Following is a set of solved exams problems

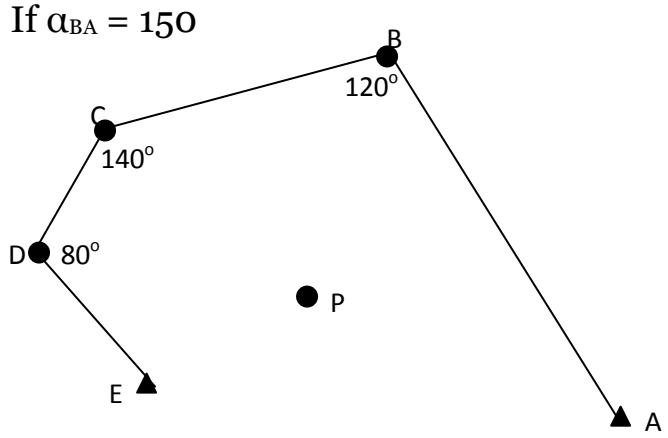
(2003 – 2007)

The solution was performed by EXCEL, which doesn't support angle notation, so I had converted the angle notation to decimal notation.

But in EXAM you have to use ANGLE notation (° ' '') with its full reading.

Question 1 (2003)

A closed line traverse ABCDE starts at A (200,100) and ends with E (68,116). If $\alpha_{BA} = 150$



Find:

A. *The azimuth for each line:*

$\alpha_{AB} = 150+180 = 330$

Station	Length (m)	Angle	Azimuth	ΔE	ΔN
A					
	100		330	-50	86.60254
B		120			
	90		270	-90	-1.7E-14
C		140			
	50		230	-38.3022	-32.1394
D		80			
	60		130	45.96267	-38.5673
E					
SUM				-132.34	15.8959

B. ϵ_E, ϵ_N and linear error of closure ϵ

From the coordinates of A and E

$\Delta E_{AE} = E_E - E_A = 68-200 = -132$ *m (calculated)*

$\Delta N_{AE} = N_E - N_A = 116-100 = 16$ *m (calculated)*

$\epsilon_E = -132.34-(-132) = 0.34$ *m*

$\epsilon_N = 15.8959-(16) = -0.1040$ *m*

$\rightarrow \epsilon = \sqrt{0.34^2 + -0.1041^2} = 0.356m$

C. The coordinates of point P if PAE = 50º and PEA = 30º

$\text{EA} = \sqrt{132^2 + 16^2} = 132.97\, m$

$$\frac{132.97}{sin\, 100} = \frac{EP}{sin\, 50} \rightarrow EP = 103.43\, m$$

$$\alpha_{EA} = tan^{-1}\left(\frac{132}{-16}\right) + 180 = 96^o\ 54'\ 40'' \rightarrow \alpha_{EP} = 96^o\ 54'\ 40'' - 30$$

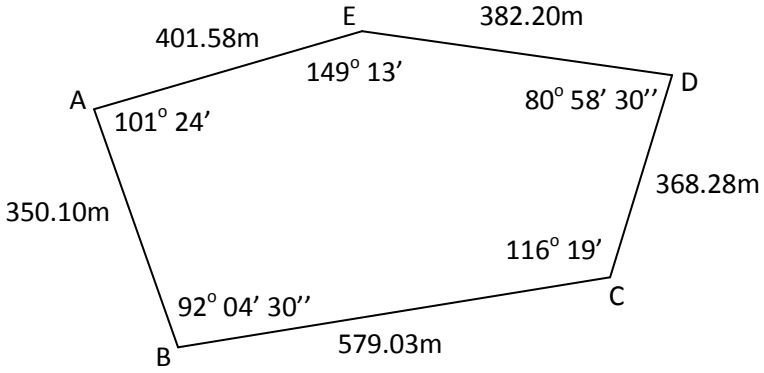
$$= 66^o\ 54'\ 40''$$

$$E_P = E_E + d_{EP}\, sin\alpha_{EP} = 68 + 95.145 = 163.145\, m$$

$$N_P = N_E + d_{EP}\, cos\alpha_{EP} = 116 + 40.56 = 156.561\, m$$

Question 2 (2005)

The following figure shows the taken measurements of a closed loop traverse ABCDEA. Determine the corrected azimuth for each traverse side and the linear error of misclosure. *The bearing of AE = N 51°22' E*



Solution:

$\alpha_{AE} = 51^o\ 22' \rightarrow \alpha_{EA} = 51^o\ 22' + 180 = 231^o\ 22'$

$\sum$ Internal angles $= 539.9833 \rightarrow\ \varepsilon_a = -0.016667$

Correction/angle $= -\frac{\varepsilon_a}{n} = \frac{0.016667}{5} = 0.003333/\text{angle}$

