1) Use the chain rule to find $\frac{dz}{dt}$.

   a) $z = x^2 y + xy^2,\ x = 2 + t^4,\ y = 1 - t^3$

   b) $z = \sin x \cos x,\ x = \pi t,\ y = \sqrt{t}$

2) Use the chain rule to find $\frac{dw}{dt}$.

   a) $w = xe^{y/z},\ x = t^2,\ y = 1 - t,\ z = 1 + 2t$

   b) $w = xy + yz^2,\ x = e^t,\ y = e^t \sin t,\ z = e^t \cos t$

3) Use the chain rule to find $\frac{\partial z}{\partial s}$ and $\frac{\partial z}{\partial t}$.

   a) $z = x^2 + xy + y^2,\ x = s + t,\ y = st$

   b) $z = \sin \alpha \tan \beta,\ \alpha = 3s + t,\ \beta = s - t$

4) Let $W(s,t) = F(u(s,t), v(s,t))$, where F, u, and v are differentiable, use the table of values to find $W_s(1,0)$ and $W_t(1,0)$.

	u	u_s	u_t	v	v_s	v_t	F_u	F_v
$(1,0)$	2	-2	6	3	5	4	-1	10

5) Use a tree diagram to write out the chain rule for: $v = f(p,q,r)$ where, $p = p(x,y,z)$, $q = q(x,y,z)$, $r = r(x,y,z)$ assume all functions are differentiable.

6) Differentiate implicitly to find $\frac{dy}{dx}$.

a) $x^2 - xy + y^2 - x + y = 0$

b) $\cos(x - y) = xe^y$

7) Differentiate implicitly to find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$.

a) $x^2 + y^2 + z^2 = 3xyz$

b) $xyz = \cos(x + y + z)$

8) The radius of a right circular cylinder is increasing at a rate of 6 inches per minute, and the height is decreasing at a rate of 4 inches per minute. What are the rates of change of the volume and surface area when the radius is 12 inches and the height is 36 inches?

9) Suppose $z = f(x, y)$, where $x = g(s,t)$ and $y = h(s,t)$, find and expression for $\frac{\partial^2 z}{\partial t^2}$.