

Warm-up: Imagine you are standing on the side of a tall hill. List three things you would want to know about your position.

On your Mark: Place your surface on the grid. Label the x and y directions on the grid and surface. Measure the slope *in the direction of greatest increase* of the surface at the blue dot. Include units.

Slope in steepest direction: _____

Get Set: The surface's height h is a function of x and y , giving $h = h(x, y)$. At the blue dot, measure both $\frac{\partial h}{\partial x}$ and $\frac{\partial h}{\partial y}$. Then form the vector $\frac{\partial h}{\partial x} \hat{\mathbf{x}} + \frac{\partial h}{\partial y} \hat{\mathbf{y}}$. Include units.

$$\frac{\partial h}{\partial x} = \underline{\hspace{2cm}} \quad \frac{\partial h}{\partial y} = \underline{\hspace{2cm}} \quad \frac{\partial h}{\partial x} \hat{\mathbf{x}} + \frac{\partial h}{\partial y} \hat{\mathbf{y}} = \underline{\hspace{2cm}} \hat{\mathbf{x}} + \underline{\hspace{2cm}} \hat{\mathbf{y}}$$

Go: At the blue dot, which way does your vector $\frac{\partial h}{\partial x} \hat{\mathbf{x}} + \frac{\partial h}{\partial y} \hat{\mathbf{y}}$ point on the surface?

1. What is your vector's magnitude?
2. How does your vector relate to the level curve through the blue dot?

Challenge: Rotate the surface 30° on the grid and redraw the x and y directions on your surface. Which of your answers to **On your Mark**, **Get Set**, and **Go** remain the same?