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1 // 2015-10-25
2 // by: Gustavo Madureira
3 // gtmadureira@gmail.com
4
5
6 // - Converts between rectangular, cylindrical, and spherical coordinates. This program has a restriction where
7 // one needs a unique set of coordinates for each point. Restricting the radius to be non-negative "  $R \geq 0$  and  $\rho \geq 0$  ".
8 // - The azimuth angle ' $\theta$ ' to lie in a specific interval spanning '360° or  $2\pi$ ', such as "  $(-180^\circ, +180^\circ]$  or  $(-\pi, +\pi]$  "
9 // and inclination angle ' $\phi$ ' to lie in a specific interval spanning '180° or  $\pi$ ', such as "  $[0^\circ, 180^\circ]$  or  $[0, \pi]$  ".
10
11
12
13 #pragma mode( separator(.,;) integer(h32) )
14
15
16
17 converter();
18
19
20
21 EXPORT COORDCONV() // This command 'COORDCONV' launches the 'converter program'.
22
23 BEGIN
24
25     converter();
26
27 END;
28
29
30
31
32
33 converter() // converter program.
34
35 BEGIN
36
37     LOCAL ch,X,Y,Z,R;
38     LOCAL  $\theta$ , $\rho$ , $\phi$ ,S1,S2;
39     LOCAL truevar,angle;
40     LOCAL msg_cyl,msg_sph;
41
42     HFormat:=1;
43     HSeparator:=0;
44     HDigits:=3;
45     HComplex:=00;
46

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47
48 IF HAngle==0 THEN
49
50 msg_cyl:="The 'radial distance' must be non-negative ( $R \geq 0$ ). And 'azimuth' interval  $-\pi < \theta \leq \pi$ .";
51 msg_sph:="The 'radial distance' must be non-negative ( $\rho \geq 0$ ). The 'azimuth' interval  $-\pi < \theta \leq \pi$  and 'inclination' interval
0  $\leq \phi \leq \pi$ .";
52 angle:= $\pi$ ;
53
54 ELSE
55
56 msg_cyl:="The 'radial distance' must be non-negative ( $R \geq 0$ ). And 'azimuth' interval  $-180 < \theta \leq 180$ .";
57 msg_sph:="The 'radial distance' must be non-negative ( $\rho \geq 0$ ). The 'azimuth' interval  $-180 < \theta \leq 180$  and 'inclination' interval
0  $\leq \phi \leq 180$ .";
58 angle:=180;
59
60 END;
61
62
63
64 // Menu to choice of coordinates.
65
66 CHOOSE(ch,"Coordinates Converter","Recta → Cylin",
67 "Cylin → Recta","Cylin → Spher","Spher → Cylin",
68 "Recta → Spher","Spher → Recta");
69
70 CASE
71
72
73
74
75 // ***** Rectangular → Cylindrical *****
76 IF ch==1 THEN
77
78 INPUT({{X,[0],[30,40,1]},{Y,[0],[30,40,2]},{Z,[0],[30,40,3]},{truevar,{"Vector","String"},{70,22,5}}},
79 "Rectangular → Cylindrical","X: ","Y: ","Z: ","Output Type ? ",
80 {"Enter 'X' coordinate.", "Enter 'Y' coordinate.", "Enter 'Z' coordinate.",
81 "Set output type.. eg: 'Vector' for math operations."},{0,0,0,1},{0,0,0,1});
82
83 R:=ROUND( $\sqrt{X^2+Y^2}$ ),3);
84
85
86 // Solving azimuth angle 'θ' with the function 'ATAN2(x,y)'.
87 // Returning the coordinates at the correct angle for all four quadrants.
88
89 IF X>0 THEN  $\theta$ :=ROUND(ATAN(Y/X),3); END; // X>0
90 IF X<0 AND Y≥0 THEN  $\theta$ :=ROUND(ATAN(Y/X)+angle,3); END; // X<0, Y≥0

