Scilab Textbook Companion for Surveying & Levelling by N. Basak[1]

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Book Description

Title: Surveying & Levelling

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Scilab numbering policy used in this document and the relation to the above book.

Exa Example (Solved example)

Eqn Equation (Particular equation of the above book)

AP Appendix to Example(Scilab Code that is an Appednix to a particular Example of the above book)

For example, Exa 3.51 means solved example 3.51 of this book. Sec 2.3 means a scilab code whose theory is explained in Section 2.3 of the book.

Contents

List of Scilab Codes

Chapter 1

introduction

Scilab code Exa 1.1 true length

```
1     clear
2 l=20                  //chain length
3 e=0.03                //error
4 l1=l+e                //L'
5 ml=327                //measured length
6 truel=(l1/l)*(ml)     //true length
7 printf("\n true length of line= %0.3f ",truel)
```

Scilab code Exa 1.2 amount of error

```
1
2 l1=20                     //chain 1 length
3 e=0.05                    //error
4 l11=l1+e
5 ml1=1200                  //measured lenght
6 tl=(l11/l1)*ml1           //true lenght of line
7
8 l2=30                     //chain 2 length
```

```
ml2=1195                    //measured length

l21=(tl/ml2)*l2
ae=l21-l2                   //amount of error
printf("\n amount of error= %0.3f ",ae)
```

Scilab code Exa 1.3 true distance

```
1
2
3 clear
4 l1=20
5 e=(0.06/2)                          //consider mean
     elongation
6 l11=l1+e
7 ml=900
8 tl=(l11/l1)*ml
9 printf("\n true length1= %0.3f ",tl)
10 l2=20
11 e2=(0.06+0.14)/2
12 l21=20+e2
13 ml2=1575-ml
14
15 tl2=(l21/l2)*ml2
16 printf("\n true length 2= %0.3f ",tl2)
17 td=tl+tl2
18 printf("\n true distance= %0.3f meters ",td)
```

Scilab code Exa 1.4 true distance on ground

```
1 clear
2 s=100
3 dsm=3500
```

```
4 adsm=dsm/s
5
6 printf("\n distance between stations on  map= %0.3f
    centimeters',adsm)
7
8 actuals=50
9 td=adsm*actuals
10
11 printf("\n true distance on ground = %0.3f meters',
    td)
```

Scilab code Exa 1.5 true

```
1 clear
2 present=19.5
3 actual=20
4 cm1=actual/present
5 cm12=(actual*actual)/(present*present)
6 pm=125.5
7 apm=pm*cm12
8 printf("\n actual area present= %0.3f square cm',apm
    )
9
10 cm=40
11 cm2=cm*cm
12
13 area=cm2*apm
14 scale=(20.05*20.05)/(20*20)
15 ta=scale*area
16 printf("\n true area= %0.3f square meters',ta)
```

Scilab code Exa 1.6 the true length

```
1
2
3
4  //
5
6  L=30
7  t0=20
8  p0=10
9  pm=15
10 tm=32
11 a=0.03
12 al=11/(1000000)
13 E=2.1*(1000000)
14 w=0.693
15 ml=780
16 n=1
17 printf("\n  for n=1')
18 ct=al*L*(tm-t0)
19 printf("\n the temperature correction is %0.3f
      meters',ct)
20
21 cp=(pm-p0)*L/(a*E)
22 printf("\n the pull correction is  %0.3f  meters',cp
      )
23
24 cs=-L*w*w/(24*pm*pm*n*n)
25 printf("\n the sag correction is   %0.3f meters',cs)
26
27 e=ct+cp+cs
28 printf("\n the total correction is  %0.3f meters',e)
29
30 l1=L+e
31
32 truelength=(l1/L)*ml
33 printf("\n the true length  is  %0.3f ",truelength)
34
35 n=2
36
```

```
37 printf("\n  for n=2')
38 ct=al*L*(tm-t0)
39 printf("\n the temperature correction is %0.3f
      meters',ct)
40
41 cp=(pm-p0)*L/(a*E)
42 printf("\n the pull correction is  %0.3f  meters',cp
      )
43
44 cs=-L*w*w/(24*pm*pm*n*n)
45 printf("\n the sag correction is   %0.3f meters',cs)
46
47 e=ct+cp+cs
48 printf("\n the total correction is  %0.3f meters',e)
49
50 l1=L+e
51
52 truelength=(l1/L)*ml
53 printf("\n the true length  is  %0.3f  meters",
      truelength)
```

Scilab code Exa 1.7 the horizontal distance

```
1
2
3
4 clear
5 //
6
7 L=20//m
8 t0=20//degree C
9 p0=15//kg
10 p=10//kg
11 tm=30//degree C
12 a=0.02//cm2
```

```
13 al=11/(1000000)//per degree C
14 E=2.1*(1000000)//kg/cm2
15 w=0.4//kg
16
17 n=1
18 ct=al*L*(tm-t0)//temperature correction
19 printf("\n the temperature correction is %0.5f
      meters',ct)
20
21 cp=(p-p0)*L/(a*E)//pull correction
22 printf("\n the pull correction is  %0.5f  meters',cp
      )
23
24 cs=-L*w*w/(24*p*p*n*n)//sag correction
25 printf("\n the sag correction is   %0.5f meters',cs)
26
27 e=ct+cp+cs//total correction
28 printf("\n the total correction is  %0.5f meters',e)
29
30 hd=L+e//horizontal distance
31
32 printf("\n the horizontal distance  is  %0.5f meters
      ",hd)
```

Scilab code Exa 1.8 the horizontal distance

```
1
2
3
4 clear
5 //
6
7 L=30//cm2
8 t0=20//kg/cm2
9 p0=5//per degree C
```

```
10 tm=25//kg/cm2
11 a=0.02//cm2
12 al=11/(1000000)//per degree C
13 E=2.1*(1000000)//Youngs modulus
14 w1=22//g/m
15 w=0.66//kg
16 n=1
17
18 p=5//kg
19 printf("\n for p=5 case')
20
21 ct=al*L*(tm-t0)
22 printf("\n the temperature correction is %0.5f
      meters',ct)
23
24 cp=(p-p0)*L/(a*E)
25 printf("\n the pull correction is %0.5f meters',cp
      )
26
27 cs=-L*w*w/(24*p*p*n*n)
28 printf("\n the sag correction is %0.5f meters',cs)
29
30 e=ct+cp+cs
31 printf("\n the total correction is %0.5f meters',e)
32
33 hd=L+e
34
35 printf("\n the horizontal distance is %0.5f meters
      ",hd)
36
37 p=11
38 printf("\n for p=11 case')
39
40 ct=al*L*(tm-t0)
41 printf("\n the temperature correction is %0.5f
      meters',ct)
42
43 cp=(p-p0)*L/(a*E)
```

```
44 printf("\n the pull correction is  %0.5f  meters',cp
   )
45
46 cs=-L*w*w/(24*p*p*n*n)
47 printf("\n the sag correction is   %0.5f meters',cs)
48
49 e=ct+cp+cs
50 printf("\n the total correction is  %0.5f meters',e)
51
52 hd=L+e
53
54 printf("\n the horizontal distance  is  %0.5f meters
   ",hd)
```

Scilab code Exa 1.9 the true length

```
1
2
3
4 clear
5 //
6
7 L=20//cm2
8 t0=20//kg/cm2
9 p0=5//per degree C
10 pm=16//kg
11 tm=32//degree C
12 a=0.03//cm2
13 al=11/(1000000)//per degree C
14 E=2.1*(1000000)//cm2
15 w=0.6//kg
16 ml=680//m
17 n=1
18
19
```

```
20 ct=al*L*(tm-t0)
21 printf("\n the temperature correction is %0.5f
      meters',ct)
22
23 cp=(pm-p0)*L/(a*E)
24 printf("\n the pull correction is  %0.5f  meters',cp
      )
25
26 cs=-L*w*w/(24*pm*pm*n*n)
27 printf("\n the sag correction is   %0.5f meters',cs)
28
29 e=ct+cp+cs
30 printf("\n the total correction is  %0.5f meters',e)
31
32 l1=L+e
33
34 truelength=(l1/L)*ml
35 printf("\n the true length  is  %0.5f meters ",
      truelength)
```

Scilab code Exa 1.10 the correct distance

```
1
2 clear
3 L=28
4 t0=20
5 p0=10
6 pm=5
7 tm=40
8 a=0.02
9 al=11/(1000000)
10 E=2.1*(1000000)
11 w1=470
12 ml=680
13 n=1
```

```
14
15 w=(470*28)/30
16 w=w/1000
17
18 ct=al*L*(tm-t0)
19 printf("\n the temperature correction is %0.3f
     meters',ct)
20
21 cp=(pm-p0)*L/(a*E)
22 printf("\n the pull correction is  %0.3f  meters',cp
     )
23
24 cs=-L*w*w/(24*pm*pm*n*n)
25 printf("\n the sag correction is   %0.3f meters',cs)
26
27 e=ct+cp+cs
28 printf("\n the total correction is  %0.3f meters',e)
29
30 l1=L+e
31
32 dis=(l1/L)*ml
33 printf("\n the correctt distance  is  %0.3f ",dis)
```

Scilab code Exa 1.11 the value of EG

```
1 clear
2 //ch-1, problems on obstacles in chaining, page-32,
     pb-1
3
4 //
5
6 //
7
8 printf("\n from fig p.1.1')
9 DE=87
```

```
printf("\n DE")
EF=(87/(cos(50*(%pi/180))))

DF=87*(tan(50*(%pi/180)))

EG=87/(cos(65*(%pi/180)))


printf("\n  the value of EF is  %0.3f meters',EF)

printf("\n  the value of DF is  %0.3f meters',DF)

printf("\n  the value of EG is  %0.3f meters',EG)
```

Scilab code Exa 1.12 width of river

```
clear
//ch-1 page-33, pb-12
//


x=(380.0285/2.5754)

PA=x
AQ=367-x
al=180-(36.45+86.55)
bt=86.35-40-35

TA=AQ*tan(46*(%pi/180))

printf("\n width of river is  %0.3f meters',TA)
```

Scilab code Exa 1.13 width of river

```
clear
// cha-1 page-34 pb-3

//

//

x=(849.224)/2.6196



PA=x
AQ=517-x
al=78-33.67
bt=180-(43.333+78)

TA=AQ*tan(58.66*(%pi/180))

printf("\n width of river is  %0.3f meters',TA)
```

Scilab code Exa 1.14 chainage of C

```
//problem 14, pg35
clear
// cha-1 page-34,35  pb-4

//

//

al=288.5-(48.5+180)
bt=90-48.5
BAC=360-41.5

AC=40*(tan(60*(%pi/180)))
```

```
14
15 A=207.8
16
17 C=A+AC
18
19 printf("\n chainage of C is %0.3f meters',C)
```

Scilab code Exa 1.15 width of the river

```
1 clear
2 //
3 BB=287.25
4 MC=62.25
5 al=(BB-180)-MC
6 BM=75
7 BC=BM*(tan(45*(%pi/180)))
8
9 printf("\n width of the river is  %0.3f meters',BC)
```

Scilab code Exa 1.16 AB

```
1 clear
2 //CH-1 PAGE-36  PB-6
3
4 //
5 //
6
7
8 AC=250
9 AD=300
10 DB=150
11 BC=100
12 DC=DB+BC
```

```
13
14 cosal=(AD*AD+DC*DC-(AC*AC))/(2*AD*DC)
15
16 AB=sqrt((AD*AD+DB*DB)-2*(AD*DB*cosal))
17
18 printf("\n AB= %0.3f ",AB)
```

Scilab code Exa 1.17 chinage of c

```
1
2 // ch-1 page-36,37    pb-7
3
4 //
5
6
7 //
8
9 BE=50
10 AB=25
11 AEC=157.5-67.5
12
13 al=atan(BE/AB)
14 al=al*(180/%pi)
15
16 printf("\n al %0.3f ",al)
17
18 bt=90-al
19 printf("\n bt= %0.3f ",bt)
20 k=(tan(bt*%pi/180))
21
22 printf("\n k= %0.3f ",k)
23 BC=BE/k
24 C=275.5+BC
25 printf("\n chinage of c is %0.3f meters',C)
```

Scilab code Exa 1.18 `true length`

```
1
2 //ch-1  page -37,38  pb-1
3
4 //
5
6 //
7
8
9 a=17.5
10 b=19.3
11 c=17.8
12 d=13.6
13 e=12.9
14
15 da=2.35
16 db=4.20
17 dc=2.95
18 dd=1.65
19 de=3.25
20
21 AB=sqrt((a*a)-(da*da))
22 BC=sqrt((b*b)-(db*db))
23 CD=sqrt((c*c)-(dc*dc))
24 DE=sqrt((d*d)-(dd*dd))
25 EF=sqrt((e*e)-(de*de))
26
27 total=AB+BC+CD+DE+EF
28 printf("\n measured length is  %0.3f meters',total)
29
30 e=0.025
31 l=20
32 l1=l-e
```

```
33 ml=total
34
35 tl=(l1/l)*ml
36
37 printf("\n true length is  %0.3f meters',tl)
```

Scilab code Exa 1.19 true length

```
1
2 //ch-1  page -38  pb-2
3
4 //
5
6 //
7
8 ab=550
9 AB=ab*(cos(15*(%pi/180)))
10
11 l=20
12 e=0.05
13 l1=l+e
14 ml=AB
15 printf("\n measured length is  %0.3f meters',ml)
16
17 tl=(l1/l)*ml
18
19 printf("\n true length is  %0.3f meters',tl)
```

Scilab code Exa 1.20 horizontal distance 3

```
1
2 //ch-1  page -38,39  pb-3
3
```

```
4 //
5
6 //
7
8 ab=280
9
10 AB1=ab*(cos(10*(%pi/180)))
11
12 printf("\n horizontal distance 1 is  %0.3f meters",
     AB1)
13
14 cosal=(10/(sqrt(101)))
15
16 AB2=ab*cosal
17
18 printf("\n horizontal distance 2 is  %0.3f meters",
     AB2)
19
20 bb=8
21 AB3=sqrt(ab*ab-(bb*bb))
22
23 printf("\n horizontal distance 3 is  %0.3f meters",
     AB3)
```

Scilab code Exa 1.21 true horizontal distance

```
1
2 //ch-1  page -39,40  pb-4
3
4 //
5
6 //
7
8 a=28.7
9 b=23.4
```

```
10 c=20.9
11 d=29.6
12
13 ag=5
14 bg=7
15 cg=10
16 dg=12
17
18 AB=a*(cos(ag*(%pi/180)))
19
20 BC=b*(cos(bg*(%pi/180)))
21
22 CD=c*(cos(cg*(%pi/180)))
23
24 DE=d*(cos(dg*(%pi/180)))
25
26 total=AB+BC+CD+DE
27
28 ml=total
29
30 printf("\n measured length is  %0.3f meters',ml)
31
32 l=30
33 e=0.025
34 l1=l-e
35
36 tl=(l1/l)*ml
37
38 printf("\n true horizontal distance is  %0.3f meters
     ',tl)
```

Scilab code Exa 1.22 theta2

```
1
2 //ch-1  page -40  pb-1
```

```
3
4 //
5
6 //
7
8
9 a=23
10 b=16.5
11 c=12
12
13
14 t1=acos((a*a+b*b-(c*c))/(2*a*b))
15 t1=t1*(180/%pi)
16
17 printf("\n theta1= %0.3f ",t1)
18
19 t2=acos((c*c+b*b-(a*a))/(2*c*b))
20 t2=t2*(180/%pi)
21 dg=int(t2)
22 mi=t2-int(t2)
23 mi=(mi*60)
24 printf("\n theta2= %0.3f degrees %0.3f minutes",dg,
   mi)
```

Scilab code Exa 1.23 theta2

```
1
2 //ch-1  page -40,41  pb-2
3
4 //
5
6 //
7
8
9 a=257
```

```
10 b=156
11 c=103
12
13
14 t1=acos((a*a+b*b-(c*c))/(2*a*b))
15 t1=t1*(180/%pi)
16
17 dg1=int(t1)
18 mi1=t1-int(t1)
19 mi1=(mi1*60)
20 printf("\n theta1= %0.3f degrees %0.3f minutes",dg1,
     mi1)
21
22
23 t2=acos((c*c+b*b-(a*a))/(2*c*b))
24 t2=t2*(180/%pi)
25 dg=int(t2)
26 mi=t2-int(t2)
27 mi=(mi*60)
28 printf("\n theta2= %0.3f degrees %0.3f minutes",dg,
     mi)
```

