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← MC 113, section A, Spring 2020

14.6 Derivada Direccional y 14.7-14.8 Optimizacion (Homework)

INSTRUCTOR
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Current Score

QUESTION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
POINTS	–/1.5	–/1	–/1	–/1	–/2	–/3	–/1	–/0	–/2	–/2	–/2	–/3.5	–/3	–/0	–/3	–/3	–/2	–/2

TOTAL SCORE

–/37.5 0.0%

Due Date

TUE, MAR 17, 2020
11:59 PM CST

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Assignment Submission & Scoring

Assignment Submission

For this assignment, you submit answers by question parts. The number of submissions remaining for each question part only changes if you submit or change the answer.

Assignment Scoring

Your last submission is used for your score.

1. –/1.5 points **SCALCET8 14.6.007.** My Notes Ask Your Teacher

Consider the following.

$f(x, y) = x/y$, $P(8, 1)$, $\mathbf{u} = \frac{3}{5}\mathbf{i} + \frac{4}{5}\mathbf{j}$

(a) Find the gradient of f.
$\nabla f(x, y) =$

(b) Evaluate the gradient at the point P.
$\nabla f(8, 1) =$

(c) Find the rate of change of f at P in the direction of the vector $\mathbf{u}$.
$D_{\mathbf{u}}f(8, 1) =$

2. –/1 points **SCALCET8 14.6.011.** My Notes Ask Your Teacher

Find the directional derivative of the function at the given point in the direction of the vector $\mathbf{v}$.

$f(x, y) = 3e^x \sin(y)$, $(0, \pi/3)$, $\mathbf{v} = \langle -6, 8\rangle$

$D_{\mathbf{v}}f(0, \pi/3) =$

3. –/1 points **SCALCET8 14.6.004.** My Notes Ask Your Teacher

Find the directional derivative of f at the given point in the direction indicated by the angle θ.

$f(x, y) = xy^3 - x^2$, $(1, 4)$, $\theta = \pi/3$

$D_{\mathbf{u}}f(1, 4) =$

4. –/1 points **SCALCET8 14.6.015.** My Notes Ask Your Teacher

Find the directional derivative of the function at the given point in the direction of the vector $\mathbf{v}$.

$f(x, y, z) = x^2y + y^2z$, $(2, 7, 9)$, $\mathbf{v} = \langle 2, -1, 2\rangle$

$D_{\mathbf{v}}f(2, 7, 9) =$

5. –/2 points **SCALCET8 14.6.023.MI.** My Notes Ask Your Teacher

Find the maximum rate of change of f at the given point and the direction in which it occurs.

$f(x, y) = 7 \sin(xy)$, $(0, 2)$

maximum rate of change

direction vector

6. –/3 points **SCALCET8 14.6.023.MI.SA.** My Notes Ask Your Teacher

This question has several parts that must be completed sequentially. If you skip a part of the question, you will not receive any points for the skipped part, and you will not be able to come back to the skipped part.

Tutorial Exercise
Find the maximum rate of change of f at the given point and the direction in which it occurs.

$f(x, y) = \sin(xy)$, $(2, 0)$

7. –/1 points **SCALCET8 14.6.029.MI.** My Notes Ask Your Teacher

Find all points at which the direction of fastest change of the function $f(x, y) = x^2 + y^2 - 2x - 6y$ is $\mathbf{i} + \mathbf{j}$. (Enter your answer as an equation.)

8. –/0 points **SCALCET8 14.6.035.** My Notes Ask Your Teacher

Let f be a function of two variables that has continuous partial derivatives and consider the points $A(1, 2)$, $B(10, 2)$, $C(1, 5)$, and $D(13, 7)$. The directional derivative of f at A in the direction of the vector $\overline{AB}$ is 8 and the directional derivative at A in the direction of $\overline{AC}$ is 15. Find the directional derivative of f at A in the direction of the vector $\overline{AD}$. (Round your answer to two decimal places.)

9. –/2 points **SCALCET8 14.6.041.** My Notes Ask Your Teacher

Find equations of the following.

$2(x - 6)^2 + (y - 1)^2 + (z - 3)^2 = 10$, $(7, 3, 5)$

(a) the tangent plane

(b) the normal line

$(x(t), y(t), z(t)) = \left(\quad \right)$

10. –/2 points **SCALCET8 14.6.045.** My Notes Ask Your Teacher

Find equations of the tangent plane and the normal line to the given surface at the specified point.

$x + y + z = 7e^{xyz}$, $(0, 0, 7)$

(a) the tangent plane

(b) the normal line

$(x(t), y(t), z(t)) = \left(\quad \right)$

11. –/2 points SCALCET8 14.6.523.XP. My Notes Ask Your Teacher

Find equations of the following.

$yz = 5\ln(x + z)$, $(0, 0, 1)$

(a) the tangent plane

(b) parametric equations of the normal line to the given surface at the specified point. (Enter your answer as a comma-separated list of equations. Let x, y, and z be in terms of t.)