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91     IF X<0 AND Y<0 THEN  $\theta$ :=ROUND(ATAN(Y/X)-angle,3); END;           // X<0, Y<0
92     IF X==0 AND Y>0 THEN  $\theta$ :=ROUND(angle/2,3); END;               // X=0, Y>0
93     IF X==0 AND Y<0 THEN  $\theta$ :=ROUND(-angle/2,3); END;             // X=0, Y<0
94     IF X==0 AND Y==0 THEN  $\theta$ :=ROUND(0,3); END;                   // X=0, Y=0
95
96
97     Z:=ROUND(Z,3);
98     S1:=[R, $\theta$ ,Z];
99     S2:=CHAR(91)+R+CHAR(32)+CHAR(32)+CHAR(8737)+ $\theta$ +CHAR(32)+CHAR(32)+Z+CHAR(93)+CHAR(32)+CHAR(64)+" (R, $\theta$ ,Z)";
100
101     IF truevar==1 THEN RETURN S1; ELSE
102
103         RETURN S2;
104
105     END;
106 END;
107 // ***** END *****
108
109
110
111
112
113
114 // ***** Cylindrical → Rectangular *****
115 IF ch==2 THEN
116
117     INPUT({{R,[0],[30,40,1]},{ $\theta$ ,[0],[30,40,2]},{Z,[0],[30,40,3]},{truevar,{"Vector","String"},{70,22,5}}},
118         "Cylindrical → Rectangular",{R: "," $\theta$ : ","Z: ","Output Type ? "},
119         {"Enter radial distance 'R' coordinate. ","Enter azimuth ' $\theta$ ' coordinate. ","Enter height 'Z' coordinate. ","
120         "Set output type.. eg: 'Vector' for math operations."},{0,0,0,1},{0,0,0,1});
121
122     IF R≥0 AND -angle< $\theta$ ≤angle THEN
123
124         X:=ROUND(R*COS( $\theta$ ),3);
125         Y:=ROUND(R*SIN( $\theta$ ),3);
126         Z:=ROUND(Z,3);
127         S1=[X,Y,Z];
128         S2:=CHAR(91)+X+CHAR(32)+CHAR(32)+Y+CHAR(32)+CHAR(32)+Z+CHAR(93)+CHAR(32)+CHAR(64)+" (X,Y,Z)";
129
130         IF truevar==1 THEN RETURN S1; ELSE
131
132             RETURN S2;
133
134         END;
135
136     ELSE

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137
138     IF MSGBOX(msg_cyl,1)==true THEN
139
140         converter();
141
142     ELSE
143
144         "GOOD BYE"
145
146     END;
147 END;
148 END;
149 // ***** END *****
150
151
152
153
154
155
156 // ***** Cylindrical → Spherical *****
157 IF ch==3 THEN
158
159     INPUT({{R,[0],[30,40,1]},{θ,[0],[30,40,2]},{Z,[0],[30,40,3]},{truevar,{"Vector","String"},{70,22,5}}},
160         "Cylindrical → Spherical","R: ","θ: ","Z: ","Output Type ? ",
161         {"Enter radial distance 'R' coordinate. ","Enter azimuth 'θ' coordinate. ","Enter height 'Z' coordinate. ",
162         "Set output type.. eg: 'Vector' for math operations."},{0,0,0,1},{0,0,0,1});
163
164     IF R==0 AND θ==0 AND Z==0 THEN
165
166         ρ:=ROUND(0,3);
167         θ:=ROUND(0,3);
168         φ:=ROUND(0,3);
169         S1=[ρ,θ,φ];
170         S2:=CHAR(91)+ρ+CHAR(32)+CHAR(32)+CHAR(8737)+θ+CHAR(32)+CHAR(32)+CHAR(8737)+φ+CHAR(93)+CHAR(32)+CHAR(64)+" (ρ,θ,φ)";
171
172         IF truevar==1 THEN RETURN S1; ELSE
173
174             RETURN S2;
175
176         END;
177
178     ELSE
179
180         IF R≥0 AND -angle<θ≤angle THEN
181
182             ρ:=ROUND(√(R²+Z²),3);

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183     θ:=ROUND(θ,3);
184     φ:=ROUND(ACOS(Z/√(R²+Z²)),3);
185     S1:=[ρ,θ,φ];
186     S2:=CHAR(91)+ρ+CHAR(32)+CHAR(32)+CHAR(8737)+θ+CHAR(32)+CHAR(32)+CHAR(8737)+φ+CHAR(93)+CHAR(32)+CHAR(64)+" (ρ,θ,φ)";
187
188     IF truevar==1 THEN RETURN S1; ELSE
189
190         RETURN S2;
191
192     END;
193
194     ELSE
195
196         IF MSGBOX(msg_cyl,1)==true THEN
197
198             converter();
199
200         ELSE
201
202             "GOOD BYE"
203
204         END;
205     END;
206 END;
207
208 // ***** END *****
209
210
211
212
213
214
215 // ***** Spherical → Cylindrical *****
216 IF ch==4 THEN
217
218     INPUT({{ρ,[0],[30,40,1]},{θ,[0],[30,40,2]},{φ,[0],[30,40,3]},{truevar,{"Vector","String"},{70,22,5}}},
219         "Spherical → Cylindrical",{ρ: ","θ: ","φ: ","Output Type ? "},
220         {"Enter radial distance 'ρ' coordinate.,"Enter azimuth 'θ' coordinate.,"Enter inclination 'φ' coordinate.",
221         "Set output type.. eg: 'Vector' for math operations."},{0,0,0,1},{0,0,0,1});
222
223     IF ρ≥0 AND -angle<θ≤angle AND 0≤φ≤angle THEN
224
225         R:=ROUND(ρ*SIN(φ),3);
226         θ:=ROUND(θ,3);
227         Z:=ROUND(ρ*COS(φ),3);
228         S1:=[R,θ,Z];