Add 0.003333/(internal angle) $(= 0^o\ 0'\ 12'')$

Station	*Length (m)*	*Angle*	*Corrected Angle*	*Azimuth*	*ΔE*	*ΔN*
E		149.21667	149.22			
	401.58			231.3667	-313.697	-250.72
A		101.4	101.40333			
	350.1			152.77	160.193	-311.301
B		92.075	92.078333			
	579.03			64.84833	524.1298	246.0969
C		116.31667	116.32			
	368.28			1.168333	7.509174	368.2034
D		80.975	80.978333			
	382.2			262.1467	-378.615	-52.2229
E						
SUM	2081.19	539.98333	540		-0.48059	0.056468

ϵ_E = -0.481 m

ϵ_N = 0.0565 m

$\rightarrow \epsilon = \sqrt{-0.481^2 + 0.0565^2} = 0.484\ m$

Question 3 (2006)

For the following table which shows a closed loop traverse ABCDEA. Determine:

A. ***The adjusted azimuth for each side if α_{AB} = 210° 40'***

B. ***ϵ_E, ϵ_N and linear error of closure ϵ***

Station	*Length (m)*	*Angle*
A		238.6667
	24.93	
B		65.5
	37.56	
C		82.5
	48.42	
D		91.75
	35.26	
E		61.16667
	25.77	
A		

Solution:

$\sum$ Internal angles $= 593.5833 \rightarrow \varepsilon_a = -0.5833$

Correction/angle $= -\frac{\varepsilon_a}{n} = \frac{0.5833}{5} = 0.083333/\text{angle}$

Add 0.083333/(internal angle) $(= 0^o\ 5'\ 0'')$

Station	*Length (m)*	*Angles*	*Corrected Angles*	*Azimuth*	*ΔE*	*ΔN*
A		238.6667	238.75			
	24.93			210.6667	-12.7154	-21.4435
B		65.5	65.58333			
	37.56			96.25	37.33676	-4.08904
C		82.5	82.58333			
	48.42			358.8333	-0.98587	48.40996
D		91.75	91.83333			
	35.26			270.6667	-35.2576	0.410259
E		61.16667	61.25			
	25.77			151.9167	12.13136	-22.7359
A						
SUM	171.94	539.5833	540		0.509276	0.551725

ϵ_E = 0.51 m

ϵ_N = 0.552 m

$\rightarrow \epsilon = \sqrt{0.51^2 + 0.552^2} = 0.752\ m$

Question 4 (2007)

For the following table which shows a closed loop traverse ABCDEA. Determine:

A. ***ϵ_E, ϵ_N and linear error of closure ϵ***

B. ***The corrected departure ΔE and latitudeΔN***

Station	*Length (m)*	*Corrected Azimuth*
A		
	29.92	220.66667
B		
	45.07	106.25
C		
	58.1	8.8333333
D		
	42.31	280.66667
E		
	30.92	161.91667
A		

Solution:

Station	*Length (m)*	*Corrected Azimuth*	$\Delta E_{Cal.}$	$\Delta N_{Cal.}$	$\Delta E_{Corr.}$	$\Delta N_{Corr.}$
A						
	29.92	220.66667	-19.4976	-22.6947	-19.6009	-22.7735
B						
	45.07	106.25	43.26945	-12.6119	43.11383	-12.7305
C						
	58.1	8.8333333	8.921879	57.41089	8.721267	57.25801
D						
	42.31	280.66667	-41.5789	7.831366	-41.725	7.720035
E						
	30.92	161.91667	9.597566	-29.3927	9.490803	-29.4741
A						
SUM	206.32		0.712397	0.542895	0	0

ϵ_E = 0.712 m

ϵ_N = 0.543 m

$\rightarrow \epsilon = \sqrt{0.712^2 + 0.543^2} = 0.895\ m$

Calculate for line AB as an example:

$$\Delta E_{\text{AB, Corr.}} = \Delta E_{\text{AB, Cal.}} - \frac{l_{AB}}{\sum lengths} * \varepsilon_E$$

$$= -19.4976 - \left(\frac{29.92}{206.32} * 0.712\right) = -19.6009\ m$$

$$\Delta N_{\text{AB, Corr.}} = \Delta N_{\text{AB, Cal.}} - \frac{l_{AB}}{\sum lengths} * \varepsilon_N$$

$$= -22.6947 - \left(\frac{29.92}{206.32} * 0.543\right) = -22.7735\ m$$

GOOD LUCK