Practice Ex 1
Set 3

\#1 (2) Find the arc-length of the curve $r(t) = \langle 2t, e^t, e^{-t}\rangle$ when $0 \le t \le \ln(2)$.

\#2 (3) (a) Find parametric equations for the tangent line to the curve $r(t) = \langle t^3, t, t^3\rangle$ at the point $(-1, 1, -1)$.

(b) At what point on the curve $r(t) = \langle t^3, t, t^3\rangle$ is the normal plane (this is the plane that is perpendicular to the tangent line) parallel to the plane $24x + 2y + 24z = 3$?

\#3 (4) Find the domain and first partial derivatives of the following functions.

(a) $f(s,t) = (s^2 + t^2)\sin(s^2 - t^2)$.

(b) $g(x,y) = \frac{2x-3y}{x+2y}$.

(c) $h(x,y) = \ln(\frac{x+y}{x-y})$.

(d) $k(x,t) = \frac{(3x+4t)e^{(x^2-t^2)}}{x^2+t^2}$.

\#4 (5) Use implicit differentiation to find z_x and z_y if $xyz = e^{x^2+y^2+z^2}$.

\#5 (6) Suppose that over a certain region of plane the electrical potential is given by $V(x,y) = x^2 - xy + y^2$.

(a) Find $\nabla V(x,y)$.

(b) Find the direction of the greatest decrease in the electrical potential at the point $(1,1)$. What is the magnitude of the greatest decrease?

(c) Find the direction of the greatest increase in the electrical potential at the point $(1,1)$. What is the magnitude of the greatest increase?

(d) Find a direction at the point $(1,1)$ in which the temperature does not increase or decrease.

(e) Find the rate of change of V at $(1,1)$ in the direction $\langle 3, -4\rangle$.