Write legibly, clearly indicate the question you are answering, and put a box or circle around your final answer. If you do not clearly indicate the question numbers, I will take off points. Write as much work as you need to demonstrate to me that you understand the concepts involved. If you have any questions, raise your hand and I will come over to you.

1. Consider the following table providing information about the function $f(x, y)$:

(x, y)	$f(x, y)$	$f_x(x, y)$	$f_y(x, y)$	$f_{xx}(x, y)$	$f_{yy}(x, y)$	$f_{xy}(x, y)$
$(-2, 1)$	7	-8	4	4	2	-4
$(0, 0)$	0	0	-2	2	2	0
$(2, -1)$	3	0	0	0	2	4

(a) [1 pt] Which of the above (x, y) is a critical point of f?

Solution: The critical point is
$$(x, y) = (2, -1)$$
because $f_x(2, -1) = 0 = f_y(2, -1)$.

(b) [1 pt] Is the (x, y) from part (a) a minimum, maximum, saddle point, or inconclusive?

Solution: $(x, y) = (2, -1)$ is a saddle point.

(c) [2 pts] Give a mathematical reason for you answer to part (b).

Solution: $(x, y) = (2, -1)$ is a saddle point because
$$D(2, -1) = f_{xx}(2, -1)f_{yy}(2, -1) - (f_{xy}(2, -1))^2 = 0(2) - (4)^2 = -16$$
is less than 0.

2. [6 pts] Let
$$f(x, y) = 3x^2 y.$$
If we want to maximize f subject to
$$3x + 2y^2 = 6$$
using the method of LaGrange multipliers, our system of equations would be
$$\boxed{6xy} = \lambda \boxed{3}$$
$$\boxed{3x^2} = \lambda \boxed{4y}$$
$$\boxed{3x + 2y^3} = \boxed{6}$$

(Fill in the green boxes.)