```
function [f, dfdx] = hw8(p, xe, fe)
    if nargin == 0
        % Initialization.
        %p = [0.22; 0.44];
        %xe = [4.5, 5.8, 5.3, 5.0, 5.3, 4.7;
        %      6.1, 5.6, 7.1, 5.7, 6.3, 6.7];
        %fe = [3, 4]*xe;

        % Input used for grading
        p = [0.12; 0.70];
        xe = [3.5, 6.8, 6.0, 4.5, 5.75, 4.3;
              5.1, 5.4, 7.2, 5.8, 6.4, 6.4];
        fe = [3.14, 4.06, -3.73, 4.13, 1.32, -4.02];
        %%%% end grading input

        plot_element(xe);
    end
    [N, dNdp] = shape6(p);
    Je = xe * dNdp;
    dNdx = dNdp / Je;
    f = fe * N;
    dfdx = fe * dNdx;
end

function [N] = shape3(p)
    N = [0.5*p.*(p-1); 1-p.^2; 0.5*p.*(p+1)];
end

function [N, dNdp] = shape6(p)
    p(3) = 1 - sum(p);
    N = [p(1)*(2*p(1) - 1);
         p(2)*(2*p(2) - 1);
         p(3)*(2*p(3) - 1);
         4*p(1)*p(2);
         4*p(2)*p(3);
         4*p(1)*p(3)];
    dNdp = [4*p(1)-1,       0;
            0,              4*p(2)-1;
            1-4*p(3),       1-4*p(3);
            4*p(2),         4*p(1);
            -4*p(2),        4*p(3)-4*p(2);
            4*p(3)-4*p(1),  -4*p(1)];
end

function [] = plot_element(xe)
    % Plots the element edges and nodes.
    clf;  hold on;
    pp = linspace(-1, 1);
    e1 = [];
    e2 = [];
    e3 = [];
    for p = pp
        N = shape3(p);
        e1(:,end+1) = xe(:,[1,4,2]) * N;
        e2(:,end+1) = xe(:,[2,5,3]) * N;
        e3(:,end+1) = xe(:,[3,6,1]) * N;
    end
    plot(e1(1,:), e1(2,:), 'k');
    plot(e2(1,:), e2(2,:), 'k');
    plot(e3(1,:), e3(2,:), 'k');
    scatter(xe(1,:), xe(2,:), 'filled');
    axis equal;
end
```