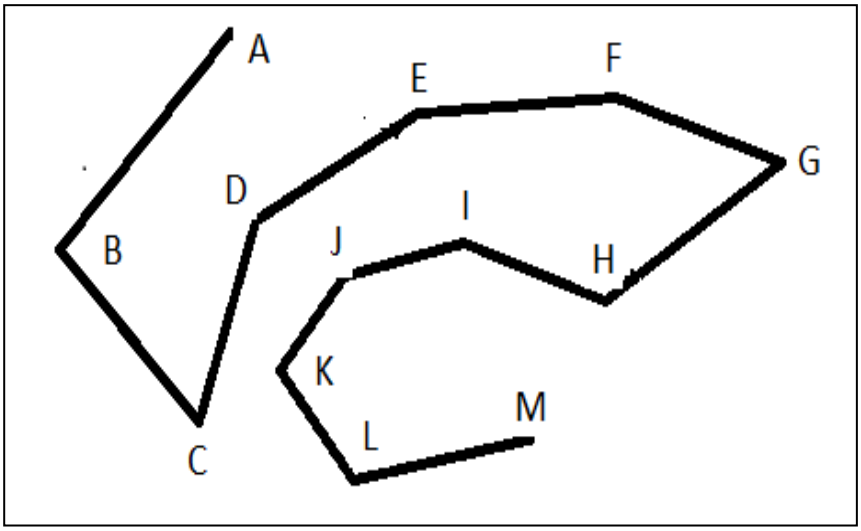
Q1: The following deflection angles were measured in a traverse (ABCDEFGHIJKLM) **read the table carefully** then calculates:

1. The total disclosure error in direction?
2. The correction value in direction for line (EF)?
3. The corrected Azimuth of line (ED)?
4. The corrected back Azimuth of line (CD)?

Angle	Deflection angle	Remarks
ABC	78° 55' 39"	Az. AB (fixed) = 202° 4' 21"
BCD	125° 12' 27"	
CDE	43° 21' 14"	
DEF	32° 50' 34"	Az. ML (fixed) = 245°27' 57"
EFG	26° 28' 54"	
FGH	120° 20' 4"	
GHI	64° 53' 18"	
HIJ	40° 3' 28"	
IJK	41° 54' 18"	
JKM	68° 39' 50"	
KLM	69° 45' 19"	



Q2: calculate the area of the close shape ACDEA, in Q1, by linear method?

Q3: The following coordinate & distance were measured in the traverse (ABCDEFA) **read the table carefully then** Design a curve passing through stations B, C &D?

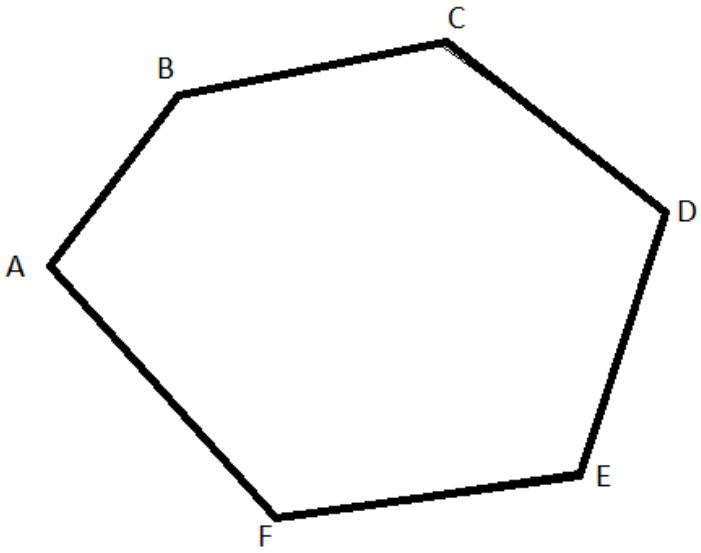


Fig (1) Traverse ABCDEFA

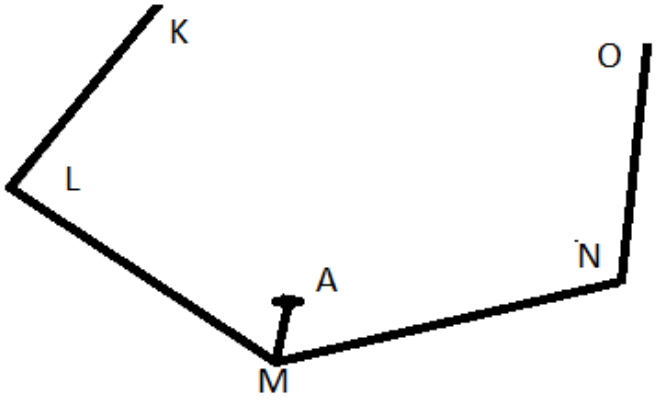
Sta.	Dist. m	Calculated Coordinate	
		E	N
A		77.143	62.187
	36.135		
B		98.964	90.990
	43.692		
C		141.798	99.604
	47.028		
D		179.783	71.878
	45.715		
E		165.236	28.539
	50.938		
F		114.859	21.002
	55.845		
A		77.003	62.387

Q4: Design a horizontal curve tangent to lines DE, EF & FA respectively in Q3?