12. –/3.5 points WAS SCALCET8 14.6.AE.008. My Notes Ask Your Teacher

Video Example

EXAMPLE 8 Find the equations of the tangent plane and normal line at the point $(-2, 1, -5)$ to the ellipsoid

$$\frac{x^2}{4} + y^2 + \frac{z^2}{25} = 3.$$

SOLUTION The ellipsoid is the level surface (with $k = 3$) of the function

$$F(x, y, z) = \frac{x^2}{4} + y^2 + \frac{z^2}{25}.$$

Therefore, we have

$F_x(x, y, z) =$

$F_y(x, y, z) = 2y$

$F_z(x, y, z) =$

$F_x(-2, 1, -5) =$

$F_y(-2, 1, -5) = 2$

$F_z(-2, 1, -5) =$.

Then this theorem gives the equation of the tangent plane at $(-2, 1, -5)$ as

$$-1(x + 2) + 2(y - 1) - \left(\square\right)(z + 5) = 0$$

$5x -$

which simplifies to $+ 2z + 30 = 0$. By this theorem, symmetric equations of the normal line are

$$\frac{x+2}{-1} = \frac{y-1}{2} =$$

.

13. –/3 points SCALCET8 14.7.006. My Notes Ask Your Teacher

Find the local maximum and minimum values and saddle point(s) of the function. If you have three-dimensional graphing software, graph the function with a domain and viewpoint that reveal all the important aspects of the function. (Enter your answers as a comma-separated list. If an answer does not exist, enter DNE.)

$f(x, y) = xy - 3x - 3y - x^2 - y^2$

local maximum value(s)

local minimum value(s)

saddle point(s) $(x, y, f) =$

14. –/0 points SCALCET8 14.7.014. My Notes Ask Your Teacher

Find the local maximum and minimum values and saddle point(s) of the function. If you have three-dimensional graphing software, graph the function with a domain and viewpoint that reveal all the important aspects of the function. (Enter your answers as a comma-separated list. If an answer does not exist, enter DNE.)

$f(x, y) = 4y\cos(x)$, $0 \le x \le 2\pi$

local maximum value(s)

local minimum value(s)

saddle point(s) $(x, y, f) =$

15. –/3 points SCALCET8 14.7.504.XP. My Notes Ask Your Teacher

Find the local maximum and minimum values and saddle point(s) of the function. If you have three-dimensional graphing software, graph the function with a domain and viewpoint that reveal all the important aspects of the function. (Enter your answers as a comma-separated list. If an answer does not exist, enter DNE.)

$f(x, y) = 9e^y(y^2 - x^2)$

local maximum value(s)

local minimum value(s)

saddle point(s) $(x, y, f) =$

16. –/3 points SCALCET8 14.7.025. My Notes Ask Your Teacher

Use a graph or level curves or both to find the local maximum and minimum values and saddle points of the function. Then use calculus to find these values precisely. (Enter your answers as a comma-separated list. If an answer does not exist, enter DNE.)

$f(x, y) = \sin(x) + \sin(y) + \sin(x + y) + 5$, $0 \le x \le 2\pi$, $0 \le y \le 2\pi$

local maximum value(s)

local minimum value(s)

saddle point(s) $(x, y, f) =$

17. –/2 points SCALCET8 14.8.003. My Notes Ask Your Teacher

This extreme value problem has a solution with both a maximum value and a minimum value. Use Lagrange multipliers to find the extreme values of the function subject to the given constraint.

$f(x, y) = x^2 - y^2; \quad x^2 + y^2 = 49$

maximum value

minimum value

18. –/2 points SCALCET8 14.8.013. My Notes Ask Your Teacher

This extreme value problem has a solution with both a maximum value and a minimum value. Use Lagrange multipliers to find the extreme values of the function subject to the given constraint.

$f(x, y, z, t) = x + y + z + t; \quad x^2 + y^2 + z^2 + t^2 = 9$

maximum value

minimum value

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19. –/3.5 points SCALCET8 14.8.029. My Notes Ask Your Teacher

Use Lagrange multipliers to prove that the rectangle with maximum area that has a given perimeter p is a square.

Let the sides of the rectangle be x and y and let f and g represent the area (A) and perimeter (p), respectively. Find the following.

$A = f(x, y) =$

$p = g(x, y) =$

$\nabla f(x, y) =$

$\lambda \nabla g =$

$\lambda = \frac{1}{2}y =$

Then implies that $x =$

.

Therefore, the rectangle with maximum area is a square with side length

.

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20. –/0 points SCALCET8 14.8.019. My Notes Ask Your Teacher

Find the extreme values of f subject to both constraints. (If an answer does not exist, enter DNE.)

$f(x, y, z) = yz + xy; \quad xy = 1, \quad y^2 + z^2 = 81$

maximum

minimum

21. –/1 points SCALCET8 14.8.038. My Notes Ask Your Teacher

Use Lagrange multipliers to find the dimensions of the box with volume 216 cm^3 that has minimal surface area. (Enter the dimensions (in centimeters) as a comma separated list.)

22. –/0 points SCALCET8 14.8.506.XP.MI. My Notes Ask Your Teacher

Find the extreme values of f subject to both constraints. (If an answer does not exist, enter DNE.)

$f(x, y, z) = x + 2y; \quad x + y + z = 1, \quad y^2 + z^2 = 4$

maximum

minimum

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