

# MAT 272

## SPRING 2015

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### Test 2

*SoMSS, ASU*

**Directions:**

1. There are 7 questions worth a total of 100 points.
2. Read all the questions carefully.
3. You must show all work in order to receive credit for the free response questions!!
4. When possible, box your answer, which must be complete, organized, and exact unless otherwise directed.
5. Always indicate how a calculator was used (i.e. sketch graph, etc. ...).
6. No calculators with QWERTY keyboards or ones like TI-89 or TI-92 that do symbolic algebra may be used.

**Honor Statement:**

By signing below you confirm that you have neither given nor received any unauthorized assistance on this exam. This includes any use of a graphing calculator beyond those uses specifically authorized by the Mathematics Department and your instructor. Furthermore, you agree not to discuss this exam with anyone until the exam testing period is over. In addition, your calculator's program memory and menus may be checked at any time and cleared by any testing center proctor or Mathematics Department instructor.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

**PRINT NAME:** \_\_\_\_\_

**RECITATION (Tuesday or Thursday):** \_\_\_\_\_

1.

- a. Find the line of intersection of the planes

$$9x - 4y + 6z = -74 \text{ and } 6x + 4y + 3z = -28$$

[8pts]

- b. Find the equation of the plane passing through the point
- $(1, 2, 3)$
- and orthogonal to the line of intersection obtained in part a. of the problem.
- 
- [6pts]

2. Let  $f(x, y) = 3x^2y + y^3 - 3x^2 - 3y^2 + 2$ .

a. Find all the critical points of  $f$ . [8 pts]

b. Apply the second derivative test to identify the critical point  $(0,0)$  of  $f$  as a maximum, minimum or saddle points. [8 pts]

3. [14pts]

a. Find and sketch the domain of the function  $f(x, y) = \sqrt{x + y + 4} + \sqrt{9 - x - y}$

b. Show that  $\lim_{(x, y) \rightarrow (0, 0)} \frac{x^2 + y^2}{x^2 - y^2}$  does not exist.

4. A company makes metal cylinders with a nominal radius of 5cm and a nominal height of 10cm. Use differentials to estimate the deviation of a cylinder's volume from the nominal value if the radius can be off by as much as 0.1cm, and the height can be off by as much as 0.2 cm. [10pts]

5. Let  $f(x, y) = xy^2 - x^2y$ .

a. Find the  $\nabla f(-1, 2)$ .

[5pts]

b. Determine the directional derivative of  $f$  in the direction  $\langle 3, 4 \rangle$ .

[5pts]

c. In which direction is the directional derivative of  $f$  maximum?

[5pts]

d. What is the maximum directional derivative of  $f$ ?

[5pts]

6. Find an equation of the tangent plane to the surface at the given point.

[10pts]

$$z = xy - x - y, (-5, 3, -13)$$

7. [16 pts] State whether the following statements are TRUE or FALSE. If FALSE, correct the statement.
- The equation  $x^2 - y^2 - z^2 = -1$  represents a cone.
  - If  $f$  is a differentiable function with  $f(1,1) = 1$  and  $f_x(1,1) = 5$  and  $f_y(1,1) = 2$ , then the linear approximation of  $f(4,2)$  is  $L(4,2) = 18$ .
  - If  $f$  is a differentiable function of two variables and  $f_x(1,2) = 3$ , then as  $x$  changes from  $x = 1$  to  $x = 2$ , the value of  $f$  changes by 3 units.
  - If  $\vec{r}(t) = \langle x(t), y(t) \rangle$  represents a level curve of a differentiable function of two variables,  $f$ , then at every point  $(x(t), y(t))$ ,  $\frac{d}{dt} \vec{r}(t)$  must be orthogonal to the gradient of  $f$ .