Q5: Calculate the area of the close shape ABCDEA, in Q2 by total coordinate product method??

Q6: The adjusted Azimuth & distance of the traverse (KLMNO) shown below design a horizontal curve tangent to LM, MN & NO respectively and passing through point A see fig.(2)

Line	Distance (m)	Adj. Az.
KL	170	200° 29′ 13″
LM	210	123°29′ 42″
MN	240	76°52′ 13″
NO	170	6°19′ 51″
MA	25	----------



Q7- Calculate the volume between the cross sections in Fig (2) by mid area method having the same road width in all cross sections (note all dimension in meter):

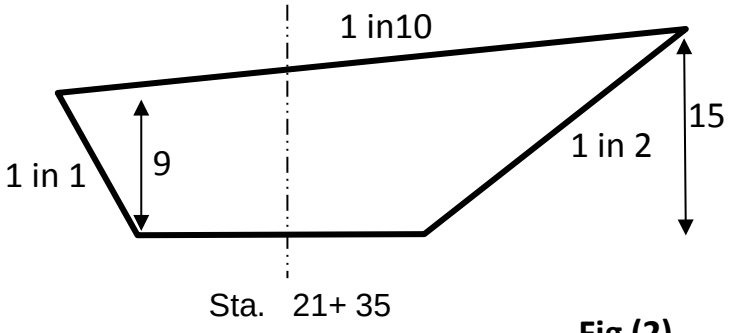
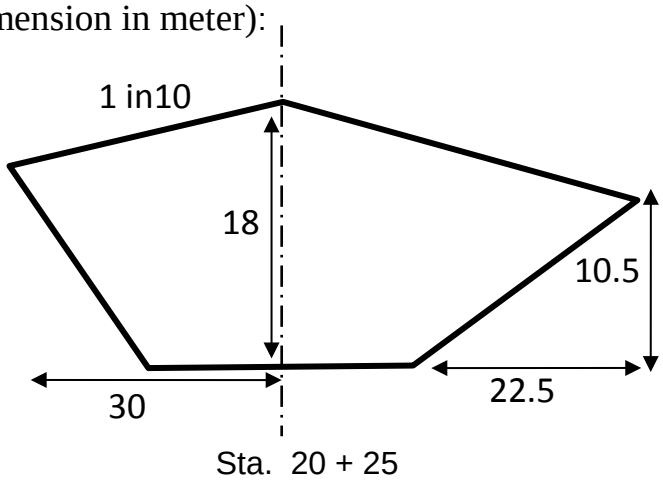


Fig (2)



Q8: The adjusted Azimuth & distance of the traverse (KLPO) shown in fig (3) design a horizontal compound curve **(with 2 radius R_1 & R_2 note R_1 must be equal $2R_2$)** tangent to LP & PO respectively and passing through point **A**.

Line	Distance (m)	Adj. Az.
KL	214	300° 39′ 18″
LP	573	225°34′ 44″
PO	456	104°25′ 46″
MN	288	177°02′ 18″

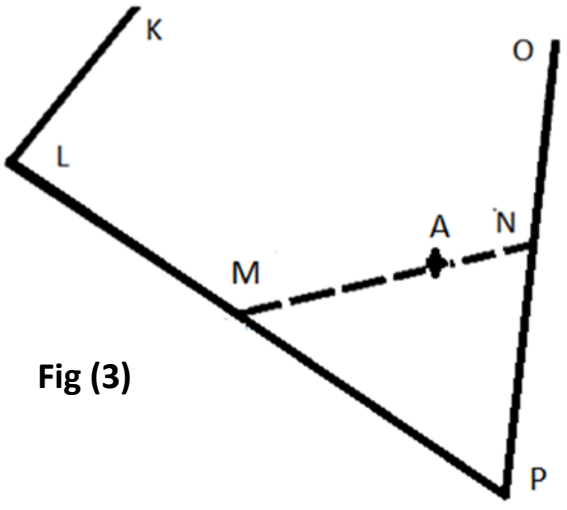


Fig (3)

Q9: The following angles & distance were measured in a traverse (ABCDEFG) below:

1. Calculate the corrected Azimuth for all traverse lines below by angle to the right method?
2. Calculate the coordinate for all traverse station below?.
3. Calculate the corrected coordinate for stations D & F?
4. Calculate the area of ADF (do not use coordinate method)?

