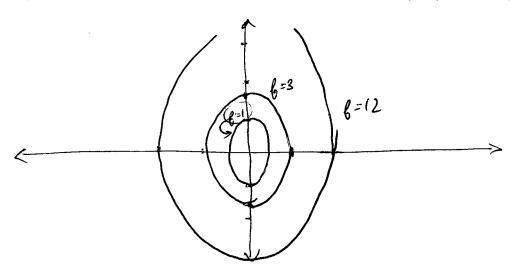
[4] 1. Give a rough sketch of a few of the level curves of the function $f(x,y) = 3x^2 + y^2$.





1. Find the first partial derivatives of the function

a.
$$f(x,y) = e^{y/x}$$

$$\frac{\partial f}{\partial x} = e^{y/x} \frac{1}{\partial x} \left(\frac{y}{x}\right) = e^{y/x} \cdot \left(\frac{y}{x^2}\right)^3$$

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3 b. $f(x,y,z) = x^2yz^3$

$$6x = 2xyz^3$$

$$6y = x^2z^3$$

$$6y = 3x^2yz^2$$

2. If z is given implicitly as a function of x and y by $\sin(x^2 + y^2 + z^2) - 3xz = 0$, use implicit differentiation to find $\partial z/\partial x$.

$$\frac{\partial}{\partial x} \left[\sin \left(x^{2} + y^{2} + z^{2} \right) - 3xz \right] = 0$$

$$\Rightarrow \cos \left(x^{2} + y^{2} + z^{2} \right) \cdot \left(2x + 0 + 2z \frac{\partial z}{\partial x} \right) - 3\left(1 \cdot z + x \cdot \frac{\partial z}{\partial x} \right) = 0$$

$$\Rightarrow \frac{\partial z}{\partial x} = -\cos \left(x^{2} + y^{2} + z^{2} \right) \cdot 2z \frac{\partial z}{\partial x} - 3x \frac{\partial z}{\partial x} = 3z - \cos \left(x^{2} + y^{2} + z^{2} \right) \cdot 2x$$

$$\Rightarrow \frac{\partial z}{\partial x} = \frac{\left[-3x + \cos \left(x^{2} + y^{2} + z^{2} \right) \cdot 2x + 3z}{\left[-3x + \cos \left(x^{2} + y^{2} + z^{2} \right) \cdot 2z} \right]} = 0$$

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