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>>>>          BACKWARD TRIG ROUTINE
2 000000          ENT ATN2.
3 000000          *          ENT BRT54          TEMP ENTRY POINT FOR HRTEST
4 000000          ENT BRT535
5 000000          ENT BRT540
6 000000          ENT ISIN
7 000000          ENT ICOS
8 000000          ENT ITAN
9 000000          NAM BACKWARD TRIG ROUTINE
10 000000        **** ATN(X/Y) ATTRIBUTES TABLE *****
11 000000 040 055          OCT 40,55
12 000002        +*****
13 000002 126 223        ATN2.  CLM R26          INITIALIZE FLAGS.
14 000004 122 223          CLM R22          SGN(ANS) REGISTER.
15 000006 316 377 377        JSB= TUOR          DEMAND TWO REALS FOR X AND Y.
16 000011 316 377 377        JSB=SEP15         SPLIT X AND Y.
17 000014 142 221          TSM R42          Y=0?
18 000016 266 025          JNZ RTP50         JMP IF Y#0.
19 000020 152 221          TSM R52          X=0?
20 000022 266 004          JNZ RTP52         JIF ANS#0.
21 000024 316 377 377        JSB= ERROR+       FATAL ERROR.
22 000027 013          OCT 110          CORRESPONDING ERROR NO.
23 000030 316 377 377 RTP52 JSB= TRC7          PI/2 TO R70.
24 000033 170 040 243        STM R70,R40       PI/2 TO R40.
25 000036 133 022 242        STB R33,R22       SGN(X)=SGN(ANS) TO R22.
26 000041 104 251 037        GTO BRT54         GO CONVERT TO DEG,RAD,OR GRDS.
26 000044 001
27 000045 132 220          RTP50 TSB R32          Y>0?
28 000047 376 007          JRZ RTP60         JMP IF Y>0.
29 000051 123 250 011        LD3 R23=9C        SET S7=S10=9 STATUS TO GIVE
30 000054 026 242          STB R23,R26       PI-T (2ND OR 3RD QUAD ANS).
31 000056 132 222          CLB R32          SGN(Y)=0.
32 000060 316 377 377 RTP60 JSB= DIV20        X/ABS(Y).
33 000063 260 036          JMP BRT10        CONTINUE.
34 000065        **** ASN ATTRIBUTES TABLE *****
35 000065 020 055          OCT 20,55
36 000067        +*****
37 000067 126 251 000 ISIN  LDM R26=0C,99C  INV(SIN) ENTRY: SET STATUS.
37 000072 231
38 000073 260 016          JMP BRT5         CONTINUE.
39 000075        **** ACS ATTRIBUTES TABLE *****
40 000075 020 055          OCT 20,55
41 000077        +*****
42 000077 126 251 011 ICOS  LDM R26=9C,99C  INV(COS) ENTRY: SET STATUS.
42 000102 231
43 000103 260 006          JMP BRT5         CONTINUE.
44 000105        **** ATN ATTRIBUTES TABLE *****
45 000105 020 055          OCT 20,55
46 000107        +*****
47 000107 126 251 000 ITAN  LDM R26=0C,9C  INV(TAN) ENTRY: SET STATUS.
47 000112 011
48 000113 122 223          BRT5  CLM R22          CLR SGN(ANS) & ADD PI/2 STATUS.
49 000115 316 377 377        JSB= ONER        GET ARGUMENT X (FLOATING PT).
50 000120 316 377 377        JSB= SEP10       SPLIT X.
  