Scilab code Exa 1.24 length of scale

```
1
2 //CH-1 PAGE-42  PB-1
3
4 //
5 //
6
7
8 sc=100
9 a=2.5
10 m=6
11
```

```
12 RF=(a/sc)
13
14 printf("\n RF is  %0.3f ",RF)
15
16 length1=RF*m*sc
17
18 printf("\n length1 of scale is  %0.3f meters',
     length1)
```

Scilab code Exa 1.25 length of final scale

```
1
2
3 //CH-1 PAGE-42,43  PB-2
4
5 //
6 //
7
8
9 sc=100 //scale length
10 area=93750 //area
11 l=6.0 //length
12 b=6.25 //bredth
13
14 cm2=(area)/(l*b) // 1 cm^2
15
16 cm=sqrt(cm2)
17 RF=1/(sc*cm)
18
19 printf("\n RF= %0.3f ",RF)
20
21 leng=14 // assumme length of scale
22 leng=leng*cm
23
24 printf("\n length of final scale is  %0.3f ",leng)
```

Scilab code Exa 1.26 length of scale

```
1
2
3 //CH-1 PAGE-43  PB-3
4
5 //
6 //
7
8 l=1.2 //length
9 al=30 //map length
10 al=al/100
11 sc=1000 //suitable scale
12
13
14 RF=(al)/(sc*l)
15 printf("\n RF= %0.3f ",RF)
16
17
18 cm1=(1/RF)/(100)
19
20 lsc=15
21 cm15=lsc*cm1
22
23 printf("\n length of scale is  %0.3f meters',cm15)
```

Scilab code Exa 1.27 length of scale

```
1
2 //CH-1 PAGE-44  PB-4
3
```

```
4  //
5  //
6
7
8  sc=100
9  hect=10000
10 area=0.45*hect
11
12 cm1=(area)/5
13 cm=sqrt(cm1)
14
15 printf("\n 1cm= %0.3f ",cm)
16 RF=1/(cm)
17 printf("\n RF= %0.3f ",RF)
18
19
20 maxl=400
21
22 los=(RF*maxl)
23
24 printf("\n length of scale is %0.3f CENTIMETERS',los
   )
```

Chapter 2

chain surveying

Scilab code Exa 2.1 max length of offset should be

```
1
2 //
3
4 //
5
6 ag=5
7 giv=0.03
8
9 L=20
10 l=(giv*L/(sin(ag*%pi/180)))
11
12
13 AB=l
14
15 BC=AB*(sin(ag*(%pi/180)))
16 BC=BC/20
17
18 printf("\n max length of offset should be %0.3f
   meters',l)
```

Scilab code Exa 2.2 displacement parallel ot chain

```
clear
//

//


AD=15;AB=15,

ag=3
AC=15*(cos(ag*(%pi/180)))

CD=AB-AC
sc=10

CD=CD/sc

printf("\n required displacement perpendicular to
   chain is %0.3f meters',CD)


BC=AB*(sin(ag*(%pi/180)))

BC=BC/sc
printf("\n displacement parallel ot chain is %0.3f
   meters',BC)
```

Chapter 3

compass traversing

Scilab code Exa 3.1 N

```
1
2
3 //
4 //
5
6 //(a)QB of AB
7 WCB_AB=45+(30/60)
8 QB_AB=WCB_AB
9 mins=(QB_AB-int(QB_AB))*60
10 deg=int(QB_AB)
11 printf("\n N %0.3f degrees %0.3f minutes E",deg,mins
   )
12
13 //(b)QB of BC
14 WCB_BC=125+(45/60)
15 QB_BC=180-WCB_BC
16 mins=(QB_BC-int(QB_BC))*60
17 deg=int(QB_BC)
18 printf("\n S %0.3f degrees %0.3f minutes E",deg,mins
   )
19
```

```
20 //(c) QB of CD
21 WCB_CD=222+(15/60)
22 QB_CD=WCB_CD-180
23 deg=int(QB_CD)
24 mins=(QB_CD-deg)*60
25 printf("\n S %0.3f degrees %0.3f minutes W",deg,mins
   )
26
27 //(d) QB of DE
28 WCB_DE=320+(30/60)
29 QB_DE=360-WCB_DE
30 deg=int(QB_DE)
31 mins=(QB_DE-deg)*60
32 printf("\n N %0.3f degrees %0.3f minutes W",deg,mins
   )
```

Scilab code Exa 3.2 degrees

```
1
2 //
3 //
4
5 //(a)
6 QB_AB=36+(30/60)
7 WCB_AB=180+QB_AB
8 mins=(WCB_AB-int(WCB_AB))*60
9 deg=int(WCB_AB)
10 printf("\n %0.3f degrees %0.3f minutes W",deg,mins)
11 //(b)
12 QB_BC=43+(30/60)
13 WCB_BC=180-QB_BC
14 mins=(WCB_BC-int(WCB_BC))*60
15 deg=int(WCB_BC)
16 printf("\n %0.3f degrees %0.3f minutes W",deg,mins)
17
```

```
18 //(c)
19 QB_CD=26+(45/60)
20 WCB_CD=QB_CD
21 mins=(WCB_CD-int(WCB_CD))*60
22 deg=int(WCB_CD)
23 printf("\n %0.3f degrees %0.3f minutes W",deg,mins)
24 //(d)
25 QB_DE=40+(15/60)
26 WCB_DE=360-QB_DE
27 mins=(WCB_DE-int(WCB_DE))*60
28 deg=int(WCB_DE)
29 printf("\n %0.3f degrees %0.3f minutes W",deg,mins)
```

Scilab code Exa 3.3 degrees

```
1
2 //
3 //
4
5 //(a)
6 QB_AB=36+(30/60)
7 WCB_AB=180+QB_AB
8 mins=(WCB_AB-int(WCB_AB))*60
9 deg=int(WCB_AB)
10 printf("\n %0.3f degrees %0.3f minutes W",deg,mins)
11 //(b)
12 QB_BC=43+(30/60)
13 WCB_BC=180-QB_BC
14 mins=(WCB_BC-int(WCB_BC))*60
15 deg=int(WCB_BC)
16 printf("\n %0.3f degrees %0.3f minutes W",deg,mins)
17
18 //(c)
19 QB_CD=26+(45/60)
20 WCB_CD=QB_CD
```

```
21 mins=(WCB_CD-int(WCB_CD))*60
22 deg=int(WCB_CD)
23 printf("\n %0.3f degrees %0.3f minutes W",deg,mins)
24 //(d)
25 QB_DE=40+(15/60)
26 WCB_DE=360-QB_DE
27 mins=(WCB_DE-int(WCB_DE))*60
28 deg=int(WCB_DE)
29 printf("\n %0.3f degrees %0.3f minutes W",deg,mins)
```

Scilab code Exa 3.4 S

```
1
2 //
3 //
4
5 //(a)
6 FB_AB=30+(30/60)
7 BB_AB=FB_AB
8 mins=(BB_AB-int(BB_AB))*60
9 deg=int(BB_AB)
10 printf("\n N %0.3f degrees %0.3f minutes W",deg,mins
    )
11
12 //(b)
13 FB_AB=40+(30/60)
14 BB_AB=FB_AB
15 mins=(BB_AB-int(BB_AB))*60
16 deg=int(BB_AB)
17 printf("\n S %0.3f degrees %0.3f minutes E",deg,mins
    )
18
19 //(c)
20 FB_AB=60+(15/60)
21 BB_AB=FB_AB
```

```
22 mins=(BB_AB-int(BB_AB))*60
23 deg=int(BB_AB)
24 printf("\n N %0.3f degrees %0.3f minutes E",deg,mins
   )
25
26 //(d)
27 FB_AB=45+(30/60)
28 BB_AB=FB_AB
29 mins=(BB_AB-int(BB_AB))*60
30 deg=int(BB_AB)
31 printf("\n S %0.3f degrees %0.3f minutes W",deg,mins
   )
```

Scilab code Exa 3.5 degrees

```
1
2 //
3 //
4
5 //(a)
6 BB_AB=40+(30/60)
7 FB_AB=BB_AB+180
8 mins=(FB_AB-int(FB_AB))*60
9 deg=int(FB_AB)
10 printf("\n %0.3f degrees %0.3f minutes W",deg,mins)
11 //(b)
12 BB_BC=310+(45/60)
13 FB_BC=BB_BC-180
14 mins=(FB_BC-int(FB_BC))*60
15 deg=int(FB_BC)
16 printf("\n %0.3f degrees %0.3f minutes W",deg,mins)
17
18 //(c)
19 BB_CD=145+(45/60)
20 FB_CD=BB_CD+180
```

```
21 mins=(FB_CD-int(FB_CD))*60
22 deg=int(FB_CD)
23 printf("\n %0.3f degrees %0.3f minutes W",deg,mins)
24
25 //(d)
26 BB_DE=215+(30/60)
27 FB_DE=BB_DE-180
28 mins=(FB_DE-int(FB_DE))*60
29 deg=int(FB_DE)
30 printf("\n %0.3f degrees %0.3f minutes W",deg,mins)
```

Scilab code Exa 3.6 N

```
1
2 //
3 //
4
5 //(a)
6 BB_AB=30+(30/60)
7 FB_AB=BB_AB
8 mins=(FB_AB-int(FB_AB))*60
9 deg=int(FB_AB)
10 printf("\n S %0.3f degrees %0.3f minutes E",deg,mins
   )
11
12 //(b)
13 BB_BC=40+(15/60)
14 FB_BC=BB_BC
15 mins=(FB_BC-int(FB_BC))*60
16 deg=int(FB_BC)
17 printf("\n N %0.3f degrees %0.3f minutes W",deg,mins
   )
18
19 //(c)
20 BB_CD=60+(45/60)
```

```
21 FB_CD=BB_CD
22 mins=(FB_CD-int(FB_CD))*60
23 deg=int(FB_CD)
24 printf("\n S %0.3f degrees %0.3f minutes W",deg,mins
   )
25
26 //(d)
27 BB_DE=45+(30/60)
28 FB_DE=BB_DE
29 mins=(FB_DE-int(FB_DE))*60
30 deg=int(FB_DE)
31 printf("\n N %0.3f degrees %0.3f minutes E",deg,mins
   )
```

Scilab code Exa 3.7 magnetic bearing of AB

```
1
2 //
3
4 //
5
6 magneticbearing=135+0.5
7 declination=5+0.25
8 truebearing=magneticbearing-declination
9 deg=int(truebearing)
10 mins=truebearing-deg
11 printf("\n truebearing of AB= %0.3f degrees %0.3f
   minutes",deg,15.0)
12
13 truebearing=210+(45/60)
14 declination=8+(15/60)
15 magnetic_bearing=truebearing+declination
16 deg=int(magnetic_bearing)
17 mins=magnetic_bearing-deg
18 printf("\n magnetic bearing of AB= %0.3f degrees %0
```

```
    .3f minutes",deg,mins)
```

Scilab code Exa 3.8 Required true bearing

```
1
2 //
3 //
4
5 RB_CD=30+(15/60)
6 WCB_CD=180+RB_CD
7 declination=10+(15/60)
8 TB=WCB_CD+declination
9 truebearing=TB-180
10 deg=int(truebearing)
11 mins=(truebearing-deg)*60
12 printf("\n Required true bearing= S %0.3f degrees %0
    .3f minutes W",deg,mins)
```

Scilab code Exa 3.9 Magnetic bearing

```
1
2 //
3 //
4
5 magneticbearing=320+(30/60)
6 declination=3+(30/60)
7 truebearing=magneticbearing-declination
8 declination2=4+(15/60)
9 MB=truebearing-declination2
10 deg=int(MB)
11 mins=(MB-deg)*60
12 printf("\n Magnetic bearing= %0.3f degrees %0.3f
    minutes",deg,mins)
```

Scilab code Exa 3.10 degrees

```
1
2 //
3 //
4
5 //(a)
6 magneticbearing=175+(30/60)
7 magneticdeclination=180-magneticbearing
8 deg=int(magneticdeclination)
9 mins=(magneticdeclination-deg)*60
10 printf("\n %0.3f degrees %0.3f minutes W",deg,mins)
11 //(b)
12
13 magneticdeclination=5+(45/60)
14 deg=int(magneticdeclination)
15 mins=(magneticdeclination-deg)*60
16 printf("\n %0.3f degrees %0.3f minutes W",deg,mins)
```

Scilab code Exa 3.11 AngleCOD

```
1
2
3 //
4 //
5
6 bearingOB=140+(15/60)//given
7 bearingOA=30+(30/60)//given
8 angleAOB=bearingOB-bearingOA
9 deg=int(angleAOB)
10 mins=(angleAOB-deg)*60//finding minutes
```

```
11 printf("\n AngleAOB= %0.3f degrees %0.3f minutes",
      deg,mins)
12
13 bearingOC=220+(45/60)//given
14 angleBOC=bearingOC-bearingOB
15 deg=int(angleBOC)
16 mins=(angleBOC-deg)*60//finding minutes
17 printf("\n AngleBOC= %0.3f degrees %0.3f minutes",
      deg,mins)
18
19 bearingOD=310+(30/60)//given
20 angleCOD=bearingOD-bearingOC
21 deg=int(angleCOD)
22 mins=(angleCOD-deg)*60//finding minutes
23 printf("\n AngleCOD= %0.3f degrees %0.3f minutes",
      deg,mins)
```

Scilab code Exa 3.12 Interior angle D

```
1
2
3 //
4
5 //
6
7 interiorB=(45+(30/60))+180-(120+(15/60))//given
8 deg=int(interiorB)//convert into mins and degrees
9 mins=(interiorB-deg)*60
10 printf("\n Interior angle B= %0.3f degrees %0.3f
      minutes",deg,mins)
11
12 interiorC=(120+(15/60))+180-(200+(30/60))
13 //convert into mins and degrees
14 deg=int(interiorC)
15 mins=(interiorC-deg)*60
```

```
16 printf("\n Interior angle C= %0.3f degrees %0.3f
      minutes",deg,mins)
17
18 exteriorD=(280+(45/60))+180-(200+(30/60))
19 //convert into mins and degrees
20 deg=int(exteriorD)
21 mins=(exteriorD-deg)*60
22 printf("\n Exterior angle D= %0.3f degrees %0.3f
      minutes",deg,mins)
23
24 interiorD=360-(260+(15/60))
25 //convert into mins and degrees
26 deg=int(interiorD)
27 mins=(interiorD-deg)*60
28 printf("\n Interior angle D= %0.3f degrees %0.3f
      minutes",deg,mins)
```

Scilab code Exa 3.13 degrees

```
1
2
3 //
4 //
5
6 //given
7
8 FB_AB=80+(30/60)
9 FB_BC=FB_AB+180-60
10 FB_CA=FB_BC-180+300
11
12 //convert into mins and degrees
13 deg1=int(FB_AB)
14 mins1=(FB_AB-deg1)*60
15 deg2=int(FB_BC)
16 mins2=(FB_BC-deg2)*60
```

```
deg3=int(FB_CA)
mins3=(FB_CA-deg3)*60


printf("\nFB_AB is %0.3f degrees %0.3f minutes W",
   deg1,mins1)
printf("\nFB_BC is %0.3f degrees %0.3f minutes W",
   deg2,mins2)
printf("\nFB_CA is %0.3f degrees %0.3f minutes W",
   deg3,mins3)
```

Scilab code Exa 3.14 degrees

```


//
//


//given
FB_AB=120+(30/60)
FB_BC=FB_AB+180-90
FB_CD=FB_BC-180+270
FB_DA=FB_CD-180-90

//convert into mins and degrees
deg1=int(FB_AB)
mins1=(FB_AB-deg1)*60
deg2=int(FB_BC)
mins2=(FB_BC-deg2)*60
deg3=int(FB_CD)
mins3=(FB_CD-deg3)*60
deg4=int(FB_DA)
mins4=(FB_DA-deg4)*60

```

```
23 printf("\nFB_AB = %0.3f degrees %0.3f minutes W",
      deg1,mins1)
24 printf("\nFB_BC = %0.3f degrees %0.3f minutes W",
      deg2,mins2)
25 printf("\nFB_CD = %0.3f degrees %0.3f minutes W",
      deg3,mins3)
26 printf("\nFB_DA = %0.3f degrees %0.3f minutes W",
      deg4,mins4)
```

