Department of Mathematics
University of Notre Dame
MATH 20550 - Calculus III
Summer 2015

Name _____

Exam 1

June 19, 2015

This exam has 5 problems worth a total of **55 points**. You will have 50 minutes to work on it. All answers should be given as exact, closed form numbers as opposed to decimal approximations. **For full credit, you must show all work.** Calculators and all other electronic devices are strictly forbidden.

Please read and sign the Honor Pledge:

Honor Pledge: As a member of the Notre Dame community, I will not participate in or tolerate academic dishonesty.

Signature: _____

Question	Points	Score
1	10	
2	15	
3	10	
4	10	
5	10	
Total:	55	

1. (10 points) Sketch the following surfaces
   (a) $x^2 + 4y^2 - z = 0$
   (b) $(x-2)^2 + (y-1)^2 + (z+1)^2 = 4$
   (c) $(x-1)^2 + 2y^2 + 4(z+2)^2 = 4$
   (d) $y^2 + 2(z-1)^2 = 4$

2. Consider the two points $P = (1, 2, 1)$ and $Q = (3, 2, 1)$

   (a) (5 points) Find an equation for the plane which contains Q and is perpendicular to $\vec{QP}$.

   (b) (5 points) Find the distance from this plane to the origin.

   (c) (5 points) Give an equation for a plane which passes through Q and is perpendicular to the plane you found in part (a). (There are several correct answers. You only need to give one example)

3. A sphere with center $(4, 3, 5)$ contains a point $(7, 3, 1)$.
   (a) (5 points) Find an equation of the sphere.
   (b) (5 points) What is the intersection of the sphere with the xz-plane?

4. (a) (5 points) Find the area of the triangle with verticies $(0,0,0)$, $(1,2,3)$, and $(2,-1,4)$.

   (b) (5 points) Find the volume of the parallelepiped spanned by the vectors

$$u = \langle 2,2,3 \rangle\,,\ v = \langle 3,0,1 \rangle\,,\ w = \langle 0,-2,0 \rangle$$

5. (10 points) A boy pulls a wagon 2km down the street to his friend's house. If the boy pulls using a force of 5N at an angle of 30° from the ground. How much work did the boy exert moving the wagon?