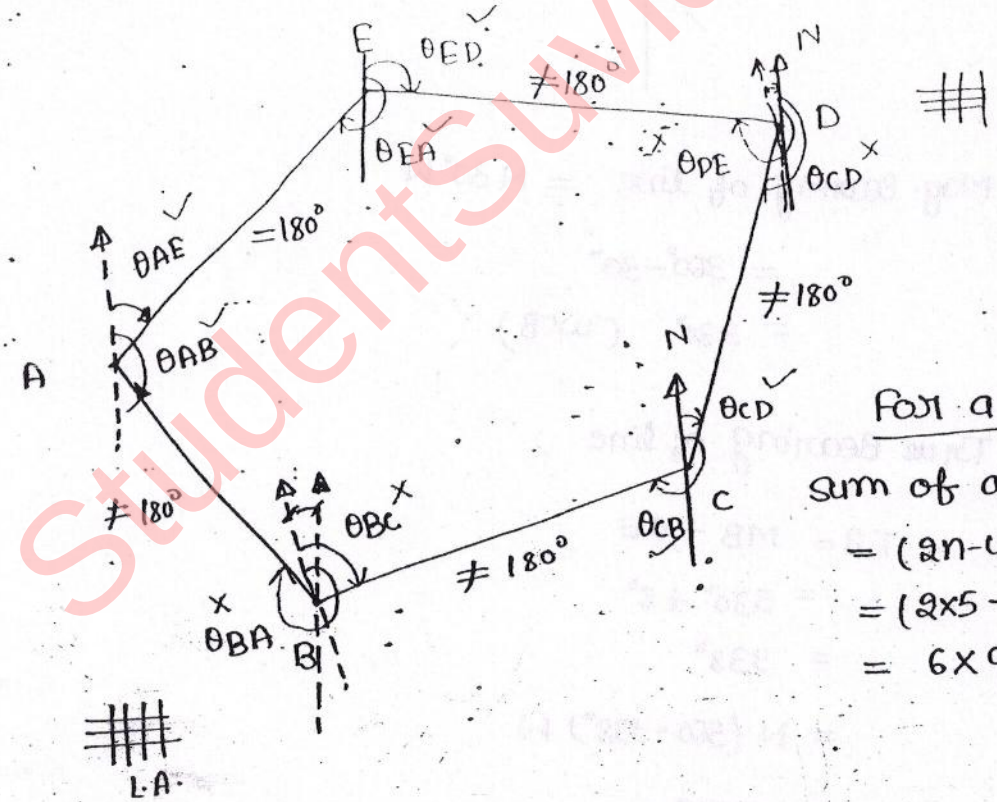
B.B = θBA

For line B.A

F.B = θBA

B.B = θAB

Local Attraction :-



For a pentagon

Sum of all angles

$= (2n-4) \times 90°$

$= (2 \times 5 - 4) \times 90°$

$= 6 \times 90° = 540°$

Important points :

(1) If difference of F.B & B.B is not equal to 180°, Any one station or both may be affected from local attraction.

(2) If difference of a line

F.B − B.B = 180°

Both station are free from local attraction.

If AE correct Angle ⇒ AE − EA = 180°

Correct Angles :- All angles measured at A & E.

AE − ✓	AB − ✓
EA − ✓	ED − ✓

(3) If any station is affected from the local attraction, error and correction on all reading taken from that station will be same.

D is affect | Correction in DC = Correction in DE

If B is affected — Correction in BA − Correction in BC

(4) For a closed traverse :

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

Ques: (1) following bearing were taken for a closed traverse

Line	FB	BB	difference
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	304° 50'	125° 5'	x

