clc;clear

syms x1 x2 x3 x4

f = 100\*(x1^2-x2)^2+(1-x1)^2+90\*(x3^2-x4)^2+(1-x3)^2+10.1\*((1-x2)^2+(1-x4)^2)+19.8\*(1-x2)\*(1-x4);

gradient(f)

hessian(f)

>> gradient(f)

ans =

2\*x1 - 400\*x1\*(- x1^2 + x2) - 2

- 200\*x1^2 + (1101\*x2)/5 + (99\*x4)/5 - 40

2\*x3 - 360\*x3\*(- x3^2 + x4) - 2

- 180\*x3^2 + (99\*x2)/5 + (1001\*x4)/5 – 40

>> hessian(f)

ans =

[ 1200\*x1^2 - 400\*x2 + 2, -400\*x1, 0, 0]

[ -400\*x1, 1101/5, 0, 99/5]

[ 0, 0, 1080\*x3^2 - 360\*x4 + 2, -360\*x3]

[ 0, 99/5, -360\*x3, 1001/5]