Scilab code Exa 3.15 degrees

```
1
2
3 //
4 //
5
6 //given
7 interiorB=540/5
8 FB_AB=30+(0/60)
9 FB_BC=FB_AB+180+interiorB
10 FB_CD=FB_BC-180+interiorB
11 FB_DE=FB_CD-180+interiorB
12 FB_EA=FB_DE+180-360+interiorB
13 FB_AB=FB_EA+180-360+interiorB
14
15 //convert into mins and degrees
16 deg1=int(FB_AB)
17 mins1=(FB_AB-deg1)*60
18 deg2=int(FB_BC)
19 mins2=(FB_BC-deg2)*60
20 deg3=int(FB_CD)
21 mins3=(FB_CD-deg3)*60
22 deg4=int(FB_DE)
23 mins4=(FB_DE-deg4)*60
24 deg5=int(FB_EA)
```

```
25 mins5=0
26 deg6=int(FB_AB)
27 mins6=0
28
29
30 printf("\nFB_AB %0.3f degrees %0.3f minutes W",deg1,
      mins1)
31 printf("\nFB_BC %0.3f degrees %0.3f minutes W",deg2,
      mins2)
32 printf("\nFB_CD %0.3f degrees %0.3f minutes W",deg3,
      mins3)
33 printf("\nFB_DE %0.3f degrees %0.3f minutes W",deg4,
      mins4)
34 printf("\nFB_EA %0.3f degrees %0.3f minutes W",deg5,
      mins5)
35 printf("\nFB_AB %0.3f degrees %0.3f minutes W",deg6,
      mins6)
```

Scilab code Exa 3.16 degrees

```
1
2
3 //
4 //given
5
6 BB_AB=330+(15/60)
7 BB_BC=200+(30/60)
8 BB_CD=115+(45/60)
9 BB_DE=38+(0/60)
10 BB_EA=300+(30/60)
11
12 //calculations
13 exteriorA=BB_EA-(150+(15/60))
14 interiorA=360-exteriorA
15 exteriorB=BB_AB-(20+(30/60))
```

```
16 interiorB=360-exteriorB
17 interiorC=(295+(45/60))-BB_BC
18 interiorD=218-BB_CD
19 interiorE=(120.5)-BB_DE
20
21 //convert into mins and degrees
22 deg1=int(exteriorA)
23 mins1=int((exteriorA-deg1)*60)
24 deg2=int(interiorA)
25 mins2=int((interiorA-deg2)*60)
26 deg3=int(exteriorB)
27 mins3=int((exteriorB-deg3)*60)
28 deg4=int(interiorB)
29 mins4=int((interiorB-deg4)*60)
30 deg5=int(interiorC)
31 mins5=int((interiorC-deg5)*60)
32 deg6=int(interiorD)
33 mins6=int((interiorD-deg6)*60)
34 deg7=int(interiorE)
35 mins7=int((interiorE-deg7)*60)
36
37 n=5
38 check=(2*n-4)*90
39 summ=interiorA+interiorB+interiorC+interiorD+
      interiorE
40
41 printf("\n exterior angle A %0.3f degrees %0.3f
      minutes",deg1,mins1)
42 printf("\n interior angle A %0.3f degrees %0.3f
      minutes",deg2,mins2)
43 printf("\n Exterior angle B %0.3f degrees %0.3f
      minutes",deg3,mins3)
44 printf("\n interior angle B %0.3f degrees %0.3f
      minutes",deg4,mins4)
45 printf("\n interior angle C %0.3f degrees %0.3f
      minutes",deg5,mins5)
46 printf("\n interior angle D %0.3f degrees %0.3f
      minutes",deg6,mins6)
```

```
47 printf("\n interior angle E %0.3f degrees %0.3f
      minutes",deg7,mins7)
48 printf("\n %0.3f degrees %0.3f degrees W",check,summ
      )
```

Scilab code Exa 3.17 degrees

```
1
2
3 //
4 //given
5
6 FB_AB=45+(30/60)
7 FB_BC=60+(0/60)
8 FB_CD=10+(30/60)
9 FB_DA=75+(45/60)
10
11
12 BB_AB=45+(30/60)
13 BB_BC=60+(0/60)
14 BB_CD=10+(30/60)
15 BB_DA=75+(45/60)
16
17
18 interiorA=180-(FB_AB+BB_DA)
19 interiorB=(FB_BC+BB_AB)
20 interiorC=180-(BB_BC+FB_CD)
21 interiorD=(FB_DA+BB_CD)
22
23 //convert into mins and degrees
24 deg1=int(interiorA)
25 mins1=int((interiorA-deg1)*60)
26 deg2=int(interiorB)
27 mins2=int((interiorB-deg2)*60)
28 deg3=int(interiorC)
```

```
29 mins3=int((interiorC-deg3)*60)
30 deg4=int(interiorD)
31 mins4=int((interiorD-deg4)*60)
32
33 //calculations
34 n=4
35 check=(2*n-4)*90
36 summ=interiorA+interiorB+interiorC+interiorD
37
38 printf("\n Interior angle A %0.3f degrees %0.3f
      minutes",deg1,mins1)
39 printf("\n Interior angle B %0.3f degrees %0.3f
      minutes",deg2,mins2)
40 printf("\n Interior angle C %0.3f degrees %0.3f
      minutes",deg3,mins3)
41 printf("\n Interior angle D %0.3f degrees %0.3f
      minutes",deg4,mins4)
42 printf("\n %0.3f degrees %0.3f degrees ",check,summ)
```

Scilab code Exa 3.18 Interior angle E

```
1
2
3 //
4 //given
5
6 BB_AB=330+(0/60)
7 BB_BC=48+(0/60)
8 BB_CD=127+(45/60)
9 BB_DE=120+(0/60)
10 BB_EA=229+(30/60)
11
12 FB_AB=150+(0/60)
13 FB_BC=230+(30/60)
14 FB_CD=306+(15/60)
```

```
15 FB_DE=298+(0/60)
16 FB_EA=49+(30/60)
17
18 //calculate
19 interiorA=BB_EA-FB_AB
20 interiorB=BB_AB-FB_BC
21 exteriorC=FB_CD-BB_BC
22 interiorC=360-(258+(15/60))
23 exteriorD=FB_DE-BB_CD
24 interiorD=360-exteriorD
25 interiorE=BB_DE-FB_EA
26
27 //convert into mins and degrees
28 deg1=int(interiorA)
29 mins1=int((interiorA-deg1)*60)
30 deg2=int(interiorB)
31 mins2=int((interiorB-deg2)*60)
32 deg3=int(exteriorC)
33 mins3=int((exteriorC-deg3)*60)
34 deg4=int(interiorC)
35 mins4=int((interiorC-deg4)*60)
36 deg5=int(exteriorD)
37 mins5=int((exteriorD-deg5)*60)
38 deg6=int(interiorD)
39 mins6=int((interiorD-deg6)*60)
40 deg7=int(interiorE)
41 mins7=int((interiorE-deg7)*60)
42
43 n=5
44 check=(2*n-4)*90
45 summ=interiorA+interiorB+interiorC+interiorD+
      interiorE
46
47 printf("\n Interior angle A= %0.3f degrees %0.3f
      minutes",deg1,mins1)
48 printf("\n Interior angle B= %0.3f degrees %0.3f
      minutes",deg2,mins2)
49 printf("\n exterior angle C= %0.3f degrees %0.3f
```

```
    minutes",deg3,mins3)
50 printf("\n Interior angle C= %0.3f degrees %0.3f
    minutes",deg4,mins4)
51 printf("\n exterior angle D= %0.3f degrees %0.3f
    minutes",deg5,mins5)
52 printf("\n Interior angle D= %0.3f degrees %0.3f
    minutes",deg6,mins6)
53 printf("\n Interior angle E= %0.3f degrees %0.3f
    minutes",deg7,mins7)
54 printf("\n %0.3f degrees %0.3f degrees ",check,summ)
55
56 error=541-540
57 correction=(-60/5)
58 printf("\n error= %0.3f degrees",error)
59 printf("\n %0.3f minutes",correction)
60
61 correctedvalue1=mins1+correction
62 correctedvalue2=mins2+correction
63 correctedvalue4=mins4+correction
64 correctedvalue6=mins6+correction
65 correctedvalue7=mins7+correction
66
67 printf("\n corrected values are:")
68 printf("\n Interior angle A= %0.3f degrees %0.3f
    minutes",deg1,correctedvalue1)
69 printf("\n Interior angle B= %0.3f degrees %0.3f
    minutes",deg2,correctedvalue2)
70 printf("\n Interior angle C= %0.3f degrees %0.3f
    minutes",deg4,correctedvalue4)
71 printf("\n Interior angle D= %0.3f degrees %0.3f
    minutes",deg6,correctedvalue6)
72 printf("\n Interior angle E= %0.3f degrees %0.3f
    minutes",deg7,correctedvalue7)
```

Scilab code Exa 3.19 FBDE

```
1
2
3  //
4  //given
5
6  BB_AB=13+(0/60)
7  BB_BC=222+(30/60)
8  BB_CD=200+(30/60)
9  BB_DE=62+(45/60)
10 BB_EA=147+(45/60)
11
12 FB_AB=191+(45/60)
13 FB_BC=39+(30/60)
14 FB_CD=22+(15/60)
15 FB_DE=242+(45/60)
16 FB_EA=330+(15/60)
17
18 //(a)
19 interiorA=FB_AB-BB_EA
20 interiorB=FB_BC-BB_AB
21 exteriorC=BB_BC-FB_CD
22 interiorC=360-(200+(15/60))
23 interiorD=FB_DE-BB_CD
24 interiorE=FB_EA-BB_DE
25
26 //convert into mins and degrees
27 deg1=int(interiorA)
28 mins1=int((interiorA-deg1)*60)
29 deg2=int(interiorB)
30 mins2=int((interiorB-deg2)*60)
31 deg3=int(exteriorC)
32 mins3=int((exteriorC-deg3)*60)
33 deg4=int(interiorC)
34 mins4=int((interiorC-deg4)*60)
35 deg6=int(interiorD)
36 mins6=int((interiorD-deg6)*60)
37 deg7=int(interiorE)
38 mins7=int((interiorE-deg7)*60)
```

```
39
40 n=5
41 check=(2*n-4)*90
42 summ=interiorA+interiorB+interiorC+interiorD+
      interiorE
43
44 printf("\n Interior angle A= %0.3f degrees %0.3f
      minutes",deg1,mins1)
45 printf("\n Interior angle B= %0.3f degrees %0.3f
      minutes",deg2,mins2)
46 printf("\n exterior angle C= %0.3f degrees %0.3f
      minutes",deg3,mins3)
47 printf("\n Interior angle C= %0.3f degrees %0.3f
      minutes",deg4,mins4)
48 printf("\n Interior angle D= %0.3f degrees %0.3f
      minutes",deg6,mins6)
49 printf("\n Interior angle E= %0.3f degrees %0.3f
      minutes",deg7,mins7)
50 printf("\n %0.3f degrees %0.3f degrees ",check,summ)
51 //(b)
52 printf("\n %0.3f correct  %0.3f correct ", FB_DE,
      FB_EA)
53
54
55 AB=FB_EA-180+interiorA
56 BC=(194+(15/60))-180+interiorB
57 CD=(40+(45/60))+180-exteriorC
58 DE=(20+(30/60))+180+interiorD
59
60 deg1=int(AB)
61 mins1=int((AB-deg1)*60)
62 deg2=int(BC)
63 mins2=int((BC-deg2)*60)
64 deg3=int(CD)
65 mins3=int((CD-deg3)*60)
66 deg4=int(DE)
67 mins4=int((DE-deg4)*60)
68
```

```
69 printf("\n corrected values are:")
70 printf("\n FB_AB= %0.3f degrees %0.3f minutes",deg1,
   mins1)
71 printf("\n FB_BC= %0.3f degrees %0.3f minutes",deg2,
   mins2)
72 printf("\n FB_CD= %0.3f degrees %0.3f minutes",deg3,
   mins3)
73 printf("\n FB_DE= %0.3f degrees %0.3f minutes",deg4,
   mins4)
```

Scilab code Exa 3.20 AB

```
1
2
3 //
4 //given
5
6 BB_AB=248+(15/60)
7 BB_BC=326+(15/60)
8 BB_CD=46+(0/60)
9 BB_DE=38+(15/60)
10 BB_EA=147+(45/60)
11
12 FB_AB=68+(15/60)
13 FB_BC=148+(45/60)
14 FB_CD=224+(30/60)
15 FB_DE=217+(15/60)
16 FB_EA=327+(45/60)
17
18 //(a)
19 includedA=-FB_AB+BB_EA
20 includedB=-FB_BC+BB_AB
21 includedC=BB_BC-FB_CD
22 includedD=360-(171+(15/60))
23 exteriorD=FB_DE-BB_CD
```

```
24 exteriorE=FB_EA-BB_DE
25 includedE=360-(289+(30/60))
26
27 //convert into mins and degrees
28 deg1=int(includedA)
29 mins1=int((includedA-deg1)*60)
30 deg2=int(includedB)
31 mins2=int((includedB-deg2)*60)
32 deg3=int(includedC)
33 mins3=int((includedC-deg3)*60)
34 deg4=int(exteriorD)
35 mins4=int((exteriorD-deg4)*60)
36 deg5=int(includedD)
37 mins5=int((includedD-deg5)*60)
38 deg6=int(exteriorE)
39 mins6=int((exteriorE-deg6)*60)
40 deg7=int(includedE)
41 mins7=int((includedE-deg7)*60)
42
43 n=5
44 check=(2*n-4)*90
45 summ=includedA+includedB+includedC+includedD+
      includedE
46
47 printf("\n included angle A= %0.3f degrees %0.3f
      minutes",deg1,mins1)
48 printf("\n included angle B= %0.3f degrees %0.3f
      minutes",deg2,mins2)
49 printf("\n included angle C= %0.3f degrees %0.3f
      minutes",deg3,mins3)
50 printf("\n exterior angle D= %0.3f degrees %0.3f
      minutes",deg4,mins4)
51 printf("\n included angle D= %0.3f degrees %0.3f
      minutes",deg5,mins5)
52 printf("\n exterior angle D= %0.3f degrees %0.3f
      minutes",deg6,mins6)
53 printf("\n included angle E= %0.3f degrees %0.3f
      minutes",deg7,mins7)
```

```
54 printf("\n %0.3f degrees %0.3f degrees ",check,summ)
55
56 //(b)
57
58 printf("\n %0.3f correct  %0.3f correct  %0.3f
      correct", FB_AB,FB_BC,BB_AB)
59
60
61 FB_BC=(328+(45/60))-(326+(15/60))
62 FB_CD=(224+(30/60))+FB_BC
63 BB_CD=227-180
64 correctionatD=1
65 FB_DE=(217+(15/60))+1
66 BB_DE=FB_DE-180
67
68 deg1=int(FB_AB)
69 mins1=int((FB_AB-deg1)*60)
70 deg2=int(FB_CD)
71 mins2=int((FB_CD-deg2)*60)
72 deg3=int(BB_CD)
73 mins3=int((BB_CD-deg3)*60)
74 deg4=int(FB_DE)
75 mins4=int((FB_DE-deg4)*60)
76 deg5=int(BB_DE)
77 mins5=int((BB_DE-deg5)*60)
78
79 printf("\n correction= %0.3f ",correctionatD)
80 printf("\n corrected values are:")
81 printf("\n FB_AB= %0.3f degrees %0.3f minutes",deg1,
      mins1)
82 printf("\n FB_CD= %0.3f degrees %0.3f minutes",deg2,
      mins2)
83 printf("\n BB_CD= %0.3f degrees %0.3f minutes",deg3,
      mins3)
84 printf("\n FB_DE= %0.3f degrees %0.3f minutes",deg4,
      mins4)
85 printf("\n BB_DE= %0.3f degrees %0.3f minutes",deg5,
      mins5)
```

```
86 printf("\n AB=100m, BC=100m,CD=50m, scale=20m for
       plot")
```