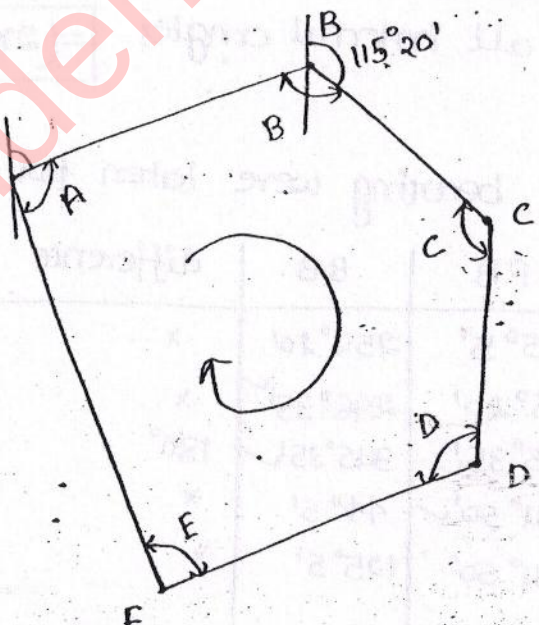
Find out the correct bearing of lines which station are free from local attraction

(#) C & D are free from local Attraction.

Line	Bearing	Correction	Correct Bearing	Calculation
AB	75°5'	+0°30'	75°35'	
BA	254°20'	+1°15'	255°35'	75°35'+180°
BC	115°20'	1°15'	116°35'	
CB	296°35'	.....0°	296°35'	116°35'+180°
CD	165°35'	0°	165°35'	
DC	345°35'	0°	345°35'	
DE	224°50'	0°	224°50'	
ED	44°5'	+0°45'	44°50'	224°50'-180°
EA	304°50'	+0°45'	305°35'	
AE	125°5'	+0°30'	125°35'	305°35'-180°

*** Method for Calculation of Internal angle for a closed traverse:

Step (1) Draw the traverse.



Step:2 Draw a clockwise circle inside the traverse.

Step:3

Internal Angle.

$\angle A$	=	AE	− AB
$\angle B$	=	BA	− BC
$\angle C$	=	CB	− CD
$\angle D$	=	DC	− DE
$\angle E$	=	ED	− EA

Step(4) If any angle is (−)ve then add 360°.

Step:(5) If any angle becomes more than 360°, then deduct 360°.

Ques: Following are the bearing of a closed traverse −

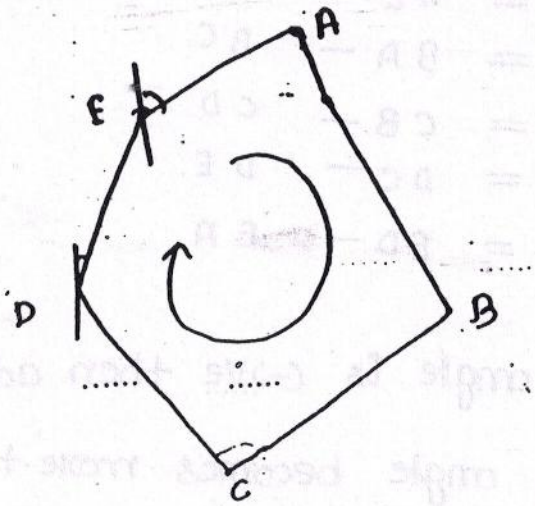
Line	F.B	B.C	~ diff.
AB	142° 30'	322° 30'	180°
BC	223° 15'	44° 15'	×
CD	287°	107° 45'	×
DE	12° 45'	193° 15'	×
EA	60°	239°	×

Solution:

not satisfying the 1st method the correction is not possible

	Bearing	Correction	Corrected Bearing	Calculation
AB	142°30'	0	142°30'	
BA	322°30'	0	322°30'	
BC	223°15'	0	223°15'	
CB	44°15'	−1°0' ←	43°15' ←	223°15'−180
CD	287°	−1° →	286°	
DC	107°45'	−1°45' ←	106° ←	286°−180
DE	12°45'	−1°45' →	11°0°	
ED	193°15'	−2°15'	191°	11°+180
EA	60°	−2°15' →	57°45'	
AE	(239°) ←	0	237.45'	57°45'+180°

We have to apply Interior angle Method



$\angle A$ =	AE —	AB	=	239° − 142°30'	= 96°30'
$\angle B$ =	BA —	BC	=	322°30' − 223°15'	= 99°15'
$\angle C$ =	CB —	CD	=	44°15' − 287° + 360°	= 117°15'
$\angle D$ =	DC —	DE	=	107°45' − 12°45'	= 95°
$\angle E$ =	ED —	EA	=	193°15' − 60°	= 133°15'
					541°15'

sum of all internal angle = $(2n-4)\times 90 = 540°$

$2\times5-4\times90 =$

Total error = (+) 1°15' (541°15' − 540°)

