

CVG 2171 – Surveying and Measurements

Assignment # 4 – Angles, Azimuths, and Bearings

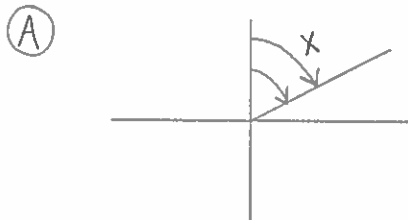
SOLUTION

Problem 1

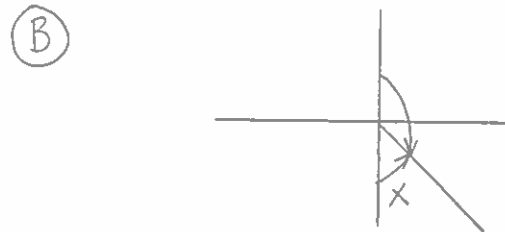
Convert the following azimuths from north to bearings, and compute the angles, smaller than 180° between successive azimuths.

$87^\circ 08' 04''$, $165^\circ 44' 58''$, $203^\circ 16' 38''$ and $313^\circ 59' 02''$

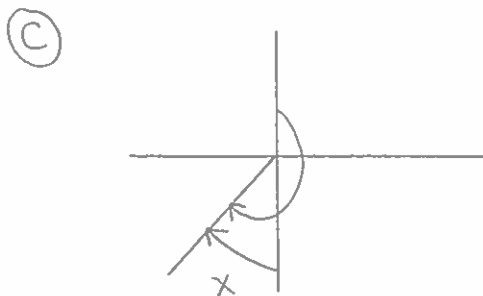
Point	Azimuth	Bearing	Calculation	Successive Angle
A	$87^\circ 08' 04''$	$N 87^\circ 08' 04'' E$	B-A	$78^\circ 36' 54''$
B	$165^\circ 44' 58''$	$S 14^\circ 15' 02'' E$	C-B	$37^\circ 31' 40''$
C	$203^\circ 16' 38''$	$S 23^\circ 16' 38'' W$	D-C	$110^\circ 42' 24''$
D	$313^\circ 59' 02''$	$N 46^\circ 00' 58'' W$	$A + (360^\circ - D)$	$133^\circ 09' 02''$



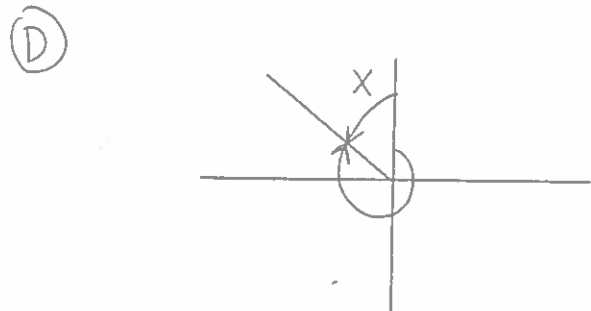
$$X = N 87^\circ 08' 04'' E$$



$$X = 180^\circ 00' 00'' - 165^\circ 44' 58'' \\ = S 14^\circ 15' 02'' E$$



$$X = 203^\circ 16' 38'' - 180^\circ 00' 00'' \\ = S 23^\circ 16' 38'' W$$



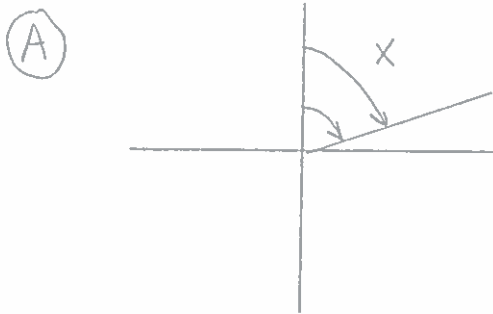
$$X = 360^\circ 00' 00'' - 313^\circ 59' 02'' \\ = N 46^\circ 00' 58'' W$$

Problem 2

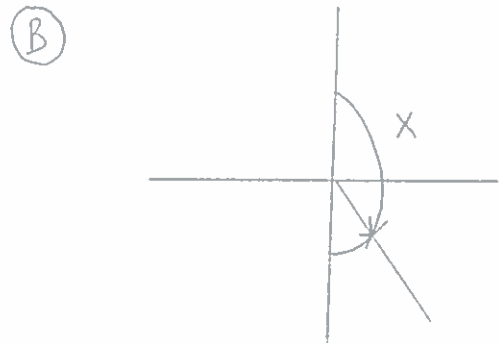
Convert the following bearings to azimuths from north and compute the angle, smaller than 180° between successive azimuths.

