76003 - NAVIGATIONAL COURSE CALCULATION
Calculates course settings for one or more adjoining legs of a proposed journey, the length of each leg, and the total distance covered on completion of the journey.

76004 - CIRCLE DETERMINED BY THREE POINTS
Calculates the radius and center point (in rectangular coordinates) of the circle defined by three given points.

76005 - AREA OF A RECTILINEAR SURFACE POLYGON
Calculates the area of any rectilinear polygon given the rectangular coordinates of the vertices.

9100B ONLY

76501 - DIAGNOSTIC (EXERCISER)
The program exercises each calculator operation and memory location with the exception of the FMT, PRINT, and error conditions.

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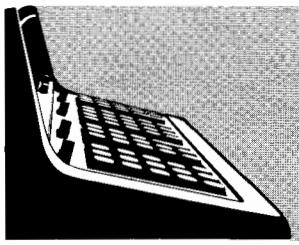


PART NO.
09100-76003

NAVIGATIONAL COURSE CALCULATION

This program is designed for the navigator concerned with courses consisting of several adjoining legs, each leg being relatively short (500 miles or less). Although there is no theoretical limit to the leg length, only one heading from source to destination is given. Long legs should therefore be subdivided to improve calculated results.

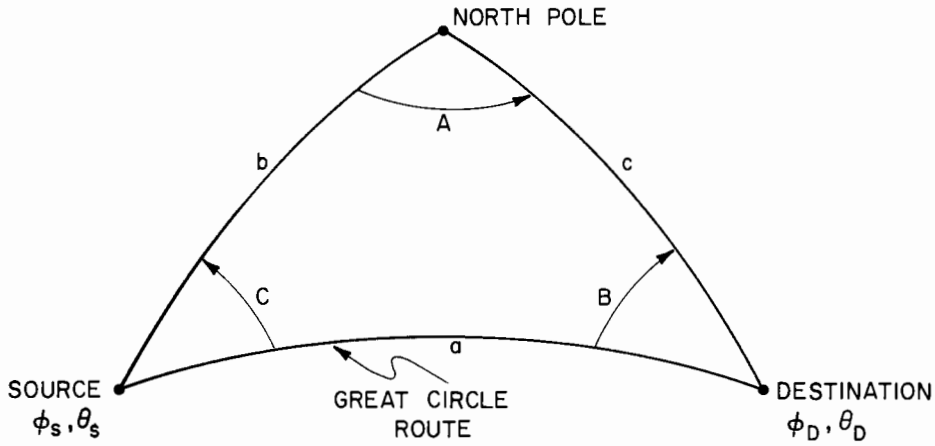
All headings lie between 0^{o} and 360^{o} with either 0^{o} or 360^{o} being a true north course; true west is 90^{o}. Leg lengths are given in nautical miles (one nautical mile equals 6,080 feet). All legs are portions of great circles and all calculations are performed in spherical coordinates.

Referring to the diagram below, the angles A, B, and C are found from the coordinates of the source (ϕ_S, θ_S) and destination (ϕ_D, θ_D). The great circle route a is found from the equation:

$$a = \cos^{-1}\left[\cos b \cos c + \sin b \sin c \cos A\right]$$

The heading (c) is then:

$$c = \cos^{-1}\left[\frac{\cos c - \cos a \cos b}{\sin a \sin b}\right]$$



Notes:

(1) Coordinates are entered in degrees, minutes and decimal fractions of minutes. The decimal point is used to separate degrees and minutes. Example: 30.173 means 30 degrees, 17.3 minutes. 45 degrees, 5 minutes, 30 seconds would be written 45.0550

degrees minutes (i.e. 5.5 min.)

(2) Headings and magnetic variations are entered in decimal degrees (i.e. 17.5^{o} = 17 degrees, 30 minutes)

(3) Northern hemisphere latitudes and western hemisphere longitude are indicated as positive number, southern and eastern coordinates are indicated as negative numbers.

(4) The program is operable over all coordinates except for legs starting or stopping at either the north or south pole, routes going directly over a pole, or a single leg which includes points which are diametrically opposite each other.

USER INSTRUCTIONS

The following notation is used:

T. H.	=	True heading
M. H.	=	Magnetic heading
L	=	Distance of each leg
$\sum$ D	=	Total distance traversed over more than one leg
ϕ	=	Latitude coordinate
θ	=	Longitude coordinate
ϕ_s, θ_s	=	Coordinates of the source of each leg
ϕ_D, θ_D	=	Coordinates of the endpoint of each leg
M.V.	=	Magnetic Variation
N.M.	=	Nautical miles

ENTER PROGRAM (Starting Address is 0 - 0)

→ PRESS: GO TO (0) (0) [or END]

PRESS: CONTINUE

DISPLAY

0 ——— Z
0 ——— Y
1 ——— X

ENTER DATA: ϕ_s (1) →Y, θ_s (1) → X

PRESS: CONTINUE

DISPLAY

NO

0 ——— Z
0 ——— Y
1 ——— X

→ENTER DATA: ϕ_D (n) → Y, θ_D (n) →X

(n indicates the number of the leg under consideration)

PRESS: CONTINUE

DISPLAY

T. H. ——— Z
L ——— Y
2 ——— X

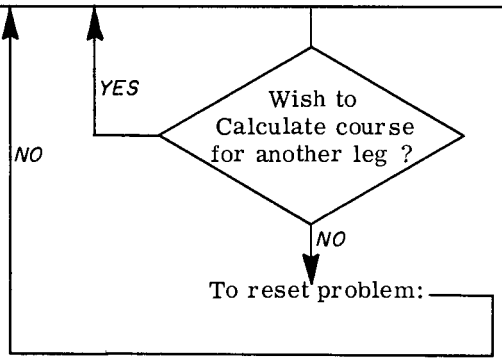
ENTER DATA: M.V. →X (do not alter the Y and Z register contents)

