

## SOME PRACTICE PROBLEMS

1. Find stationary points of the following functions and discuss the maxima & minima at those points.

1)  $x^3 + 3xy^2 - 15x^2 - 15y^2 + 72x$

2)  $x^4 + y^4 - 2x^2 + 4xy - 2y^2$

3)  $x^3 + xy^2 - 12x^2 - 2y^2 + 21x + 10$

4)  $x^3y^2(1 - x - y)$

5)  $x^2y^3(1 - x - y)$

6)  $xy(3a - x - y)$

7)  $x^2y - 3x^2 - 2y^2 - 4y + 3$

8)  $y^2 + 4xy + 3x^2 + x^3$

9)  $xy(3 - x - y)$

10)  $x^3 + 3xy^2 - 3x^2 - 3y^2 + 4$

11)  $2(x^2 - y^2) - x^4 + y^4$

12)  $xy + a^3 \left( \frac{1}{x} + \frac{1}{y} \right)$

2. A real number  $k, k > 0$  is divided into 3 parts such that the sum of their products taken two at a time is maximum. Find the numbers.
3. A rectangular box, open at top has volume  $V$ . Find dimensions of the box requiring least material for its construction.
4. Find the maximum value of  $\cos A \cos B \cos C$ , where  $A, B, C$  are angles of a triangle.
5. Find the maximum volume of a parallelepiped inscribed in a sphere  $x^2 + y^2 + z^2 = a^2$ .