Aux.
LIBRARY ROUTINE   T6 - 238

By   J. C. McCall
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TITLE   Fast Arcsine

TYPE   Closed

NUMBER OF WORDS   10

TEMPORARY STORAGE   One word at 1

ACCURACY   Let the error E in degrees $= \Theta - \dfrac{180}{\pi} \sin \Theta \left(c + \dfrac{a}{b} \dfrac{|\sin \Theta|}{b - |\sin \Theta|} \right)$

where a = .061359232513

       b = 1.1275

       c = 1.002685164
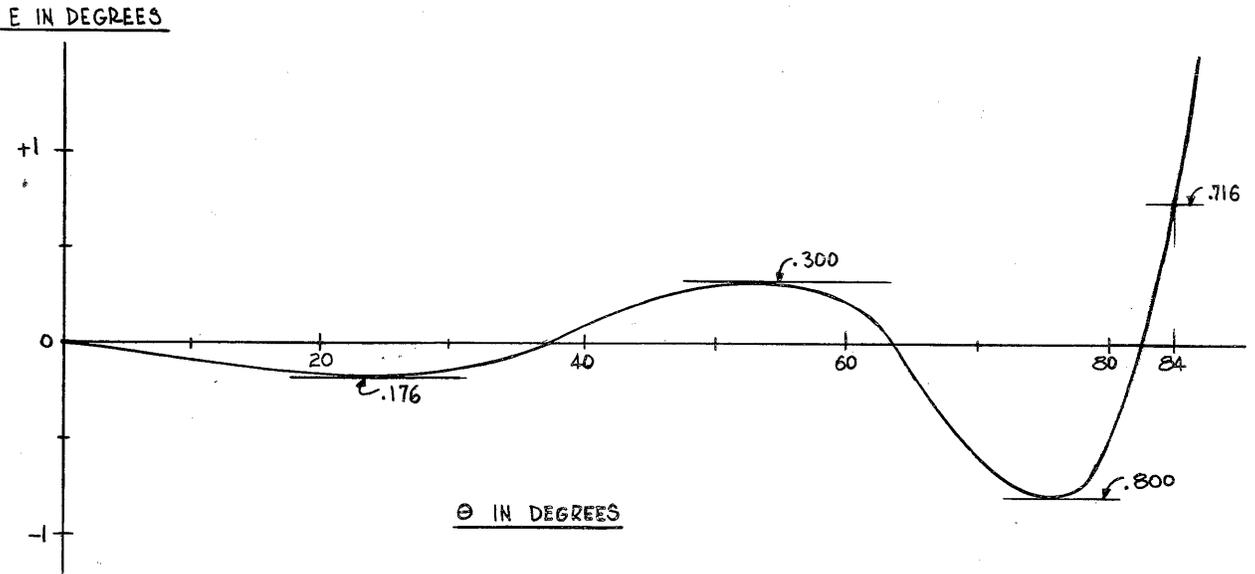
SPEED   2.64 milliseconds

ENTRY

p	
	50 p
	26 m
p+1	

This routine located at m.

USE

If $\frac{1}{2}\sin\theta$ is placed in location zero before the routine is entered, where $-\frac{1}{2}\sin 84^\circ \leq \frac{1}{2}\sin\theta \leq \frac{1}{2}\sin 84^\circ$, then a number will be placed in A which can be interpreted as

$$\frac{\theta\ \deg}{720} \quad \text{or} \quad \frac{\theta\ \text{rad}}{\pi 4} \quad \text{or} \quad \frac{\theta\ \text{rev}}{2} \quad \text{or} \quad \frac{\theta\ \text{semi-snyds}}{2^9} \quad \text{and location}$$

zero will still contain $\frac{1}{2}\sin\theta$. One semi-snyd is $\frac{1}{256}$ of a revolution. If $\sin 84^\circ < |\sin\theta| < 1.11659$ the routine will not hang up but the results become meaningless. Any location can be used instead of location zero.

REMARKS

This routine approximates the curve $\theta = $ arcsine x by the curve

$$\theta* = cx + \frac{a \cdot x \cdot |x|}{b - |x|} \quad \text{radians}$$

which is a straight line plus the product of a parabola and a hyperbola with a pole at $x = b$. If a different scaling is desired, one should determine an "a" which can be represented by simple shifts then change "c" appropriately and if necessary change "b".

DATE   August 1, 1957

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APPROVED BY D. E. Muller

LOCATION	ORDER		NOTES	PAGE 1
0	K5 F			
	42 7L			
1	L5 8L			
	L2 F		$\dfrac{b}{2} - \dfrac{\lvert \sin\theta \rvert}{2}$	
2	40 1F			
	L7 F			
3	10 2F		$\dfrac{a}{2\pi}\dfrac{\lvert \sin\theta\rvert}{2} \equiv \left(\dfrac{1}{128}+\dfrac{1}{512}\right)\dfrac{\lvert \sin\theta\rvert}{2}$	
	L6 F			
4	10 7F			
	66 1F			
5	S5 F		$\dfrac{c}{2\pi} + \dfrac{\dfrac{a}{2\pi}\dfrac{\lvert \sin\theta\rvert}{2}}{\dfrac{b}{2}-\dfrac{\lvert \sin\theta\rvert}{2}}$	
	L4 9L			
6	40 1F			
	50 1F			
7	7J F			
	22 F			
8	00 F			
	00 5637 5000 0000J		$\dfrac{b}{2}$	
9	00 F			
	00 1595 8230 0000J		$\dfrac{c}{2\pi}$	