

MATH 2400: Calculus 3, Spring 2014
Midterm 1

February 5, 2014

NAME:

“On my honor, as a University of Colorado at Boulder student, I have neither given nor received unauthorized assistance on this work.”

Circle your section.

- 001 J. MIGLER (9AM)
- 002 T. DAVISON (10AM)
- 003 I. MISHEV (11AM)
- 004 I. MISHEV (12PM)
- 005 M. WALTER (1PM)
- 006 S. ANDREWS (2PM)

You must show all of your work. Please write legibly and box your answers. The use of calculators, books, notes, etc. is not permitted on this exam. Please provide exact answers when possible. For example, if the answer is π , write the symbol “ π ” and not the decimal 3.14159. . . .

Question	Points	Score
1	18	
2	12	
3	18	
4	18	
5	18	
6	16	
Total:	100	

1. (18 points) A plane heading due north with an airspeed of 1,000 km/hr experiences a wind of 100 km/hr blowing towards the northeast.

(a) Find the plane's ground speed vector.

(b) Find the magnitude of the plane's ground speed vector.

(c) Compute the angle between the plane's ground speed vector and the unit vector in the north direction.

2. (12 points) (a) Find a function $f(x, y, z)$ whose level surface at 2 is the cylinder of radius 1 centered on the x -axis.

- (b) Find a function $g(x, y, z)$ whose level surface at 2 is the graph of the function $z = x^2 + y^2 + 4$.

3. (18 points) Let $\vec{u} = a\vec{j} + \vec{k}$ and $\vec{v} = \vec{i} - 2\vec{j} + b\vec{k}$.
- (a) Are there any values of a and b which will make \vec{u} and \vec{v} parallel?
(Circle One) YES NO
Explain your answer.
- (b) Are there any values of a and b which will make \vec{u} and \vec{v} perpendicular?
(Circle One) YES NO
Explain your answer.

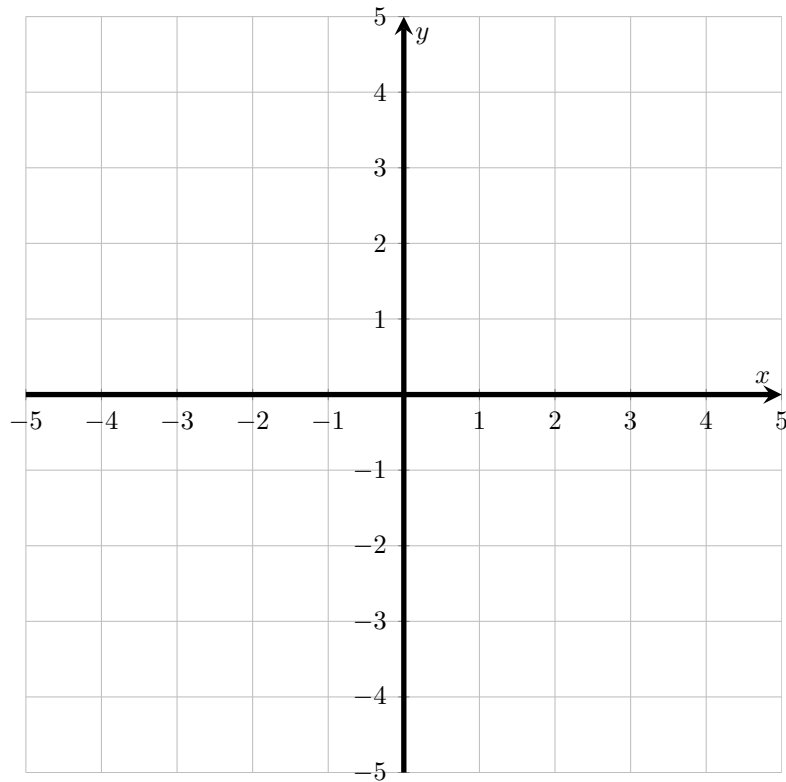
4. (18 points) Let T be the triangle with vertices $A = (1, 2, 3)$, $B = (3, 3, 6)$, and $C = (2, 2, 5)$.
- (a) Calculate $\overrightarrow{AB} \times \overrightarrow{AC}$.

(b) Find an equation of the form $ax + by + cz = d$ for the plane containing the triangle T .

(c) Find the area of T .

5. (18 points) Consider the function $f(x, y) = y^2 - x + 10$.
- (a) Find the equation for the contour of f that goes through the point $(-2, -1)$.

- (b) Sketch a contour diagram of f with at least 3 level curves. Include the level curve found in (a). Make sure to label each curve with the value that f takes on that curve.



6. (16 points) Determine whether each of the following functions is continuous at the given point. In each case, justify your conclusion carefully.

(a) The function

$$f(x, y) = \begin{cases} \frac{x^4}{(x^2+y^2)^2} & \text{if } (x, y) \neq (0, 0) \\ 0 & \text{if } (x, y) = (0, 0) \end{cases}$$

at the point $(0, 0)$.

(b) The function

$$g(x, y) = \begin{cases} \frac{e^{x^2+y^2}-1}{x^2+y^2} & \text{if } (x, y) \neq (0, 0) \\ 1 & \text{if } (x, y) = (0, 0) \end{cases}$$

at the point $(0, 0)$.