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229 S2:=CHAR(91)+R+CHAR(32)+CHAR(32)+CHAR(8737)+θ+CHAR(32)+CHAR(32)+Z+CHAR(93)+CHAR(32)+CHAR(64)+" (R,θ,Z)";
230
231 IF truevar==1 THEN RETURN S1; ELSE
232
233 RETURN S2;
234
235 END;
236
237 ELSE
238
239 IF MSGBOX(msg_sph,1)==true THEN
240
241 converter();
242
243 ELSE
244
245 "GOOD BYE"
246
247 END;
248 END;
249 END;
250 // ***** END *****
251
252
253
254
255
256
257 // ***** Rectangular → Spherical *****
258 IF ch==5 THEN
259
260 INPUT({{X,[0],[30,40,1]},{Y,[0],[30,40,2]},{Z,[0],[30,40,3]},{truevar,{"Vector","String"},{70,22,5}}},
261 "Rectangular → Spherical","X: ","Y: ","Z: ","Output Type ? ",
262 {"Enter 'X' coordinate.","Enter 'Y' coordinate.","Enter 'Z' coordinate.",
263 "Set output type.. eg: 'Vector' for math operations."},{0,0,0,1},{0,0,0,1});
264
265 IF X==0 AND Y==0 AND Z==0 THEN
266
267 ρ:=ROUND(0,3);
268 θ:=ROUND(0,3);
269 φ:=ROUND(0,3);
270 S1:=[ρ,θ,φ];
271 S2:=CHAR(91)+ρ+CHAR(32)+CHAR(32)+CHAR(8737)+θ+CHAR(32)+CHAR(32)+CHAR(8737)+φ+CHAR(93)+CHAR(32)+CHAR(64)+" (ρ,θ,φ)";
272
273 IF truevar==1 THEN RETURN S1; ELSE
274

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275     RETURN S2;
276
277     END;
278
279     ELSE
280
281      $\rho := \text{ROUND}(\sqrt{X^2 + Y^2 + Z^2}, 3);$ 
282
283
284     // Solving azimuth angle 'θ' with the function 'ATAN2(x,y)'.
285     // Returning the coordinates at the correct angle for all four quadrants.
286
287     IF X>0 THEN θ:=ROUND(ATAN(Y/X),3); END; // X>0
288     IF X<0 AND Y≥0 THEN θ:=ROUND(ATAN(Y/X)+angle,3); END; // X<0, Y≥0
289     IF X<0 AND Y<0 THEN θ:=ROUND(ATAN(Y/X)-angle,3); END; // X<0, Y<0
290     IF X==0 AND Y>0 THEN θ:=ROUND(angle/2,3); END; // X=0, Y>0
291     IF X==0 AND Y<0 THEN θ:=ROUND(-angle/2,3); END; // X=0, Y<0
292     IF X==0 AND Y==0 THEN θ:=ROUND(0,3); END; // X=0, Y=0
293
294
295      $\phi := \text{ROUND}(\text{ACOS}(Z/\sqrt{X^2 + Y^2 + Z^2}), 3);$ 
296     S1:=[ρ,θ,φ];
297     S2:=CHAR(91)+ρ+CHAR(32)+CHAR(32)+CHAR(8737)+θ+CHAR(32)+CHAR(32)+CHAR(8737)+φ+CHAR(93)+CHAR(32)+CHAR(64)+" (ρ,θ,φ)";
298
299     IF truevar==1 THEN RETURN S1; ELSE
300
301     RETURN S2;
302
303     END;
304     END;
305     END;
306     // ***** END *****
307
308
309
310
311
312
313     // ***** Spherical → Rectangular *****
314     IF ch==6 THEN
315
316     INPUT({{ρ,[0],[30,40,1]},{θ,[0],[30,40,2]},{φ,[0],[30,40,3]},{truevar,{"Vector","String"},{70,22,5}}},
317         "Spherical → Rectangular",{"ρ: ","θ: ","φ: ","Output Type ? "},
318         {"Enter radial distance 'ρ' coordinate.", "Enter azimuth 'θ' coordinate.", "Enter inclination 'φ' coordinate.",
319         "Set output type.. eg: 'Vector' for math operations."},{0,0,0,1},{0,0,0,1});
320

```

```

321 IF p≥0 AND -angle<θ≤angle AND 0≤φ≤angle THEN
322
323 X:=ROUND(ρ*SIN(φ)*COS(θ),3);
324 Y:=ROUND(ρ*SIN(φ)*SIN(θ),3);
325 Z:=ROUND(ρ*COS(φ),3);
326 S1:=[X,Y,Z];
327 S2:=CHAR(91)+X+CHAR(32)+CHAR(32)+Y+CHAR(32)+CHAR(32)+Z+CHAR(93)+CHAR(32)+CHAR(64)+" (X,Y,Z)";
328
329 IF truevar==1 THEN RETURN S1; ELSE
330
331     RETURN S2;
332
333 END;
334
335 ELSE
336
337     IF MSGBOX(msg_sph,1)==true THEN
338
339         converter();
340
341     ELSE
342
343         "GOOD BYE"
344
345     END;
346 END;
347 END;
348 // ***** END *****
349
350
351
352
353
354
355 DEFAULT
356     RETURN "GOOD BYE";
357
358 END;
359
360
361
362 END;

```