MA 16020

Instructions. Show all work, with clear logical steps. No work or hard-to-follow work will lose points.

Problem 1. (6 points) Find and classify all critical points of the function

$$f(x,y) = 54x^4 + 64x + \frac{16}{3}y^3 - y + 2.$$

Problem 2. (4 points) Given the information in the table below, find and classify any critical points for the function g(x, y).

(a,b)	g(a,b)	$g_x(a,b)$	$g_y(a,b)$	$g_{xx}(a,b)$	$g_{xy}(a,b)$	$g_{yy}(a,b)$
(0,1)	0	3	0	0	-2	4
(4,3)	-3	0	0	-1	2	-6
(2,7)	15	0	0	4	5	8
(5,6)	4	0	0	3	5	2

Second Derivative Test. Suppose (a, b) is a critical point of f and the second partial derivatives exist and are continuous. Let

$$D = D(a,b) = f_{xx}(a,b)f_{yy}(a,b) - [f_{xy}(a,b)]^2.$$

Then

- (a) If D > 0 and $f_{xx}(a, b) > 0$, then f(a, b) is a local minimum.
- (b) If D > 0 and $f_{xx}(a, b) < 0$, then f(a, b) is a local maximum.
- (c) If D < 0, then f(a, b) is a saddle point.
- (d) If D = 0 then the test is inconclusive.