MATH 2400: CALCULUS 3

5:15 - 6:45 pm, Mon. Sep. 21, 2015

MIDTERM 1

I have neither given nor received aid on this exam.

Name:_____

Check one below !

- ◯ **001** Bulin ..... (9am)
- ◯ **002** Molcho ..... (10am)
- ◯ **003** Ih ..... (11am)
- ◯ **004** Spina ..... (12pm)
- ◯ **005** Spina ..... (1pm)
- ◯ **006** Preston ..... (2pm)
- ◯ **007** Preston ..... (3pm)
- ◯ **008** Chhay ..... (9am)
- ◯ **009** Walter ..... (11am)

If you have a question raise your hand and remain seated. In order to receive full credit your answer must be **complete**, **logical**, **legible**, and **correct**. Show all of your work, and give adequate explanations. No shown work even with the correct final answer, no points ! Only one answer to each problem ! In case of two different answers to one problem, the lower score will be chosen !

DO NOT WRITE IN THIS BOX!

Problem	Points	Score
1	17 pts	
2	17 pts	
3	16 pts	
4	17 pts	
5	16 pts	
6	17 pts	
TOTAL	100 pts	

1. (17 points) Let P_0 be the point $(1, 1, 2)$ and let $\wp$ be the plane given by the equation $2x - y + 2z = 2$

(a) **(9 points)** Find parametric equations of the line L passing through the point P_0 and perpendicular to the plane $\wp$.

(b) **(8 points)** Find the intersection point of the line L in (a) above and the plane $\wp$.

2. (17 points) Consider the surface S given by the equation

$$z = 3\sqrt{x^2 + y^2}.$$

(a) **(10 points)** Sketch the intersections of the surface S with each of the five planes

(a) $x = 0$; (b) $y = 0$; (c) $z = 0$; (d) $z = 1$; (e) $z = 3$.

What does each of these intersections look like roughly on each plane ?

(b) **(7 points)** Write down the equation of the cone with apex at $(0, 0, 0)$, which is symmetric about the z-axis and which intersects the plane given by the equation $z = 1$ at a circle of radius 2.

3. (16 points) Which of the following is the angle between the (big) diagonal of a unit cube and one of its edges, where the diagonal and the edge start at the same point ? (Circle one of them and justify your answer. Show all work for full credit.)

(a) $\arcsin \frac{1}{\sqrt{3}}$ (b) $\arccos \frac{1}{\sqrt{3}}$ (c) $\arcsin \frac{2}{\sqrt{6}}$ (d) $\arccos \frac{2}{\sqrt{6}}$

4. (17 points) Let C be the helix $\boldsymbol{r}(t) = \langle \sin(\pi t), \cos(\pi t), t \rangle$ and let S be the sphere $x^2+y^2+z^2 = 5$.

(a) **(8 points)** At what points do the helix C intersect the sphere S ?

(b) **(9 points)** Find the tangent line to the helix C at the intersection point having positive z-coordinate.

5. (16 points)

(a) **(8 points)** Find the spherical coordinates of the point given by $(1, 1, -\sqrt{2})$ in rectangular coordinates.

(b) **(8 points)** In Cartesian coordinates, write down the equation of the surface given by the equation $r = 2\cos\theta$ in cylindrical coordinates and describe the surface in words or in a picture.

6. (17 points) Let C be the curve given by $\boldsymbol{r}(t) = \langle 2t, \ln t, t^2 \rangle$, where ln stands for the natural logarithm.

(a) **(9 points)** Find the arc length of the curve C for $1 \leq t \leq 4$.

(b) **(8 points)** Find the curvature of the curve C at $t = 1$.