6G5Z3001_1314 \\ Mathematical Methods

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Multi-variable calculus

Multi-variable calculus \\ Chain Rule examples

Use the chain rule to solve the following problems (taken from Schaum's Calculus Chapt. 49)

1. Consider a function f defined on points in the plane. Translate the expression
$$\left(\frac{\partial f}{\partial x}\right)^2 + \left(\frac{\partial f}{\partial y}\right)^2$$
into polar coordinates.

2. Consider a right-circular cone of height 15cm and radius 10cm. Suppose that the height is increasing at a rate of 0.2cm/min and the radius is decreasing at a rate of 0.3cm/min. How fast is the volume of the cone changing at this moment?

3. Consider a cylinder of height 8cm and radius 6cm. Suppose that the height is decreasing at a rate of 0.4cm/min and the radius is increasing at a rate of 0.4cm/min. How fast is the volume of the cone changing at this moment? How about the surface area?

4. Consider a particle moving in the plane whose x and y coordinates are given by
$$x(t) = 2 + 3t, \quad y(t) = t^2 + 4,$$
where x and y are measure in centimetres and t is measured in seconds. At what rate is the distance of the particle from the origin changing at time $t = 1$.