PRESS: CONTINUE

DISPLAY

M. H. ——— Z
$\sum$ D ——— Y
1 ——— X

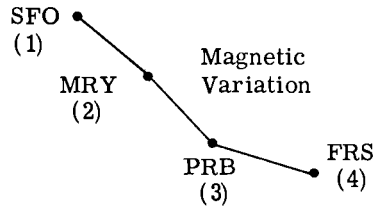
USER INSTRUCTIONS (con't)



Note: The beginning (source) coordinates and end coordinates are both entered for the first leg only; for additional legs the end coordinates of the previous leg are retained as the source coordinates of the next leg. Therefore, after the first leg only endpoint coordinates are entered as data.

EXAMPLE

A flight from San Francisco, California, to Monterey, to Paso Robles, to Fresno is to be charted.



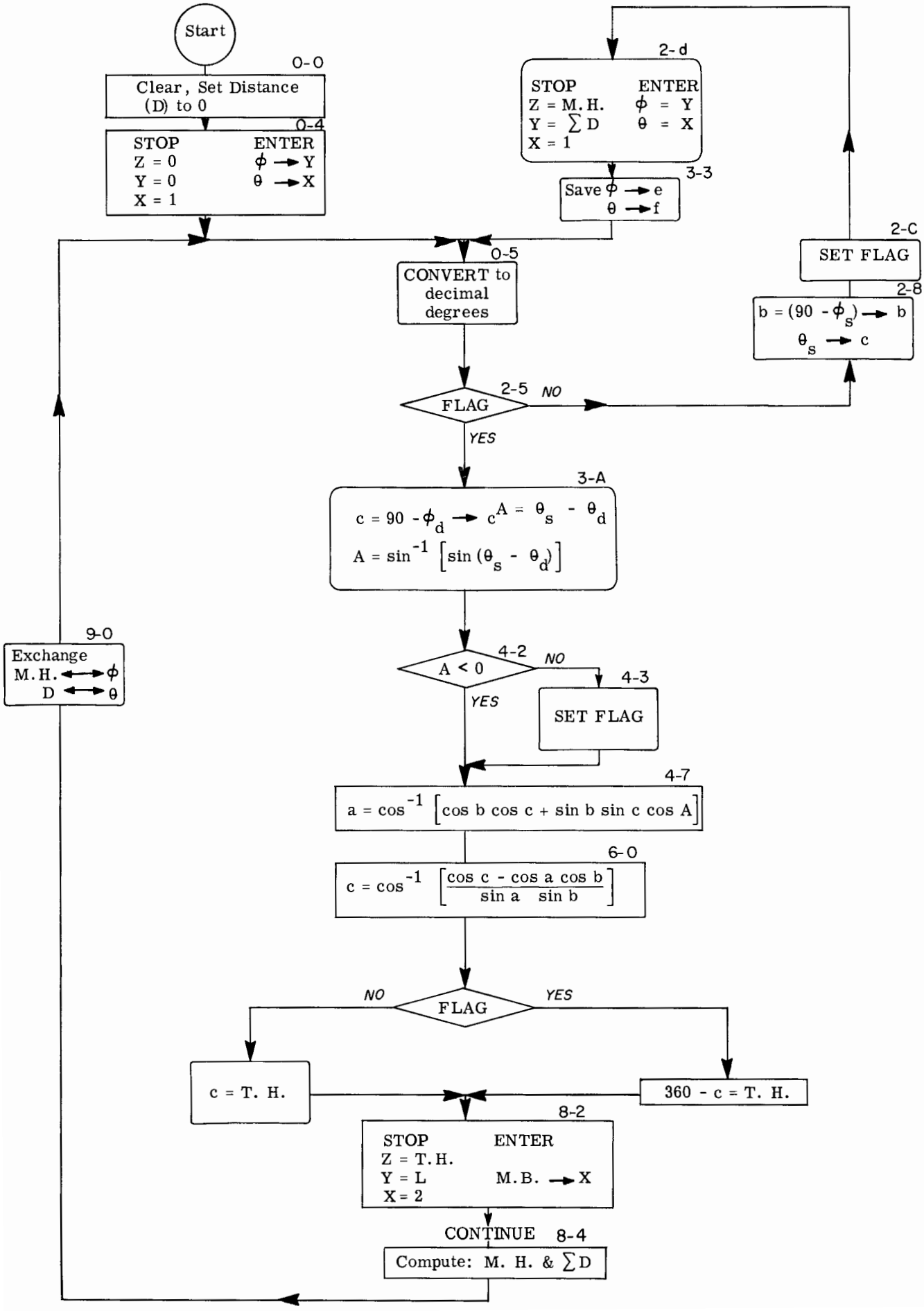
Data:

Points	ϕ	θ	M.V.
(1)	N37.37°	W122.23°	
(2)	N36.35°	W121.51°	17°E
(3)	N35.40°	W120.38°	16.5°E
(4)	N36.44°	W119.49°	16.3°E

Magnetic variation will be input as a negative number due to the easterly coordinate.

