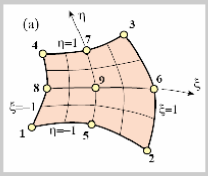
LECCION 5 - EJERCICIO 3 (16.3) v.2005

INICIO

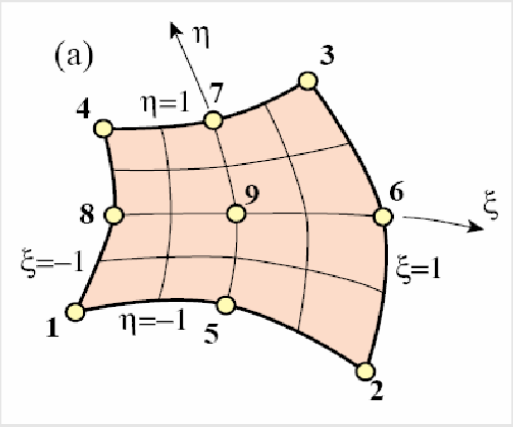
```
Off[General::"spell1"]
Off[General::"spell"]
```

ELEMENTO CUADRILATERO CUADRATICO DE NUEVE NODOS

Cuad9 = 

;

```
Show[Cuad9, ImageSize → 250]
```



DEFINICION FUNCIONES DE FORMA EN COORDENADAS NATURALES

```
N1[ξ_, η_] = 1 / 4 * (1 - ξ) * (1 - η) * ξ * η;
```

```
N2[ξ_, η_] = -1 / 4 * (1 + ξ) * (1 - η) * ξ * η;
```

```
N3[ξ_, η_] = 1 / 4 * (1 + ξ) * (1 + η) * ξ * η;
```

```
N4[ξ_, η_] = -1 / 4 * (1 - ξ) * (1 + η) * ξ * η;
```

```
N5[ξ_, η_] = -1 / 2 * (1 - ξ^2) * (1 - η) * η;
```

```
N6[ξ_, η_] = 1 / 2 * (1 + ξ) * (1 - η^2) * ξ;
```

```
N7[ξ_, η_] = 1 / 2 * (1 - ξ^2) * (1 + η) * η;
```

```
N8[ξ_, η_] = -1 / 2 * (1 - ξ) * (1 - η^2) * ξ;
```

```
N9[ξ_, η_] = (1 - ξ^2) * (1 - η^2);
```

DEFINICION VECTOR FUNCIONES DE FORMA

```
Nf[ξ_, η_] =
 {{N1[ξ, η]}, {N2[ξ, η]}, {N3[ξ, η]}, {N4[ξ, η]}, {N5[ξ, η]}, {N6[ξ, η]}, {N7[ξ, η]}, {N8[ξ, η]}, {N9[ξ, η]}}
```

$$\left\{\left\{\frac{1}{4}(1-\eta)\,\eta\,(1-\xi)\,\xi\right\},\left\{-\frac{1}{4}(1-\eta)\,\eta\,\xi\,(1+\xi)\right\},\left\{\frac{1}{4}\eta\,(1+\eta)\,\xi\,(1+\xi)\right\},\left\{-\frac{1}{4}\eta\,(1+\eta)\,(1-\xi)\,\xi\right\},\right.$$
$$\left.\left\{-\frac{1}{2}(1-\eta)\,\eta\left(1-\xi^2\right)\right\},\left\{\frac{1}{2}\left(1-\eta^2\right)\xi\,(1+\xi)\right\},\left\{\frac{1}{2}\eta\,(1+\eta)\left(1-\xi^2\right)\right\},\left\{-\frac{1}{2}\left(1-\eta^2\right)(1-\xi)\,\xi\right\},\left\{\left(1-\eta^2\right)\left(1-\xi^2\right)\right\}\right\}$$

```
Dimensions[%]
```

```
{9, 1}
```

COMPROBACION SUMA FUNCIONES DE FORMA

```
Suma = Sum[Nf[ξ, η][[i, 1]], {i, 9}]
```

$$\frac{1}{4}(1-\eta)\,\eta\,(1-\xi)\,\xi-\frac{1}{4}\eta\,(1+\eta)\,(1-\xi)\,\xi-\frac{1}{2}\left(1-\eta^2\right)(1-\xi)\,\xi-\frac{1}{4}(1-\eta)\,\eta\,\xi\,(1+\xi)+$$
$$\frac{1}{4}\eta\,(1+\eta)\,\xi\,(1+\xi)+\frac{1}{2}\left(1-\eta^2\right)\xi\,(1+\xi)-\frac{1}{2}(1-\eta)\,\eta\left(1-\xi^2\right)+\frac{1}{2}\eta\,(1+\eta)\left(1-\xi^2\right)+\left(1-\eta^2\right)\left(1-\xi^2\right)$$

```
Simplify[%]
```

```
1
```