

MATH 2400: CALCULUS 3

February 14, 2007

MIDTERM 1

I have neither given nor received aid on this exam.

Name: _____

001 E. KIM (9AM)

004 J. BOISVERT (12AM)

002 E. ANGEL (10AM)

005 A. GOROKHOVSKY (1PM)

003 I. MISHEV (11AM)

If you have a question raise your hand and remain seated. In order to receive full credit your answer must be **complete**, **legible** and **correct**. Show all of your work, and give adequate explanations.

DO NOT WRITE IN THIS BOX!

Problem	Points	Score
1	9 pts	
2	9 pts	
3	18 pts	
4	10 pts	
5	9 pts	
6	9 pts	
7	18 pts	
8	9 pts	
9	9 pts	
TOTAL	100 pts	

4.

(a) (9 pt.) Find parametric equations of the tangent line to the parametric curve $\mathbf{r}(t) = \langle 2 + t^3, 1 - 4t, 5 - t^2 \rangle$ at the point where $t = 1$.

(b) (9 pt.) Find the point of intersection of this line with the xy -plane.

5. (10 pt.) Find the equation of the sphere centered at $(0, 1, 5)$ and tangent to the plane $3x + 6y - 2z - 5 = 0$.

6. (9 pt.) Find the area of the triangle defined by the points $P_1(-1, 0, 0)$, $P_2(0, 1, 0)$, $P_3(1, 1, 1)$.

7. (18 pt.) Match each rectangular equation from the first column with an equivalent cylindrical equation in the second column. Then match each cylindrical equation in the second column with an equivalent spherical equation in the third column.

(1) $x^2 + y^2 + z^2 = 9$	(a) $z = 3r^2$	(i) $\rho - 2 \sin \phi \cos \theta = 0$
(2) $z = 3x^2 + 3y^2$	(b) $r^2 + z^2 = 9$	(ii) $\rho = 3$
(3) $(x - 1)^2 + y^2 + z^2 = 1$	(c) $r^2 + z^2 - 2r \cos \theta = 0$	(iii) $\cos \phi - 3\rho \sin^2 \phi = 0$

8. (9 pt.) Solve the initial value problem $\mathbf{r}'(t) = \mathbf{i} + e^t\mathbf{j} + \frac{1}{t+1}\mathbf{k}$, $\mathbf{r}(0) = \mathbf{0}$.

9. (9 pt.) Find the arc length parametrization of the parametric curve $x = \frac{1}{2}t$, $y = \frac{1}{3}(1-t)^{\frac{3}{2}}$, $z = \frac{1}{3}(1+t)^{\frac{3}{2}}$, $-1 \leq t \leq 1$ that has the same orientation as the given curve. Use the point when $t = 0$ as the reference point.