Faculty of Engineering Civil Eng. Department Dr. Ragab Khalil	Homework (4) Covering Lectures: 21-26 (4 points)	Surveying (CE 371) Fall 2108

Problem (1)

A tract of land with a polygon shape with the following coordinates. A (100, 100), B (150, 300), C (250, 450), D (400, 300), E (350, -100). Units are in meters. Compute the proper scale if you want to plot this land on A4 paper (2 cm margins at each side).

Solution

X min= 100, X max = 400 difference= 300 m

Y min = -100, Y max = 450 difference = 550 m

A4 size = 210 x 297 mm drawing area = 170 x 257 mm

X scale = 0.170/300 = 1/ 1764.7 Y scale = 0.257/550 = 1/ 2140

The proper scale is 1/2200

Problem (2)

Compute the area of the tract of land in problem (1) using point coordinates.

point	x	y
A	100	100
B	150	300
C	250	450
D	400	300
E	350	-100
A	100	100

Area = 0.5 [(100x300 + 150x450 + 250x300 + 400x-100 + 350x 100) – (100x150 + 300x250 + 450x400 + 300x350 + (-100)x100)] = 98750 m^2

Problem (3)

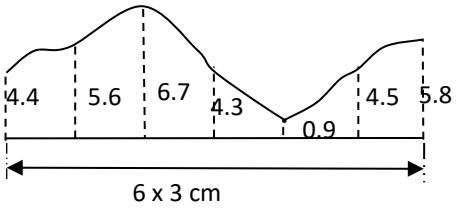
Compute the departures and latitudes of the sides of the tract of land in problem (1), then compute its area using double meridian method.

line	DX	DY	DM	DA
AB	50	200	50	10000
BC	100	150	200	30000
CD	150	-150	450	-67500
DE	-50	-400	550	-220000
EA	-250	200	250	50000
			Area=	98750 m^2

Problem (4)

Compute the area of the given figure using

a) Trapezoidal rule
b) Simpson rule
c) Compute the actual area if the drawing scale 1: 250



Solution

Trapezoidal rule

Area = 3/2 [(4.4+5.8) + 2x(5.6+6.7+4.3+0.9+4.5)] = 81.3 cm^2

Simpson rule

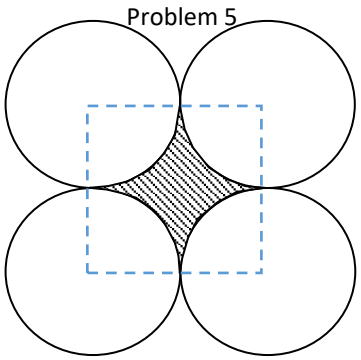
Area = 3/3 [(4.4+5.8) +2x(6.7+0.9) +4x(5.6+4.3+4.5)] = 83 cm^2

Actual area (TR) = 81.3 x (250)2 /(100)2 = 508.125 m^2

Actual area (SR) = 83 x (250)2 /(100)2 = 518.75 m^2

Problem (5)

Compute the shaded area if the radius of circles is 5 m.



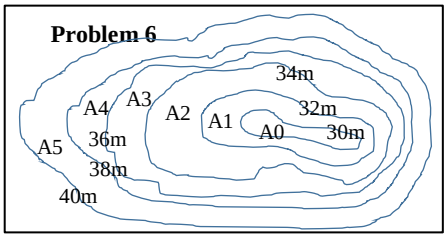
Solution

Area of shaded zone = area of square – 4 x area of the sector
= 10x10 – 4x(π x $(5)^2$ x90/360)
= 100 – 78.54 = 21.46 m^2

Problem (6)

for the given contour map the area within each contour is: A0=4000m^2, A1=9500m^2, A2=18000m^2, A3=44,000m^2, A4=100,000m^2, and A5=150,000m^2.

a) Is it for a summit or a depression?
b) What is the contour interval?
c) Compute the volume of cut and fill to grade the area at level 36 m.