Scilab code Exa 3.21 FBEA

```
1
2
3
4 //
5 //given
6
7 BB_AB=239+(00/60)
8 BB_BC=317+(00/60)
9 BB_CD=36+(30/60)
10 BB_DE=29+(00/60)
11 BB_EA=138+(45/60)
12
13 FB_AB=59+(00/60)
14 FB_BC=139+(30/60)
15 FB_CD=215+(15/60)
16 FB_DE=208+(0/60)
17 FB_EA=318+(30/60)
18
19 printf("\n %0.3f correct  %0.3f correct  %0.3f
       correct", FB_AB,FB_BC,BB_AB)
20
21
22 correctionatC=2+(30/60)
23 FB_CD=(215+(15/60))+correctionatC
24 correctionatD=1+(15/60)
25 FB_DE=208+correctionatD
26 correctionatE=(15/60)
27 FB_EA=(318+(30/60))+correctionatE
28
29 //convert into mins and degrees
```

```
30 deg2=int(FB_CD)
31 mins2=int((FB_CD-deg2)*60)
32 deg4=int(FB_DE)
33 mins4=int((FB_DE-deg4)*60)
34 deg5=int(FB_EA)
35 mins5=int((FB_EA-deg5)*60)
36
37 printf("\n correctionatC= %0.3f ",correctionatC)
38 printf("\n correctionatD= %0.3f ",correctionatD)
39 printf("\n correctionatE= %0.3f ",correctionatE)
40 printf("\n corrected values are:")
41 printf("\n BB_CD= %0.3f  BB_DE= %0.3f  BB_EA= %0.3f
     ",217.75,209.25,138.75)
42 printf("\n FB_CD= %0.3f degrees %0.3f minutes",deg2,
     mins2)
43 printf("\n FB_DE= %0.3f degrees %0.3f minutes",deg4,
     mins4)
44 printf("\n FB_EA= %0.3f degrees %0.3f minutes",deg5,
     mins5)
45 printf("\n declination= -10 degrees W")
46
47 BB_AB=239+(00/60)-10
48 BB_BC=317+(00/60)-10+correctionatC
49 BB_CD=36+(30/60)-10+correctionatD
50 BB_DE=29+(00/60)-10
51 BB_EA=138+(45/60)-10
52
53 FB_AB=59-10
54 FB_BC=(139+(30/60))-10
55 FB_CD=(215+(15/60))-10+correctionatC
56 FB_DE=(208+(0/60))-10+correctionatD
57 FB_EA=(318+(30/60))-10+correctionatE
58
59 printf("\n true bearing values:")
60 printf("\n BB_AB= %0.3f ",BB_AB)
61 printf("\n BB_BC= %0.3f ",BB_BC)
62 printf("\n BB_CD= %0.3f ",BB_CD)
63 printf("\n BB_DE= %0.3f ",BB_DE)
```

```
64 printf("\n BB_EA= %0.3f ",BB_EA)
65
66 printf("\n FB_AB= %0.3f ",FB_AB)
67 printf("\n FB_BC= %0.3f ",FB_BC)
68 printf("\n FB_CD= %0.3f ",FB_CD)
69 printf("\n FB_DE= %0.3f ",FB_DE)
70 printf("\n FB_EA= %0.3f ",FB_EA)
```

Scilab code Exa 3.22 FBCD

```
1
2
3 //
4 //given
5
6 BB_AB=45+(30/60)
7 BB_BC=60+(40/60)
8 BB_CD=3+(20/60)
9 BB_DA=85+(00/60)
10
11
12 FB_AB=45+(30/60)
13 FB_BC=60+(0/60)
14 FB_CD=5+(30/60)
15 FB_DA=83+(30/60)
16
17
18 printf("\n %0.3f correct  %0.3f correct  %0.3f
     correct", FB_AB,FB_BC,BB_AB)
19
20
21 correctionatC=-0+(40/60)
22 FB_CD=(5+(30/60))+correctionatC
23 correctionatD=1+(30/60)
24 FB_DA=83+(30/60)+correctionatD
```

```
25
26 //convert into mins and degrees
27
28 deg2=int(FB_CD)
29 mins2=int((FB_CD-deg2)*60)
30 deg4=int(FB_DA)
31 mins4=int((FB_DA-deg4)*60)
32
33
34 printf("\n correctionatC= %0.3f ",correctionatC)
35 printf("\n correctionatD= %0.3f ",correctionatD)
36
37 printf("\n corrected values are:")
38 printf("\n BB_CD=N %0.3f  W BB_BC=N %0.3f degrees W"
    ,4.83,60)
39 printf("\n FB_CD=N %0.3f W FB_DA=N %0.3f degrees W"
    ,4.83,85)
```

Scilab code Exa 3.23 FBCD

```
1
2
3 //
4 //given
5
6 BB_AB=41+(15/60)
7 BB_BC=79+(30/60)
8 BB_CD=20+(0/60)
9 BB_DA=80+(00/60)
10
11
12 FB_AB=40+(30/60)
13 FB_BC=80+(45/60)
14 FB_CD=19+(30/60)
15 FB_DA=80+(00/60)
```

```
16
17
18 printf("\n %0.3f correct  %0.3f correct  %0.3f
      correct", FB_DA,FB_AB,BB_DA)
19
20 //calculations
21 correctionatB=-0+(45/60)
22 FB_BC=(80+(45/60))+correctionatB
23 correctionatC=0+(30/60)
24 FB_CD=19+(30/60)+correctionatC
25
26
27 printf("\n correctionatB= %0.3f ",correctionatB)
28 printf("\n correctionatC= %0.3f ",correctionatC)
29
30 printf("\n corrected values are:")
31 printf("\n BB_AB=N %0.3f E  BB_BC=N %0.3f degrees E"
      ,40.5,80)
32 printf("\n FB_CD=N %0.3f E  FB_DA=S %0.3f degrees E"
      ,20,80)
```

Scilab code Exa 3.24 corrected values

```
1
2
3 //
4 //given
5
6 BB_AB=239+(00/60)
7 BB_BC=317+(0/60)
8 BB_CD=36+(30/60)
9 BB_DE=29+(00/60)
10 BB_EA=138+(45/60)
11
12 FB_AB=59+(0/60)
```

```
13 FB_BC=139+(30/60)
14 FB_CD=215+(15/60)
15 FB_DE=208+(0/60)
16 FB_EA=318+(30/60)
17
18 //(a)
19 includedA=-FB_AB+BB_EA
20 includedB=-FB_BC+BB_AB
21 includedC=BB_BC-FB_CD
22 includedD=360-(171+(30/60))
23 exteriorD=FB_DE-BB_CD
24 exteriorE=FB_EA-BB_DE
25 includedE=360-(289+(30/60))
26
27
28 //convert into mins and degrees
29 deg1=int(includedA)
30 mins1=int((includedA-deg1)*60)
31 deg2=int(includedB)
32 mins2=int((includedB-deg2)*60)
33 deg3=int(includedC)
34 mins3=int((includedC-deg3)*60)
35 deg4=int(exteriorD)
36 mins4=int((exteriorD-deg4)*60)
37 deg5=int(includedD)
38 mins5=int((includedD-deg5)*60)
39 deg6=int(exteriorE)
40 mins6=int((exteriorE-deg6)*60)
41 deg7=int(includedE)
42 mins7=int((includedE-deg7)*60)
43
44 n=5
45 check=(2*n-4)*90
46 summ=includedA+includedB+includedC+includedD+
      includedE
47
48 printf("\n included angle A= %0.3f degrees %0.3f
      minutes",deg1,mins1)
```

```
49 printf("\n included angle B= %0.3f degrees %0.3f
      minutes",deg2,mins2)
50 printf("\n included angle C= %0.3f degrees %0.3f
      minutes",deg3,mins3)
51 printf("\n exterior angle D= %0.3f degrees %0.3f
      minutes",deg4,mins4)
52 printf("\n included angle D= %0.3f degrees %0.3f
      minutes",deg5,mins5)
53 printf("\n exterior angle D= %0.3f degrees %0.3f
      minutes",deg6,mins6)
54 printf("\n included angle E= %0.3f degrees %0.3f
      minutes",deg7,mins7)
55 printf("\n %0.3f degrees %0.3f degrees ",check,summ)
56 //(b)
57 printf("\n %0.3f correct  %0.3f correct  %0.3f
      correct", FB_AB,FB_BC,BB_AB)
58
59
60
61 FB_CD=(215+(15/60))+(2+(30/60))
62 BB_CD=(37+(45/60))
63 correctionatD=(1+(15/60))
64 FB_DE=(208+(0/60))+correctionatD
65 FB_EA=(318+(30/60))+(0+(15/60))
66
67
68 printf("\n correction= %0.3f ",correctionatD)
69 printf("\n corrected values are:")
```

Chapter 5

levelling

Scilab code Exa 5.1 collimation error

```
1
2 //
3
4 //
5
6 a=150
7 b=100
8 ar=2.525
9 br=1.755
10
11 sc=1000
12 d=(a*a)/(sc*sc)
13
14 A=0.0673*d*d
15
16 fa=ar-A
17
18 printf("\n correct reading on A = %0.3f meters',fa)
19
20
21 d=(b*b)/(sc*sc)
```

```
22
23 B=0.0673*d*d
24 fb=br-B
25
26 printf("\n correct reading of B = %0.3f meters',fb)
27
28 AB=fa-fb
29 printf("\n true difference is %0.3f meters',AB)
```

Scilab code Exa 5.2 height of lighthouse

```
1
2 //
3
4 //
5
6
7 d=30
8 sc=1000
9
10 h=0.0673*d*d
11
12 printf("\n heigght of lighthouse is %0.3f meters',h)
```

Scilab code Exa 5.3 dimp of horizon

```
1
2 //
3
4 //
5
6 h=50
7
```

```
d=sqrt(h/0.0673)
printf("\n D= %0.3f ",d)

r=6370
dip=d/r
printf("\n dimp  of horizon %0.3f degrees',dip)

dip1=dip*((180*60)/%pi)
printf("\n dimp  of horizon %0.3f minutes',dip1)
```

Scilab code Exa 5.4 distance between man and object

```
1
2 //
3
4 //
5
6 h1=50
7 h2=10
8 c=0.0673
9
10 d1=sqrt(h1/c)
11
12 d2=sqrt(h2/c)
13
14 dis=d1+d2
15
16 printf("\n distance between man and object is %0.3f
   meters',dis)
```

Scilab code Exa 5.5 height of the hill

```
1
```

```
2 //
3
4 //
5
6 h1=10
7 c=0.0673
8 d1=sqrt(h1/c)
9
10 d2=d1-80                    //since d1+d2=80
11 h2=c*d2*d2
12
13 printf("\n height of the hill is  %0.3f meters',h2)
```

Scilab code Exa 5.6 distance AB

```
1
2 //
3
4 //
5
6 h1=100
7 h2=150
8
9 r2=12880
10 c=(6/7)*(1000/r2)
11 d1=sqrt(h1/c)
12 d2=sqrt(h2/c)
13
14 d=d1+d2
15 printf("\n distance AB = %0.3f meters',d)
```

Scilab code Exa 5.7 sensitiveness of bubble

```
1
2 //
3
4 //
5
6 r1=2.550
7 r2=2.500
8
9 s=r1-r2
10 d=0.002
11 D=100
12 n=5
13 r=(n*d*D/s)
14
15 printf("\n R= %0.3f ",r)
16
17 alp=(s/(n*D))*206265
18
19 printf("\n sensitiveness of bubble is %0.3f seconds
   ",alp)
```

Scilab code Exa 5.8 error

```
1
2 //
3
4 //
5
6 n=2
7 D=100
8 alp=20
9
10
11 s=(alp*n*D)/206265
12
```

```
13 printf("\n error is  %0.3f meters',s)
```

Scilab code Exa 5.9 RL of B

```
1  clear
2  //
3
4  //
5
6  a=2.245
7  b=3.375
8  AB=b-a
9
10 ap=1.955
11 bp=3.055
12
13 dAB=bp-ap
14
15 tl=(AB+dAB)/2
16 printf("\n true level of difference is %0.3f meters
       ',tl)
17 rla=125.55
18 rlb=rla-tl
19
20
21 printf("\n RL of B = %0.3f meters',rlb)
```

Scilab code Exa 5.10 collimation error per 100m

```
1
2  //
3
4  //
```

```
5
6  aa=1.155
7  ab=2.595
8  ba=0.985
9  bb=2.415
10
11 td=((ab-aa)+(bb-ba))/2
12
13 rla=525.5
14 rlb=rla-td
15 dab=500
16 printf("\n true RL of B %0.3f meters',rlb)
17
18 dab1=dab/1000
19
20 correct=0.0673*dab1*dab1
21 printf("\n combined corrction for 500m= %0.3f meters
     ',correct)
22
23 sc=100
24 a=1.155
25 e=-(0.0118*sc)/(dab)
26
27
28 printf("\n collimation error per 100m= %0.3f meters
     ',e)
```

Scilab code Exa 5.11 amount of collimation error

```
1
2  //
3
4  //
5
6  aa=1.725
```

```
7  ab=1.370
8  ba=1.560
9  bb=1.235
10
11 A=aa-ab
12 B=ba-bb
13
14 AB=(A+B)/2
15
16 printf("\n true difference between A and B is  %0.3f
       meters',AB)
17
18 CB=bb
19 CA=CB+AB
20
21 OCA=1.560
22 e=OCA-CA
23
24 printf("\n amount of collimation error = %0.3f
     meters',e)
```

Scilab code Exa 5.12 RL of B

```
1
2 //
3
4 //
5
6 aa=1.725
7 ab=2.245
8 ba=2.145
9 bb=3.045
10
11 AB=200
12 rla=450
```

```
13
14
15 aAB=ab-aa
16
17 printf("\n apparent difference of level between A
      and B is %0.3f meters',aAB)
18
19 dB=bb-ba
20
21 printf("\n apparent difference of level at B %0.3f
      meters',dB)
22
23 td=(aAB+dB)/2
24
25 printf("\n true differece of level= %0.3f ",td)
26
27 CB=bb
28
29 CA=CB-td
30
31 e=ba-CA
32
33 printf("\n correction to be applied at A is = %0.3f
      ",e)
34
35 rlb=rla-td
36
37 printf("\n RL of B= %0.3f meters',rlb)
```

Scilab code Exa 5.13 RL of B

```
1
2 //
3
4 //
```

```
5
6  aa=1.725
7  ab=2.245
8  ba=2.145
9  bb=3.045
10 dAB=200
11 rla=450.0
12 AB=ab-aa
13 printf("\n AB")
14 adif=bb-ba
15
16 printf("\n apparent difference of level = %0.3f
       meters',adif)
17
18 //a
19 td=(AB+adif)/2
20 printf("\n true difference of level= %0.3f meters',
       td)
21 //b
22
23 tb=bb
24 ta=bb-td
25
26 printf("\n true reading on A= %0.3f meters',ta)
27
28 //c
29
30 e=ba-ta
31
32 printf("\n collimation error = %0.3f meters',e)
33
34 //d
35
36 rlb=rla-td
37 printf("\n RL of B= %0.3f meters',rlb)
```

Scilab code Exa 5.14 collimation error

```
1
2 //
3 //
4
5 ma=1.585
6 mb=1.225
7 aa=1.425
8 ab=1.150
9
10 dAB=100
11
12 //a
13 td=ma-mb
14 B=aa-td
15
16 printf("\n correct staff reading on B should be = %0
   .3f meters',B)
17
18 //c
19
20
21 e=ab-B
22 printf("\n collimation error is  %0.3f meters',e)
```

Scilab code Exa 5.15 correction at B

```
1
2 //ch-5 page 187  pb-3
3
4 //
```

```
5  //
6
7  dAB=100
8
9  aa=1.875
10 ab=1.790
11
12 le=10
13
14 ba=1.630
15 bb=1.560
16
17
18 td=aa-ab
19
20 apd=ba-bb
21 printf("\n first setting')
22 printf("\n true difference is %0.3f meters',td)
23 printf("\n apparent difference of level = %0.3f
      meters',apd)
24
25 printf("\n second setting')
26
27 A=ba-td
28
29 e1=bb-A
30
31 cA=(le/dAB)*e1
32 cB=((le+dAB)/dAB)*e1
33 printf("\n collimation error is %0.3f meters',e1)
34 printf("\n correction at A= %0.3f meters',cA)
35 printf("\n correction at B= %0.3f meters',cB)
```

Scilab code Exa 5.16 k1

```
1
2  //
3  //
4
5  bs1=2.375,bs2=2.835,bs3=0.435,
6
7  is1=1.730,is2=0.615,is3=2.070,is4=1.835,is5=1.630,
8
9  is6=2.255
10 fs1=3.450,fs2=0.985,fs3=3.630,
11
12
13 sbs=bs1+bs2+bs3
14 sis=is1+is2+is3+is4+is5+is6
15 sfs=fs1+fs2+fs3
16
17 r1=bs1-is1
18 r2=is1-is2
19 r3=bs2-is3
20 r4=is3-is4
21 r5=is4-fs2
22 sr=r1+r2+r3+r4+r5
23 printf("\n r1,r2,r3,r4,r5,sr")
24
25
26 f1=bs2
27 f2=is5-bs3
28 f3=fs3-is6
29 f4=is6-is5
30 sf=f1+f2+f3+f4
31 printf("\n f1,f2,f4,f3,sf")
32
33 k=sbs-sfs
34 printf("\n k= %0.3f ",k)
35 k1=sr-sf
36 printf("\n k1= %0.3f ",k1)
```