Solution:

LEG	T. H.	M. H.	L(N.M.)	$\sum$D(N.M.)
First leg	157.46°	140.46°	67.05	67.05
Second leg	132.65°	116.15°	80.63	147.68
Third leg	31.47°	15.17°	75.23	222.91


Start
0-0
Clear, Set Distance (D) to 0
0-4
STOP
Z = 0
Y = 0
X = 1
ENTER
ϕ → Y
θ → X
0-5
CONVERT to decimal degrees
2-5
FLAG
NO
YES
2-d
STOP
Z = M.H.
Y = ∑D
X = 1
ENTER
ϕ = Y
θ = X
3-3
Save ϕ → e
θ → f
2-C
SET FLAG
2-8
b = (90 - ϕs) → b
θs → c
3-A
c = 90 - ϕd → cA = θs - θd
A = sin-1 [sin (θs - θd)]
4-2
A < 0
NO
YES
4-3
SET FLAG
4-7
a = cos-1 [cos b cos c + sin b sin c cos A]
6-0
c = cos-1 [(cos c - cos a cos b) / (sin a sin b)]
FLAG
NO
YES
c = T. H.
360 - c = T. H.
8-2
STOP
Z = T.H.
Y = L
X = 2
ENTER
M.B. → X
CONTINUE
8-4
Compute: M. H. & ∑D
9-0
Exchange
M.H. ⟷ ϕ
D ⟷ θ

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Step		Key	Code	Display x	Display y	Display z	Storage f	e	d	c	b	a
0	0	CLEAR	20									
	1	$x\rightarrow()$	23									
	2	a	13									
	3	1	01									
	4	STOP	41	θ	ϕ	0						
	5	$y\rightarrow()$	40									
	6	d	17									
	7	↑	27									
	8	int x	64									
	9	−	34									
	a	$x\rightleftarrows y$	30									
	b	↑	27									
	c	·	21									
	d	6	06									
1	0	÷	35									
	1	ROLL ↓	31									
	2	+	33									
	3	$y\rightleftarrows()$	24									
	4	d	17									
	5	↓	25									
	6	↑	27									
	7	int x	64									
	8	−	34									
	9	$x\rightleftarrows y$	30									
	a	ROLL ↑	22									
	b	÷	35									
	c	9	11									
	d	0	00									
2	0	ROLL ↓	31									
	1	+	33									
	2	↓	25									
	3	−	34									
	4	d	17									
	5	IF FLAG	43									
	6	3	03									
	7	8	10									
	8	$x\rightarrow()$	23									
	9	c	16									
	a	$y\rightarrow()$	40									
	b	b	14									
	c	SET FLAG	54									
	d	RCL	61									

ENTER LATITUDE AND LONGITUDE OF THE ORIGIN OF EACH LEG

STORE ϕ

CONVERT θ TO DECIMAL DEGREES AND STORE

CONVERT ϕ TO DECIMAL DEGREES AND CALCULATE $90° - \phi$

BRANCH IF FLAG IS SET TO CALCULATE DISTANCE AND TRUE HEADING OF EACH LEG. FLAG IS SET AUTOMATICALLY AFTER BOTH END POINTS OF EACH LEG HAVE BEEN ENTERED

STORE θ_s AND $(90° - \phi) = b$

RECALL ACCUMULATED DISTANCE AND MAGNETIC HEADING FOR DISPLAY. CLEAR *e* AND *f* REGISTERS

FROM 3-7 & 9-c

PART NO. 09100-76003

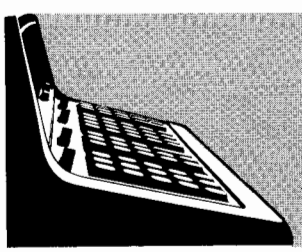
Step	Key	Code	Display x	Display y	Display z	Storage f	e	d	c	b	a	
3 0	ACC −	63										
1	↑	27										ENTER LATITUDE AND LONGITUDE OF ENDPOINT OF EACH LEG
2	1	01										
3	STOP	41	θ	φ	0							
4	ACC +	60										STORE COORDINATES OF ENDPOINTS OF EACH LEG
5	GO TO( )( )	44										BRANCH TO CONVERT ENDPOINT COORDINATES TO DECIMAL DEGREES
6	0	00										
7	5	05										
8	$y\rightleftarrows()$	24										
9	C	16										
a	−	34										
b	0	00										
c	$x\rightleftarrows y$	30										
d	↑	27										
4 0	sin x	70										
1	ROLL ↑	22										
2	IF $x<y$	52										SET THE FLAG IF $\sin(\theta_S-\theta_D)>0$
3	SET FLAG	54										
4	SET FLAG	54										
5	ROLL ↑	22										
6	cos x	73										
7	↑	27										
8	b	14										
9	sin x	70										CALCULATE DISTANCE (a) OF EACH LEG
a	×	36										
b	C	16										
c	sin x	70										
d	×	36										
5 0	C	16										
1	cos x	73										
2	↑	27										
3	b	14										
4	cos x	73										
5	×	36										
6	↓	25										
7	+	33										
8	↓	25										
9	arc ▾	72										
a	cos x	73										
b	$x\rightarrow()$	23										
c	d	17										
d	cos x	73										

