# HOMEWORK 6

MA1132: ADVANCED CALCULUS, HILARY 2017

(1) Find the equation to the tangent plane of the surface $z = f(x, y) = xe^y$ at the point where $x = 3$, $y = 0$. Also find parametric equations of the normal line to this plane.

(2) Describe the intersection between the two surfaces $x^2 + y^2 + z^2 = 2$ and $z^2 = x^2 + y^2$. Show that at all points in the intersection, the normal vectors of the two corresponding tangent planes are perpendicular. Further find parametric equations of the tangent line to the curve of intersection passing through $P = (1, 0, -1)$ at $P$.

(3) Find the local (aka relative) extrema and saddle points of the function
$$f(x, y) = -4x^2y + 2x^2 + y^2 - 7.$$

(4) Find the point on the plane $3x + 2y + z = 1$ closest to the point $(-1, 2, 1)$ (hint: instead of minimizing the function describing the distance between a point on the plane and $(1, -2, 1)$, minimize a related function).

(5) Find the absolute minimum and maximum values (guaranteed to exist by the Extreme Value Theorem) of the function
$$f(x, y) = x^2y - 3xy + x^3 + 7$$
on the triangular region (including the interior and the boundary) bounded by the triangle with vertices at $(0, 0)$, $(2, 0)$, and $(0, -1)$.