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Webwork Assignments

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1. Express revenue as a function of two quantity demand-price pairs and quantity, assuming that demand price is a linear function, where the quantity demand-pairs are (0,20) and (101,19) and the quantity is 148.

Ans. Revenue (q) = $20q - \frac{1}{101}q^2$

Revenue (148) = 2743.13

2. The function is $f(x, y) = x^2 + 2xy + y^2$.

P_1= (9,3) and P_2= (3,2)

a. Give the 2 functions of one variable through P_1 obtained by holding each variable constant

Ans.

$f(9, y) = 81 + 18y + 7y^2$

$f(x, 3) = x^2 + 6x + 63$

b. Find the partial derivatives of the original function.

Ans

$f_x(x, y) = 2x + 2y$

$f_y(x, y) = 2x + 14y$

c. Evaluate the partial derivatives at P_1

Ans. $f_x(9,3) = 24$

$f_y(9,3) = 60$

d. Give the equation of the tangent plane through P_1

Ans. $f(3,2) = -6$

3. The function is $f(x,y)=\frac{x+7y}{x^2+y^2}$. P_1= (8,3) and P_2 = (4,9)

a. Give the 2 function of one variable through P_1 obtained by holding each variable constant.

Ans. $f(8,y)=\frac{8+7y}{64+y^2}$

$$f(x,3)=\frac{x+21}{x^2+9}$$

b. Find the partial derivatives at P_1

Ans. $f_x=\frac{(x^2+y^2)-(x+7y)2x}{(x^2+y^2)\text{^}2}$

$$f_y=\frac{(x^2+y^2)7-(x+7y)(2y)}{(x^2+y^2)\text{^}2}$$

c. Evaluate the partial derivatives at P_1

Ans. $f_x(8,3)=\frac{-391}{5329}$

$$f_y(8,3)=\frac{337}{5329}$$

d. Give the equation of the tangent plane through P_1

Ans. $f(x,y)=\frac{-391x}{5329}+\frac{337y}{5329}+\frac{58}{73}$

e. The approximation at P_2 obtained from the tangent line

Ans. $f(4,9)=\frac{5703}{5329}$

4. The function is $(x, y) = x^2(x + 6^y)$. P_1 = (10,-5) , P_2 = (2,5)

a. Give the 2 functions of one variable through P_1 obtained by holding each variable constant.

Ans. $f(10, y) = 100(10 + 6^y)$

$f(x, -5) = x^2(x + 6^{-5})$

b. Find the partial derivatives of the original function.

Ans. $f_x(x, y) = x^2 + 2x(x + 6^y)$

$f_y(x, y) = x^2(6^y logy)$

c. Evaluate the partial derivatives at P_1

Ans . $f_x(10, -5) = \frac{583205}{1944}$

$f_y(10, -5) = \left(\frac{25}{1944}\right) log6$

d. Give the equation of the tangent plane through P_1

Ans. $f(x, y) = \frac{583205x}{1944} + \frac{25ylog6}{1944} - \frac{3888025}{1944}$

e.The approximation at P_2 obtained from the tangent plane.

Ans. $f(2,5) = \frac{250log6 - 2721615}{1944}$

5. Given the function $f(x, y) = x^2 + 2xy + 10y^2 + 3x — 5y$

a. Find the partial derivatives of the original function.

Ans. $f_x(x, y) = 2x + 2y + 3$

$f_y(x, y) = 2x + 20y + 5$

$f_{xx} = 2$

$f_{xy} = 2,\ \ f_{yy} = 20$

b. Find the critical point in the region.

Ans. The point is $(\frac{-25}{18}, \frac{-1}{9})$

c. Compute the discriminant at the critical point.

Ans. The discriminant is 36.

d. Determine if the critical point is a maxima, minima or saddle point.

Ans. Maxima.

6. Given the function $f(x, y) = x^2 + 7xy + 3y^2 + x - 7y$

a. Find the partial derivatives of the original function.

Ans. $f_x(x, y) = 2x + 7y + 1$

$f_y(x, y) = 7x + 6y - 7$

$f_{xx}(x, y) = 2\ ,\ \ f_{xy}(x, y) = 7\ , f_{yy}(x, y) = 6$

b. Find the critical point in the region.

Ans. The point is $(\frac{55}{37}, \frac{-21}{37})$

c. Compute the discriminant at the critical point.

Ans. The discriminant is -37

d. Determine if the critical point is a maxima, minima or saddle point.

Ans. Saddle point.

7. Given the function $f(x, y) = 4xy - 4x^2 + 3y^2 + 9x - 8y$.

a. Find the partial derivatives of the original function.

Ans. $f_x(x, y) = 4y - 8x + 9$

$f_y(x, y) = 4x + 6y - 8$

$f_{xx}(x, y) = -8\,, f_{xy}(x, y) = 4\,, f_{yy}(x, y) = 6$

b. Find the critical point in the region.

Ans. The region is $\left(\frac{43}{32}, \frac{7}{16}\right)$

c. Compute the discriminant at the critical point.

Ans. The discriminant is -64.

d. Determine if the critical point is a maxima, minima or saddle point.

Ans. Saddle point.

8. Based on the information given, classify each of the following points as a local maximum, local minimum, saddle point, not a critical point or not enough information to classify.

Ans.

p	f_x	f_y	f_{xx}	f_{xy}	f_{yy}	Classification
A	0	1	4	1	-5	Not critical
B	0	0	6	5	1	Saddle Point
C	0	0	6	-1	-6	Saddle Point
D	1	0	-1	-3	3	Not Critical
E	0	0	-3	3	15	Saddle Point
F	0	0	1	5	4	Saddle Point
G	0	0	7	-1	4	Local Minimum

9. Given the points:

X	-7	4	13	25
Y	-32	15	49	101

a. Add a linear tradeline. Give the equation of the line.

Ans. $y = 4.1289x - 2.87788$

b. Find the values of slope m and the intercept b.

Ans.

m	4.1289
b	-2.87788

10. Given the points:

x	-1	5	9
y	46	12	-6

a. Plot the points in excel and add a linear tradeline. Give the equation of the line.

Ans. $y = -5.23684x + 40.02632$

b. Find the value of the slope and the y-intercept b that minimizes the error function by taking partial derivatives and setting them equal to 0.

m	-5.23684
b	40.02632