The multi-variate chain rule

1. Find dz/dt if $z = x^2 + y^2 + xy$, $x = \sin t$ and $y = e^t$.

2. Find dw/dt if $w = xe^{y/z}$, $x = t^2$, $y = 1 - t$ and $z = 1 + 2t$

3. Find all possible first partials of $z = x^4 + x^2y$ if $x = s + 2t - u$ and $y = stu^2$.

4. If $z = f(x, y)$ and f is differentiable with $x = g(t)$ and $y = h(t)$, use the following table of avlues to compute dz/dt at $t = 3$.

$$g(3) = 2 \quad g'(3) = 5 \quad f_x(2, 7) = 6$$
$$h(3) = 7 \quad h'(3) = -4 \quad f_y(2, 7) = -8$$

5. Find $\partial w/\partial r$ and $\partial w/\partial \theta$ at $r = 2$ and $\theta = \pi/2$ if $w = xy + yz + zx$, $x = r\cos\theta$, $y = r\sin\theta$ and $z = r\theta$.