0
0
0
M
$M \subset$
$\mathbf{R}^3$
Z
0
$\mathrm{d}Z =$
0
M
$\mathbf{p} \in$
M
$\mathrm{d}Z =$
0
Z
M
$\mathbf{p}$
Z
$\mathbf{q} \in$
M
$M.$
$\alpha :$
$[0,1] \to$
M
$\alpha(0) =$
$\mathbf{p}, \alpha(1) =$
$\mathbf{q}$
h

$h(t) = \langle \alpha(t) - \mathbf{p}, Z \rangle$

$h(0) =$
0
h
$t \in$
$(0,1)$
$h'(t) = \langle \alpha'(t), Z \rangle = 0.$

h
$(0,1)$
$[0,1]$
$[0,1]$
$h(0) =$
0
$h(t) =$
0
$h(1) =$
$\langle \mathbf{q} -$
$\mathbf{p}, Z \rangle =$
0
$\mathbf{q} \in$
M
$\mathbf{p} \in$
M
$\kappa_1(\mathbf{p}) =$
$\kappa_2(\mathbf{p}) =$
0
$\mathrm{d}Z_{\mathbf{p}} =$
0
??
M
M $M \subset$
$\mathbf{R}^3$
M
M **:**
$\mathbf{p} \in$
M
$\mathbf{v} \in$
$T_{\mathbf{p}}$
$\mathbf{p} \in$
M
$\kappa_1(\mathbf{p}) =$
$\kappa_2(\mathbf{p}) =$
k
$\mathbf{e}_1, \mathbf{e}_2$
$\mathbf{v} =$
$a\mathbf{e}_1 +$
$b\mathbf{e}_2 \in$
$T_{\mathbf{p}}M$
${}_{\mathbf{p}}(\mathbf{v}) =$
$a\,\mathrm{d}Z_{\mathbf{p}}(\mathbf{e}_1) +$
$b\,\mathrm{d}Z_{\mathbf{p}}(\mathbf{e}_2)$
$=$
$-a\,k\,\mathbf{e}_1 -$
$b\,k\,\mathbf{e}_2$
$=$
$-k\,\mathbf{v}.$
:
$\mathbf{x} :$
$D \subset$
$\mathbf{R}^2 \to$
M
$V =$
$\mathbf{x}(D)$
V
$\mathbf{q} \in$
V