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ITEM	LOC	OBJECT CODE	SRC=OCHR2	OBJ=GENHR2	3/11/1981	12:13 PM	PG 2
BACKWARD TRIG ROUTINE							
51	000123	132 220	BRT10	TSB R32	A<0?		
52	000125	376 017		JRZ BRT12	JMP IF A>=0.		
53	000127	122 216		NCB R22	S4=9 FOR NEGATIVE ANSWER.		
54	000131	127 220		TSB R27	WHICH FUNCTION? (TEST S13).		
55	000133	376 011		JRZ BRT12	JMP IF RTP.		
56	000135	126 220		TSB R26	INV(SIN), INV(COS), OR INV(TAN)?		
57	000137	376 005		JRZ BRT12	JMP IF INV(SIN) OR INV(COS).		
58	000141	204		LLB R26	SET S10=0 (SAYS FIND INV(SIN)).		
59	000142	123 216		NCB R23	S7=9 FOR ADD PI/2.		
60	000144	122 222		CLB R22	S4=0 FOR POS (+ ANS).		
61	000146	137 220	BRT12	TSB R37	POSITIVE EXPONENT?		
62	000150	374 077		JLZ BRT70	JMP IF A=0 OR A>=1.		
63	000152	127 220		TSB R27	WHICH FUNCTION? (TEST S6).		
64	000154	374 154		JLZ BRT30	JMP IF RTP OR INV(TAN).		
65	000156	136 024 243		STH R36, R24	SAVE EXP(A).		
66	000161	140 012 345		PUMD R40+R12	SAVE MANT(A).		
67	000164	316 177 001		JSB= BRTS35	SHIFT MANT; MOVE DEC TO LEFT.		
68	000167	134 223		CLM R34	CLR EXP(1+A).		
69	000171	140 050 243		STH R40, R50	MOVE MANT(A).		
70	000174	157 207		LRM R57	PREPARE TO ADD 1.		
71	000176	312 020		ADB R57=10C	A+1.		
72	000200	140 215		TCM R40	=1-A IF 0<A<1; =0 IF A=0.		
73	000202	373 111		JCY BRT20	JMP IF A=0.		
74	000204	316 377 377		JSB= SHF10	ELIMINATE LEAD ZEROS.		
75	000207	316 377 377		JSB= MPY30	(1+A)(1-A) (=1-AA).		
76	000212	136 213		DCM R36	CORRECT DEC PT TO NORMAL LOC.		
77	000214	316 377 377		JSB= SQR30	SQR(1-AA).		
78	000217	134 024 241		LD1 R34, R24	GET EXP(A).		
79	000222	150 012 343		PCMD R50-R12	GET MANT(A).		
80	000225	316 377 377		JSB= DIV20	A/SQR(1-AA).		
81	000230	360 071		JMP BRT22	CONTINUE.		
82	000232	127 220	BRT72	TSB R27	WHICH FUNCTION?		
83	000234	374 004		JLZ BRT76	JMP IF ITAN OR RTP.		
84	000236	316 377 377		JSB= ERROR+	GO PROCESS ERROR.		
85	000241	013		OCT 110	CORRESPONDING ERROR NO.		
86	000242	316 377 377	BRT76	JSB= FTR53	GIVES 1/X.		
87	000245	126 216		NCB R26	COMPLEMENT S10 STATUS.		
88	000247	360 061		JMP BRT30	GO TO PSEUDO-DIVIDE.		
89	000251	136 221	BRT70	TSM R36	A=0, 1<=A<10, OR A>=10?		
90	000253	366 355		JNZ BRT72	JMP IF A>=10.		
91	000255	140 050 243		STH R40, R50	MOVE MANT(A).		
92	000260	367 123		JZR BRT50	JMP IF A=0.		
93	000262	157 314 020		SBB R57=10C	A-1.		
94	000265	150 221		TSM R50	A=1 OR 1<A<10?		
95	000267	366 341		JNZ BRT72	JMP IF 1<A<10.		
96	000271	127 220		TSB R27	WHICH FUNCTION? (TEST S6).		
97	000273	374 066		JLZ BRT74	JMP IF INV(TAN) OR RTP.		
98	000275	126 216		NCB R26	9 TO 0 IF ICOS; 0 TO 9 IF ISIN.		
99	000277	140 223		CLM R40	ICOS(1)=0; ISIN(1)=PI/2-0.		
100	000301	360 102		JMP BRT50	GO DO PI/2 ADJUSTMENT.		
101	000303	170 261 377	BRT74	LDMD R70=DCON1	PI/4 TO R70(=ITAN(1)).		
101	000306	377					
102	000307	040 243		STH R70, R40	PI/4 TO R40.		

BACKWARD TRIG ROUTINE

ITEM	LOC	OBJECT CODE	SRC	OBJ	DATE	TIME	PG
9	000311	136 213					
104	000313	260 970					
105	000315	140 012 343	BRT20				
106	000320	136 024 241					
107	000323	132 222	BRT22				
108	000325	137 310 120					
109	000330	372 310					
110	000332	140 050 243	BRT30				
111	000335	134 036 241					
112	000340	313 007 000					
113	000343	372 040					
114	000345	170 223					
115	000347	140 223					
116	000351	147 210					
117	000353	157 207					
118	000355	150 060 243	BRT32				
119	000360	040 305					
120	000362	372 124					
121	000364	170 210					
122	000366	136 024 242					
123	000371	167 207	BRT36				
124	000373	207					
125	000374	124 210					
126	000376	366 371					
127	000400	140 060 303					
128	000403	360 350					
129	000405	316 377 377	BRT50				
130	000410	126 220					
131	000412	376 012					
132	000414	316 201 001					
133	000417	140 070 305					
134	000422	215					
135	000423	316 377 377					
136	000426	123 220	BRT52				
137	000430	376 006					
138	000432	316 201 001					
139	000435	140 070 303					
140	000440	136 034 243	BRT54				
141	000443	125 260 160					
142	000446	200					
143	000447	265 030					
144	000451	134 211					
145	000453	211					
146	000454	136 223					
147	000456	140 050 243					
148	000461	070 241					
149	000463	316 377 377					
150	000466	125 220					
151	000470	362 007					
152	000472	140 050 243					
153	000475	157 207					
154	000477	140 305					
155	000501	122 032 242	BRT60				