Solution

This map is for a depression

Contour interval = 2 m

To grade the area at level 36 m

V(fill) = 2/2 [(4000+44000) + 2(9500+18000)] = 103000 m^3

V(cut) = (100000-44000) x (2+0)/2 + (150000-100000) x (4+2)/2

V(cut) = 56000 + 150000 = 206000 m^3

Problem (7)

The following table is the area of cross sections along a road project (100 m stationing). Compute volume of earth work using:

a) Average-end-area method.
b) Prismoidal method.

station	Cross section Area m^2
0+00	223
0+25	309
0+50	485
0+75	390
1+00	264
1+25	138

Solution

Distance between each two sections = 25 m

Average-end-area method

V= 25/2 [(223+138) + 2x(309+485+390+264)] = 40712.5 m^3

Prismoidal method

Since Prismoidal method used with even number of distances

The volume from station 0+00 to station 1+00 will be computed using Prismoidal method, while Volume between stations 1+00 and 1+25 will be computed using Average-end-area method

V= 25/3 [(223+264) + 2x(485) + 4x(309+390)] + 25/2 (264+138)

V= 35441.67 + 5025 = 40466.67 m^3

Problem (8)

A circular curve is to be laid down such that the tangent distance must be 300.00 m. Deflection angle is equal to 22° 37' 11.5". if the stationing of PI is 23+15.00 (using 100 m stationing). Compute the following:

a) Stationing of PC and PT along the curve.
b) Stationing of PT along the tangent.
c) Curve parameters, R, L, LC, D, E and M.
d) A complete table of deflection angles and chords

Solution

Curve parameters

R= T/tan(I/2) = 300/tan(22° 37' 11.5"/2) = 1500 m
L = π. R.I/180 = π x 1500 x 22° 37' 11.5"/180 = 592.19 m
LC = 2R sin (i/2) = 2x1500x sin(22° 37' 11.5"/2) = 588.35 m
D = S/R x (180/π) = 100/1500 x 180/π = 3° 49' 11"
E= R/cos (I/2) -R = 1500/cos(22° 37' 11.5"/2) -1500 = 29.71 m
M= R-R. cos (I/2) = 1500- 1500 x cos (22° 37' 11.5"/2) = 29.13 m

Stationing of PC = 23+15.00 – 3 = 20+15.00
Stationing of PT along the curve = 20+15.00 + 5+92.19 = 26+07.19

Stationing of PT along the tangent = 23+15.00 +3 = 26+15.00

By definition, arc S = 100.00 m

Sa = (21+00) - PC = 2100 – 2015.00 = 85 m
Sb = PT - (26+00) = 2607.19 - 2600 = 07.19 m
da = Sa(D/S) = 85 (3.82°/100) = 3° 14’ 49.2”
db = Sb(D/S) = 07.19(3.82° /100) = 0° 16’ 28.77”
C = 2R sin(D/2) = 99.99 m
Ca = 2R sin(da/2) = 84.99 m
Cb = 2R sin(db/2) = 7.19 m

Deflection angle increment between any two full stations=D/2= 1°54’ 35.5”
Deflection angle increment for the first full station =da/2=1° 37’ 24.6”
Deflection angle increment from the last full station =db/2=0° 8’ 14.39”
The following is a complete table of deflection angles and increment chords method.

Station	Stationing value	Arc length	Subtended angle at the center	Chord length	Deflection angle increment	Deflection angle
PT	26+07.19	7.19	0° 16’ 28.77”	7.19	0° 8’ 14.39”	11° 18’ 36.5”
26	26+00	100	3° 49’ 12”	99.99	1°54’ 35.5”	11° 10’ 22.1”
25	25+00	100	3° 49’ 12”	99.99	”1°54’ 35.5	9° 15’ 46.6”
24	24+00	100	”3° 49’ 12	99.99	”1°54’ 35.5	7° 21’ 11.1”
23	23+00	100	”3° 49’ 12	99.99	”1°54’ 35.5	5° 26’ 35.6”
22	22+00	100	”3° 49’ 12	99.99	”1°54’ 35.5	3° 32’ 0.1”
21	21+00	85.00	”3° 14’ 49.2	84.99	”1° 37’ 24.6	1° 37’ 24.6”
PC	20+15.00					