FROM 2-7

Step		Key	Code	Display x	Display y	Display z	Storage f	Storage e	Storage d	Storage c	Storage b	Storage a	
6	0	↑	27										
	1	b	14										
	2	cos x	73										
	3	×	36										
	4	c	16										
	5	cos x	73										
	6	−	34										
	7	d	17										
	8	sin x	70										
	9	÷	35										CALCULATE TRUE HEADING (c) OF EACH LEG
	a	b	14										
	b	sin x	70										
	c	÷	35										
	d	3	03										
7	0	6	06										
	1	0	00										
	2	x⇄y	30										
	3	CHG SIGN	32										
	4	arc ▾	72										
	5	cos x	73										
	6	IF FLAG	43										CALCULATE TRUE HEADING = (360 − c) IF $\sin(\theta_S - \theta_D) < 0$; OTHERWISE (c) IS THE TRUE HEADING.
	7	↑	27										
	8	0	00										
	9	−	34										
	a	d	17										
	b	↑	27										
	c	6	06										
	d	0	00										
8	0	×	36										
	1	2	02										DISPLAY DISTANCE AND TRUE HEADING OF EACH LEG; ENTER MAGNETIC VARIATION.
	2	STOP	41	2	D	T.H.							
	3	ROLL ↑	22										CALCULATE MAGNETIC VARIATION (M.V.)
	4	+	33										PLUS TRUE HEADING (T.H.)
	5	3	03										
	6	6	06										
	7	0	00										
	8	IF x>y	53										ADD 360° IF (M.V. + T.H.) < 360°
	9	arc ▾	72 ▲										RESULT: MAGNETIC HEADING (M.H.) =
	a	+	33 ▲										(M.V. + T.H.) + 360°
	b	IF x<y	52										SUBTRACT 360° IF (M.V. + T.H.) > 360°
	c	arc ▾	72 ▲										RESULT: M.H. = (M.V. + T.H.) − 360°
	d	−	34 ▲										

▲ Denotes Revision

Step	Key	Code	Display x	Display y	Display z	Storage e	Storage d	Storage c	Storage b	Storage a	
9 0	$y\rightleftarrows()$	24									STORE M.H. FOR RECALL AND FUTURE DISPLAY;
1	e	12									RECALL ϕ_D.
2	a	13									SUM THE DISTANCES TRAVERSED BY EACH LEG (ΣD)
3	ROLL ↑	22									
4	+	33									
5	$y\rightarrow()$	40									
6	a	13									
7	$y\rightleftarrows()$	24									STORE ΣD FOR RECALL AND FUTURE DISPLAY;
8	f	15									RECALL θ_D.
9	↓	25									
a	GO TO( )( )	44									BRANCH TO DISPLAY ΣD AND M.H. AND ENTER NEW ENDPOINT COORDINATES FOR NEXT LEG.
b	0	00									
c	5	05									
d	END	46									
0											
1											
2											
3											
4											
5											
6											
7											
8											
9											
a											
b											
c											
d											
0											
1											
2											
3											
4											
5											
6											
7											
8											
9											
a											
b											
c											
d											

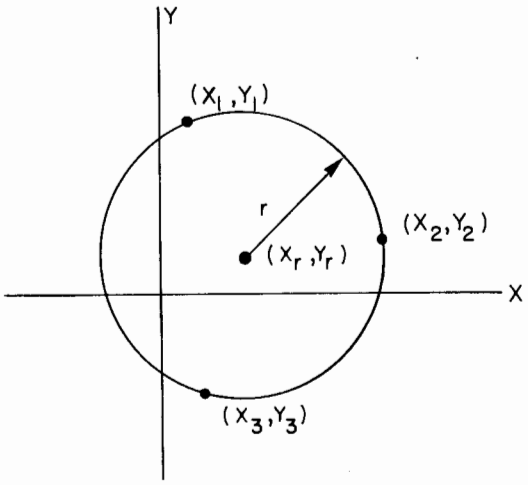


PART NO.
09100-76004

CIRCLE DETERMINED BY THREE POINTS

This program solves for the radius and center point of a circle which is determined by three given points in rectangular coordinates; i.e. (X_i, Y_i), (i = 1, 2, or 3)

Consider the following representative diagram:



The following equations are used to solve for X_r, Y_r and r.

1) $(X_1 - X_r)^2 + (Y_1 - Y_r)^2 = r^2$

2) $(X_2 - X_r)^2 + (Y_2 - Y_r)^2 = r^2$

3) $(X_3 - X_r)^2 + (Y_3 - Y_r)^2 = r^2$

Combining Equations 1 and 2:

4) $X_2^2 - 2X_2X_r + X_r^2 + Y_2^2 - 2Y_2Y_r + Y_r^2 = X_1^2 - 2X_1X_r + X_r^2 + Y_1^2 - 2Y_1Y_r + Y_r^2$

Rearranging:

5) $\underbrace{(X_2 - X_1)}_{A}\underbrace{(X_2 + X_1)}_{B} + \underbrace{(Y_2 - Y_1)}_{C}\underbrace{(Y_2 + Y_1)}_{D} = 2X_r(X_2 - X_1) + 2Y_r(Y_2 - Y_1)$

Substituting the variables indicated in equation (5) we have:

6) $AB + CD = 2AX_r + 2CY_r$

Rearranging:

7) $X_r = \underbrace{\frac{AB + CD}{2A}}_{K_1} \underbrace{- \frac{C}{A}}_{N_1} Y_r$

From equation (7) we then have:

8) $X_r = K_1 - N_1 Y_r$

Combining equations 1 & 3 we obtain:

$$\underbrace{(X^3 - X_1)}_{a}\ \underbrace{(X_3 + X_1)}_{b} + \underbrace{(Y_3 - Y_1)}_{c}\ \underbrace{(Y_3 + Y_1)}_{d} = 2X_r (X_3 - X_1) + 2Y_r (Y_3 - Y_1)$$

OR

$$9)\quad X_r = \underbrace{\frac{ab + cd}{2a}}_{K_2} - \underbrace{\frac{c}{a}}_{N_2} Y_r$$

Therefore:

$$10)\quad X_r = K_2 - N_2 Y_r$$

Combining equations (8) and (10):

$$11)\quad Y_r = \frac{K_2 - K_1}{N_2 - N_1}$$

Equations (10) and (11) are used to solve for X_r and Y_r.

