[12.5] Show (i) that *d**x*2 has components <0, 1, 0, … , 0> and (ii) represents the tangent hyperplane elements to *x*2 = constant.

(i)



Using component notation,  ✔

(ii)

From [12.4], if *Φ* : **M → ℜ** is a scalar field, then *d* is a vector orthogonal to the (n-1) dimensional hyperplane where ** is constant. So, define

*Φ* : **M → ℜ**: *Φ* (*x*1, *x*2, … , *x*n) = *x*2.

Thus, d*x2* = d*Φ* (*x*1, *x*2, … , *x*n) is orthogonal to the (n-1) dimensional hyperplane (i.e., the tangent hyperplane) at (0, *x*2, 0, … , 0) where *Φ* = *x*2 is constant.