Calculus 3 Workbook

Chain rule

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MATH

CHAIN RULE FOR MULTIVARIABLE FUNCTIONS

■ **1.** If $x = e^t$, $y = t^2 - 3$, and $z = 2t + 1$, use chain rule to find df/dt.

$$f(x, y, z) = xy^2z^3$$

■ **2.** If $r = \phi^2$ and $\theta = \phi + \pi$, use chain rule to find $dz/d\phi$ at $\phi = \pi/4$.

$$z(r, \theta) = r^2 \sin \theta$$

■ **3.** If $u = \ln(3t)$ and $v = \ln t$ with $t > 0$, use chain rule to find the global maximum of the function.

$$f(u, v) = 3u - 2v^2$$

CHAIN RULE FOR MULTIVARIABLE FUNCTIONS AND TREE DIAGRAMS

■ **1.** If $x = \sin(t + s)$, $y = 2ts$, and $z = 2t - 5s$, use chain rule to find the partial derivatives f_t and f_s.

$$f(x, y, z) = 7x + 2y^2 z$$

■ **2.** If $x = \log_2(ts)$ and $y = \log_3(2t + s)$, use chain rule to find partial derivatives f_s and f_t at $(1,1)$.

$$f(x, y) = x^2 - 2xy - y^2 + x + 3y - 4$$

■ **3.** If $x = 2t - s$ and $y = t + 2s$, use chain rule to find the point (s, t) where $f_t = f_s = 0$.

$$f(x, y) = 2x^2 - 3xy + y^2 + y + 9$$