Scilab code Exa 5.17 k1

```
1
2 //
3 //
4
5 bs1=3.150,bs2=3.860,bs3=0.470,
6
7 is1=2.245,is2=2.125,is3=0.760,is4=1.935,is5=3.225,
8
9 fs1=1.125,fs2=2.235,fs3=3.890,
10
11
12 sbs=bs1+bs2+bs3
13 sis=is1+is2+is3+is4+is5
14 sfs=fs1+fs2+fs3
15
16 r1=bs1-is1
17 r2=is1-fs1
18 r3=bs2-is2
19 r4=is2-is3
20
21 sr=r1+r2+r3+r4
22 printf("\n r1,r2,r3,r4,sr")
23
24
25 f1=fs2-is3
26 f2=is4-bs3
27 f3=is5-is4
28 f4=fs3-is5
29 sf=f1+f2+f3+f4
30 printf("\n f1,f2,f4,f3,sf")
31
32 k=sbs-sfs
```

```
33 printf("\n k= %0.3f ",k)
34 k1=sr-sf
35 printf("\n k1= %0.3f ",k1)
```

Chapter 7

computation of area

Scilab code Exa 7.1 area

```
1
2
3
4 //
5 //s
6
7
8 printf("\n chainage 0 and 20')
9 a1=0,b1=20,
10
11 //finding base and height of each triangle
12 base=b1-a1
13 o1=0,o2=42,
14
15 mo1=(o2+o1)/2
16 //calculating area
17 ae1=base*mo1
18 printf("\n area ACG= %0.3f sq m",ae1)
19
20 printf("\n chainage 20 and 65')
21 a1=20,b1=65,
```

```
22
23
24 base=b1-a1
25 o1=58,o2=42,
26
27 mo2=(o2+o1)/2
28
29 ae2=base*mo2
30 printf("\n area IEB= %0.3f sq m",ae2)
31
32
33 printf("\n chainage 65 and 110')
34 a1=65,b1=110,
35
36
37 base=b1-a1
38 o1=0,o2=58,
39
40 mo3=(o2+o1)/2
41
42 ae3=base*mo3
43 printf("\n area DHA= %0.3f sq m",ae3)
44
45
46 printf("\n chainage 90 and 110')
47 a1=90,b1=110,
48
49
50 base=b1-a1
51 o1=0,o2=60,
52
53 mo4=(o2+o1)/2
54
55 ae4=base*mo4
56 printf("\n area BFJ= %0.3f sq m",ae4)
57
58 printf("\n chainage 40 and 90')
59
```

```
a1=40,b1=90,


base=b1-a1
o1=60,o2=20,

mo5=(o2+o1)/2

ae5=base*mo5
printf("\n area FJHD= %0.3f sq m",ae5)

printf("\n chainage 0 and 40')
a1=0,b1=40,


base=b1-a1
o1=20,o2=0,

mo6=(o2+o1)/2

ae6=base*mo6
printf("\n area DHA= %0.3f sq m",ae6)


area=ae1+ae2+ae3+ae4+ae5+ae6

printf("\n area of field = %0.3f sq m",area)
```

Scilab code Exa 7.2 total

```


//

```

```
6  //
7
8
9  printf("\n chainage 15.5 and 27.5')
10 a1=15.5,b1=27.5,
11
12 //finding base and height of each triangle
13
14 base=b1-a1
15 o1=0,o2=22.5,
16
17 mo1=(o2+o1)/2
18 //calculating area
19 ae1=base*mo1
20 ap1=0
21 an1=ae1
22 printf("\n area GAM= %0.3f sq meters",ae1)
23
24 printf("\n chainage 15.5 and 50')
25 a1=15.5,b1=50,
26
27
28 base=b1-a1
29 o1=22.5,o2=30,
30
31 mo2=(o2+o1)/2
32
33 ae2=base*mo2
34 ap2=ae2
35 an2=0
36 printf("\n area GABI= %0.3f sq meters",ae2)
37
38
39 printf("\n chainage 50 and 75.5')
40 a1=50,b1=75.5,
41
42
43 base=b1-a1
```

```
44 o1=30,o2=35.5,
45
46 mo3=(o2+o1)/2
47
48 ae3=base*mo3
49 ap3=ae3
50 an3=0
51 printf("\n area IBCK= %0.3f sq meters",ae3)
52
53
54 printf("\n chainage 75.5 and 86.7')
55 a1=75.5,b1=86.7,
56
57
58 base=b1-a1
59 o1=35.5,o2=0,
60
61 mo4=(o2+o1)/2
62
63 ae4=base*mo4
64 ap4=ae4
65 an4=0
66 printf("\n area KCN= %0.3f sq meters",ae4)
67
68 printf("\n chainage 86.7 and 90')
69
70 a1=86.7,b1=90,
71
72
73 base=b1-a1
74 o1=0,o2=10.5,
75
76 mo5=(o2+o1)/2
77
78 ae5=base*mo5
79 ap5=0
80 an5=ae5
81 printf("\n area NLD= %0.3f sq meters",ae5)
```

```
82
83 printf("\n chainage 60 and 90')
84 a1=60,b1=90,
85
86
87 base=b1-a1
88 o1=10.5,o2=25.0,
89
90 mo6=(o2+o1)/2
91
92 ae6=base*mo6
93 ap6=ae6
94 an6=0
95 printf("\n area LDEJ= %0.3f sq meters",ae6)
96
97 printf("\n chainage 35.5 and 60')
98 a1=35.5,b1=60,
99
100
101 base=b1-a1
102 o1=25,o2=15,
103
104 mo7=(o2+o1)/2
105
106 ae7=base*mo7
107 ap7=ae7
108 an7=0
109 printf("\n area JEFH= %0.3f sq meters",ae7)
110
111 printf("\n chainage 27.5 and 35.5')
112 a1=27.5,b1=35.5,
113
114
115 base=b1-a1
116 o1=15,o2=0,
117
118 mo8=(o2+o1)/2
119
```

```
ae8=base*mo8
ap8=ae8
an8=0
printf("\n area FHM= %0.3f sq meters",ae8)

an=an1+an2+an3+an4+an5+an6+an7+an8
ap=ap1+ap2+ap3+ap4+ap5+ap6+ap7+ap8

area=ap-an
printf("\n ap,ae= %0.3f %0.3f",ap,an)
printf("\n total area of field = %0.3f sq meters ",
   area)
```

Scilab code Exa 7.3 required area

```
1
2
3
4 //
5
6 //GIVEN
7
8
9 dis=10
10 a=0,g=0,
11
12 b=2.5,c=3.5,d=5,e=4.6,f=3.2,
13
14
15 printf("\n Mid ordinate rule')
16 //FINDING MID ORDINATES
17 h1=(a+b)/2
18 h2=(b+c)/2
19 h3=(c+d)/2
20 h4=(d+e)/2
```

```
21 h5=(e+f)/2
22 h6=(f+g)/2
23 //find area
24 area=dis*(h1+h2+h3+h4+h5+h6)
25
26 printf("\n required area is %0.3f square meters',
     area)
27
28 printf("\n average ordinate rule')
29 dis=10//m
30 p=6//no of divs
31 bl=dis*p//base length
32 no=7//no of ordinates
33
34
35 area2=bl*(a+b+c+d+e+f+g)/no
36
37 printf("\n required area is %0.3f square meters',
     area2)
38
39 printf("\n trapezoidal rule')
40
41
42 area3=(dis/2)*(2*(a+b+c+d+e+f+g))
43
44 printf("\n required area is  %0.3f square meters',
     area3)
45 printf("\n simpsons rule')
46
47 area4=(dis/3)*(4*(b+d+f)+2*(c+e))
48 printf("\n required area is  %0.3f square meters',
     area4)
```

Scilab code Exa 7.4 required area

```
1
2
3
4  //ch-7 page 216    pb-2
5  //
6
7  //given
8
9  printf("\n trapezoidal rule')
10 //given offsets
11 o1=3.5,o2=4.3,o3=6.75,o4=5.25,o5=7.5,o6=8.8,o7=7.9,
12
13 o8=6.4,o9=4.4,o10=3.25,
14
15 //distances
16 dis=15
17
18 area1=(dis/2)*(o1+o10+(2*(o2+o3+o4+o5+o6+o7+o8+o9)))
19
20 printf("\n required area is  %0.3f square meters',
     area1)
21
22 printf("\n simpsons rule')
23
24 A1=dis/3*(o1+o9+4*(o2+o4+o6+o8)+2*(o3+o5+o7))
25
26 A2=dis/2*(o10+o9)
27
28 area2=A1+A2
29 printf("\n%0.3f %0.3f ", A1,A2)
30
31 printf("\n required area is  %0.3f square meters',
     area2)
```

Scilab code Exa 7.5 total area

```
1
2
3
4  //
5
6  //offsets
7
8  o1=2.5,o2=3.8,o3=4.6,o4=5.2,o5=6.1,o6=4.7,o7=5.8,o8
       =3.9,o9=2.20,
9
10 //here intervals are non uniform
11 d1=5
12 d2=10
13 d3=20
14
15
16 printf("\n trapezoidal rule')
17
18 //area of first section
19 del1=(d1/2)*(o1+o5+2*(o2+o3+o4))
20
21 //area of second section
22 del2=(d2/2)*(o5+o7+2*(o6))
23
24 //area of third section
25 del3=(d3/2)*(o7+o9+2*(o8))
26
27 //total area
28 total1=del1+del2+del3
29 printf("\n%0.3f %0.3f %0.3f", del1,del2,del3)
30
31 printf("\n total area= %0.3f square meters',total1)
32
33 printf("\n simpsons rule')
34
35 de1=(d1/3)*(o1+o5+4*(o2+o4)+2*(o3))
36 de2=(d2/3)*(o5+o7+4*(o6))
37 de3=(d3/3)*(o7+o9+4*(o8))
```

```
38
39
40 total2=de1+de2+de3
41 printf("\n%0.3f %0.3f %0.3f", de1,de2,de3)
42
43 printf("\n total area is  %0.3f square meters',
     total2)
```

Scilab code Exa 7.6 required area

```
1
2
3
4 //cha 7 page -225 pb-1
5
6 //
7
8 //givwn readings
9
10 ir=9.377
11 fr=3.336
12 m=100
13 c=23.521
14
15 n=1
16
17 a1=m*(fr-ir+10*(n)+c)//cm2
18
19 a2=m*(fr-ir-10*(n)+c)//cm2
20
21 printf("\n A= %0.3f ",a2)
22 printf("\n required area is %0.3f square meters',a2)
```

Scilab code Exa 7.7 required area

```
1
2
3
4 //
5
6 //readings
7
8 ir=8.652
9 fr=6.798
10 c=20
11 m=100//natural scale
12 n=1
13
14 sc=100
15
16 a2=m*(fr-ir-10*(n)+c)
17
18 a2=a2*sc
19
20 printf("\n A= %0.3f ",a2)
21 printf("\n required area is %0.3f square meters',a2)
```

Scilab code Exa 7.8 required area

```
1
2
3
4 //
5
6 //readings
7
8 ir=4.855
9 fr=8.754
```

```
10 m=100
11
12 n=0//no comment
13 c=0//anchor point outside
14 sc=25
15 a=m*(fr-ir)
16 a=a*sc
17 printf("\n required area is %0.3f square meters',a)
```

Scilab code Exa 7.9 area of zero circle

```
1
2
3
4 //
5
6 //
7
8 printf("\n case 1')
9
10 ir=3.415
11 fr=4.415
12 n=0//anchor point outside
13 c=0
14 sc=16    //1cm^2=16m^2
15 h=10000
16 ag=0.16*h
17
18 am=ag/sc
19 printf("\n A= %0.3f square centimeters",am)
20
21 m=am/(fr-ir)
22
23 printf("\n M= %0.3f ",m)
24
```

```
25 printf("\n case 2')
26
27 fr_ir=2.25
28 c=21.22
29 n=1
30
31 a1=m*(fr_ir-10+c)
32 printf("\n required area is %0.3f square centimeters
     ",a1)
33
34 area=m*c
35
36 printf("\n area of zero circle is %0.3f square
     centimeters",area)
```

Scilab code Exa 7.10 area of zero circle

```
1
2
3
4 //
5
6 //given
7
8 l=10,b=15,
9
10 a1=l*b
11
12 ir=0.686
13 fr=9.976
14 n=2
15 m=100
16
17 marea=150//measured area
18
```

```
19 c=(marea/100)+10.710
20
21 area=m*c
22 printf("\n area of zero circle is %0.3f square
     centimeters',area)
```

Scilab code Exa 7.11 area of zero circle

```
1
2
3
4 //
5
6 //
7
8 printf("\n case 1')
9 n=1
10 c=0////anchor point outside
11 m=100
12 fr=4.825
13 ir=7.775
14 area1=m*(fr-ir+10*n)
15
16 printf("\n area of figure is %0.3f square cm',area1)
17
18 printf("\n case 2')
19 fr=8.755
20 ir=2.325
21 m=100
22 n=2
23 area2=m*(fr-ir-10*n+c)
24
25 printf("\n area of figure is %0.3f sq cm',area2)
26 c=(area1/m)+13.570
27 printf("\n C= %0.3f ",c)
```

```
28
29 areac=m*c
30 printf("\n area of zero circle is %0.3f square cm',
      areac)
```

Chapter 8

computation of volume

Scilab code Exa 8.1 V

```
1
2
3
4 //
5
6 //given
7
8 h1=0.90,h2=1.25,h3=2.15,h4=2.50,h5=1.85,h6=1.35,h7
     =0.85,
9
10
11 b=10//width in m
12 sh=1.5//side slope in m
13
14 h=40//m
15
16 d1=(b+(sh*h1))*h1
17 d2=(b+(sh*h2))*h2
18 d3=(b+(sh*h3))*h3
19 d4=(b+(sh*h4))*h4
20 d5=(b+(sh*h5))*h5
```

```
21 d6=(b+(sh*h6))*h6
22 d7=(b+(sh*h7))*h7
23
24 printf("\n d1= %0.3f sq. meter,d2 = %0.3f sq. meter,
      d3= %0.3f sq. meter,d4= %0.3f sq. meter,d5= %0.3f
       sq. meter,d6= %0.3f sq. meter,d7= %0.3f sq.meter
      ",d1,d2,d3,d4,d5,d6,d7)
25 printf("\n by trapezoidal rule')
26 v=(h/2)*(d1+d7+2*(d2+d3+d4+d5+d6))
27 printf("\n V= %0.3f meter cube',v)
28
29 printf("\n by prismoidal rule')
30
31 v1=(h/3)*(d1+d7+4*(d2+d4+d6)+2*(d3+d5))
32
33 printf("\n V= %0.3f meter cube',v1)
```

Scilab code Exa 8.2 total fitting

```
1
2
3
4 //
5
6 //
7
8 h1=0.75,h2=1.15,h3=0.80,h4=1.30,h5=1.5,h6=0.75
9
10 b=8 //m
11 sh=2 //m
12
13
14 x1=(50*h1)/(h1+h2)
15 x2=(50*h2)/(h2+h3)
16 x3=(50*h3)/(h4+h3)
```

```
x4=(50*h4)/(h4+h5)
printf("\n x1=%0.3f m, x2=%0.3f m, x3=%0.3f m, x4=%0.3f
    m",x1,x2,x3,x4)

a1=(b+(sh*h1))*h1
a2=(b+(sh*h2))*h2
a3=(b+(sh*h3))*h3
a4=(b+(sh*h4))*h4
a5=(b+(sh*h5))*h5
a6=(b+(sh*h6))*h6
printf("\n a1=%0.3f sq.m, a2=%0.3f sq.m, a3=%0.3f sq.m
    , a4=%0.3f sq.m, a5=%0.3f sq.m, a6=%0.3f sq.m",a1,a2
    ,a3,a4,a5,a6)

printf("\n from chainage 0 to 50')
c1=(a1/2)*(x1)
f1=(a2/2)*(x2+0.79)
printf("\n c1=%0.3f cu.m,f1=%0.3f cu.m",c1,f1)



printf("\n from chainage 50 to 100')
f2=(a2/2)*(x2)
c2=(a3/2)*(x3+1.46)
printf("\n c2=%0.3f cu.m, f2=%0.3f cu.m",c2,f2)

printf("\n from chainage 100 to 150')
c3=(a3/2)*(x3)
f3=(a4/2)*(30.95)
printf("\n c3%0.3f cu.m,f3=%0.3f cu.m",c3,f3)

printf("\n from chainage 150 to 200')
f4=(a4/2)*(x4)
c4=(a5/2)*(x4+3.59)
printf("\n c4=%0.3f cu.m, f4=%0.3f cu.m",c4,f4)

printf("\n from chainage 200 to 250')
c5=((a1+a5)/2)*50
```

```
52
53 printf("\n c5=%0.3f cu.m",c5)
54
55 tc=c1+c2+c3+c4+c5
56 tf=f1+f2+f3+f4
57
58 printf("\n total cutting = %0.3f cu. meters",tc)
59 printf("\n total fitting= %0.3f cu. meters",tf)
```

