Programming assignment #8

Write a MATLAB function that implements shape functions and their gradients for the 3-node (linear) and 6-node (quadratic) two-dimensional triangular elements in terms of *area coordinates*.
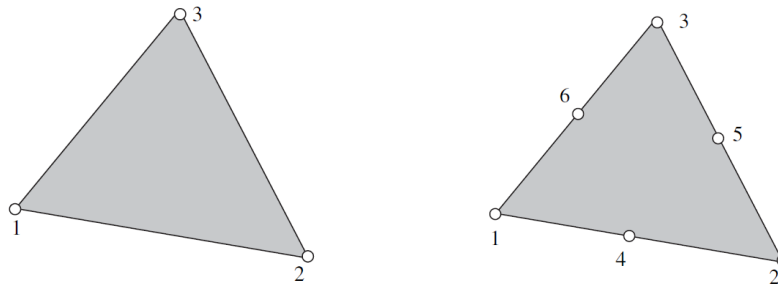

Figure 1 – Node orderings of the TRI3 and TRI6 elements.

Instructions for programming and assignment submission:

- Submit a single file (MATLAB code). The file name must be in the format "asurite_hw8.m". Note that the separator is an underscore and you must substitute your ASU id, e.g., jdoe123.
- The file **must** define a function of the same name as the file name (but without the ".m").
- The order of the input variables and output variables must not be changed.
- **The input variables are:**
  - **p**: [2×1] matrix containing the parent coordinates (p = [ξ; η]).
  - **xe:** [2×nne] matrix containing the element nodal coordinates.
- **The output variable is:**
  - **N:** [nne×1] matrix of the shape functions evaluated at the given parent coordinates.
  - **dNdp:** [nne×2] matrix of the shape functions with respect to the parent coordinates.
  - **dNdx:** [nne×2] matrix of the shape functions with respect to the global coordinates.

Template code for programming assignment

```
function [N, dNdp, dNdx] = asurite_hw8(xe, p)
    nne = length(xe);
    if nne == 3
        [N, dNdp] = shape_tri3(p);
    else if nne == 6
        [N, dNdp] = shape_tri6(p);
    end
    dNdx = zeros(nne, 2);
end

function [N, dNdp] = shape_tri3(p)
% SHAPE_TRI3 returns the shape functions and their gradients for a 3-node element.
  N = zeros(3,1);     % replace with correct expression.
  dNdp = zeros(3,2);  % replace with correct expression.
end

function [N, dNdp] = shape_tri6(p)
% SHAPE_TRI6 returns the shape functions and their gradients for a 6-node element.
  N = zeros(6,1);     % replace with correct expression.
  dNdp = zeros(6,2);  % replace with correct expression.
end
```