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DCM R36          EXP(PI/4) = -1.
JMP BRT50        GO DO PI/2 ADJUSTMENT.
PCMD P40-R12    GET MANT(A).
LDM R36,R24     GET EXP(A).
CLB R32         CLR SGN.
CMG R37=50C     TEST SIZE OF NUMBER.
JNC BRT76       JMP IF 1<=NUMBER.
STH R40,R50     MOVE MANT.
LDM R34,R36     SAVE EXP.
ADM R34=7C,0C   NO. DECADES-1 IN R34 (0-6).
JNC BRT50       SM. ANGLES: JMP IF EXP(A)<-7.
CLM R70        CLEAR PQ AREA.
CLM R40        PREPARE FOR CONSTANT 1.
ICB R47        GENERATE CONSTANT 1.
LRM R57        GENERATE LEAD 0 (BUFFER AREA).
STH R50,R60    SAVE Z.
SBM R50,R40    Z=Z-X.
JNC BRT34      JMP IF UNSUCCESSFUL SUBTRACT.
ICB R70        TALLY 1 IN PQ.
STB R36,R24    INIT SHIFT COUNTER TO -J.
LRM R67        Z<10 TO -J) LAST TIME THRU.
LRM R67        Z<10 TO -2J) LAST TIME THRU.
ICB R24        INCREMENT SHIFT COUNTER.
JNZ BRT36      LOOP TILL COUNTER=0.
ADM R40,R60    X=X+Z<10 TO -2J).
JMP BRT32      CONTINUE.
JSB=TRC7      PI/2 TO R70.
TSB R26       SUB. T FROM PI/2? (TEST S10).
JRZ BRT52     JMP IF S10=0 (NO SUBTRACT).
JSB=BRTS40    T RT SHIFT TO ALIGN DEC PTS.
SBM R40,R70   T-PI/2.
TCM R40       T = PI/2 - T.
JSB=SHF10    ELIMINATE LEAD ZEROS.
TSB R23       ADD PI/2?
JRZ BRT54     JMP IF S7=0 (NO ADD).
JSB=BRTS40    SHIFT T RT TO ALIGN DECIMAL.
ADM R40,R70   T=T+PI/2.
STH R36,R34   MOVE EXP(T).
LDBD R25=DRG  GET DEG,RAD,GRD INDICATOR.

JPS BRT60     JMP IF RAD.
ICM R34       10T.
ICM R34       100T.
CLM R36       EXP(PI/2)=0.
STH R40,R50   MOVE MANT(100T).
LDM R40,R70   PI/2 TO R40 FOR DIVIDE.
JSB=DIY20    T GRD = 400 T RAD/2PI.
TSB R25       DEG OR GRD MODE SET?
JOD BRT60     JMP IF GRD.
STH R40,R50   COPY T GRD.
LRM R57       .1T GRD.
SBM R40,R50   T DEG = .9T GRD.
STB R22,R32   GET SIGN ANS.
  
