```fortran
 1: Program Aula07do01exerc01
 2: COMMON/xm/xmax
 3: COMMON/NN/N
 4: Real xmax, PI, s, xmin, h
 5: parameter (PI = 3.1415926)
 6: open(13, file="Aula07do01exerc01.txt")
 7: N = 300
 8: xmax = 1.0
 9: xmin = -xmax
10: call int3d(xmin, xmax, s)
11: exata = 4.0*PI*(xmax**5)/5.0
12: error = ABS(exata - s)/exata*100
13: write(13, *)"Integral de r^2 sobre um volume esferico"
14: write(13, *)"Raio:", xmax
15: write(13, *)"Valor exato:", exata
16: write(13, *)"Valor numerico:", s
17: write(13, *)"Erro percentual:", error, "%"
18: end program
19:
20: Subroutine int3d(x1,x2,ss)
21: real ss,x1,x2,h
22: external h
23: call qtrapz(h,x1,x2,ss)
24: return
25: end
26:
27: Subroutine qtrapz(func,A,B,SS)
28: Real SS, func, soma
29: COMMON/NN/N
30: External func
31: h = (B-A)/N
32: soma = 0.0
33: do i = 1, N-1
34: soma = soma + func(A+i*h)
35: enddo
36: SS = h/2.0 * (func(A) + 2.0*soma + func(B))
37: return
38: end
39:
40: real function z1(x,y)
41: COMMON/xm/xmax
42: real x, y, xmax
43: z1 = -sqrt(ABS(xmax**2 - x**2 - y**2))
44: end
45:
46: real function z2(x,y)
47: COMMON/xm/xmax
48: real x, y, xmax
49: z2 = sqrt(ABS(xmax**2 - x**2 - y**2))
50: end
51:
52: real function y1(x)
53: COMMON/xm/xmax
54: real x, xmax
55: y1 = -sqrt(ABS(xmax**2 - x**2))
56: end
57:
58: real function y2(x)
59: COMMON/xm/xmax
60: real x, xmax
61: y2 = sqrt(ABS(xmax**2 - x**2))
62: end
63:
64: function h(xx)
65: real h, xx, g, y1, y2, x, y, z, ss
66: external g
67: COMMON/xyz/x,y,z
68: x = xx
69: call qtrapz(g, y1(x), y2(x), ss)
70: h = ss
71: return
72: end
```

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 73:
 74: function g(yy)
 75: real g, yy, f, z1, z2, x, y, z, ss
 76: external f
 77: COMMON/xyz/x,y,z
 78: y = yy
 79: call qtrapz(f, z1(x,y), z2(x,y), ss)
 80: g = ss
 81: return
 82: end
 83:
 84: function f(zz)
 85: real f, zz, func, x, y, z
 86: COMMON/xyz/x,y,z
 87: z = zz
 88: f = func(x,y,z)
 89: return
 90: end
 91:
 92: real function func(x,y,z)
 93: real x,y,z
 94: func = x**2+y**2+z**2
 95: return
 96: end
 97:
 98:
 99:
100:
101:
102:
103:
104:
105:
106:
107:
```