Angle	Angle to the right	Line	Distance (m)	Remarks	
ABC	225° 14' 19"	AB	215.32	Adj. Az. of Line AB	131° 58' 58"
BCD	128° 16' 09"	BC	171.32	Adj. Az of Line FG	210° 04' 23"
CDE	115° 13' 26"	CD	171.468	Fix coordinate of Sta. A	(500 , 1000)
DEF	285° 00' 24"	DE	124.629	Fix coordinate of Sta. G	(845.356 ,168.416)
EFG	224° 21' 22"	EF	254.491		
		FG	267.377		

Q10: The table below is field book notes for a road construction with road width of 24 m. Draw the cross sections for stations (44+00) & (45+00)? Use scale (1:500)?

Station	Left	Center	Right	
43+00	$-\frac{10}{34}$	$-\frac{24}{0}$	$-\frac{10}{24}$	$-\frac{8}{30}$
43+80	$-\frac{6}{30}$ $-\frac{10}{24}$	$-\frac{12}{0}$	$-\frac{0}{12}$	
44+00	$-\frac{8}{20}$ $-\frac{10}{14}$	$\frac{0}{0}$	$\frac{6}{16}$	$\frac{16}{22}$
45+00	$\frac{14}{24}$	$\frac{20}{0}$	$\frac{14}{16}$	$\frac{10}{24}$

Q11: Calculate the area and the volumes of cut using the most accurate method in Q10?

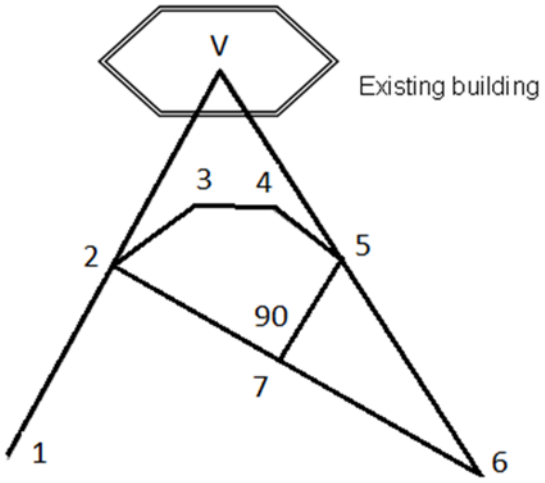
Q12: A rising gradient of (1:50) is to be connected to another falling gradient by means vertical parabolic curve. The reduced level of the intersection point of the gradients is (120 m) at chain age of (30+50) while the reduced level of the second tangent point (T2) is (117.5 m) at chain age of (33+00). Calculate the reduced levels at (100 m) intervals from station (27+00) to the highest point on the curve?

Q13: A circular curve of 700 m radius has been set out connecting two straights with a deflection angle of (42^o 04' 44"). It is decided, for construction reasons, that the mid-point of the curve must be moved 5 m towards the center, i.e. away from the intersection point. The alignment of the straights is to remain unaltered, design the above curve?

Q14: A horizontal curve of 125 m radius is to be set out between two straights (1-V) and (V-6), but the intersection point (V) is inaccessible. In order to overcome the problem points 2, 3, 4, and 5 were selected and the following information was recorded:

1. Design the above Curve.

Line	Adj. Azimuth	Distance (m)
12	149 º 6 ‘ 23 “	171.000
23	172 º 56 ‘ 23 “	79.800
34	210 43 ‘ 23 “	57.000
45	246 º 42 ‘ 45 “	74.100
56	267 12 ‘ 12 “	199.500
Coordinate of sta. 1	(410.150, 420.230)	
Coordinate of sta. 6	(211.391, 106.167)	



Q15: Calculate the corrected Azimuth for all traverse lines in Q14?

Q16: Calculate the volume between the cross sections at station (10+30) and (12+50) shown in Fig (2) by mid area method having the same road width in all cross sections (note all dimension in meter):

