

14.1 The Partial Derivative

Name:

Date:

P 1. Given the table of values for $z = f(x, y)$, estimate $f_x(3, 2)$ and $f_y(3, 2)$. Assume that f is differentiable.

$x \setminus y$	0	2	5
1	1	2	4
3	-1	1	2
6	-3	0	0

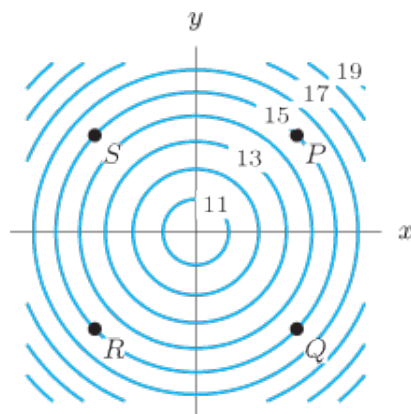
P 2. Using difference quotients, estimate $f_x(3, 2)$ and $f_y(3, 2)$ for the function given by

$$f(x, y) = \frac{x^2}{y + 1}$$

P 4. The price P in dollars to purchase a used car is a function of its original cost, C , in dollars, and its age, A , in years.

- (a) What are the units of $\partial P/\partial A$?
- (b) What is the sign of $\partial P/\partial A$ and why?
- (c) What are the units of $\partial P/\partial C$?
- (d) What is the sign of $\partial P/\partial C$ and why?

P 11. Determine the sign of f_x and f_y at P .



P 20. The average price of large cars getting low gas mileage (“gas guzzlers”) is x and the average price of a gallon of gasoline is y . The number, q_1 , of gas guzzlers bought in a year, depends on both x and y , so $q_1 = f(x, y)$. Similarly, if q_2 is the number of gallons of gas bought to fill gas guzzlers in a year, then $q_2 = g(x, y)$.

- (a) What do you expect the signs of $\partial q_1/\partial x$ and $\partial q_2/\partial y$ to be? Explain.
- (b) What do you expect the signs of $\partial q_1/\partial y$ and $\partial q_2/\partial x$ to be? Explain.

P 34. The cardiac output, represented by c , is the volume of blood flowing through a person's heart per unit time. The systemic vascular resistance (SVR), represented by s , is the resistance to blood flowing through veins and arteries. Let p be a person's blood pressure. Then p is a function of c and s , so $p = f(c, s)$.

- (a) What does $\partial p / \partial c$ represent? Suppose now that $p = kcs$, where k is a constant.
- (b) Sketch the level curves of p . What do they represent? Label your axes.
- (c) For a person with a weak heart, it is desirable to have the heart pumping against less resistance, while maintaining the same blood pressure. Such a person may be given the drug nitroglycerine to decrease the SVR and the drug Dopamine to increase the cardiac output. Represent this on a graph showing level curves. Put a point A on the graph representing the person's state before drugs are given and a point B for after.
- (d) Right after a heart attack, a patient's cardiac output drops, thereby causing the blood pressure to drop. A common mistake made by medical residents is to get the patient's blood pressure back to normal by using drugs to increase the SVR, rather than by increasing the cardiac output. On a graph of the level curves of p , put a point D representing the patient before the heart attack, a point E representing the patient right after the heart attack, and a third point F representing the patient after the resident has given the drugs to increase the SVR.