

THE UNIVERSITY OF BRITISH COLUMBIA

MATH 253

**Midterm 1**

9 October 2013

TIME: 50 MINUTES

LAST NAME: \_\_\_\_\_ FIRST NAME: \_\_\_\_\_

STUDENT # : \_\_\_\_\_ SIGNATURE: \_\_\_\_\_

This Examination paper consists of 8 pages (including this one). Make sure you have all 8.

INSTRUCTIONS:

No memory aids allowed. No calculators allowed. No communication devices allowed.

**PLEASE CIRCLE YOUR INSTRUCTOR'S NAME BELOW**

MARKING:

<b>Q1</b>	/9
<b>Q2</b>	/9
<b>Q3</b>	/8
<b>Q4</b>	/9
<b>TOTAL</b>	/ 35

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NAMES OF INSTRUCTORS: Jim Bryan, Dale Peterson, Sabin Cautis, Lior Silberman

**Q1** [9 marks]

Find the partial derivatives  $\frac{\partial z}{\partial x}$ ,  $\frac{\partial z}{\partial y}$ , and  $\frac{\partial^2 z}{\partial x \partial y}$  where  $z$  is defined (possibly implicitly) as a function of  $x$  and  $y$  by the equations below.

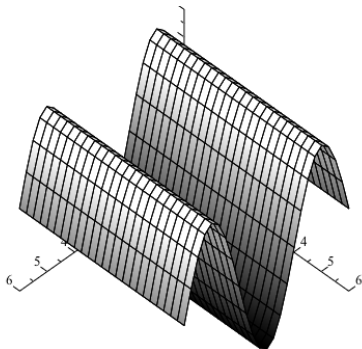
(a)  $z = x \cos(xy)$

(b)  $z = x^2 \int_0^y \sin^8(\sqrt{t}) dt$

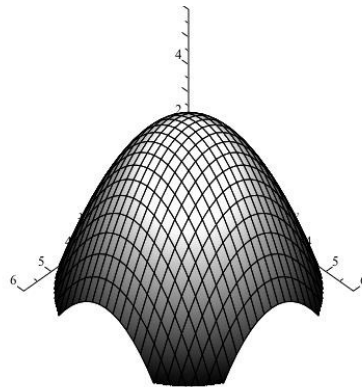
(c)  $z + e^z = x^2 + y^2$

Q2 [9 marks]

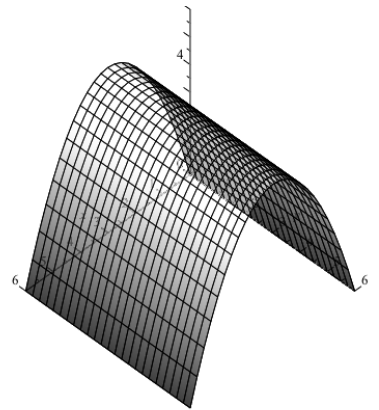
Put the letter of each graph in the box below the corresponding contour plot on the next page. The axes of the below graphs are all oriented in the standard way: the positive  $x$ -axis is on the left, the positive  $y$ -axis is on the right, and the positive  $z$ -axis is upward.



