2E2 Tutorial Sheet 20 Third Term¹

13 April 2004

Vectors calculus. With f(x, y, z) a scalar field the grad of f, ∇f , is

grad
$$f = \frac{\partial f}{\partial x}\mathbf{i} + \frac{\partial f}{\partial y}\mathbf{j} + \frac{\partial f}{\partial z}\mathbf{k}$$
 (1)

- 1. (2) $f = x^2 + 2x^2yz$, find grad f. If $g = x^2yz + 2z$, what is $\nabla f \cdot \nabla g$.
- 2. (2) Find the directional derivative of $z/(x^2 + y^2)$ in the direction **i**.
- 3. (2) f = xyz, work out grad f. What is the value of grad f at (2, 1, 2). What is the directional derivative of f in the **i**-direction at (2, 1, 2).
- 4. (2) $f = x^2 + y^2 + z^2$, find grad f. What is the directional derivative of f in the direction of $\mathbf{b} = (1, 1, 1)$ at the point (1, 1, 1). Remember to use a unit vector when working out the directional derivative. What is the directional derivative in the \mathbf{i} direction at (1, 0, 0); what about the \mathbf{j} direction?

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