Scilab code Exa 8.3 volume

```
1
2
3
4 //
5
6 //
7 h=50
8 h1=2.50,h2=1.25,h3=0.95,h4=1.65,h5=2.20,h6=2.85,h7
    =0.75,
9
10 b=8,sh=1,
11 //metres
12
13
14 a1=(b+(sh*h1))*h1
15 a2=(b+(sh*h2))*h2
16 a3=(b+(sh*h3))*h3
17 a4=(b+(sh*h4))*h4
18 a5=(b+(sh*h5))*h5
19 a6=(b+(sh*h6))*h6
20 a7=(b+(sh*h7))*h7
21
22 printf("\n a1=%0.3f sq.m,a2=%0.3f sq.m,a3=%0.3f sq.m
    ,a4=%0.3f sq.m,a5=%0.3f sq.m,a6=%0.3f sq.m,a7=%0
```

```
    .3f sq.m",a1,a2,a3,a4,a5,a6,a7)
23
24 v=(h/3)*(a1+a7+4*(a2+a4+a6)+2*(a3+a5))
25
26
27 printf("\n volume= %0.3f meter cube",v)
```

Scilab code Exa 8.4 volume

```
1
2
3
4 //
5
6 //areas
7
8 a1=2050,a2=8400,a3=16300,a4=24600,a5=31500,
9
10
11 h=5
12
13 printf("\n according to trapezoidal rule')
14
15 v1=(h/2)*(a1+a5+2*(a2+a3+a4))
16
17 printf("\n volume = %0.3f meter cube",v1)
18
19 printf("\n according to prismoidal rule')
20
21 v2=(h/3)*(a1+a5+4*(a2+a4)+2*(a3))
22
23 printf("\n volume = %0.3f meter cube",v2)
```

Scilab code Exa 8.5 area

```
1
2
3
4 //
5
6 //
7
8 printf("\n bottom section ')
9 L=40//m
10 B=30//m
11 a1=L*B//m2
12 printf("\n area A1= %0.3f sq. meters",a1)
13
14 printf("\n mid section')
15 b=40//m
16 sh=2.5//m
17
18 l=L+2*2*sh
19 b=B+2*2*sh
20 a2=l*b
21 printf("\n area A2= %0.3f sq. meters",a2)
22
23 printf("\n top section ')
24 sh=5
25
26 l1=L+2*sh
27 b1=B*2*2*sh
28 a3=l1*b1
29 printf("\n area A3= %0.3f sq. meters",a3)
```

Scilab code Exa 8.6 area

```
1
```

```
2
3
4  //
5
6  //
7
8  b=8//m
9  h=2//m
10 n=10
11 s=1
12
13 printf("\n first section')
14 b1=(b/2)+((n*s)/(n-s))*(h+(b/(2*n)))
15 b2=(b/2)+((n*s)/(n+s))*(h-(b/(2*n)))
16
17 a1=0.5*((((b/(2*s))+h))*(b1+b2)-((b*b)/(2*s)))
18 printf("\n b1=%0.3f,b2=%0.3f",b1,b2)
19
20 printf("\n area A1= %0.3f sq. meters",a1)
21
22 printf("\n second section')
23 b=8,h=3,n=10,s=1,
24
25
26
27 b1=(b/2)+((n*s)/(n-s))*(h+(b/(2*n)))
28 b2=(b/2)+((n*s)/(n+s))*(h-(b/(2*n)))
29
30 a2=0.5*((((b/(2*s))+h))*(b1+b2)-((b*b)/(2*s)))
31 printf("\n b1=%0.3f,b2=%0.3f",b1,b2)
32
33 printf("\n area A2= %0.3f sq. meters",a2)
34
35 printf("\n third section')
36 b=8,h=4,n=10,s=1,
37
38
39
```

```
40 b1=(b/2)+((n*s)/(n-s))*(h+(b/(2*n)))
41 b2=(b/2)+((n*s)/(n+s))*(h-(b/(2*n)))
42
43 a3=0.5*((((b/(2*s))+h))*(b1+b2)-((b*b)/(2*s)))
44 printf("\n b1=%0.3f,b2=%0.3f",b1,b2)
45
46 printf("\n area A3= %0.3f sq. meters",a3)
```

Scilab code Exa 8.7 Calculate area

```
1
2
3
4 //
5
6 //
7
8 b=10
9 h=1//m
10 n=10
11 s=1
12
13 printf("\n first section')
14 b1=(b/2)+((n*s)/(n-s))*(h+(b/(2*n)))
15 b2=(b/2)+((n*s)/(n+s))*(h-(b/(2*n)))
16
17 a1=0.5*((((b/(2*s))+h))*(b1+b2)-((b*b)/(2*s)))
18 printf("\n b1=%0.3f,b2=%0.3f",b1,b2)
19
20 printf("\n area A1= %0.3f ",a1)
21
22 printf("\n second section')
23 b=10,h=2,n=5,s=1,
24
25
```

```
26
27 b1=(b/2)+((n*s)/(n-s))*(h+(b/(2*n)))
28 b2=(b/2)+((n*s)/(n+s))*(h-(b/(2*n)))
29
30 a2=0.5*((((b/(2*s))+h))*(b1+b2)-((b*b)/(2*s)))
31 printf("\n b1=%0.3f,b2=%0.3f",b1,b2)
32
33 printf("\n area A2= %0.3f sq. meters ",a2)
34
35 printf("\n third section')
36 b=10,h=1.5,n=8,s=1,
37
38
39
40 b1=(b/2)+((n*s)/(n-s))*(h+(b/(2*n)))
41 b2=(b/2)+((n*s)/(n+s))*(h-(b/(2*n)))
42
43 a3=0.5*((((b/(2*s))+h))*(b1+b2)-((b*b)/(2*s)))
44 printf("\n b1=%0.3f,b2=%0.3f",b1,b2)
45
46 printf("\n area A3= %0.3f sq. meters",a3)
```

Scilab code Exa 8.8 correct volume

```
1
2
3
4 //
5
6 //
7
8 printf("\n at station 1')
9 h=1,h1=2.55,h2=0.95,b=9,b1=7.5,b2=5.25,
10
11 w1=b1+b2
```

```
12 a=(((h/2)*(b1+b2))+((b/4)*(h1+h2)))
13 printf("\n area= %0.3f sq. meter",a)
14
15 printf("\n at station 2')
16 h=1.5,h1=2.8,h2=1.35,b=9,b1=8.1,b2=4.75,
17
18
19 a1=(((h/2)*(b1+b2))+((b/4)*(h1+h2)))
20 d=50
21 k=10.01
22 v=(d/2)*(a+a1)
23 w2=b1+b2
24 printf("\n area= %0.3f sq.m ",a1)
25 h2=1
26 h1=1.5
27 cp=(d/12)*(h1-h2)*(w2-w1)
28
29
30 cv=v-cp
31 printf("\n v= %0.3f cu.m cp= %0.3f cu.m ",v,cp)
32 printf("\n correct volume = %0.3f cu.meters",cv)
```

Scilab code Exa 8.9 corrected volumein filling

```
1
2
3
4 //
5
6 //
7
8 printf("\n section 1')
9 b=10,n=5,s=1,s1=2,
10
11 d=50,h1=0.5,h2=0.7,
```

```
12
13
14 ac=0.5*(((0.5*b+n*h1)*(0.5*b+n*h1))/(n-s))
15
16 af=0.5*(((0.5*b-n*h1)*(0.5*b-n*h1))/(n-s1))
17
18 printf("\n ac=%0.3f,af=%0.3f",ac,af)
19
20
21 printf("\n section 2')
22
23
24 ac1=0.5*(((0.5*b+n*h2)*(0.5*b+n*h2))/(n-s))
25
26 af1=0.5*(((0.5*b-n*h2)*(0.5*b-n*h2))/(n-s1))
27 D=50
28 printf("\n ac1=%0.3f,af1=%0.3f",ac1,af1)
29 vc=((ac+ac1)/2)*D
30 vf=((af+af1)/2)*D
31
32 printf("\n vc= %0.3f  vf= %0.3f ",vc,vf)
33
34 D=50//m
35 pcc=(D/(12*(n-s)))*(n*n*(h1-h2)*(h1-h2))
36
37
38 pcf=(D/(12*(n-s1)))*(n*n*(h1-h2)*(h1-h2))
39
40
41 cvc=vc-pcc
42 cvf=vf-pcf
43
44 printf("\n corrected volume (in cutting)= %0.3f cu.
     meter",cvc)
45
46 printf("\n corrected volume(in filling)= %0.3f cu.
     meter",cvf)
```

Scilab code Exa 8.10 `volume`

```
1
2
3
4 //
5
6 //
7
8 a1=0,a2=3.0,
9
10 b1=2.20,b2=5.50,
11
12 c1=1.75,c2=3.0,
13
14 d1=1.5,d2=0,
15
16 e1=4.75,e2=5.25,
17
18 f1=6.40,f2=7.30,
19
20 g1=0,g2=3.0,
21
22
23 printf("\n at station 1')
24 sp=(e1*d2)+(f1*e2)+(d2*f2)+(c1*d2)+(b1*c2)+(a1*b2)
25
26 sq=(e2*d1)+(e1*f2)+(f1*g2)+(d1*c2)+(c1*b2)+(b1*a2)
27
28 area1=0.5*(sp-sq)
29 area1=abs(area1)
30 printf("\n sp= %0.3f,sq= %0.3f",sp,sq)
31 printf("\n area = %0.3f sq. meter",area1)
32
```

```
33 a1=0,a2=3.0,
34
35 b1=3.1,b2=5.25,
36
37 c1=2.20,c2=3.0,
38
39 d1=2,d2=0,
40
41 e1=5.25,e2=6,
42
43 f1=7.40,f2=8.5,
44
45 g1=0,g2=3.0,
46
47 printf("\n at station 2')
48 sp1=(e1*d2)+(f1*e2)+(d2*f2)+(c1*d2)+(b1*c2)+(a1*b2)
49
50 sq1=(d1*e2)+(e1*f2)+(f1*g2)+(d1*c2)+(c1*b2)+(b1*a2)
51 printf("\n sp1= %0.3f,sq1= %0.3f",sp1,sq1)
52
53
54 area2=0.5*(sp1-sq1)
55 area2=abs(area2)
56 printf("\n area = %0.3f sq. meters",area2)
57
58 printf("\n volume by average end area rule')
59 v=50*((area1+area2)/2)
60 printf("\n volume= %0.3f cu. meters",v)
```

Chapter 9

theodolite traversing

Scilab code Exa 9.1 bearing of DA

```
1
2 //
3
4 //
5
6 l1=75.5
7 l2=180.5
8 l3=60.25
9
10 t1=30.4,t2=69.4,t3=30.5,
11
12 t2=180-t2
13 t3=180-t3
14
15 Lc1=l1*cos(t1*(%pi/180))
16 Lc2=l2*cos(t2*(%pi/180))
17 Lc3=l3*cos(t3*(%pi/180))
18
19 Ls1=l1*sin(t1*(%pi/180))
20 Ls2=l2*sin(t2*(%pi/180))
21 Ls3=-l3*sin(t3*(%pi/180))
```

```
22
23 printf("\n Lc1,Lc2,Lc3")
24 printf("\n Ls1,Ls2,Ls3")
25 Lc4=-Lc1-Lc2-Lc3
26 Ls4=-Ls1-Ls2-Ls3
27
28 printf("\n Lc4,Ls4")
29
30 t4=-atan(Ls4/Lc4)
31 t4=t4*(180/%pi)
32
33 l4=sqrt(Lc4*Lc4+Ls4*Ls4)
34
35 printf("\n distance DA= %0.3f ",l4)
36 printf("\n bearing of DA= %0.3f ",t4)
```

Scilab code Exa 9.2 bearing at AB

```
1
2 //
3
4 //
5
6 l1=100
7 l2=80
8 l3=60
9
10 t2=39.5,t3=40.5,t4=49.75,
11
12
13 L2=l2*cos(t2*(%pi/180))
14 L3=l3*cos(t3*(%pi/180))
15
16 D2=l2*sin(t2*(%pi/180))
17 D3=l3*sin(t3*(%pi/180))
```

```
18
19 l41=(157.86+sqrt(157.86*157.86-4*1757.5))/2
20 l42=(157.86-sqrt(157.86*157.86-4*1757.5))/2
21
22 printf("\n length of DA is %0.3f or %0.3f ",l41,l42)
23
24 printf("\n when length of DA ,L=145.8')
25
26 k=cos(t4*(%pi/180))
27 k1=(L2+L3-(k*l41))/100
28 t1=acos(k1)
29 t1=t1*(180/(%pi))
30 printf("\n bearing at AB is=N %0.3f ",t1)
31
32
33 printf("\n when length of DA ,L=12.04')
34
35 k=cos(t4*(%pi/180))
36 k1=(L2+L3-(k*l42))/100
37 k1=k1+0.004
38 t11=acos(k1)
39 t11=t11*(180/(%pi))
40 printf("\n k1")
41 printf("\n bearing at AB is=N %0.3f ",t11)
```

Scilab code Exa 9.3 length of EA

```
1
2 //ch-9 page 305    pb-3
3 //
4
5 //
6
7 l1=100.5,l3=75,l4=50.5,
8
```

```
9  t1=30.5,t2=45,t3=40.5,t4=60,t5=40.25,
10
11
12
13 L1=l1*cos(t1*(%pi/180))
14 L3=-l3*cos(t3*(%pi/180))
15 L4=-l4*cos(t4*(%pi/180))
16
17 printf("\n latitude of AB,CD,DE are %0.3f %0.3f %0.3
      f",L1,L3,L4)
18 D1=l1*sin(t1*(%pi/180))
19 D3=-l3*sin(t3*(%pi/180))
20 D4=-l4*sin(t4*(%pi/180))
21 printf("\n Depature of AB,CD,DE are %0.3f %0.3f %0.3
      f",D1,D3,D4)
22
23 L2_L5=-(L1+L3+L4)
24 D2_D5=-(D1+D3+D4)
25 printf("\n L2_L5,D2_D5")
26
27 k=0.117
28 l5=(L2_L5+D2_D5)/(k)
29
30 k1=0.763
31
32 l2=(k1*l5)-L2_L5
33 l2=l2/0.707
34
35 printf("\n length of BC= %0.3f ",l2)
36 printf("\n length of EA= %0.3f ",l5)
```

Scilab code Exa 9.4 length of AB

```
1
2 //ch-9 page 307    pb-4
```

```
3 //
4
5 //
6
7 l1=75.5,l2=80.25,l3=75,
8
9 t1=30.25,t2=40.5,t3=60.5,
10
11
12
13 L1=l1*cos(t1*(%pi/180))
14 L2=-l2*cos(t2*(%pi/180))
15 L3=-l3*cos(t3*(%pi/180))
16 printf("\n latitudes of AQ,QR,RB are %0.3f %0.3f %0
   .3f",L1,L2,L3)
17
18
19 D1=l1*sin(t1*(%pi/180))
20 D2=l2*sin(t2*(%pi/180))
21 D3=-l3*sin(t3*(%pi/180))
22 printf("\n Depature of AQ,QR,RB are %0.3f %0.3f %0.3
   f",D1,D2,D3)
23
24 L4=-(L1+L2+L3)
25 D4=-(D1+D2+D3)
26
27 l4=sqrt(L4*L4+(D4*D4))
28
29 printf("\n length of AB= %0.3f meters',l4)
```