The radius (r) is found from equation (1):

$$r = \sqrt{(X_1 - X_r)^2 + (Y_1 - Y_r)^2}$$

USER INSTRUCTIONS

EXAMPLE

ENTER PROGRAM: (Starting Address is 0 - 0)

PRESS: GO TO (0) (0) [or END]

PRESS: CONTINUE

DISPLAY

0	Z
0	Y
1	X

ENTER DATA: $Y_1 \rightarrow Y$, $X_1 \rightarrow X$

$X_1 = 2$

$Y_1 = 1$

PRESS: CONTINUE

DISPLAY

0	Z
0	Y
2	X

ENTER DATA: $Y_2 \rightarrow Y$, $X_2 \rightarrow X$

$X_2 = 2.5$

$Y_2 = .9$

PRESS: CONTINUE

DISPLAY

0	Z
0	Y
3	X

ENTER DATA: $Y_3 \rightarrow Y$, $X_3 \rightarrow X$

$X_3 = 1$

$Y_3 = -3$

PRESS: CONTINUE

DISPLAY

R	Z
Y_R	Y
X_R	X

$R = 2.092$

$Y_R = -1.086$

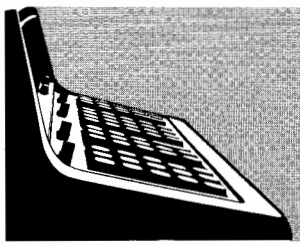
$X_R = 1.843$

To enter new data points:

PART NO 09100-76004

Step		Key	Code	Display x	Display y	Display z	Storage f	e	d	c	b	a	
0	0	CLEAR	20										
	1	1	01										
	2	STOP	41	X_1	Y_1	0							ENTER DATA
	3	$x\rightarrow()$	23										STORE X_1 AND Y_1
	4	a	13										
	5	$y\rightarrow()$	40										
	6	b	14										
	7	CLEAR	20										
	8	2	02										
	9	STOP	41	X_2	Y_2	0							ENTER DATA
FROM 4-1	a	↑	27										CALCULATE A or a
	b	a	13										
	c	−	34										
	d	$y\rightarrow()$	40										
1	0	c	16										
	1	+	33										CALCULATE B or b
	2	+	33										
	3	c	16										
	4	×	36										CALCULATE AB or ab
	5	$y\rightarrow()$	40										
	6	d	17										
	7	b	14										
	8	ROLL ↑	22										
	9	+	33										
	a	↑	27										CALCULATE C D or c d
	b	b	14										
	c	−	34										
	d	↓	25										
2	0	×	36										
	1	ROLL ↓	31										
	2	$y\rightleftarrows()$	24										CALCULATE AB + CD or ab + cd
	3	d	17										
	4	+	33										
	5	$y\rightleftarrows()$	24										
	6	d	17										CALCULATE $\frac{C}{A}$ or $\frac{c}{a}$
	7	↓	25										
	8	c	16										
	9	÷	35										
	a	↑	27										
	b	+	33										CALCULATE $\frac{AB+CD}{2A}$ or $\frac{ab+cd}{2a}$
	c	d	17										
	d	$x\rightleftarrows y$	30										

Step		Key	Code	Display x	Display y	Display z	Storage f	e	d	c	b	a	
3	0	÷	35										
	1	↓	25										
	2	x⇄y	30										
	3	IF FLAG	43										
	4	4	04										BRANCH AFTER ENTRY OF X_3 AND Y_3
	5	2	02										
	6	ACC −	63										CALCULATE $-N_1$ AND $-K_1$
	7	CLEAR x	37										
	8	↑	27										
	9	↑	27										
	a	3	03										
	b	STOP	41	X_3	Y_3	0							ENTER DATA
	c	SET FLAG	54										
	d	GO TO( )( )	44										
4	0	0	00										BRANCH FOR EQUATIONS INVOLVING X_1, Y_1 AND OR X_3, Y_3
	1	a	13										
	2	ACC +	60										CALCULATE $N_2 - N_1$ AND $K_2 - K_1$
	3	y→( )	40										STORE K_2
	4	c	16										
	5	RCL	61										CALCULATE Y_r
	6	÷	35										
	7	↓	25										
	8	×	36										
	9	ROLL ↓	31										CALCULATE X_r
	a	y⇄( )	24										
	b	c	16										
	c	−	34										
	d	b	14										
5	0	ROLL ↑	22										
	1	x→( )	23										
	2	d	17										
	3	−	34										CALCULATE $r = \sqrt{(X_1 - X_r)^2 + (Y_1 - Y_r)^2}$
	4	a	13										
	5	ROLL ↑	22										
	6	−	34										
	7	ROLL ↓	31										
	8	TO POLAR	62										
	9	ROLL ↓	31										
	a	d	17										RECALL AND POSITION DISPLAY
	b	x⇄y	30										
	c	END	46	X_r	Y_r	r							DISPLAY
	d												



AREA OF A POLYGON

PART NO.
09100-76005

This program calculates the area of a polygon of n sides, where $n \geq 3$. The endpoint coordinates of each side of the polygon must be in rectangular form.