N88°05'23"E, S23°56'23"E, S44°00'48"W, and N14°24'44"W

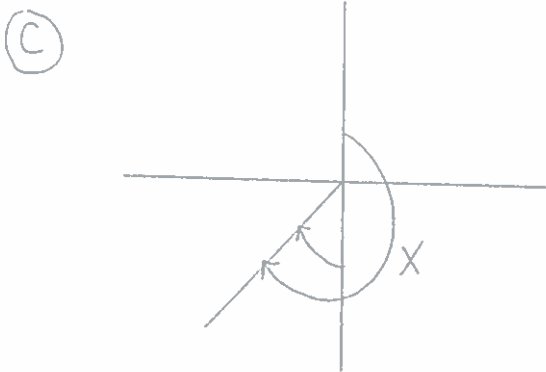
Point	Bearing	Azimuth	Calculation	Successive Angle
A	N88°05'23"E	88°05'23"	B - A	67°58'14"
B	S23°56'23"E	156°03'37"	C - B	67°57'11"
C	S44°00'48"W	224°00'48"	D - C	121°34'28"
D	N14°24'44"W	345°35'16"	A + (360° - D)	102°30'07"



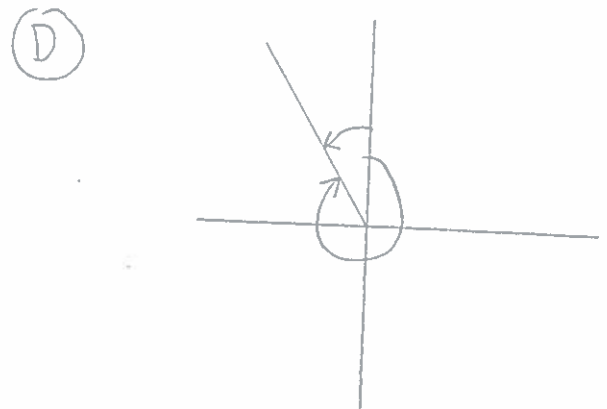
$$X = 88^{\circ}05'23''$$



$$X = 180^{\circ}00'00'' - 23^{\circ}56'23'' \\ = 156^{\circ}03'37''$$



$$X = 180^{\circ}00'00'' + 44^{\circ}00'48'' \\ = 224^{\circ}00'48''$$



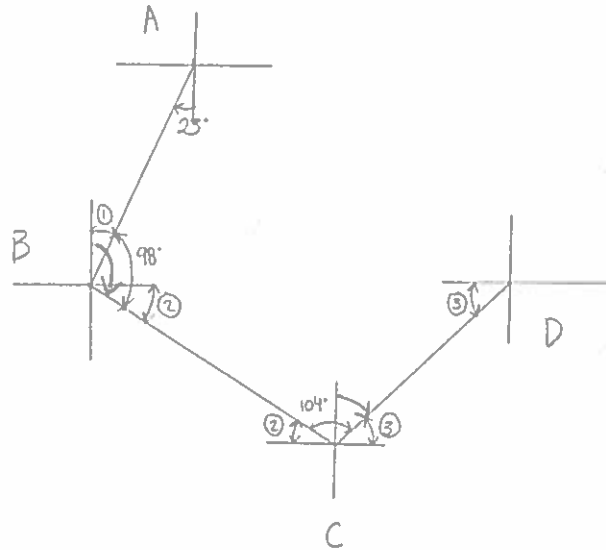
$$X = 360^{\circ}00'00'' - 14^{\circ}24'44'' \\ = 345^{\circ}35'16''$$

Problem 3

Compute the azimuth from north of line CD given the following information. Azimuths of AB are also from North.