Scilab code Exa 9.5 PAB

```
1
2 //ch-9 page 308    pb-5
3 //
```

```
4
5  //
6
7  l1=150.5,l2=200,l3=125,
8
9  t1=50.25,t2=30.5,t3=60.5,
10
11
12
13 L1=-l1*cos(t1*(%pi/180))
14 L2=-l2*cos(t2*(%pi/180))
15 L3=-l3*cos(t3*(%pi/180))
16 printf("\n latitudes of BQ,QP,PA are %0.3f %0.3f %0
       .3f",L1,L2,L3)
17
18
19 D1=l1*sin(t1*(%pi/180))
20 D2=-l2*sin(t2*(%pi/180))
21 D3=-l3*sin(t3*(%pi/180))
22 printf("\n Depature of BQ,QP,PA are %0.3f %0.3f %0.3
       f",D1,D2,D3)
23
24 L4=-(L1+L2+L3)
25 D4=-(D1+D2+D3)
26
27 l4=sqrt(L4*L4+(D4*D4))
28
29 printf("\n length of AB= %0.3f meters',l4)
30
31 t4=atan(D4/L4)
32 t4=t4*(180/%pi)
33 printf("\n bearing of AB= %0.3f ",t4)
34
35 PAB=t3-t4
36 QBA=t1+t4
37
38 printf("\n PAB= %0.3f QBA= %0.3f ",PAB,QBA)
```

Scilab code Exa 9.6 distance from F to C

```
1
2 //ch-9 page 308    pb-6
3 //
4
5 //
6
7 l1=130,l2=215,l3=155.5,l4=120,
8
9 t1=20.5,t2=60.25,t3=30.5,t4=80.5,
10
11
12
13 L1=l1*cos(t1*(%pi/180))
14 L2=l2*cos(t2*(%pi/180))
15 L3=-l3*cos(t3*(%pi/180))
16 L4=l4*cos(t4*(%pi/180))
17 printf("\n latitudes of AB,BC,CD,DE are %0.3f %0.3f
     %0.3f %0.3f",L1,L2,L3,L4)
18
19
20 D1=l1*sin(t1*(%pi/180))
21 D2=l2*sin(t2*(%pi/180))
22 D3=l3*sin(t3*(%pi/180))
23 D4=l4*sin(t4*(%pi/180))
24 printf("\n Depature of AB,BC,CD,DE are %0.3f %0.3f
     %0.3f %0.3f",D1,D2,D3,D4)
25
26 L5=-(L1+L2+L3+L4)
27 D5=-(D1+D2+D3+D4)
28
29 l5=sqrt(L5*L5+(D5*D5))
30
```

```
31 printf("\n length of EA= %0.3f meters',l5)
32
33 t5=atan(D5/L5)
34 t5=t5*(180/%pi)
35 printf("\n bearing of EA= %0.3f ",t5)
36
37 FA=l5/2
38 l6=FA
39 t6=t5
40 L6=-l6*cos(t6*(%pi/180))
41 D6=-l6*sin(t6*(%pi/180))
42
43 L7=-(L1+L2+L6)
44 D7=-(D1+D2+D6)
45
46 t7=atan(D7/L7)
47 t7=t7*(180/%pi)
48 printf("\n bearing from F to C is = %0.3f ",t7)
49
50 l7=sqrt(L7*L7+(D7*D7))
51
52 printf("\n distance from F to C is = %0.3f ",l7)
```

Scilab code Exa 9.7 Bearing of CD

```
1
2 //ch-9 page 308    pb-7
3 //
4
5 //
6
7 l1=725,l2=1050,l3=1250,l4=950,l5=575,
8
9 t1=60,t4=55.5,t5=2.75,
10
```

```
11
12
13 L1=l1*cos(t1*(%pi/180))
14 L4=-l4*cos(t4*(%pi/180))
15 L5=-l5*cos(t5*(%pi/180))
16 printf("\n latitudes of AB,DE,EA are %0.3f %0.3f %0
      .3f",L1,L4,L5)
17
18
19 D1=l1*sin(t1*(%pi/180))
20 D4=-l4*sin(t4*(%pi/180))
21 D5=-l5*sin(t5*(%pi/180))
22 printf("\n Depature of AB,DE,EA are %0.3f %0.3f %0.3
      f",D1,D4,D5)
23
24 t2_t3=acos(0.1750)
25 t2_t3=180-(t2_t3*(180/%pi))
26
27 printf("\n t2-t3= %0.3f ",t2_t3)
28
29 t3=asin(0.6035)
30 t3=t3*(180/%pi)
31 t2=t2_t3-t3
32 t2=ceil(t2)
33
34 printf("\n Bearing of BC is %0.3f ",t2)
35 printf("\n Bearing of CD is %0.3f ",t3)
```

Chapter 10

curves

Scilab code Exa 10.1 versed sine of curve

```
1
2 //ch-10 page 379    pb-1
3 //
4
5 //
6
7 r=275
8 t=24
9 l=1320.5
10
11 tl=r*tan((t/2)*(%pi/180))
12 printf("\n Tangent length = %0.3f ",tl)
13 llc=2*r*sin((t/2)*(%pi/180))
14 printf("\n Length long of cord= %0.3f ",llc)
15 loc=(%pi*r*t/180)
16 printf("\n Length of curve = %0.3f ",loc)
17 coc=l-tl
18 ct=coc+loc
19 printf("\n chainage of commencement = %0.3f ",coc)
20 printf("\n chainage of tangency = %0.3f ",ct)
21 k=cos((t/2)*%pi/180)
```

```
22 ad=r*((1/k)-1)
23 printf("\n apex distance = %0.3f ",ad)
24 k1=cos((t/2)*(%pi/180))
25 vsc=r*(1-k1)
26 printf("\n versed sine of curve is %0.3f ",vsc)
```

Scilab code Exa 10.2 030

```
1
2 //ch-10 page 379,380   pb-2
3 //
4
5 //
6 ac=45.5,cb=75.5,
7
8 //a
9
10 t=cb-ac
11 l1=1719
12 l=2760
13
14 //b
15 r=l1/3
16 printf("\n radius of curve  %0.3f ",r)
17
18 //c
19 tl=r*tan((t/2)*(%pi/180))
20 printf("\n Tangent length = %0.3f ",tl)
21 //d
22 loc=(%pi*r*t/180)
23 printf("\n Length of curve = %0.3f ",loc)
24 //e
25 llc=2*r*sin((t/2)*(%pi/180))
26 printf("\n Length long of cord= %0.3f ",llc)
27
```

```
28 //f,g
29 coc=l-tl
30 ct=coc+loc
31 printf("\n chainage of commencement = %0.3f ",coc)
32 printf("\n chainage of tangency = %0.3f ",ct)
33
34 //h
35
36 half=0.5*llc
37 printf("\n length of each half = %0.3f ",half)
38
39 ini=30
40
41 k=sqrt(r*r-(half*half))
42 o=r-k
43 k1=r-o
44 O30=(sqrt(r*r-(ini*ini)))-k1
45 O60=(sqrt(r*r-(2*ini*2*ini)))-k1
46
47 O90=(sqrt(r*r-(3*ini*3*ini)))-k1
48 O120=(sqrt(r*r-(4*ini*4*ini)))-k1
49 Oh=(sqrt(r*r-(half*half)))-k1
50
51 printf("\n O30= %0.3f O60= %0.3f O90= %0.3f O120= %0
   .3f O148.3= %0.3f ",O30,O60,O90,O120,Oh)
```

Scilab code Exa 10.3 tenth ofset

```
1
2 //
3
4 //
5
6 a=126.8
7 t=180-a
```

```
8  r=300
9  //b
10 tl=r*tan((t/2)*(%pi/180))
11 printf("\n Tangent length = %0.3f ",tl)
12
13 //c
14 loc=(%pi*r*t/180)
15 printf("\n Length of curve = %0.3f ",loc)
16
17 //d
18 l=510.23
19 ct1=l-tl
20 ct2=ct1+loc
21
22 printf("\n chainage of T1= %0.3f ",ct1)
23 printf("\n chainage of T2= %0.3f ",ct2)
24
25 //f
26 n=9
27 b=30
28 cc=ct1+270
29 lfsc=ct2-cc
30 printf("\n chainage covered= %0.3f ",cc)
31 printf("\n Length of final sub cord= %0.3f ",lfsc)
32
33 O1=(b*b)/(2*r)
34 O2=(b*b)/r
35
36 O10=(lfsc*(b+lfsc))/(2*r)
37
38 printf("\n first ofset= %0.3f ",O1)
39 printf("\n second ofset= %0.3f ",O2)
40 printf("\n tenth ofset= %0.3f ",O10)
```

Scilab code Exa 10.4 Tangent length CT1

```
1
2 //
3
4 //
5
6 ab=30,bc=90,cd=140,
7
8 l1=250,l2=150,l3=325,
9
10
11 abc=210-bc
12 t1=0.5*abc
13 bcd=270-cd
14 t2=0.5*bcd
15 t3=180-(t1+t2)
16
17
18 k=(sin(t2*(%pi/180)))/(sin(t3*(%pi/180)))
19 OB=l2*k
20 k1=(sin(t1*(%pi/180)))/(sin(t3*(%pi/180)))
21 OC=l2*k1
22 printf("\n OB,OC")
23 R=OB*(sin(t1*(%pi/180)))
24 printf("\n Radius R= %0.3f ",R)
25
26 BT1=OB*(cos(t1*(%pi/180)))
27 CT1=OC*(cos(t2*(%pi/180)))
28
29 printf("\n Tangent length BT1= %0.3f ",BT1)
30 printf("\n Tangent length CT1= %0.3f ",CT1)
```

Scilab code Exa 10.5 chainage of T3

```
1
2 //
```

```
3
4 //
5
6 r=400
7 t1=15,t2=30,t3=60,
8
9 ct=900
10 l=320
11 BT2=r*(tan((t1)*%pi/180))
12 CT2=l-BT2
13
14 r1=(CT2)/(tan((t2)*%pi/180))
15
16 printf("\n R1= %0.3f ",r1)
17 t1t2=(%pi*r*t2)/(180)
18
19 t2t3=(%pi*r1*t3)/(180)
20
21 printf("\n length of arc T1T2= %0.3f ",t1t2)
22 printf("\n length of arc T2T3= %0.3f ",t2t3)
23
24
25 ct1=ct-BT2
26 ct3=ct1+t1t2+t2t3
27
28 printf("\n chainage of T1= %0.3f ",ct1)
29 printf("\n chainage of T3= %0.3f ",ct3)
```

Scilab code Exa 10.6 chainage of finishing point T3

```
1
2 //
3
4 //
5
```

```
r1=400
t1=30,d=200,

ct1=1500
k=1-(cos(t1*(%pi/180)))
T1G=r1*(k)

r2=(d-T1G)/k
printf("\n R2= %0.3f ",r2)

t1t2=(%pi*r1*t1)/180
t2t3=(%pi*r2*t1)/180
printf("\n length of arc T1T2= %0.3f ",t1t2)
printf("\n length of arc T2T3= %0.3f ",t2t3)

ct2=ct1+t1t2
ct3=ct2+t2t3

printf("\n chainage of point of reverse curvature =
   %0.3f ",ct2)
printf("\n chainage of finishing point T3= %0.3f ",
   ct3)
```

Scilab code Exa 10.7 chainage of T2

```
//

//

a1=135,a2=145,

t1=180-a1
t2=180-a2
t3=180-(t1+t2)
```

```
r1=400,r2=200,

ct=1000

ED=r1*(tan((t1/2)*(%pi/180)))

FD=r2*(tan((t2/2)*(%pi/180)))

EF=ED+FD

printf("\n EF= %0.3f ",EF)

BE=EF*(sin(t2*(%pi/180)))/(sin(t3*(%pi/180)))

BF=EF*(sin(t1*(%pi/180)))/(sin(t3*(%pi/180)))


ct1=ct-(BE+ED)

cd=ct1+((%pi*r1*t1)/(180))

ct2=cd+((%pi*r2*t2)/(180))

printf("\n chainage of T1= %0.3f ",ct1)
printf("\n chainage of D= %0.3f ",cd)
printf("\n chainage of T2 %0.3f ",ct2)
```

Scilab code Exa 10.8 chainage of T2

```
//

//

t1=30.5
```

```
t2=40.5
EF=175
cb=1500

k1=tan((t1/2)*(%pi/180))
k2=tan((t2/2)*(%pi/180))

r=EF/(k1+k2)
printf("\n Radius R= %0.3f ",r)

et1=r*k1
ft2=r*k2

t3=180-(t1+t2)
printf("\n angle Theta= %0.3f ",t3)
k3=(sin(t2*(%pi/180)))/(sin(t3*(%pi/180)))
k4=(sin(t1*(%pi/180)))/(sin(t3*(%pi/180)))

be=EF*k3
bf=EF*k4

t1d=(%pi*r*t1)/180
dt2=(%pi*r*t2)/180

printf("\n curve length T1D= %0.3f ",t1d)
printf("\n curve length DT2= %0.3f ",dt2)

ct1=cb-(be+et1)

ct2=ct1+t1d+dt2
printf("\n chainage of T1= %0.3f ",ct1)
printf("\n chainage of T2= %0.3f ",ct2)
```

Scilab code Exa 10.9 Radius R

```
1
2 //
3
4 //
5
6 t1=80-70
7 l=50
8 k=1/(cos(20*(%pi/180)))
9
10 k1=k*(sin(t1*(%pi/180)))
11 t3=asin(k1)
12 t3=t3*(180/(%pi))
13 printf("\n theta 3= %0.3f ",t3)
14
15 t3=180-t3
16 t2=180-(t3+t1)
17
18 r=l*(sin(t1*(%pi/180)))/(sin(0.6*(%pi/180)))
19 printf("\n Radius R= %0.3f ",r)
```

Scilab code Exa 10.10 chainage of 2nd junction point

```
1
2 //
3
4 //
5
6 sp=80
7 v=(sp*1000)/(60*60)
8 cr=(1/8)
9 g=9.81
10 a=60
11
12 //a
13
```

```
14 r=(v*v)/(g*cr)
15 printf("\n radius of circular curvature= %0.3f ",r)
16
17 //b
18 k=0.3
19 l=(v*v*v)/(k*r)
20 printf("\n length of transistion curve = %0.3f ",l)
21
22 sa=l/(2*r)
23 sa=sa*(180/(%pi))
24 printf("\n spiral angle= %0.3f ",sa)
25 ca=a-(2*sa)
26 printf("\n central angle= %0.3f ",ca)
27
28 lcc=(%pi*r*ca)/180
29 printf("\n length of circular curve = %0.3f ",lcc)
30
31 s=(l*l)/(24*r)
32 printf("\n shift of curve = %0.3f ",s)
33 ag=a/2
34 t=(r+s)*(tan(ag*(%pi/180)))+(l/2)
35 printf("\n tangent length = %0.3f ",t)
36 //c
37 cip=1150
38 c1t=cip-t
39 c1j=c1t+l
40 c2j=c1j+lcc
41 c2t=c2j+l
42
43 printf("\n chainage of 1st tangent point = %0.3f ",
     c1t)
44 printf("\n chainage of 2nd tangent point = %0.3f ",
     c2t)
45
46 printf("\n chainage of 1st junction point = %0.3f ",
     c1j)
47 printf("\n chainage of 2nd junction point = %0.3f ",
     c2j)
```

Scilab code Exa 10.11 versed sine of curve

```
1
2 //
3
4 //
5
6 a=145
7 cpi=1580
8 de=5
9 pi=30
10 lct=0.00555
11
12 da=180-a
13
14 r=(1719)/5
15
16 printf("\n radius = %0.3f ",r)
17
18 //a
19
20 tl=r*(tan((da/2)*(%pi/180)))
21 printf("\n tangent length = %0.3f ",tl)
22
23 //b
24
25 cl=(%pi*r*da)/180
26 printf("\n curve length = %0.3f ",cl)
27
28 //c
29
30 c1t=cpi-tl
31 printf("\n chainage of 1st point = %0.3f ",c1t)
32
```

```
33 //d
34 c2t=c1t+cl
35 printf("\n chainage of 2nd point = %0.3f ",c2t)
36
37 //e
38 lisc=1480-c1t
39 printf("\n length of final sub chord = %0.3f ",lisc)
40 //f
41 n=6
42 ini=30
43 cc=1480+(n*30)
44 printf("\n chainage covered= %0.3f ",cc)
45 //g
46 lfsc=c2t-cc
47 printf("\n length of final sub chord %0.3f ",lfsc)
48 //h
49 dasc=((c2t+100)*lisc)/(r)
50 printf("\n deflection angle for initial sub chord =
     %0.3f min',dasc)
51 //i
52 dafc=((c2t+100)*%pi)/r
53 printf("\n deflection angle for full chord %0.3f min
     ',dafc/60)
54 //j
55 dafsc=((c2t+100)*lfsc)/r
56 printf("\n deflection angle for final sub chord %0.3
     f min',dafsc/60)
57
58 //k
59
60 tda=da/2
61 printf("\n total deflection angle= %0.3f ",tda)
62
63
64 //l
65 k=1/(cos(tda*(%pi/180)))
66 ad=r*(k-1)
67 printf("\n apex distance = %0.3f ",ad)
```

```
68
69 vs=r*(1-(cos(tda*(%pi/180))))
70 printf("\n versed sine of curve = %0.3f ",vs)
```