Total correction = (−) 1°15'

Correction per angle = $\frac{(-)\ 1°15'}{5} = (-)\ 0°15'$

Corrected internal Angles —

$\angle A = 96°15'$ (96°30' − 0°15')

$\angle B = 99°$ (99°35' − 0°15')

$\angle C = 117°$ (117°15' − 0°15')

$\angle D = 94°45'$ (95° − 0°15')

$\angle E = 133°$ (133°15' − 0°15')

AB = 142°30'
+ ∠A = 96°15'
AE = 238°45'
− 180°
EA = 58°45'

AE = ∠A + AB

∠E = +133°
ED = 191°45'
− 180°
DE = 11°45'

ED = ∠E + EA

∠D = +94°45'
DC = 106°30'
+180°
CD = 286°30'

DC = ∠D + DE

∠C = +117°
403°30'
− 360°
CB = 43°30'
+180°
BC = 223°30'

CB = ∠C + CD

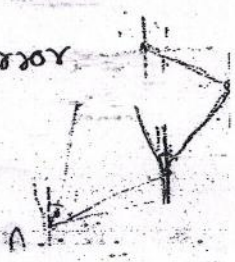
∠B = +99°
BA = 322°30'
− 180°
AB = 142°30'

BA = BC + ∠B

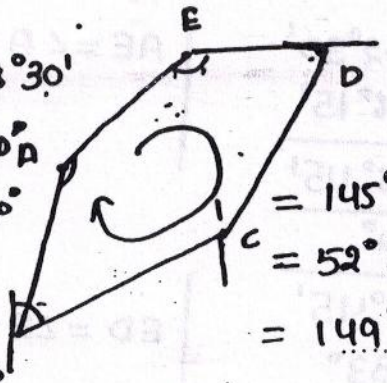
AB is to solve AB kai tm aise coming same so this is correct.

Ques: (3) Work out the correct bearing of a closed traverse.

	FB	B.B		
AB	191°30'	13°	178°30'	(1°30') (less error
BC	69°30'	246°30'	−177°0'	(3°)
CD	32°15'	210°30'	178°15'	(1°45')
DE	262°45'	80°45'	182°	(2°)
EA	230°15'	53°	177°15'	2°45'



Soln: Internal Angle Method:



$\angle A = AB - AE = 191°30' - 53° = 138°30'$

$\angle B = BC - BA = 69°30' - 13° = 56°30'$

$\angle C = CD - CB = 321° - 246°30' + 360° = 145°45'$

$\angle D = DE - DC = 262°45' - 210°30' = 52°15'$

$\angle E = EA - ED = 230°15' - 80°45' = 149°30'$

$= 542°30'$

Total error $= +2°30'$

correction $= (-)\ 2°30'$

Correction per angle $= (-)\ 0°30'$

$\frac{1°30'}{2} = 0°45'$

Corrected Angle -

$\angle A = 138°$

$\angle B = 56°$

$\angle C = 145°15'$

$\angle D = 51°45'$

$\angle E = 149°$

$540°$

AB has least error — (when any line is reciprocal from I-A then we select line which have least error.)

$AB = 191°30' + 0°45' = 192°15'$

$BA = 13° - 0°45' = 12°15'$

} diff $= 180°$

$AB = 192°15'$

$-\angle A = 138°$

$AE = 53°45'$

$+180°$

$EA = 234°15'$

$AE = AB - \angle A$

$EA = 234°15'$
$-LE = -149°$
$ED = 85°15°$
$+180°$
$DE = 265°15°$

$ED = EA - LE$

$LD = -51°45'$
$DC = 213°30'$
$= -180°$
$CD = 33°30'$

$DC = DE - LD$

$LC = (-)145°15'$
$= -111°45°$
$+360°$
$CB = 248°15°$
$-180°$
$BC = 68°15'$

$CB = CD - LC$
$+36°$

$LB = 56°$
$BA = 12°15'$
$+180°$
$AB = 192°15'$

$BA = BC - LB$

Same value of AB is found.
Correct.

Ques: (4)
ES-2002
2(c) 10 marks

Ques: (5)
ES-2005
8(c)