Bearing AB = S23°08'24"W

Angles to the right	ABC	98°20'06"
	BCD	104°21'08"



① Z-pattern : 23°08'24"

Azm BC becomes : ① + 98°20'06" = 23°08'24" + 98°20'06" = 121°28'30"

② 121°28'30" - 90°00'00" = 31°28'30"

③ 180° - ② - 104°21'08" = 180° - 31°28'30" - 104°21'08" = 44°10'22"

Azm CD becomes : 90° - 44°10'22" = 45°49'38"

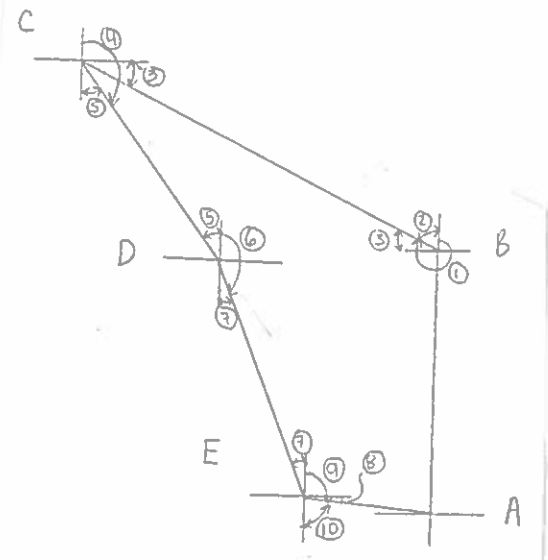
Problem 4

Course AB of a five-sided traverse runs due north. Given the following balanced interior angles to the right, compute and tabulate the bearings and azimuths from north for each side of the traverse.

A	B	C	D	E
82°13'15"	116°35'18"	28°45'22"	195°16'28"	117°09'37"

Course	Bearing	Azimuth
AB	Due North	00° 00' 00"
BC	N 63° 24' 42" W	296° 35' 18"
CD	S 34° 39' 20" E	145° 20' 40"
DE	S 19° 22' 52" E	160° 37' 08"
EA	S 82° 13' 15" E	97° 46' 45"

- ① $180^\circ + 116^\circ 35' 18'' = 296^\circ 35' 18''$
- ② $360^\circ - 296^\circ 35' 18'' = 63^\circ 24' 42''$
- ③ $90^\circ - 63^\circ 24' 42'' = 26^\circ 35' 18''$
- ④ $90^\circ + 26^\circ 35' 18'' + 28^\circ 45' 22'' = 145^\circ 20' 40''$
- ⑤ $180^\circ - 145^\circ 20' 40'' = 34^\circ 39' 20''$
- ⑥ $195^\circ 16' 28'' - 34^\circ 39' 20'' = 160^\circ 37' 08''$
- ⑦ $180^\circ - 160^\circ 37' 08'' = 19^\circ 22' 52''$
- ⑧ $117^\circ 09' 37'' - 90^\circ - 19^\circ 22' 52'' = 7^\circ 46' 45''$
- ⑨ $90^\circ + 7^\circ 46' 45'' = 97^\circ 46' 45''$
- ⑩ $180^\circ - 97^\circ 46' 45'' = 82^\circ 13' 15''$

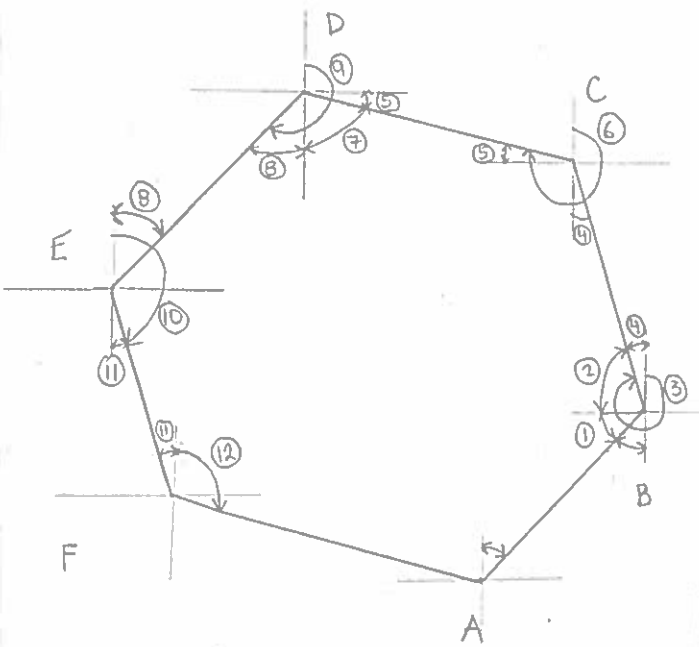


Problem 5

Compute and tabulate the azimuths of the sides of a regular hexagon (polygon with six equal sides) given the following information:

Bearing of AB = $45^{\circ}04'20''$

Station C is westerly of B



Sum of interior angles: $(n-2)180^{\circ}$
 With $n=6 \rightarrow \Sigma \text{angles} = (6-2)180^{\circ} = 720^{\circ}$
 \therefore interior angles = $120^{\circ}00'00''$