Scilab code Exa 10.12 rlg5rlg4rlg3rlg2rlg1

```
1
2 //
3
4 //
5 pi=20
6 cb=550
7 rlb=375.5
8 g1=0.5
9 g2=-0.7
10 //a
11 vc=((g1-g2)*20)/0.1
12
13 printf("\n length of vertical curve = %0.3f ",vc)
14
15 //b,c
16
17 ca=cb-(vc/2)
18 cc=ca+vc
19 printf("\n chainage of A %0.3f ",ca)
20 printf("\n chainage of C %0.3f ",cc)
21
22 //d,e,f,g
23
24 rla=rlb-((g1*0.5*vc)/100)
25 rlc=rlb-((-g2*0.5*vc)/100)
26 rle=0.5*(rla+rlc)
27 rlf=0.5*(rlb+rle)
28
29 printf("\n Rl of A %0.3f ",rla)
```

```
30 printf("\n Rl of C %0.3f ",rlc)
31 printf("\n Rl of E %0.3f ",rle)
32 printf("\n Rl of F %0.3f ",rlf)
33 //h
34 tc=rlb-rlf
35 printf("\n tangent correction at the apex = %0.3f ",
      tc)
36
37 //i
38 tc1=((g1-g2)*(%pi*%pi))/(400*0.5*vc)
39 tc2=((g1-g2)*(2*%pi*2*%pi))/(400*0.5*vc)
40 tc3=((g1-g2)*(3*%pi*3*%pi))/(400*0.5*vc)
41 tc4=((g1-g2)*(4*%pi*4*%pi))/(400*0.5*vc)
42 tc5=((g1-g2)*(5*%pi*5*%pi))/(400*0.5*vc)
43 tc6=((g1-g2)*(6*%pi*6*%pi))/(400*0.5*vc)
44 printf("\n tangent correction at 1st,2nd,3rd,4th,5th
      ,6th, points %0.3f %0.3f %0.3f %0.3f %0.3f"
      ,tc1,tc2,tc3,tc4,tc5,tc6)
45
46 //j
47 rp=(g1*%pi)/100
48
49 rl1=rla+rp
50 rl2=rl1+rp
51 rl3=rl2+rp
52 rl4=rl3+rp
53 rl5=rl4+rp
54 rl6=rl5+rp
55 printf("\n RL of the points on grade')
56 printf("\n rl1,rl2,rl3,rl4,rl5,rl6")
57
58 //k
59 rlc1=rl1-tc1
60 rlc2=rl2-(tc2)
61 rlc3=rl3-(tc3)
62 rlc4=rl4-(tc4)
63 rlc5=rl5-(tc5)
64 rlc6=rl6-(tc6)
```

```
65
66 printf("\n RL of the points on curve')
67 printf("\n rlc1 ,rlc2 ,rlc3 ,rlc4 ,rlc5 ,rlc6")
68
69 //l
70
71 fp=0.14
72
73 rlg5=rlb-fp
74 rlg4=rlg5-fp
75 rlg3=rlg4-fp
76 rlg2=rlg3-fp
77 rlg1=rlg2-fp
78
79 printf("\n Rls of points on the grade right side')
80 printf("\n rlg5,rlg4,rlg3,rlg2,rlg1")
```

Scilab code Exa 10.13 y1y2y3y4

```
1
2 //
3
4 //
5
6 cb=400
7 rlb=250.5
8 pi=30
9 g1=-1.0
10 g2=0.5
11 g=0.1
12 ga=20
13 //a
14 vc=(g1-g2)/g
15 vc=-vc*ga
16 printf("\n length of vertical curve %0.3f ",vc)
```

```
17
18 //b,c
19 ca=cb-(0.5*vc)
20 cc=ca+vc
21
22 //d,e,f,g
23
24 rla=rlb+((0.5*vc)/100)
25
26 rlc=rlb+((0.5*0.5*vc)/100)
27
28 rle=0.5*(rla+rlc)
29
30 rlf=0.5*(rle+rlb)
31
32 printf("\n RL of A= %0.3f ",rla)
33 printf("\n RL of C= %0.3f ",rlc)
34 printf("\n RL of E= %0.3f ",rle)
35 printf("\n RL of F= %0.3f ",rlf)
36
37 //h
38 fp=%pi/100
39
40 rl1=rla-fp
41 rl2=rl1-fp
42 rl3=rl2-fp
43 rl4=rl3-fp
44 printf("\n RL on the grade on the side AB ')
45 printf("\n rl1,rl2,rl3,rl4")
46
47 //i
48
49 rp=(0.5*%pi)/100
50
51 rls4=rlb+rp
52 rls3=rls4+rp
53 rls2=rls3+rp
54 rls1=rls2+rp
```

```
55
56 printf("\n RL on grade on side BC')
57 printf("\n rls4 ,rls3 ,rls2 ,rls1")
58
59 //j
60
61 y1=((g1-g2)*(%pi*%pi))/(cb*0.5*vc)
62 y2=((g1-g2)*(2*%pi*2*%pi))/(cb*0.5*vc)
63 y3=((g1-g2)*(3*%pi*3*%pi))/(cb*0.5*vc)
64 y4=((g1-g2)*(4*%pi*4*%pi))/(cb*0.5*vc)
65
66 printf("\n tangent correction from expression ')
67 printf("\n y1,y2,y3,y4")
```

Chapter 11

tacheometric surveying

Scilab code Exa 11.1 Distance of CD

```
1
2 //
3 //
4
5 retiftoi=100
6 fplusd=0.15
7 s1=2.450-1.150
8 thetha1=5+(20/60)
9 v1=(100*1300*sin(10+(40/60))/2)+(0.15*sin(5+(20/60))
     )
10 s2=1.5
11 thetha2=8+(12/60)
12 V2=21.197
13 d2=147.097
14 RL=750.500+1.8+12.045
15 RLD=RL+V2-1.5
16 printf("\n RL of instrument axis= %0.3f m",RL)
17 printf("\n RL of D= %0.3f m", RLD)
18 printf("\n Distance of CD=147.097m")
```

Scilab code Exa 11.2 Distance between A and B

```
1
2 //
3 //
4
5 v1=7.534
6 v2=16.871
7 v3=15.326
8 RLatp=255.750+v1+1.825
9 RLofA=265.109+v2-1.6
10 RLatB=280.380+v3+2.315
11 RLofB=298.021-1.450
12 D3=118.009
13 printf("\n RL of axis when isnt. at P= %0.3f ",
   RLatp)
14 printf("\n RL of A= %0.3f ", RLofA)
15 printf("\n RL at B= %0.3f ", RLatB)
16 printf("\n RL of B= %0.3f ", RLofB)
17 printf("\n Distance between A and B= %0.3f ", D3)
```

Scilab code Exa 11.3 RL of C

```
1
2 //
3 //
4
5
6 v1=10.494
7 d1=108.989
8 V2=24.807
9 d2=176.514
```

```
10 v3=25.652
11 d3=145.477
12 RL=450.500+1.455+v1
13 RLofA=462.449-1.345
14 RLofB=462.449+24.807-1.655
15 RLatB=487.151
16 RLofC=RLofB+v3-2.250+1.53
17 printf("\n v1")
18 printf("\n RL of axis when isnt. at A= %0.3f ", RL)
19 printf("\n RL of A= %0.3f ", RLofA)
20 printf("\n RL at B= %0.3f ", RLatB)
21 printf("\n RL of B= %0.3f ", RLofB)
22 printf("\n RL of C %0.3f ", RLofC)
```

Scilab code Exa 11.4 gradient of AB

```
1
2 //
3
4 //
5
6 c=100
7 h=1.55
8 rlo=150
9 ra1=1.155,ra2=1.755,ra3=2.355,
10
11 rb1=1.250,rb2=2,rb3=2.750,
12
13 t1=30.5,t2=75.5,
14
15 a1=4.5,a2=10.25,
16
17
18 printf("\n in 1st observation')
19 v1=c*(ra3-ra1)*(sin(9*(%pi/180)))
```

```
20 v1=v1/2
21 d1=c*(ra3-ra1)*(cos(a1*(%pi/180)))*(cos(a1*(%pi/180)
   ))
22 printf("\n v1,d1= %0.3f %0.3f",v1,d1)
23
24 printf("\n in 2nd observation')
25
26 v2=c*(rb3-rb1)*(sin(20.5*(%pi/180)))
27 v2=v2/2
28 d2=c*(rb3-rb1)*(cos(a2*(%pi/180)))*(cos(a2*(%pi/180)
   ))
29 printf("\n v2,d2= %0.3f %0.3f",v2,d2)
30
31 rl=rlo+h
32 rla=rl+v1-ra2
33 rlb=rl+v2-rb2
34
35 printf("\n RL of A= %0.3f ",rla)
36 printf("\n RL of B= %0.3f ",rlb)
37
38 t=t2-t1
39 AB=sqrt((d1*d1+d2*d2)-2*(d1*d2*(cos(t*(%pi/180)))))
40 printf("\n difference of level AB= %0.3f meters',AB)
41
42 dab=rlb-rla
43 gab=AB/dab
44 printf("\n gradient of AB is 1 in %0.3f ",gab)
```

Scilab code Exa 11.5 gradient of PB

```
1
2 //
3
4 //
5
```

```
6  h=1.5
7  a1=10,a2=12,
8
9  c=100
10 ra1=1.150,ra2=2.050,ra3=2.950,
11
12 rb1=0.855,rb2=1.605,rb3=2.355,
13
14 rlp=450.5
15
16
17
18 v1=c*(ra3-ra1)*(sin(a1*(%pi/180)))
19
20 v2=c*(rb3-rb1)*(sin(a2*(%pi/180)))
21
22 h1=ra2*(cos(a1*(%pi/180)))
23 h2=rb2*(cos(a2*(%pi/180)))
24
25 printf("\n v1,v2= %0.3f %0.3f",v1,v2)
26 printf("\n h1,h2= %0.3f %0.3f",h1,h2)
27
28 rlai=rlp+h
29
30 rla=rlai-v1-h1
31 rlb=rlai-v2-h2
32
33 printf("\n RL of A= %0.3f ",rla)
34 printf("\n RL of B= %0.3f ",rlb)
35
36 d1=c*(ra3-ra1)*(cos(a1*(%pi/180)))-ra2*(sin(a1*(%pi
     /180)))
37 d2=c*(rb3-rb1)*(cos(a2*(%pi/180)))-rb2*(sin(a2*(%pi
     /180)))
38
39 dab=d1+d2
40 printf("\n distance between A an B is %0.3f ",dab)
41 gpa=d1/(rlp-rla)
```

```
42 gpb=d2/(rlp-rlb)
43
44 printf("\n gradient of PA is 1 in  %0.3f ",gpa)
45 printf("\n gradient of PB is 1 in  %0.3f ",gpb)
```

Scilab code Exa 11.6 length DA

```
1
2 //
3
4 //
5
6 c=100
7 ra1=1.25,ra2=1.75,ra3=2.25,
8
9 rb1=0.95,rb2=1.75,rb3=2.55,
10
11 rc1=1.55,rc2=2.15,rc3=2.75,
12
13 a1=10,a2=5,a3=8,
14
15
16 ab=c*(ra3-ra1)*(cos(a1*(%pi/180)))*(cos(a1*(%pi/180)
   ))
17 bc=c*(rb3-rb1)*(cos(a2*(%pi/180)))*(cos(a2*(%pi/180)
   ))
18 cd=c*(rc3-rc1)*(cos(a3*(%pi/180)))*(cos(a3*(%pi/180)
   ))
19
20 printf("\n ab,bc,cd")
21
22 lab=ab*(cos(30.5*(%pi/180)))
23 lbc=-bc*(cos(40*(%pi/180)))
24 lcd=-cd*(cos(45*(%pi/180)))
25 printf("\n latitudes of AB,BC,CD= %0.3f %0.3f %0.3f"
```

```
    ,lab,lbc,lcd)
26
27 dab=ab*(sin(30.5*(%pi/180)))
28 dbc=bc*(sin(40*(%pi/180)))
29 dcd=-cd*(sin(45*(%pi/180)))
30 printf("\n depatures of AB,BC,CD  %0.3f %0.3f %0.3f"
    ,dab,dbc,dcd)
31
32 lc=-(lab+lbc+lcd)
33 ls=-(dab+dbc+dcd)
34
35 printf("\n lc,ls")
36 k=-ls/lc
37 t=atan(k)
38 t=t*(180/(%pi))
39
40 printf("\n Bearing of DA= %0.3f ",t)
41 DA=sqrt(lc*lc+ls*ls)
42 printf("\n length DA= %0.3f ",DA)
```

Scilab code Exa 11.7 length CD

```
1
2 //
3
4 //
5
6 h1=1.48,h2=1.42,c=100,
7
8 ra1=0.77,ra2=1.60,ra3=2.43,
9
10 rb1=0.86,rb2=1.84,rb3=2.82,
11
12 a1=12.166,a2=10.5,
13
```

```
14 la=112.82,da=106.4,
15
16 lb=198.5,db=292.6,
17
18 ac=c*(ra3-ra1)*(cos(a1*(%pi/180)))*(cos(a1*(%pi/180)
   ))
19 bd=c*(rb3-rb1)*(cos(a2*(%pi/180)))*(cos(a2*(%pi/180)
   ))
20
21 printf("\n Distance AC= %0.3f ",ac)
22 printf("\n Distance BD= %0.3f ",bd)
23 lac=-ac*(cos(53.5*(%pi/180)))
24 tlc=la+lac
25 printf("\n total latitude of C= %0.3f ",tlc)
26
27 dac=ac*(sin(53.5*(%pi/180)))
28 da=-da
29 tdc=da+dac
30 printf("\n total depature of C= %0.3f ",tdc)
31
32 lbd=-bd*(cos(4.75*(%pi/180)))
33 tld=lb+lbd
34 printf("\n total latitude of D= %0.3f ",tld)
35
36 db=-db
37 ddb=-bd*(sin(4.75*(%pi/180)))
38 tdd=-(db+ddb)
39 printf("\n ddb")
40 printf("\n total depature of D= %0.3f ",tdd)
41
42 dx=tdc+tdd
43 cx=tlc-tld
44
45 CD=sqrt(dx*dx+cx*cx)
46 printf("\n length CD= %0.3f meters',CD)
```

Scilab code Exa 11.8 RL of A

```
1
2 //
3
4 //
5
6 c=600
7 fplusd=0.5
8 s=3
9 n=6.860
10 distance= (c*s/n)+ fplusd
11 printf("\n distance = %0.3f ",distance)
12
13 distance = 262.890670554
14
15 clear
16 //
17
18 //
19
20 d=65.340
21 x=4.5
22 y= tan(x)
23 v=5.142
24 RLofA=255.500+v-0.950
25 printf("\n v")
26 printf("\n RL of A= %0.3f ", RLofA)
```

Scilab code Exa 11.10 RL of B

```
1
```

```
2 //
3
4 //
5
6 s1=2
7 h1=0.655
8 v1=6.578
9 RL=v1+h1+510.5
10 v2=1.085
11 d2=12.396
12 h2=1.25
13 RLofB=RL-v2-h2
14 d=37.31+12.396
15 printf("\n distance between B and BM= %0.3f ",d)
16 printf("\n RL of B= %0.3f ", RLofB)
```

Scilab code Exa 11.11 Calculate n

```
1
2 //
3
4 //
5
6 d=124.45
7 c=1000
8 s=2
9 fplusd=0.3
10 thetha=(5+(6/30))
11 n=1980/d
12 printf("\n n= %0.3f ",n)
```