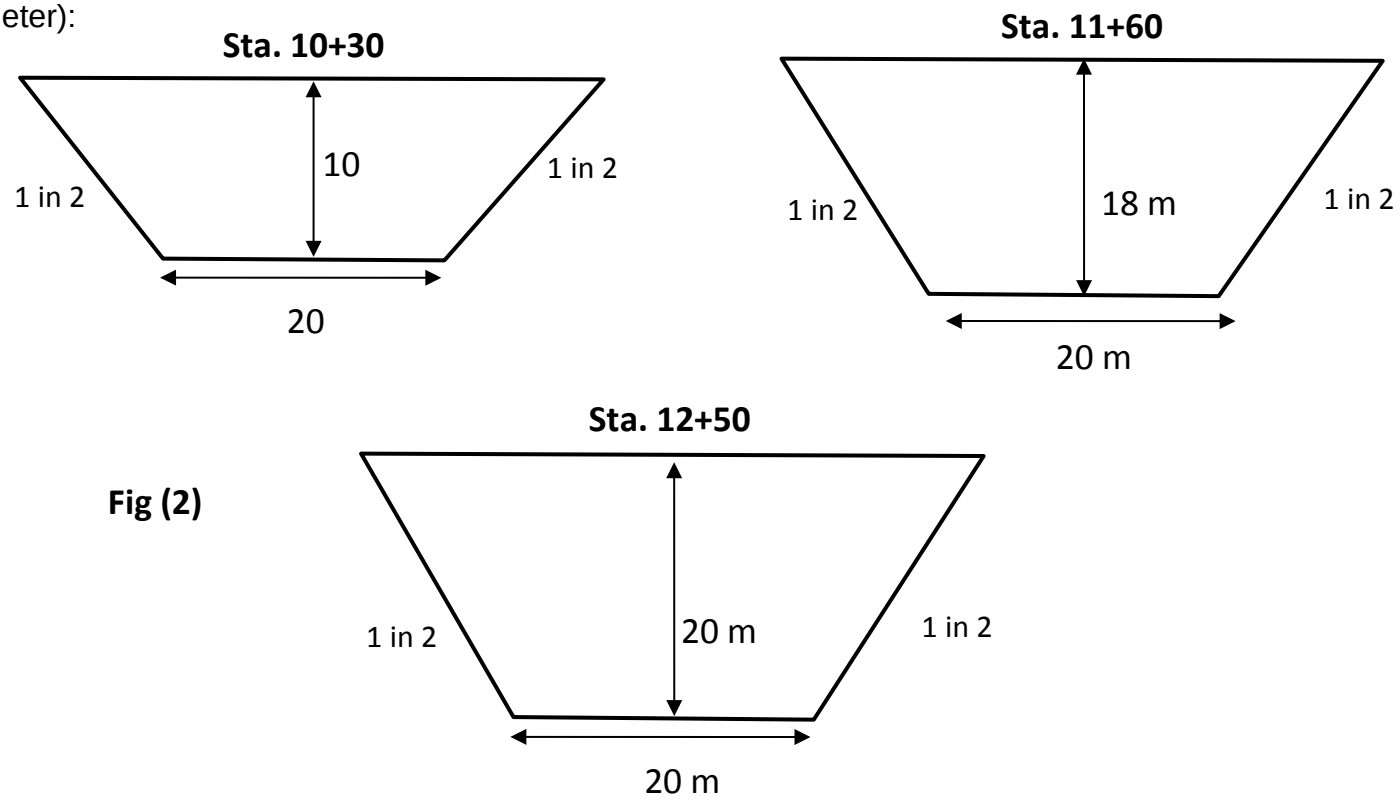


Fig (2)

Q17: The following staff readings in meter were obtained when leveling along the center line of the storm water sewer, the proposed sewer level have a fall slop of (1 to 125) and the elevation of it at sta. (600) is (61.000) m. Calculate the earthwork (cut and fill) work that we?

Station	BS	IS	FS	Remarks
600	1.245			BM 1 elevation =61.500 m
620		1.270		
640		2.100		
650		2.300		
680	1.324		1.983	
700		1.768		
710		1.456		
720	1.479		2.110	
740	2.130		1.380	
750		0.456		
760	0.985		0.652	
800		1.500		
820			1.518	BM 2 elevation =61.000 m

Q18: How many methods we have to set out horizontal curves & what are they?

Q19: How you will set out a straight line on an existing one on site (practically) so that the angle between them equal (105^{o}) using only a simple cord? (Explain it with figures).

Q20: Set out a horizontal curve with following information's by **offset from the main chord**

Curve radius	80 m
Deflection angle	46^{o}
Interval	5.0meter

Q21: The following staff readings in meter were obtained when leveling along the center line of a high way, the proposed highway level have a slop of (+1 to 40) from station (30+00) to station (30+80) and a slop of (-1 to 50) from station (30+80) to station (32+00), the elevation of it at sta. (30+00) must be 28 m. Calculate the earthwork (cut and fill) work that we need along the center line of the highway? {Note (m=36)}

Station	BS	IS	FS	Elevation m
30+00	1.54			BM 1 ground level 25 m
30+20		2.23		
30+50	1.352		2.152	
30+60		1.45		
30+70	1.254		1.75	
30+80	1.785		1.856	
31+00		1.95		
31+20		1.655		
31+60		1.256		
32+00			1.243	BM 2 ground level 24 m

Q22: The following angles & distance were measured in the traverse (ABCDEF):

1. Draw a simple scaled sketch for the above traverse?
2. Calculate the corrected Azimuth for all traverse lines?
3. Calculate the coordinate for all traverse station below?

Angle	Angle Direction	Deflection angle			Line	Distance (m)
ABC	To the left	108°	34 ‘	25“	AB	64.270
BCD	To the left	34°	57 ‘	36“	BC	87.592
CDE	To the left	112 °	48 ‘	51“	CD	65.654
DEF	To the left	86 °	55 ‘	22“	DE	66.199
					EF	59.181
Fix Az. of Line AB					169° 59’ 56”	
Fix Az. of Line FE					6° 43’ 58”	
Fix coordinate of Sta. A					(109.732 , 124.615)	
Fix coordinate of Sta. F					(154.176 , 107.305)	

Q23: Calculate the **corrected distance** between Station A & D in Q22?

