

# MAC 2313, Section 05

## Test 1

Name: \_\_\_\_\_

SSN: \_\_\_\_\_

Notebooks, textbooks and journals are NOT allowed. Calculators are permitted. On this test, vectors are denoted in **bold** font. This test will be graded out of 40.

1. (4 marks) A man travels 25 km northeast, 15 km east and 10 km south. How far and in what direction is he from his starting point?

2. (5 marks) Find an equation for the tangent plane to the surface  $x^2yz + 3y^2 = 2xz^2 - 8z$  at the point (1,2,-1).

3. (6 marks) (a) Sketch level surfaces of the function  $g(x, y, z) = x^2 - y^2 - z^2$ .

4. (6 marks) (a) Find the directional derivative of  $h(x, y, z) = 2x^3y - 3y^2z$  at the point  $(1, 2, -1)$  in a direction toward the point  $(3, -1, 5)$ .

(b) What is the magnitude of the maximum directional derivative at the given point?

5. (4 marks) Determine the volume of the parallelepiped which has corners located at  $A=(0,0,0)$ ,  $B=(3, -2, -5)$ ,  $C=(1, 4, -4)$  and  $D=(0, 3, 2)$  where  $AB$ ,  $AC$  and  $AD$  form the length, height and width of the parallelepiped.

6. (9 marks) Given the function  $f(x, y) = \sin(\sqrt{x^2 + y^2})$ ,

(a) sketch level curves for this function.

(b) find a tangent plane approximation to  $f(x, y)$  near the point  $(0, \pi)$ .

(c) compute the differential of  $f(x, y)$  at the point  $(0, \pi)$ .

(d) use your answer from (c) to compute the change in  $y$  if  $x$  is held constant and  $f$  is increased by 0.1 at the given point.

7. (6 marks) (a) Find the equation of the linear function  $f(x, y, z) = ax + by + cz + d$  which has the given values for the cross-sections  $x = 3$  and  $x = 5$ .

		z	
y		1	4
	0	4	
	1		
		x = 3	

		z	
y		1	4
	0	8	14
	1		9
		x = 5	

(b) Sketch contour maps for this function.

Bonus (5 marks): Explain when a directional derivative for a function  $f(x, y)$  is the same as (i)  $f_x$  and (ii)  $f_y$ . Illustrate your answers using a function of your choosing for  $f$ .