The equation used to calculate the area sums the area of trapezoids and is given below:

$$A = \frac{(X_1 + X_2)(Y_1 - Y_2) + (X_2 + X_3)(Y_2 - Y_3) + \ldots + (X_n + X_1)(Y_n - Y_1)}{2}$$

Reference: Analytic Geometry
C. E. Love and E. D. Rainville
MacMillan Co., 5th Edition

USER INSTRUCTIONS

ENTER PROGRAM: (Starting Address is 0 - 0)

PRESS: GO TO (0) (0) [or END]

PRESS: CONTINUE

DISPLAY

0	Z
0	Y
i	X

ENTER DATA: $Y_i \rightarrow Y$, $X_i \rightarrow X$

Has area been closed? (Area is closed after first point has been entered the second time.)

NO

YES

PRESS: SET FLAG

PRESS: CONTINUE

DISPLAY

0	Z
area	Y
n + 1	X

Note: If there are n distinct data sets, there will be n+1 entries (the first point entered twice).

EXAMPLES

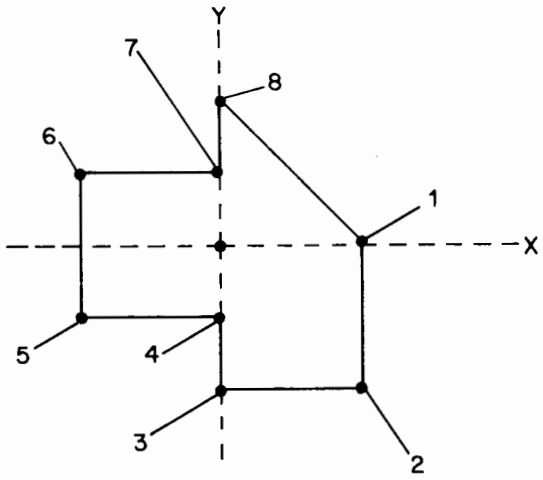
Note: When traversing counterclockwise, the area will be displayed as a negative number.

DATA:

Point (i)	Coordinates (x, y)
1	1, 0
2	1, -1
3	0, -1
4	0, -.5
5	-1, -.5
6	-1, .5
7	0, .5
8	0, 1
1	1, 0

SOLUTION:

Area = 2.5
n + 1 = 9



PART NO 09100-76005

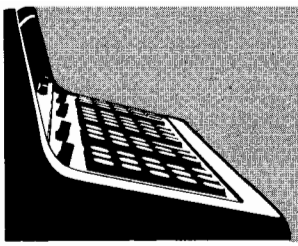
Step		Key	Code	Display x	Display y	Display z	Storage f	Storage e	Storage d	Storage c	Storage b	Storage a	
0	0	CLEAR	20										CLEAR AND INITIALIZE REGISTERS AND DISPLAY 1 TO INDICATE FIRST ENTRY
	1	$x\rightarrow()$	23										
	2	C	16										
	3	1	01										
	4	$x\rightarrow()$	23										
	5	d	17										
	6	STOP	41	X_i	Y_i	0							ENTER Y_i AND X_i
	7	ACC +	60										INCREMENT COUNTER
	8	d	17										
	9	$x\rightleftarrows y$	30										
	a	1	01										
	b	+	33										
	c	$y\rightarrow()$	40										
	d	d	17										
1	0	$\downarrow$	25										POSITION i TO INDICATE ENTRY
	1	STOP	41	X_i	Y_i	0							ENTER Y_i AND X_i
	2	$\uparrow$	27										CALCULATE $(Y_{i-1} - Y_i)$
	3	e	12										
	4	ROLL $\uparrow$	22										
	5	−	34										
	6	ROLL $\uparrow$	22										LET Y_i REPLACE Y_{i-1} IN STORAGE
	7	$y\rightleftarrows()$	24										
	8	e	12										
	9	$x\rightleftarrows y$	30										LET X_i REPLACE X_{i-1} IN STORAGE
	a	$\downarrow$	25										
	b	$\uparrow$	27										
	c	$y\rightleftarrows()$	24										
	d	f	15										
2	0	+	33										CALCULATE $(X_i + X_{i-1})$
	1	2	02										
	2	÷	35										CALCULATE $(Y_i - Y_{i-1})\left(\frac{X_i + X_{i-1}}{2}\right)$
	3	CLEAR x	37										
	4	ROLL $\downarrow$	31										
	5	×	36										
	6	C	16										RECALL Σ AREA AND ADD $AREA_i$
	7	+	33										
	8	$y\rightarrow()$	40										
	9	C	16										
	a	d	17										RECALL COUNTER
	b	IF FLAG	43										BRANCH WHEN FLAG IS SET AFTER ALL DATA HAS BEEN ENTERED
	c	3	03										
	d	3	03										

FROM 3-2

PART NO 09100-76005

FROM 2-d

Step	Key	Code	Display x	Display y	Display z	Storage f	e	d	c	b	a
3 0	GO TO( )( )	44									
1	0	00	BRANCH TO DATA ENTRY								
2	9	11									
3	END	46	n+1	AREA	0	DISPLAY					
4											
5											
6											
7											
8											
9											
a											
b											
c											
d											
0											
1											
2											
3											
4											
5											
6											
7											
8											
9											
a											
b											
c											
d											
0											
1											
2											
3											
4											
5											
6											
7											
8											
9											
a											
b											
c											
d											



This program exercises every calculator operation to verify that the calculator is functioning correctly.