Q24: Calculate the Area of shape BEDB by coordinate method in Q22?

Q2: During the leveling along the center line of a high way project the following staff readings in meter were obtained, the construction road profile have a slop of +(1 to 80) and the elevation of it at Sta. 10+00 must be (20.000 m).

1. **(10%):** Calculate the earthwork excavation (cut and fill) that we need along the center line of the high way?
2. **(10%):** Draw the profile of natural ground level?

Note:

- Station 10+00 is a B.M. with Fix elevation of (23.000 m).
- Station 14+50 is a B.M. with Fix elevation of (22.500 m).
- Use (m = 12) for error limitation equations**.**

station	BS	IS	FS
10+00	1.345		
10+20		1.24	
10+40		1.91	
10+70		2.424	
10+90	1.324		1.985
11+50		1.655	
12+00		1.435	
12+50	1.479		2.154
13+10	2.135		1.435
13+30		0.456	
13+50	0.245		0.675
14+00		0.655	
14+50			0.799

Q26: It decided to join the two straights, AB (Azimuth = 15° 55‘ 30“ and length=650m) and BC (length=600m) by a horizontal compound curve. The curve consists of two parts. The first part must have sub-tangent length (t_1) equal (105.796m) and chord length of (208.378m) while the second part has a radius of (320m) and maximum off-set of (6.993m).

1. Calculate the Azimuth of line BC?
2. Design the above curve?

Q27: The following angles & distance were measured in a traverse (ABCDEF) in Fig (1) below by using total station:

1. Calculate the corrected Azimuth for all traverse lines below by deflection angle method.
2. Calculate the coordinate (E, N) for all traverse station below.
3. How much disclosure error we have in coordinate?
4. Calculate the area of BCDEP (use coordinate method)?

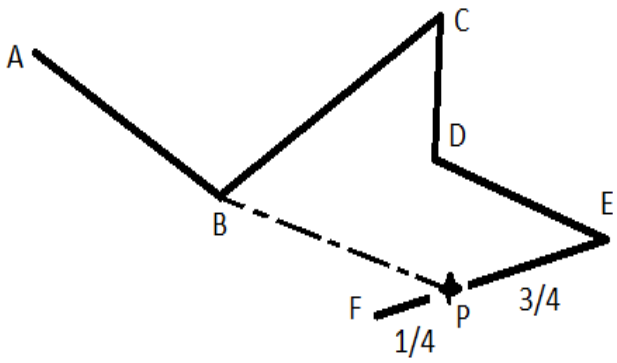


Fig (1)

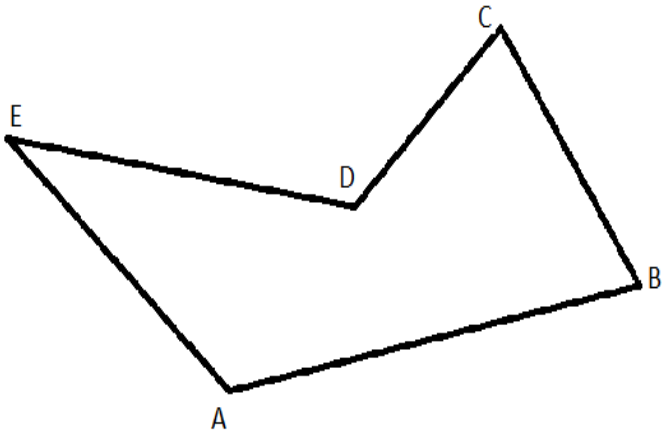
Line	Distance (m)	Vertical angle	HI	HR	Horizontal angle (Deflection)	
AB	68.883	16 °18‘ 16“	1.670	1.350	ABC	64 °28‘ 51“
BC	86.586	21 °56‘ 10“	1.720	1.350	BCD	124 °38‘ 12“
CD	36.501	11 °09‘ 19“	1.680	1.350	CDE	71 °29‘ 35“
DE	59.416	18 °16‘ 26“	1.660	1.650	DEF	115 °34‘ 32“
EF	77.130	14 °36‘ 56“	1.710	1.650		

Fix Azimuth BA	301 °08‘ 16“	
Fix Azimuth FG	255 °22‘ 34“	
Fix coordinate A	(44.251, 111.852, 34.980)	

Q28: Calculate the reduce level (elevations) for all the stations in Q27?

Q29: The following corrected Azimuths were calculated in a traverse (ABCDEA) **read the table carefully** then calculate:

1. The total disclosure error in coordinate?
2. The corrected coordinate for all traverse stations
3. The corrected back Azimuth of line (CD)?



line	Corrected Azimuth			Distance (m)
AB	77°	58 ‘	07“	290.224
BC	328°	11 ‘	30“	181.306
CD	223°	59 ‘	42“	148.477
DE	279°	09‘	39“	243.430
EA	133°	21 ‘	24“	212.900
Fix coordinate of station A (E, N) (200, 150)				

Q30: Calculate area of close shape ABCDEA in Q29 (do not use coordinate method)?

