Math 126 F - Winter 2019
Midterm Exam Number Two
February 28, 2019

Name: _____ Student ID no. : _____

Signature: _____

1	8	
2	8	
3	12	
4	12	
5	10	
6	10	
Total	60	

- This exam consists of **six** problems on **four** double-sided pages.
- Show all work for full credit.
- You may use a TI-30X IIS calculator during this exam. Other calculators and electronic devices are not permitted.
- You do not need to simplify your answers.
- If you use a trial-and-error or guess-and-check method when a more rigorous method is available, you will not receive full credit.
- Draw a box around your final answer to each problem.
- **Do not write within 1 centimeter of the edge!** Your exam will be scanned for grading.
- If you run out of room, write on the back of the first or last page and indicate that you have done so. If you still need more room, raise your hand and ask for an extra page.
- You may use one hand-written double-sided 8.5" by 11" page of notes.
- You have 80 minutes to complete the exam.

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1. **[8 points]** Write the equation of the plane tangent to $z = x^2y - x$ at the point $(2, 3, 10)$.

2. **[8 points]** An integral on the first page? Weird. Compute $\displaystyle\int_0^1 \int_{\sqrt{3}\,x}^{\sqrt{4-x^2}} x\sqrt{x^2+y^2}\,dy\,dx$.

3. **[2 points each]** Here are six multivariable functions and their names:

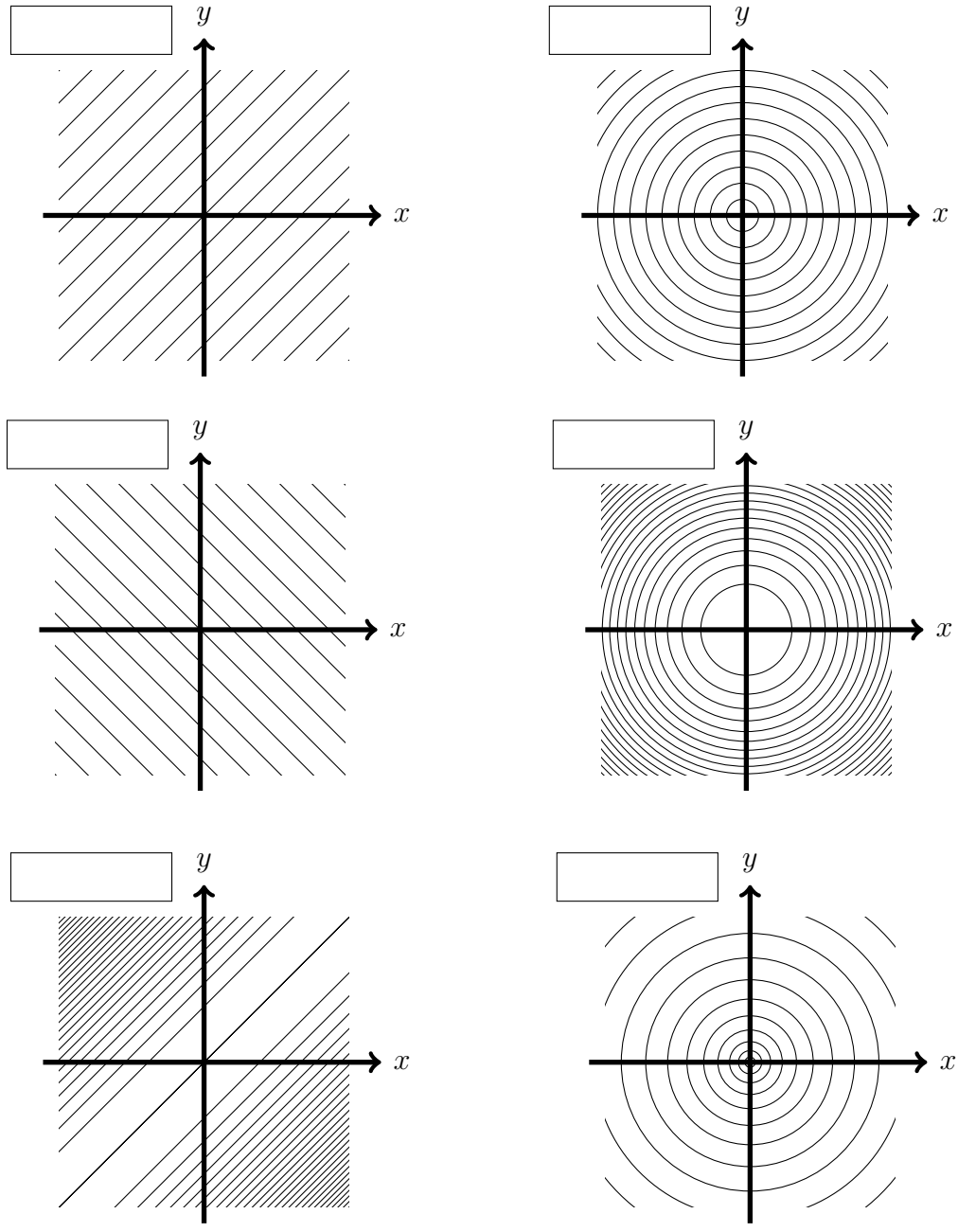
(Andrea) $f(x,y) = x + y$ (Dorian) $f(x,y) = x - y$

(Barry) $f(x,y) = x^2 + y^2$ (Erin) $f(x,y) = x^2 - 2xy + y^2$

(Chantal) $f(x,y) = \sqrt{x^2 + y^2}$ (Fernand) $f(x,y) = \sqrt[4]{x^2 + y^2}$

Write the name of each function in the box next to its level curves below.

You do not need to show any work for this problem.



(The names are because last time I just used letters, and it's super hard to read some people's handwriting from just one letter.)

This problem is sponsored by the triangle T with vertices $(0,0)$, $(0,1)$, and $(1,1)$.

4. **[12 points]** Let $f(x,y) = x^2 + 2y^2 - xy - 2x - y$.

   Find the absolute minimum and maximum values of f on the domain T.

   (Just to be clear: T includes both the interior and the boundary of the triangle.)

This problem is also sponsored by the triangle T with vertices $(0, 0)$, $(0, 1)$, and $(1, 1)$.

5. Let $\mathcal{S}$ be the solid bounded above by $z = e^{y^2}$ and below by T in the xy-plane.

   (a) **[5 points]** Set up a double integral for the volume of $\mathcal{S}$ in two different ways, once using $dx\,dy$ and once using $dy\,dx$. (Don't evaluate it yet.)

   (b) **[5 points]** Okay, now find the volume of $\mathcal{S}$. Use whichever setup you prefer.

6. (a) **[7 points]** Find all the critical points (in $\mathbb{R}^2$) of $f(x, y) = x\sin(y) + y^2$.

   (There are a lot of them! You should list them all somehow, but I don't really care about the format of your answer.)

   (b) **[3 points]** Classify your critical points from part (a) as local maxima, local minima, or saddle points.