QUIZ 13 SOLUTIONS: LESSONS 18-19
MARCH 2, 2018

Write legibly, clearly indicate the question you are answering, and put a box or circle around your final answer. If you do not clearly indicate the question numbers, I will take off points. Write as much work as you need to demonstrate to me that you understand the concepts involved. If you have any questions, raise your hand and I will come over to you.

1. [5 pts] Find the domain of $f(x, y) = \dfrac{\sqrt{x}}{\ln(y) - 2}$. Write your answer in set builder notation.

We check the following 3 things to determine the domain of f:

① No division by 0

$\ln(y) - 2 = 0 \iff \ln(y) = 2 \iff e^{\ln y} = e^2 \iff y = e^2$

So we may write $\ln(y) - 2 \neq 0$ or $y \neq e^2$.

② Even roots have non-negative input

$x \geq 0$

③ $\ln(y)$ exists, so $y > 0$

Putting this together: $\boxed{\{(x,y): y \neq e^2, x \geq 0, y > 0\}}$

Note: We can write the answer in many different ways.

2. [5 pts] Compute $f_x(3, 10)$ if $f(x, y) = \dfrac{3x^2 + 3y}{\sqrt{y-1}}$.

We are asked to find $f_x(3,10)$, which means we differentiate wrt x and then evaluate at $(3,10)$.

$$f_x = \frac{\partial}{\partial x}\left(\frac{3x^2 + 3y}{\sqrt{y-1}}\right) = \frac{\partial}{\partial x}\left(\left(\frac{1}{\sqrt{y-1}}\right)\left(3x^2 + 3y\right)\right)$$

No x, so constant

$$= \frac{1}{\sqrt{y-1}}\left[\frac{\partial}{\partial x}\left(3x^2 + 3y\right)\right] = \frac{1}{\sqrt{y-1}}\left[\frac{\partial}{\partial x}\left(3x^2\right) + \frac{\partial}{\partial x}\left(3y\right)\right]$$

Constant wrt x

$$= \frac{1}{\sqrt{y-1}}\left(6x\right) = \frac{6x}{\sqrt{y-1}}$$

$$f_x(3,10) = \frac{6(3)}{\sqrt{10-1}} = \frac{18}{\sqrt{9}} = \frac{18}{3} = \boxed{6}$$