Q31: A rising gradient of (1:40) is to be connected to a falling gradient of (1:80) by means of vertical parabolic curve (380 m) in length. The reduced level of the intersection point of the gradients is (27.000 m). Calculate:

- The reduced levels at 80 m intervals along the curve.
- The reduced level & distance of lowest & highest point along the above curve.

Q32: A falling gradient of (1:50) is to be connected to a rising gradient of (1:100) by means of vertical parabolic curve. The reduced level of the intersection point of the gradients is (54.000 m). The lowest reduced level in the curve must be (55.8 m) calculate the reduced levels at 120 m intervals along the curve.

Q33: A falling gradient of (1:40) is to be connected to another falling gradient of (1:100) by means of vertical parabolic curve. The reduced level of the first tangent point (T1) is (80.000 m) and the reduced level of the second tangent point (T2) is (66.000 m). Calculate the reduced levels at (150 m) intervals along the curve.

Q34: A rising gradient of (1:100) is to be connected to a rising gradient of (1:80) by means of vertical parabolic curve (400 m) in length. The reduced level of the intersection point of the gradients is (48.000 m). Calculate:

- The reduced levels at 80 m intervals along the curve.
- The reduced level & distance of lowest & highest point along the above curve.

Q35: A rising gradient is to be connected to another falling gradient of (1:125) by means vertical parabolic curve. The reduced level of the intersection point of the gradients is (18.000 m) at chain age of (22+30) while the reduced level of the first tangent point (T1) is (14.000 m) at chain age of (20+30). Calculate:

- The reduced levels at (90 m) intervals along the curve.
- The reduced level & distance of lowest & highest point along the above curve.

Q36: A falling gradient of (1:80) is to be connected to another rising gradient by means vertical parabolic curve. The reduced level of the intersection point of the gradients is (80.000 m) at chain age of (70+20) while the reduced level of the second tangent point (T2) is (83.600 m) at chain age of (72+00). Calculate:

1. The reduced levels at (75 m) intervals from station (68+00) to the lowest point on the curve?.

Q37: What is the deference between Closed Traverse & open traverse?

Q38: What is the deference between Azimuth & bearing angle?

Q39: what is the deference between Simple and compound horizontal circular curve?

Q40: what is the deference between Vertical interval & vertical index contour?

Q41: what is the deference between Departure & latitude?

Q42: why we take two readings in angle measurement by theodolite (face right & face left)?

Q43: why we doing repetition in angle measurement by theodolite?

Q44: Why we Using curves in intersection area?

Q45: Write four of the purposes that traverse surveying are made for?

Q46: Write four methods for horizontal curve set outing & explain one of them which is used for small curves?

Q47: Why we must equalize the distance of BS & FS in leveling progress? How?

Q48: What are the parameters effects the selection of the interval length in profile leveling?

Q49: Write four of the common mistakes made in leveling? Explain one of them?

Q50: Define Total station and write four applications for it?

Q51: Define Tangential angle method explain it briefly?

Q52: What is “Parallax” and how we can avoid it?

Q53 Define Surveying?

Q54 Define Variable systematic error?

Q55: What is the difference between Borrow and fill material?

Q56: What is the difference between Waste and cut material?

Q57: What is the difference between error and mistakes?

Q58: How we can minimize Systematic error on using theodolite?

Q59: How we can minimize random error on using theodolite?

Q60: How we can minimize Atmospheric refraction effect on using level?

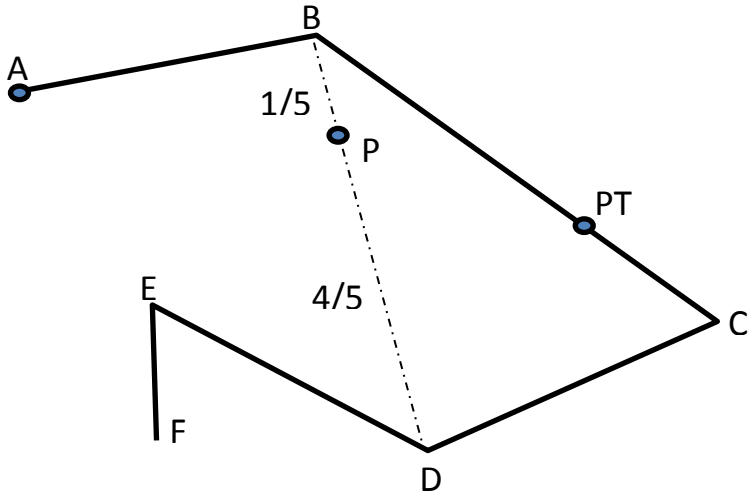
Q61: How we can minimize Earth's curvature effect on using level?

