

## Chain rule with constraints

1. Let  $P = (1, 2, 3)$  and assume  $f(x, y, z)$  is a differentiable function with  $\nabla f = \mathbf{i} - 2\mathbf{j} + 3\mathbf{k}$  at  $P$ . Also assume that  $x$ ,  $y$  and  $z$  satisfy the relation  $x^3 - y^2 + z = 0$ .

Take  $x$  and  $y$  to be the independent variables and let  $g(x, y) = f(x, y, z(x, y))$ . Find  $\nabla g$  at the point  $(1, 2)$ .

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