

**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:** The surface represents the hill's height  $h$ . If  $x$  and  $y$  (and  $h$ ) are measured in feet, measure the *steepest* slope possible at the blue dot. Include units.

Steepest slope: \_\_\_\_\_

**Get Set:** Measure  $\frac{\partial h}{\partial x}$  and  $\frac{\partial h}{\partial y}$  at the blue dot. Then form the vector  $\frac{\partial h}{\partial x} \hat{\mathbf{x}} + \frac{\partial h}{\partial y} \hat{\mathbf{y}}$ . Include units.

$$\frac{\partial h}{\partial x} = \text{_____} \quad \frac{\partial h}{\partial y} = \text{_____} \quad \frac{\partial h}{\partial x} \hat{\mathbf{x}} + \frac{\partial h}{\partial y} \hat{\mathbf{y}} = \text{_____} \hat{\mathbf{x}} + \text{_____} \hat{\mathbf{y}}$$

**Go:** Find the magnitude of  $\frac{\partial h}{\partial x} \hat{\mathbf{x}} + \frac{\partial h}{\partial y} \hat{\mathbf{y}}$ .

**Challenge:** Rotate the surface some amount on the grid. Redraw the  $x$  and  $y$  directions extending through the blue dot, and redo **On your Mark**, **Get Set**, and **Go**. Did anything change? Stay the same? Why?