Q62: For the traverse ABCDEF shown in the Figure:

1. Calculate the coordinate for all traverse stations? (do all the possible corrections).
2. Design a compound horizontal curve (with two part) tangent to AB and BC at (A) and (PT) respectively and passing through station P, the radius of the first part must be equal to (600 m)?

Line	Deflection angle	Length
AB		275.093
BC	48° 55′ 56″	462.702
CD	116° 15′ 40″	295.033
DE	56° 07′ 55″	285.563
EF	120° 14′ 10″	Missing
AZ $_{AB}$	78° 54′ 31″	
AZ $_{FE}$	Due North	

Fix Coordinate Station (A)	107.419, 377.374
Fix Coordinate Station (F)	230.653, 149.819

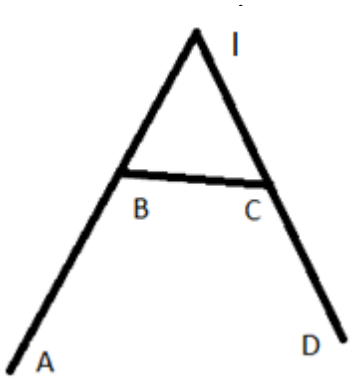


Q63: Calculate the area of the closed loop PDCP in Q62 S methoh (linear method) ?

Q64: Calculate the distance between station (B) and line (CD) in Q62? (shortest distance)

Q65: The following data were derived from traverse ABCD. Design a joined the straights AI & IB. (see the Fig)

AC	580 m	Angle ACD	252°	15 ‘	48 “
CD	270 m	Angle CDB	230 °	07 ‘	10 “



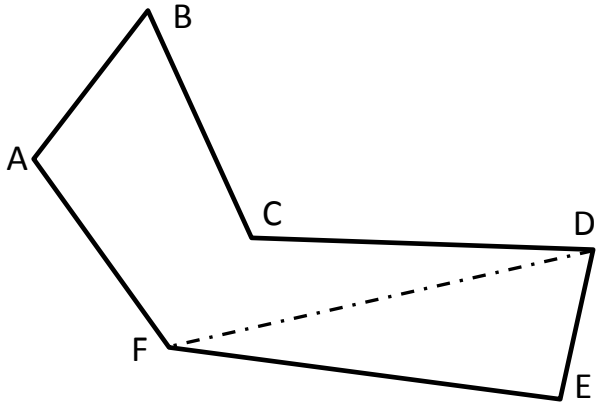
Q66: The table is the known coordinate of points A, B, and C. calculate the radius and design the curve pass through all three points.

Point	Easting	Northing
A	12	12
B	17	14
C	21	10

Q67: The following angles & distance were measured in a close loop traverse (ABCDEFA) below:

1. Calculate the corrected Azimuth for all traverse lines?
2. Calculate the corrected coordinate for all traverse station below?
3. Calculate the **corrected distance** of line DF?
4. Calculate the Area of the close shape (ABEA) by coordinate method?

Angle	Interior angle	Line	Distance (m)
ABC	45° 59 ‘ 35“	AB	184.398
BCD	246° 08 ‘ 25“	BC	261.143
CDE	89 ° 16 ‘ 03“	CD	277.965
DEF	87 ° 48 ‘ 18“	DE	166.825
EFA	120 ° 39 ‘ 30“	EF	337.450
FAB	130 ° 07 ‘ 51“	FA	245.650
Adj. Az. of Line AB		50° 32’ 28”	
Fix coordinate of Sta. A		(500 , 220)	



Q68: Two straights (AB & BC) intersecting at a point B have the following Azimuths, BA 160◦, BC 10◦. They are to be joined by a circular curve which must pass through a point D which is 165 m from B and the Azimuth of BD is 145◦. Find the required radius, then Design Curve?

Q69: A rising gradient of (1:50) is to be connected to another falling gradient by means vertical parabolic curve. The reduced level of the intersection point of the gradients is (360 m) at chain age of (30+50) while the reduced level of the second tangent point (T2) is (357.5 m) at chain age of (33+00). Calculate the reduced levels at (100 m) intervals from station (27+00) to the highest point on the curve?

Q70: Set out a horizontal curve with following information’s by **offset from the main tangent method**?

Curve radius	80 m
Deflection angle	46°
Interval	5.0 meter

Q71: How you will set out a straight line on an existing one on site (practically) so that the angle between them equal (45 °) using only a simple cord? (Explain it with figures)

Q72: The following readings were taken with a level and 4 m staff. Draw up a level book page and reduce the levels by the height of instrument method.
0.578 B.M.(= 58.250 m), 0.933, 1.768, 2.450, (2.005 and 0.567) C.P., 1.888, 1.181, (3.679 and 0.612) C.P., 0.705, 1.810.

Q73: Calculate reduce the levels of the stations from the readings given in the Q59 by the rise and fall method.

