The final will be comprehensive and the midterm II will cover only from the Spherical coordinates. However you better start to review for the final now.

1. Find the tangent plane of $xu(x, y) + y(u(x, y))^2 = 2x^2$ at the point (1, 1, 1). Find the tangent plane of $x^2 + y^2 + 2z^2 = 4$ at (1, 1, 1).

2. Plot level curves for the function

 $z = f(x, y) = 4x^2 + y^2.$

Plot the level surfaces of the function $f(x, y, z) = x^2 + y^2 + 4z^2$.

3. Find the direction in which the function $z = 2x + \sin(2y - x)$

increases the most from the point (0, 0). What is the rate of change there in that direction?

4. Find the directional derivative of $z = f(x, y) = 4x^2 + y^2$

in the direction of i+j at the point (1,1).

What is physical meaning of this derivative?

5. Compute: $(x^y)_{xy}$.

6. Find the area of the unit sphere in the upper cone $z^2 = x^2 + y^2$. $ti+tj+t^2$ k.

7. Find the center of the mass of upper half ball.

8. Find parametrization of the curves $4x^2 + y^2 = 1$ and $\frac{1}{4}x^2 + y^2 = 1$.

9. Find maxima and maximal value of the function 2x + y inside the unit circle.

10. Find the integral $\int \int \int_D x^2 dvol$, where D is the upper half unit ball $x^2 + y^2 + z^2 \le 1$, $z \ge 0$.

11. Find maxima and maximal value of the function $x^2 + 2y$ in the triangle x + 3y = 1, y = 0 and x = 0.

12. Find the integral $\int \int \int_D x dvol$, where D is the part of the unit ball $x^2 + y^2 + z^2 \leq 1$ and $x \geq 0, y \geq 0, z \geq 0$.

13. Find the extrema of the function x^2y in the triangle bounded by the x - axis

and y - axis and the line x + y = 1.

14. Compute $\int \int_D x^2 y dx dy$, where D is the upper half disk.

15. Compute the divergence and curl of the vector fields $x^2yi + \cos(x + y)j+zk$. The physical meaning of divergence is the density of the source of the vector field and that for curl is the vector valued circulation density.

16.Compute $\int_C yx dx + x dy$, where C is the counterclockwise unit circle.

17. Compute $\int_S x^2 ds$, where S is the upper half circle.

18. Compute the center of mass of upper unit circle with density $d(x, y) = x^2$.

19. Write down the change of variable formulas for spherical and cylindrical coordinates.

20. Compute the integral $\int \int_{x^2+4y^2 \le 4} (x+y^2) dx dy$.

21. Compute $\int \int_{\Sigma} F \bullet n dS$ where Σ is the region bounded by the upper half unit sphere

and $F = xy^2 \mathbf{i} + (x+y)\mathbf{j} + z\mathbf{k}$.

22. Compute $\int_C F \bullet dr$, where $F = x^2 y \mathbf{i} + (x+y)\mathbf{j} + z\mathbf{k}$ and C is the intersection of the unit sphere and the plane x = z, with the right hand orientation.

23. Compute $\int \int_{\Sigma} F dS$ where Σ is the region bounded by the upper half unit sphere

and F = z.

24. Approximate $\sqrt{99}~$ and $~\sin(46^o).$ You have to show the formula. An answer

from calculate will yield 0 point.

25. Find the maximum of xyz if $x + y + z = \dot{1}$ and positive.