

UNIVERSITY OF MANITOBA

DATE: March 14, 2013

MIDTERM II

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COURSE: MATH 2130TIME: 70 minutes

EXAMINATION: Engineering Mathematical Analysis 1 EXAMINER: M. Davidson

- [5] 1. Find an equation in simplified form, of the plane ~~normal~~^{tangent} to the surface $z^2 - x^2z + xy^2 = 3y + 10$ 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 $\frac{\partial z}{\partial v}\bigg|_w$.
- [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 $\vec{r}(t) = (3t + 2, t^2, t^2 + t + 2)$.
- [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 $\frac{\partial z}{\partial v}$.

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

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