

Direction of Mecca - Brian's Solution

HP-25 Program Form

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Switch to PRGM mode, press **PRGM** , then key in the program.

DISPLAY		KEY ENTRY	X	Y	Z	T	COMMENTS	REGISTERS
LINE	CODE							
00								
01	09	9						R ₀ lat MECCA
02	00	0						21.4
03	31	ENTER						R ₁ lon MECCA
04	24 02	RCL 2	lat CAIRO	90				39.9
05	41	-	a					R ₂ lat CAIRO
06	23 04	STO 4						30.0
07	9	9						R ₃ lon CAIRO
08	0	0						31.2
09	31	ENTER	lat MECCA	90				R ₄ a
10	24 00	RCL 0	b				a and b stored	R ₅ b
11	41	-						R ₆ c
12	23 05	STO 5						R ₇ d
13	24 04	RCL 4						
14	14 05	f cos	cos a					
15	24 05	RCL 5						
16	14 05	f cos	cos b					
17	61	X						
18	24 04	RCL 4						
19	14 04	f sin	sin a					
20	24 05	RCL 5						
21	14 04	f sin	sin b					
22	61	X						
23	24 01	RCL 1						
24	24 03	RCL 3						
25	41	-	c					
26	23 07	STO 7						
27	14 05	f cos	cos c					
28	61	X						
29	51	+						
30	15 05	g cos ⁻¹	C					
31	23 06	STO 6						
32	14 04	f sin	sin C					
33	15 22	g Vx						
34	24 05	RCL 5						
35	14 04	f sin	sin b					
36	61	X						
37	24 07	RCL 7						
38	14 04	f sin	sin C _i					
39	61	X						
40	15 04	g sin ⁻¹	B					
41	13 00	STO 00						
42								
43								
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Programmer Brian Hill

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Key in program on reverse			
2	Store latitudes and longitudes in R1 to R4 as specified on reverse.			
3	Run program		f PRGM R/S	The angle B
4	Examine output - correct angle if it is in the wrong quadrant (due to ambiguity of \sin^{-1}).			
<u>Theory</u>				
<p> $a = 90^\circ - \text{lat}_{\text{CAIRO}}$ $b = 90^\circ - \text{lat}_{\text{MECCA}}$ $c = \text{lon}_{\text{MECCA}} - \text{lon}_{\text{CAIRO}}$ </p>				
$c = \cos^{-1}(\cos a \cos b + \sin a \sin b \cos C)$				
$B = \sin^{-1} \frac{\sin b \sin C}{\sin c}$				

Law of Cosines
Law of Sines