USER INSTRUCTIONS

SET: [ ] RADIANS [ ] FLOATING [ ]

PRESS: END

ENTER PROGRAM: Side A followed by Side B

PRESS: CONTINUE

CORRECT DISPLAY FLASHING

-- --- --- --- ---	Z
n nnn nnn nnn nn	Y
-- --- --- --- ---	X

n = 0, 1, 2 . . . 9, 0; CYCLIC

PART NO. 09100-76501 9100B ONLY

HEWLETT·PACKARD

Step	Key	Code	Display x	Display y	Display z
0 0	CLEAR	20			
(+) 1	IF x=y	50			
2	0	00			
3	5	05			
4	STOP	41			
5	IF FLAG	43			
6	STOP	41			
7	STOP	41			
8	SET FLAG	54			
9	IF FLAG	43			
a	0	00			
b	d	17			
c	STOP	41			
d	IF FLAG	43			
1 0	STOP	41			
(+) 1	STOP	41			
2	3	03			
3	•	21			
4	1	01			
5	4	04			
6	1	01			
7	5	05			
8	9	11			
9	2	02			
a	6	06			
b	5	05			
c	3	03			
d	6	06			
2 0	0	00			
(+) 1	↑	27			
2	π	56			
3	IF x=y	50			
4	2	02			
5	7	07			
6	STOP	41			
7	√x	76			
8	y→( )	40			
9	e	12			
a	ROLL ↓	31			
b	√x	76			
c	ROLL ↑	22			
d	×	36			

HEWLETT·PACKARD

Step	Key	Code	Display x	Display y	Display z
3 0	e	12			
(+) 1	CHG SIGN	32			
2	+	33			
3	a	13			
4	|y|	55			
5	IF x>y	53			
6	3	03			
7	9	11			
8	STOP	41			
9	x⇄y	30			
a	IF x<y	52			
b	4	04			
c	0	00			
d	STOP	41			
4 0	•	21			
(+) 1	7	07			
2	8	10			
3	↑	27			
4	7	07			
5	8	10			
6	ENTER EXP	26			
7	CHG SIGN	32			
8	1	01			
9	−	34			
a	IF x>y	53			
b	CLEAR x	37			
c	ROLL ↑	22			
d	IF x=y	50			
5 0	STOP	41			
(+) 1	STOP	41			
2	IF x<y	52			
3	STOP	41			
4	STOP	41			
5	↓	25			
6	IF x>y	53			
7	STOP	41			
8	STOP	41			
9	π	56			
a	int x	64			
b	↑	27			
c	y⇄( )	24			
d	e	12			

HEWLETT·PACKARD

Step	Key	Code	Display x	Display y	Display z
6 0	↓	25			
(+) 1	int x	64			
2	↑	27			
3	CLEAR x	37			
4	x←( )	67			
5	e	12			
6	IF x=y	50			
7	CLEAR x	37			
8	3	03			
9	IF x=y	50			
a	6	06			
b	d	17			
c	STOP	41			
d	π	56			
7 0	x⇄y	30			
(+) 1	÷	35			
2	×	36			
3	π	56			
4	IF x=y	50			
5	7	07			
6	8	10			
7	STOP	41			
8	CLEAR	20			
9	π	56			
a	↑	27			
b	+	33			
c	ACC +	60			
d	ACC +	60			

Storage

f	
e	
d	
c	
b	
a	
9	
8	
7	
6	
5	
4	
3	
2	
1	
0	

Step	Key	Code	Display x	Display y	Display z
8 0	ACC −	63			
(+) 1	ACC +	60			
2	RCL	61			
3	↑	27			
4	π	56			
5	—	34			
6	↓	25			
7	—	34			
8	—	34			
9	—	34			
a	IF x=y	50			
b	b	14			
c	8	10			
d	STOP	41			
9 0	sin x	70			
(+) 1	arc ▾	72			
2	sin x	70			
3	cos x	73			
4	arc ▾	72			
5	cos x	73			
6	tan x	71			
7	arc ▾	72			
8	tan x	71			
9	GO TO ( )	44			
a	▲SUB▼	77			
b	b	14			
c	0	00			
d	RETURN	77			
a 0	0	00			
(+) 1	0	00			
2	0	00			
3	0	00			
4	0	00			
5	0	00			
6	0	00			
7	0	00			
8	0	00			
9	1	01			
a	9	11			
b	CLEAR	20			
c	0	00			
d	0	00			

Step	Key	Code	Display x	Display y	Display z
b 0	—	34			
(+) 1	|y|	55			
2	a	13			
3	IF x<y	52			
4	SET FLAG	54			
5	x→( )	23			
6	RETURN	77			
7	STOP	41			
8	3	03			
9	÷	35			
a	↓	25			
b	↑	27			
c	x→( )	23			
d	—	34			
c 0	e	12			
(+) 1	GO TO ( )	44			
2	▲SUB▼	77			
3	9	11			
4	0	00			
5	IF FLAG	43			
6	STOP	41			
7	STOP	41			
8	x←( )	67			
9	—	34			
a	e	12			
b	↑	27			
c	GO TO ( )	44			
d	▲SUB▼	77			
d 0	—	34			
(+) 1	b	14			
2	a	13			
3	IF FLAG	43			
4	STOP	41			
5	STOP	41			
6	y⇄( )	24			
7	—	34			
8	e	12			
9	↓	25			
a	↑	27			
b	SET FLAG	54			
c	GO TO ( )	44			
d	▲SUB▼	77			

Step	Key	Code	Display x	Display y	Display z
0 0	—	34			
(−) 1	8	10			
2	6	06			
3	—	34			
4	|y|	55			
5	a	13			
6	IF x<y	52			
7	STOP	41			
8	STOP	41			
9	GO TO ( )	44			
a	▲SUB▼	77			
b	3	03			
c	3	03			
d	CLEAR	20			
1 0	SET FLAG	54			
(−) 1	e	12			
2	f	15			
3	y→( )	40			
4	—	34			
5	f	15			
6	y⇄( )	24			
7	—	34			
8	f	15			
9	ACC +	60			
a	ACC +	60			
b	ACC −	63			
c	RCL	61			
d	0	00			