Course	Azimuths
AB	$45^{\circ}04'20''$
BC	$345^{\circ}04'20''$
CD	$285^{\circ}04'20''$
DE	$225^{\circ}04'20''$
EF	$165^{\circ}04'20''$
FA	$105^{\circ}04'20''$

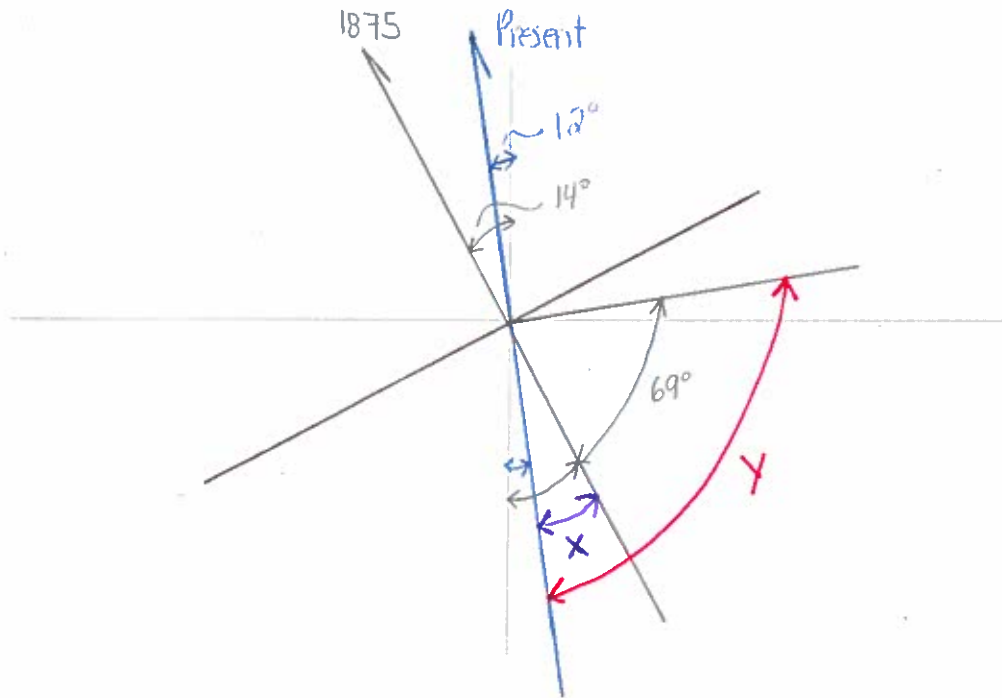
- ① $90^{\circ} - 45^{\circ}04'20'' = 44^{\circ}55'40''$
- ② $120^{\circ} - 44^{\circ}55'40'' = 75^{\circ}04'20''$
- ③ $270^{\circ} + 75^{\circ}04'20'' = 345^{\circ}04'20''$
- ④ $360^{\circ} - 345^{\circ}04'20'' = 14^{\circ}55'40''$
- ⑤ $120^{\circ} - 90^{\circ} - 14^{\circ}55'40'' = 15^{\circ}04'20''$
- ⑥ $270^{\circ} + 15^{\circ}04'20'' = 285^{\circ}04'20''$
- ⑦ $90^{\circ} - 15^{\circ}04'20'' = 74^{\circ}55'40''$
- ⑧ $120^{\circ} - 74^{\circ}55'40'' = 45^{\circ}04'20''$
- ⑨ $180^{\circ} + 45^{\circ}04'20'' = 225^{\circ}04'20''$
- ⑩ $45^{\circ}04'20'' + 120^{\circ} = 165^{\circ}04'20''$

- ⑪ $180^{\circ} - 165^{\circ}04'20'' = 14^{\circ}55'40''$
- ⑫ $120^{\circ} - 14^{\circ}55'40'' = 105^{\circ}04'20''$

Problem 6

What magnetic bearing is needed to retrace a line for the following conditions:

1875 Magnetic Bearing	1875 Declination	Present Declination
$S69^{\circ}20'E$	$14^{\circ}20'W$	$12^{\circ}30'W$



Value of X : $1875 \text{ declination} - \text{Present declination} = 14^{\circ}20' - 12^{\circ}30' = 1^{\circ}50'$

Value of Y : $1875 \text{ bearing} + X = 69^{\circ}20' + 1^{\circ}50' = S 71^{\circ}10' E$