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2. Practice Exam

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1

1/1 point (ungraded)

Suppose that $f(x,y) = xy + y^3$. At the moment, $x = 2$ and $y = 1$. We can either increase x by 0.04 or increase y by 0.01. We would like to make f as large as we can. Which of the two options makes f bigger?

- increase x by 0.04
- **increase y by 0.01** ✔
- they both change f by the same amount

Solution:

Computing the partial derivatives of $f(x,y)$ at $(2,1)$ gives

$$\begin{aligned} f_x = y &\implies f_x(2,1) = 1, \\ f_y = x + 3y^2 &\implies f_y(2,1) = 5. \end{aligned}$$

This means:

1. Increasing x by 0.04 changes f by about $f_x(2,1) \cdot \Delta x = (1)(0.04) = 0.04$.
2. Increasing y by 0.01 changes f by about $f_y(2,1) \cdot \Delta x = (5)(0.01) = 0.05$.

Therefore the $\boxed{\textbf{second option}}$ makes f bigger.

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Answers are displayed within the problem

2

1/1 point (ungraded)

Suppose that the height above sea-level at the point (x,y) is $h(x,y)$. At every point, a hiker going in the positive y direction is going downhill. Which one of the following functions could be the function $h(x,y)$?

- [x] $x^3 - x^2y - y$
- [ ] $x^3 - x^2y + y$
- [ ] $x^3 + x^2y + y$
- [ ] None of the above

✔

Solution:

We are given that any hiker going in the positive y-direction is going downhill; that is, f decreases when y increases along the hiker's path. Therefore, $f_y(x,y) < 0$. Computing f_y for each of the three options gives

- $f_y = -x^2 - 1$,

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- $f_y = -x^2 + 1$,
- $f_y = x^2 + 1$.

The first option is the only one for which f_y is always negative.

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Answers are displayed within the problem

2. Practice Exam

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(Staff) A typo in the solution 2
"is going hill" - not "downhill"? 2

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