Storage

f	
e	
d	
c	
b	
a	
9	
8	
7	
6	
5	
4	
3	
2	
1	
0	

HEWLETT·PACKARD HEWLETT·PACKARD HEWLETT·PACKARD HEWLETT·PACKARD

PART NO. 09100-76501 9100B ONLY

Step	Key	Code	Display x	Display y	Display z
20	0	00			
21	0	00			
22	0	00			
23	0	00			
24	0	00			
25	0	00			
26	0	00			
27	0	00			
28	0	00			
29	IF x=y	50			
2a	2	02			
2b	d	17			
2c	STOP	41			
2d	GO TO ( )	44			
30	+	33			
31	0	00			
32	0	00			
33	CLEAR	20			
34	ENTER EXP	26			
35	1	01			
36	2	02			
37	x→( )	23			
38	f	15			
39	1	01			
3a	↑	27			
3b	GO TO ( )	44			
3c	▲SUB▼	77			
3d	8	10			
40	6	06			
41	RCL	61			
42	CLEAR x	37			
43	IF x=y	50			
44	7	07			
45	a	13			
46	9	11			
47	IF x=y	50			
48	7	07			
49	3	03			
4a	RCL	61			
4b	x⇄y	30			
4c	↑	27			
4d	↓	25			

Step	Key	Code	Display x	Display y	Display z
50	÷	35			
51	↓	25			
52	+	33			
53	ENTER EXP	26			
54	1	01			
55	1	01			
56	×	36			
57	1	01			
58	x⇄y	30			
59	ACC +	60			
5a	x→( )	23			
5b	f	15			
5c	↓	25			
5d	9	11			
60	GO TO ( )	44			
61	▲SUB▼	77			
62	b	14			
63	0	00			
64	RCL	61			
65	•	21			
66	1	01			
67	×	36			
68	↓	25			
69	↑	27			
6a	GO TO ( )	44			
6b	3	03			
6c	b	14			
6d	STOP	41			
70	STOP	41			
71	STOP	41			
72	STOP	41			
73	RCL	61			
74	↑	27			
75	GO TO ( )	44			
76	▲SUB▼	77			
77	b	14			
78	1	01			
79	RETURN	77			
7a	1	01			
7b	x→( )	23			
7c	e	12			
7d	GO TO ( )	44			

Step	Key	Code	Display x	Display y	Display z
80	▲SUB▼	77			
81	b	14			
82	0	00			
83	GO TO ( )	44			
84	3	03			
85	b	14			
86	TO POLAR	62			
87	TO RECT	66			
88	e^x	74			
89	log x	75			
8a	↑	27			
8b	ENTER EXP	26			
8c	1	01			
8d	ln x	65			
90	×	36			
91	↓	25			
92	IF FLAG	43			
93	x←( )	67			
94	RETURN	77			
95	SET FLAG	54			
96	GO TO ( )	44			
97	▲SUB▼	77			
98	b	14			
99	a	13			
9a	IF FLAG	43			
9b	STOP	41			
9c	STOP	41			
9d	RETURN	77			

Storage

f	
e	
d	
c	
b	
a	
9	
8	
7	
6	
5	
4	
3	
2	
1	
0	

Step	Key	Code	Display x	Display y	Display z	Step	Key	Code	Display x	Display y	Display z	Step	Key	Code	Display x	Display y	Display z
a 0	CHG SIGN	32				d 0	GO TO ( )	44				0					
(−) 1	CHG SIGN	32				(−) 1	▲SUB▼	77				1					
2	CHG SIGN	32				2	+	33				2					
3	CHG SIGN	32				3	b	14				3					
4	CHG SIGN	32				4	0	00				4					
5	CHG SIGN	32				5	RETURN	77				5					
6	CHG SIGN	32				6	GO TO ( )	44				6					
7	CHG SIGN	32				7	▲SUB▼	77				7					
8	CHG SIGN	32				8	+	33				8					
9	CHG SIGN	32				9	9	11				9					
a	CHG SIGN	32				a	0	00				a					
b	CHG SIGN	32				b	RETURN	77				b					
c	CHG SIGN	32				c	END	46				c					
d	CHG SIGN	32				d						d					

Step	Key	Code	Display x	Display y	Display z	Step	Key	Code	Display x	Display y	Display z	Step	Key	Code	Display x	Display y	Display z
b 0	÷	35				0						0					
(−) 1	x←( )	67				1						1					
2	−	34				2						2					
3	a	13				3						3					
4	↑	27				4						4					
5	ROLL ↓	31				5						5					
6	PAUSE	57				6						6					
7	PAUSE	57				7						7					
8	PAUSE	57				8						8					
9	RETURN	77				9						9					
a	hyper ▾	67				a						a					
b	sin x	70				b						b					
c	arc ▾	72				c						c					
d	hyper ▾	67				d						d					

Step	Key	Code	Display x	Display y	Display z	Step	Key	Code	Display x	Display y	Display z
c 0	sin x	70				0					
(−) 1	hyper ▾	67				1					
2	cos x	73				2					
3	arc ▾	72				3					
4	hyper ▾	67				4					
5	cos x	73				5					
6	hyper ▾	67				6					
7	tan x	71				7					
8	arc ▾	72				8					
9	hyper ▾	67				9					
a	tan x	71				a					
b	IF FLAG	43				b					
c	d	17				c					
d	6	06				d					

Storage	
f	
e	
d	
c	
b	
a	
9	
8	
7	
6	
5	
4	
3	
2	
1	
0	