

The second midterm will cover from 13.8 to 15.3.

Here are some practice problems.

1. Find maxima and maximal value of the function $2x - y$ inside the unit circle.

2. Find the integral $\iiint_B x^2 dvol$, where B is the unit ball
 $x^2 + y^2 + z^2 \leq 1$.

3. Find maxima and maximal value of the function $x^2 + 2y$ in the half disk

$$x^2 + 3y^2 \leq 1 \text{ and } x \geq 0.$$

4. Find the integral $\iiint_D x dvol$, where D is the part of the unit ball

$$x^2 + y^2 + z^2 \leq 1 \text{ and } x \geq 0, y \geq 0, z \geq 0.$$

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

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

6. Compute $\iint_D x^2 y dx dy$, where D is the upper half disk.

7. Compute the divergence and curl of the vector fields $x^2y\mathbf{i} + \cos(x+y)\mathbf{j} + z\mathbf{k}$. 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.

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

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

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

11. Write down the change of variable formulae for

spherical and cylindrical coordinates.

12. Compute the integral

$$\iint_{x^2+4y^2 \leq 4} (x+y^2) dx dy.$$