```
program questao1
  implicit none
  real :: v1, v2, v3, v4
  integer :: ni, nx, ny, i, j, k
  real, dimension(1000, 1000) :: v

  v1 = 10.0
  v2 = 100.0
  v3 = 40.0
  v4 = 0.0
  ni = 200
  nx = 16
  ny = 11

  do i = 1, nx
    do j = 1, ny
      v(i,j) = 0
    end do
  end do

  do i = 2, nx-1
    v(i,1) = v1;
    v(i,ny) = v3;
  end do

  do j = 2, ny-1
    v(i,j) = v4;
    v(nx,j) = v2
  end do

  v(1,1) = 0.5*(v1 + v4)
  v(nx,1) = 0.5*(v1 + v2)
  v(1,ny) = 0.5*(v3 + v4)
  v(nx,ny) = 0.5*(v2 + v3)

  do k = 1, ni
    do i = 2, nx-1
      do j = 2, ny-1
        v(i,j) = 0.25*( v(i+1, j) + v(i-1, j) + v(i,j+1) + v(i,j-1) )
      end do
    end do
  end do

  print *, "Value"

  print *, v(6,6)
  print *, v(9,9)
  print *, v(11,6)
  print *, v(9,3)
end program questao1


```

```
program questao2
  implicit none
  real, dimension(1000, 1000) :: A, C
  real, dimension(1000) :: X, Y, Z, B, rho
  real :: ER, E0, AA, BB, D, DX, DY, DL, R, sum, Q
  real, parameter :: pi = 4.D0*DATAN(1.D0)
  integer :: N, M, NT, K1, K2, K3, I, J, K

  ER = 1.0
  E0 = 8.8541E-12
  AA = 1.0
  BB = 1.0
  D = 1.0
  N = 25
  NT = 2*N
  M = sqrt(real(N, 8))
  DX = AA/M
  DY = BB/M
  DL = DX
  A = 0.0

  K = 0
  do K1 = 1, 2
    do K2 = 1, M
      do K3 = 1, M
        K = K + 1
        X(K) = DX*(K2 - 0.5)
        Y(K) = DY*(K3 - 0.5)
      end do
    end do
  end do

  do K1 = 1, N
    Z(K1) = 0.0
    Z(K1+N) = D
  end do

  do I = 1, NT
    do J = 1, NT
      if ( I==J ) then
        A(I,J) = DL*0.8814/(pi*E0)
      else
        R = sqrt( (X(I)-X(J))**2 + (Y(I)-Y(J))**2 + (Z(I)-Z(J))**2 )
        A(I,J) = DL**2/(4*pi*E0*R)
      end if
    end do
  end do

  do K = 1, N
    B(K) = 1.0
    B(K+N) = -1.0
  end do

  call invert(A, C, NT)
  do i = 1, NT
    rho(i) = 0
    do j = 1, NT
      rho(i) = rho(i)+C(i,j)*B(j)
    end do
  end do
```

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61
62    sum = 0.0
63
64    do i = 1, N
65      sum = sum + rho(i)
66    end do
67    Q = sum*(DL**2)
68    print *, abs(Q)/2.0
69    C = abs(Q)/2.0
70  end program questao2
71
72  subroutine invert(a, C, n)
73    implicit none
74    real, dimension(1000,1000) :: a, C, L, U
75    real, dimension(1000) :: b, d, x
76    real :: coeff
77    integer :: i, j, k, n
78
79    L = 0.0
80    U = 0.0
81    b = 0.0
82    do k = 1, n-1
83      do i = k+1, n
84        coeff = a(i,j)/a(k,k)
85        L(i,k) = coeff
86        do j = k+1, n
87          a(i,j) = a(i,j)-coeff*a(k, j)
88        end do
89      end do
90    end do
91
92    do i = 1, n
93      L(i,i) = 1.0
94    end do
95
96    do j = 1, n
97      do i = 1, j
98        U(i,j) = a(i,j)
99      end do
100   end do
101
102   do k = 1, n
103     b(k) = 1.0
104     d(1) = b(1)
105     do i = 2, n
106       d(i) = b(i)
107       do j = 1, i-1
108         d(i) = d(i) - L(i,j)*d(j)
109       end do
110     end do
111     x(n) = d(n)/U(n,n)
112     do i = n-1, 1, -1
113       x(i) = d(i)
114       do j = n, i+1, -1
115         x(i)=x(i)-U(i,j)*x(j)
116       end do
117       x(i) = x(i)/U(i,i)
118     end do
119     do i = 1, n
120       C(i,k) = x(i)
```

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    end do
    b(k) = 0.0
  end do
end subroutine invert

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