7) Show that the following limit does not exist.

$$\lim_{(x,y)\to(0,0)} \frac{x^2 - y^2}{7x^2 + 3y^2}$$

x-axis $(y=0)$

$$\lim_{(x,0)\to(0,0)} \frac{x^2}{7x^2} = \lim_{x\to 0} \frac{1}{7} = \frac{1}{7}$$

y-axis $(x=0)$

$$\lim_{(0,y)\to(0,0)} \frac{-y^2}{3y^2} = \lim_{y\to 0} \frac{-1}{3} = \frac{-1}{3}$$

Since the above limits do not agree the general limit does not exist

8) Find all first and second partial derivatives of $f(x,y) = x\sin y + \frac{x}{y} - e^x$

$f_x = \sin y + \frac{1}{y} - e^x$	$f_y = x\cos y - \frac{x}{y^2}$
$f_{xx} = -e^{-x}$	$f_{yy} = -x\sin y + \frac{2x}{y^3}$
$f_{xy} = \cos y - \frac{1}{y^2}$	$f_{yx} = \cos y - \frac{1}{y^2}$

9) If $x^2 y^3 = \sin(xy)$, find dy/dx without using implicit differentiation

$$\frac{dy}{dx} = \frac{-f_x}{f_y} = -\left(\frac{2xy^3 - y\cos(xy)}{3x^2 y^2 - x\cos(xy)}\right)$$