Q74: The following consecutive readings were taken with a level on continuously sloping ground at a common interval of 20 m. The last station has an elevation of 155.272 m. Rule out a page of level book and enters the readings. Calculate
(*i*) The reduced levels of the points by rise and fall method, and
(*ii*) The gradient of the line joining the first and last points.
0.420, 1.115, 2.265, 2.900, 3.615, 0.535, 1.470, 2.815, 3.505, 4.445, 0.605, 1.925, 2.885.

Q75: The fore bearings and back bearings of the lines of a closed traverse *ABCDA* were recorded as below. Determine which of the stations are affected by local attraction and compute the values of the corrected bearings.

Line	Fore bearing	Back bearing
AB	77°30′	259°10′
BC	110°30′	289°30′
CD	228°00′	48°00′
DA	309°50′	129°10′

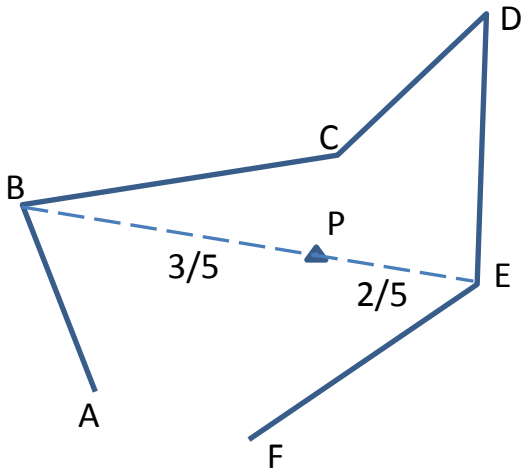
Q76 The following staff readings in meter were obtained when leveling along the center line of a high way, the proposed highway level have a slop of (+1 to 125) from station (80+00) to station (80+80) and a slop of (-1 to 100) from station (80+80) to station (82+00), the elevation of it at station (80+00) must be (29.0) m. Calculate the earthwork (cut and fill) work that we need along the center line of the highway? {Note (m=36) check & distribute the disclosure error depending on No. of setup}

Station	BS	IS	FS	Elevation m
80+00	1.340			BM 1 ground level 30 m
80+20		2.030		
80+50	1.152		1.952	
80+60		1.250		
80+70	1.054		1.550	
80+80	1.585		1.656	
81+00		1.750		
81+20		1.455		
81+60		1.036		
82+00			1.033	BM 2 ground level 29 m

Q77: The following angles and distance were measured during the traverse ABCDEF as shown in the following table and Figure.

1. Calculate the corrected coordinate for all traverse stations?
2. Calculate the area of close shape ACDEA? (use coordinate method)
3. Calculate the area of the triangle BCD? (do not use coordinate method)

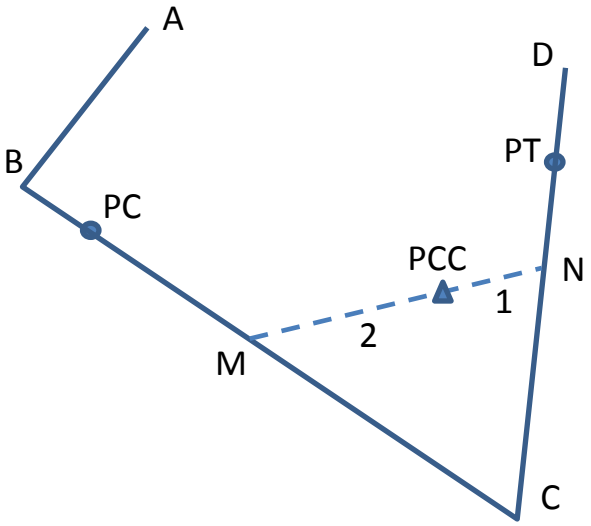
Line	Length (m)	Angle to the right			
AB	69.350	FAB	232°	03′	45″
BC	114.254	ABC	283°	20′	51″
CD	75.042	BCD	146°	22′	32″
DE	93.840	CDE	314°	28′	01″
EF	99.260	DEF	234°	22′	59″
		EFA	229°	22′	10″
Fix Coordinate (A)		111.960		136.283	
Fix Coordinate (F)		167.741		120.042	



Q78: Find the coordinate of station (P) as show in the Figure in Q77?

Q79: A new highway center line is to be set out a long a valley by means of vertical parabolic curve. The two gradients have slops of (1:50) & (-1:100) respectively. The reduced level of the intersection point of the gradients is (50.000 m). The highest point level on the road must not be higher than (48.000 m). Calculate the reduced levels at 125 m intervals along the curve.

Q80: The adjusted Azimuth & distance of the traverse (ABCD) shown in the Figure. Design a horizontal compound curve tangent to lines BC & CD at PC and PT respectively, and passing through point **PCC? (PCC is on the line MN as shown)**.



Line	Distance (m)	Adj. Azimuth
AB	235	250° 39′ 18″
BC	630	175°34′ 44″
CD	501	54°25′ 46″
MN	315	127°02′ 18″