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>>>> BACKWARD TRIG ROUTINE
155 000504 104 251 377          GTO SHRONF      SHIFT, ROUND, NFR, AND EXIT.
155 000507 377
156 000510 136 212          BRT34 DCB R36      DECREMENT -J (INCREMENT J).
157 000512 170 205          LLM R70      INITIALIZE NEW PQ DIGIT TO 0.
158 000514 150 060 241      LDM R50,R60  GET 2.
159 000517 205          LLM R50      10Z.
160 000520 134 212          DCB R34      DECREMENT PQ DECADE COUNTER.
161 000522 373 231          JCY BRT32    LOOP TILL ALL DECADES DONE.
162 000524 223          CLM R34      CLEAR EXP FOR DIVIDE.
163 000525 235          CLE          READY FOR DIV77.
164 000526 316 377 377      JSB= DIV77   Y/X=TAN(T)=T (Y=10TO-6,X=1).
165 000531 170 050 243      STM R70,R50  PQ TO R50.
166 000534 130 251 377      LDM R30=TBL3B POINTER TO TRIG CONSTANTS.
166 000537 377
167 000540 170 030 343 BRT40 PCMD R70-R30 GET NEXT TRIG CONSTANT.
168 000543 157 207          LRM R57      SHIFT RT NEXT PQ DIG; 0 TO E.
169 000545 136 211          ICM R36      INCREMENT DECADE COUNTER.
170 000547 360 010          JMP BRT42    JMP TO PSEUDO-MULTIPLY LOOP.
171 000551 150 212          BRT44 DCB R50      DECREMENT PQ DIGIT.
172 000553 140 070 303      ADN R40,R70  ADD CONSTANT TO SUM.
173 000556 372 001          JNC BRT42    JIF NO CARRY.
174 000560 234          ICE          ELSE UP VALUE IN E.
175 000561 150 220          BRT42 TSB R50  TEST CURRENT PQ DIGIT.
176 000563 377 364          JRH BRT44    JMP(LOOP) IF NOT YET=0.
177 000565 147 203          ERM R47      SHIFT ACCUMULATING RES RIGHT.
178 000567 150 221          TSM R50      ANY MORE NON-ZERO PQ DIGITS?
179 000571 367 212          JZR BRT50    JMP(EXIT LOOP) IF R50=0.
180 000573 360 343          JMP BRT40    CONTINUE LOOP.
181 000575 147 207          BRTS30 LRM R47     SHIFT MANTISSA RIGHT.
182 000577 136 211          BRTS35 ICM R36  INCREMENT EXPONENT.
183 000601 137 220          BRTS40 TSB R37  HAS EXPONENT REACHED 0 YET?
184 000603 364 370          JNG BRTS30  JMP(LOOP) IF EXP NOT YET 0.
185 000605 136 223          CLM R36      CLEAR REGISTER.
186 000607 236          RTH          RETURN.
187 000610          EXT DCOH1
188 000610          EXT ERROR
189 000610          EXT ERROR+
190 000610          EXT FTR53
191 000610          EXT OHER
192 000610          EXT TWOR
193 000610          EXT SEP15
194 000610          EXT MPY30
195 000610          EXT SQR30
196 000610          EXT ROU10
197 000610          EXT DIV20
198 000610          EXT OVF10
199 000610          EXT SEP10
200 000610          EXT SHF10
201 000610          EXT SHRONF
202 000610          EXT DIV77
203 000610          EXT TBL3B
204 000610          EXT TRC01
205 000610          EXT TRC7
  
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SYMBOL	VALUE	TYPE	CCUNT	Symbol Table
BRT10	000123	LCL	1	
BRT12	000146	LCL	3	
BRT20	000315	LCL	1	
BRT22	000323	LCL	1	
BRT30	000332	LCL	2	
BRT32	000355	LCL	2	
BRT34	000510	LCL	1	
BRT36	000371	LCL	1	
BRT40	000540	LCL	1	
BRT42	000561	LCL	2	
BRT44	000551	LCL	1	
BRT5	000113	LCL	2	
BRT50	000405	LCL	5	
BRT52	000426	LCL	1	
BRT54	000440	LCL	2	
BRT60	000501	LCL	2	
BRT70	000251	LCL	1	
BRT72	000232	LCL	2	
BRT74	000303	LCL	1	
BRT76	000242	LCL	2	
BRTS30	000575	LCL	1	
BRTS35	000577	ENT	2	
BRTS40	000601	ENT	3	
DCON1	177777	EXT	1	
DIV20	177777	EXT	3	
DIV77	177777	EXT	1	
DRG	100160	G DAD	1	
ERROR	177777	EXT	0	<--- NOT REFERENCED??
ERROR+	177777	EXT	2	
FTR53	177777	EXT	1	
ICOS	000077	ENT	1	
ISIH	000067	ENT	1	
ITAN	000107	ENT	1	
MPY30	177777	EXT	1	
QNER	177777	EXT	1	
QVF10	177777	EXT	0	<--- NOT REFERENCED??
ROU10	177777	EXT	0	<--- NOT REFERENCED??
RTR50	000045	LCL	1	
RTR52	000030	LCL	1	
RTR50	000060	LCL	1	
SEP10	177777	EXT	1	
SEP15	177777	EXT	1	
SHF10	177777	EXT	2	
SHRONF	177777	EXT	1	
SQR30	177777	EXT	1	
TBL3B	177777	EXT	1	
TRC01	177777	EXT	0	<--- NOT REFERENCED??
TRC7	177777	EXT	2	
TWOR	177777	EXT	1	