Web**Assign**

Hw 15 (14.6): Directional Der. and Grad. Vector (Homework)

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Current Score: 20 / 20 **Due:** Tuesday, September 25 2012 11:00 PM EDT

1. 2.85/2.85 points | Previous Answers

SCalcET7 14.6.021.

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

$$f(x, y) = 4y\sqrt{x}, \quad (4, 1)$$

maximum rate of change

direction vector

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2. 2.85/2.85 points | Previous Answers

SCalcET7 14.6.023.MI.

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

$$f(x, y) = 3 \sin(xy), (0, 7)$$

maximum rate of change

direction vector

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3. 2.85/2.85 points | Previous Answers

SCalcET7 14.6.025.

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

$$f(x, y, z) = \sqrt{x^2 + y^2 + z^2},$$
 (9, 2, -9)

maximum rate of change



direction vector



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4. 2.85/2.85 points | Previous Answers

SCalcET7 14.6.027.

(a) Show that a differentiable function f decreases most rapidly at \mathbf{x} in the direction opposite the gradient vector, that is, in the direction of $-\nabla f(\mathbf{x})$.

Let θ be the angle between $\nabla f(\mathbf{x})$ and unit vector \mathbf{u} . Then $D_{\mathbf{u}}f = |\nabla f|\cos\theta$. Since the minimum value of $\cos\theta$ is -1 occurring, for $0 \le \theta < 2\pi$, when $\theta =$



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, the minimum value of $D_{\bf u}f$ is $-|\nabla f|$, occurring when the direction of $\bf u$ is the opposite of $\bf v$ the direction of $\bf v$ (assuming $\bf v$ is not zero).

(b) Use the result of part (a) to find the direction in which the function $f(x, y) = x^4y - x^2y^4$ decreases fastest at the point (4, -5).



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5. 2.85/2.85 points | Previous Answers

SCalcET7 14.6.029.MI.

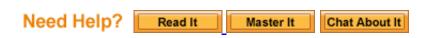
Find all points at which the direction of fastest change of the function $f(x, y) = x^2 + y^2 - 4x - 8y$ is $\mathbf{i} + \mathbf{j}$. (Enter your answer as an equation.)



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6. 2.85/2.85 points | Previous Answers

SCalcET7 14.6.031.

The temperature T in a metal ball is inversely proportional to the distance from the center of the ball, which we take to be the origin. The temperature at the point (1, 2, 2) is 130° .

(a) Find the rate of change of T at (1, 2, 2) in the direction toward the point (4, 3, 5).



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(b) Show that at any point in the ball the direction of greatest increase in temperature is given by a vector that points towards the origin.

The gradient of T is in a direction of -<x, y, z>, which always towards the origin. So, the gradient of T must always towards the origin as well.

Score: 1.43 out of 1.43

Comment:



7. 2.9/2.9 points | Previous Answers

SCalcET7 14.6.033.

Suppose that over a certain region of space the electrical potential V is given by the following equation.

$$V(x, y, z) = 3x^2 - 5xy + xyz$$

(a) Find the rate of change of the potential at P(3, 2, 7) in the direction of the vector $\mathbf{v} = \mathbf{i} + \mathbf{j} - \mathbf{k}$.



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(b) In which direction does V change most rapidly at P?



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(c) What is the maximum rate of change at P?



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