MA 213 Worksheet #11

Section 14.5

1 *14.5.1* Use the Chain Rule to find dz/dt for

$$z = xy^3 - x^2y, \quad x = t^2 + 1, \quad \text{and} \quad y = t^2 - 1$$

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2 *14.5.11* Use the Chain Rule to find $\partial z/\partial s$ and $\partial z/\partial t$ for

$$z = e^r \cos(\theta), \quad r = st, \quad \text{and} \quad \theta = \sqrt{s^2 + t^2}.$$

3 *14.5.13* Let $p(t) = f(x, y)$, where f is differentiable, $x = g(t)$, $y = h(t)$, $g(2) = 4$, $g'(2) = -3$, $h(2) = 5$, $h'(2) = 6$, $f_x(4, 5) = 2$, $f_y(4, 5) = 8$. Find $p'(2)$.

4 *14.5.19* Use a tree diagram to write out the Chain Rule for the following. Assume all functions are differentiable.

$T = F(p, q, r)$ where $p = p(x, y, z)$ and
$r = r(x, y, z)$ $q = q(x, y, z)$.

5 *14.5.31* Find $\partial z/\partial x$ and $\partial z/\partial y$ assuming z is defined implicitly as a function of x and y as

$$x^2 + 2y^2 + 3z^2 = 1.$$

6 *14.5.39* Due to strange and difficult-to-explain circumstances, the length ℓ, width w, and height h of a box change with time. At a certain instant the dimensions are $\ell = 1$ m and $w = h = 2$ m, and ℓ and w are increasing at a rate of 2 m/s while h is decreasing at a rate of 3 m/s . At that instant find the rates at which the following quantities are changing.

(a) The volume

(b) The surface area

(c) The length of a diagonal

Additional Recommended Problems

7 *14.5.3* Use the Chain Rule to find dz/dt for $z = \sin(x)\cos(y)$, $x = \sqrt{t}$ and $y = 1/t$.

8 *14.5.15* Suppose f is a differentiable function of x and y, and $g(u, v) = f(e^u + \sin(v), e^u + \cos(v))$. Use the table of values to calculate $g_u(0, 0)$ and $g_v(0, 0)$.

	f	g	f_x	f_y
$(0, 0)$	3	6	4	8
$(1, 2)$	6	3	2	5

9 *14.5.23* Use the Chain Rule to find $\dfrac{\partial w}{\partial r}$ and $\dfrac{\partial w}{\partial \theta}$ when $r = 2$, $\theta = \pi/2$.

$w = xy + yz + zx \quad x = r\cos(\theta) \quad y = r\sin(\theta) \quad z = r\theta$

10 *14.5.33* Find $\partial z/\partial x$ and $\partial z/\partial y$ assuming z is defines implicitly as a function of x and y as: $e^z = xyz$.