tangent
[5] 1. Find an equation in simplified form, of the plane ~~normal~~ to the surface
$z^2 - x^2 z + xy^2 = 3y + 10$ at the point $(3, 1, -1)$.

[5] 2. If $z = f(x, y)$, $y = g(v, w, x)$ and $x = h(v, w)$, find the chain rule for $\left(\dfrac{\partial z}{\partial v}\right)_w$.

[7] 3. Find the rate of change of $f(x, y, z) = 3yz^2 - x^2y^3$ at the point $(-1, 1, 2)$ in the
direction $\vec{r}(t) = \langle 3t + 2, t^2, t^2 + t + 2 \rangle$.

[4] 4. Find all directions where the rate of change of $f(x, y) = x^2 + x^3y^2 + 7y$ is equal
to 0 at the point $(2, -1)$. (Any answer should be in the form of a vector.)

[8] 5. The following equations

$$u^3y^2 + 2xz^2 + v = u + y,$$
$$ux^2 + v^3y^2 + zy = z^2 - v$$

define x and z as functions of the other variables. Find $\dfrac{\partial z}{\partial v}$.

[11] 6. Find and classify all critical points of

$$f(x, y) = 2x^2y + xy^2 - 6xy.$$