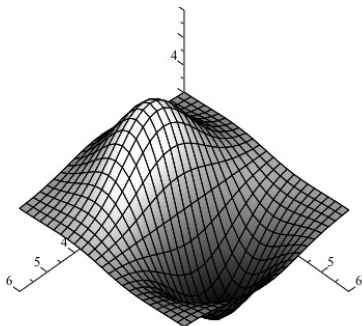
A



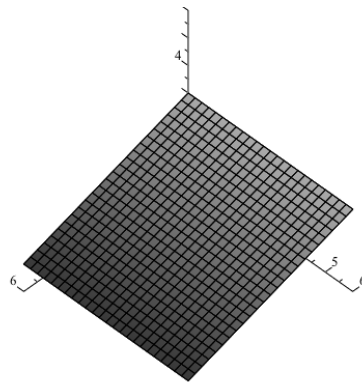
B



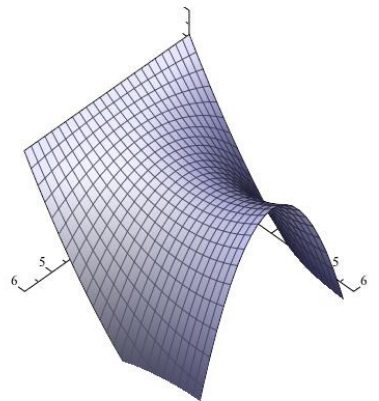
C



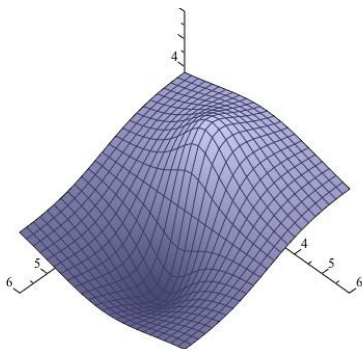
D



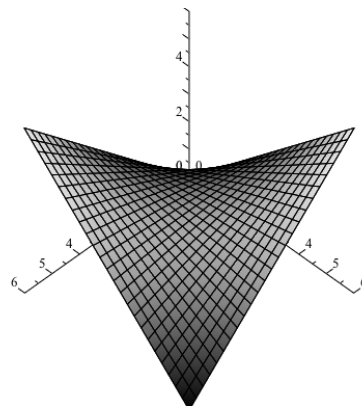
E



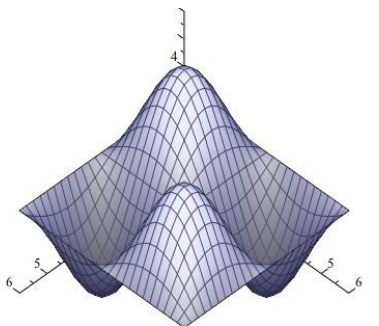
F



G

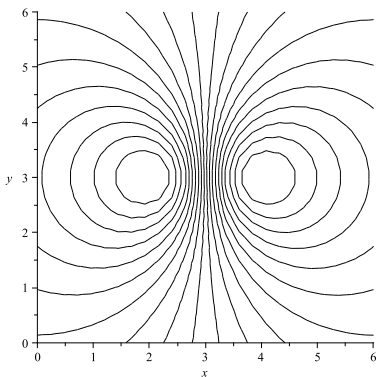


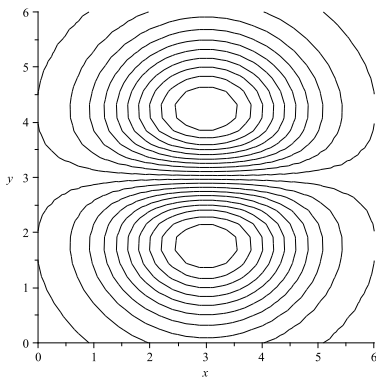
H

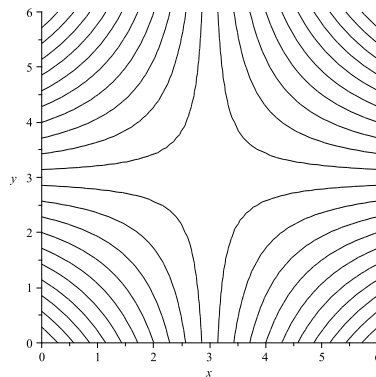


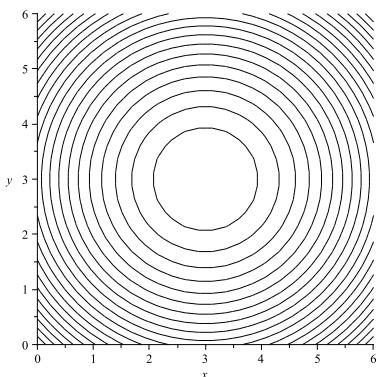
I

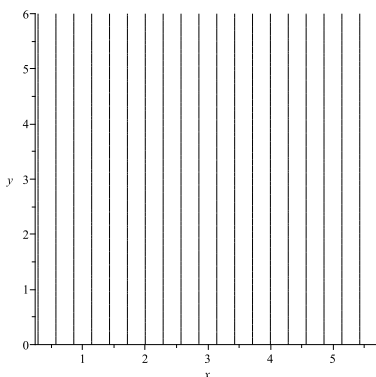
In the below contour plots, the *values* of the contours are evenly spaced. Put the letter of the corresponding graph in the box below the contour plot.

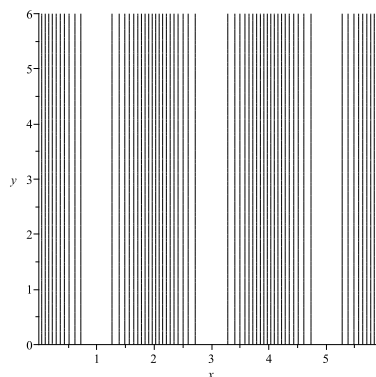


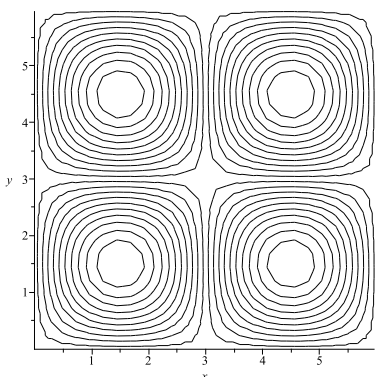


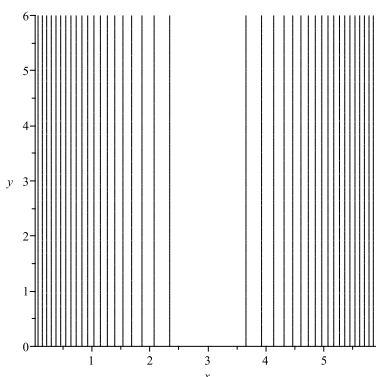


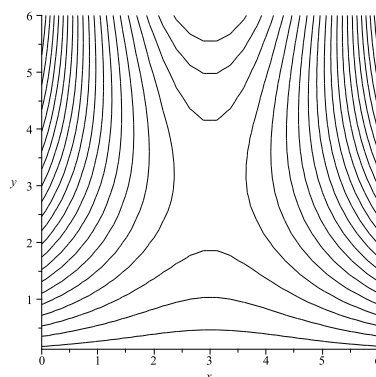












**Q3** [8 marks]

Let  $f(x, y) = \sqrt{1 + x^2y^3}$ .

(a) Find an equation of the plane tangent to the surface  $z = f(x, y)$  at the point  $(1, 2, 3)$ .

(b) Use your answer in part (a) to find an approximate value for  $f(1.03, 1.98)$ .

**Q4** [9 marks]

Let  $P$  be the plane passing through the points  $(2, 1, 0)$ ,  $(2, 0, 2)$ , and  $(0, 2, 0)$  and let  $L$  be the line passing through the points  $(2, 0, 0)$  and  $(1, 1, 2)$ .

(a) Find the equation of the plane  $P$ . Simplify your answer and write it in the form  $z = f(x, y)$ .

(b) Find the point of intersection of the plane  $P$  and the line  $L$ .

- (c) Find the angle between the plane  $P$  and the line  $L$ .