# MA 261 Quiz 4
## February 5, 2019

If you do not know how to do any one of these problems, circle **"(E) I don't know"** as your answer choice. You will receive **two points** for doing that. **Each problem** is worth **five points**. You get **two points** for writing your **full name** and **three points** for writing your **section number**.

**Problem 4.1.** What is the domain of the function $f(x, y) = \ln(x/(y + 2))$?

(A) $x > 0$, $y > -2$
(B) $x > 0$, $y > 2$
(C) $x > 0$, $y > -2$ or $x < 0$, $y < -2$
(D) $x > 0$, $y > 2$ or $x < 0$, $y < 2$
(E) I don't know how to do this

*Solution.* This problem is a bit tricky if you don't notice that $x/(y + 2)$ is positive when $x < 0$ and $y < -2$.

What's even more troubling is that if you try to separate $\ln(x/(y + 2))$ into $\ln x + \ln(y + 2)$, as you were taught to do, the domain of the function changes since $\ln x$ is undefined for negative values of $x$. The thing to note here is that $\ln(x - y) = \ln x - \ln y$ only makes sense for positive $x$ and $y$. This identity no longer holds when $x$ or $y$ is less that 0.

**Answer:** (C). ◇

**Problem 4.2.** Find $dy/dx$ for $3y^4 + x^7 = 5x$.

(A) $(7x^6 - 5)/(12y^3)$
(B) $(5 - 7x^6)/(12y^3)$
(C) $12y^3/(5 - 7x^6)$
(D) $2x^3/(1 - x^6)$
(E) I don't know how to do this

*Solution.* A very simple way to compute this is as we showed in class, that is,

$$\begin{aligned} \frac{d}{dx}\left(3y^4 + x^7\right) &= \frac{d}{dx}(5x) \\ 12y^3\frac{dy}{dx} + 7x^6 &= 5 \\ \frac{dy}{dx} &= \frac{5 - 7x^6}{12y^3}. \end{aligned}$$

**Answer:** (B). ◇

**Problem 4.3.** What are the level curves of $f(x, y) = \sqrt{x^2 + 4y^2 + 4} - x$?

(A) hyperbolas
(B) ellipses
(C) parabolas
(D) circles
(E) I don't know how to do this

*Solution.* We provided a method for tackling these types of problems in class. The method goes as follows. Fix a number $k$ and let $f(x, y) = k$. Then

$$k = \sqrt{x^2 + 4y^2 + 4} - x$$

and we play around with this equation until we arrive at some conic section we recognize. That is,

$$\begin{aligned} k &= \sqrt{x^2 + 4y^2 + 4} - x \\ (k + x)^2 &= x^2 + 4y^2 + 4 \\ k^2 + 2kx + x^2 &= x^2 + 4y^2 + 4 \\ x &= \frac{4y^2 + 4 - k^2}{2k}. \end{aligned}$$

The last equation is that of a *parabola* increasing along the $x$ axis.

**Answer:** (C). ◇