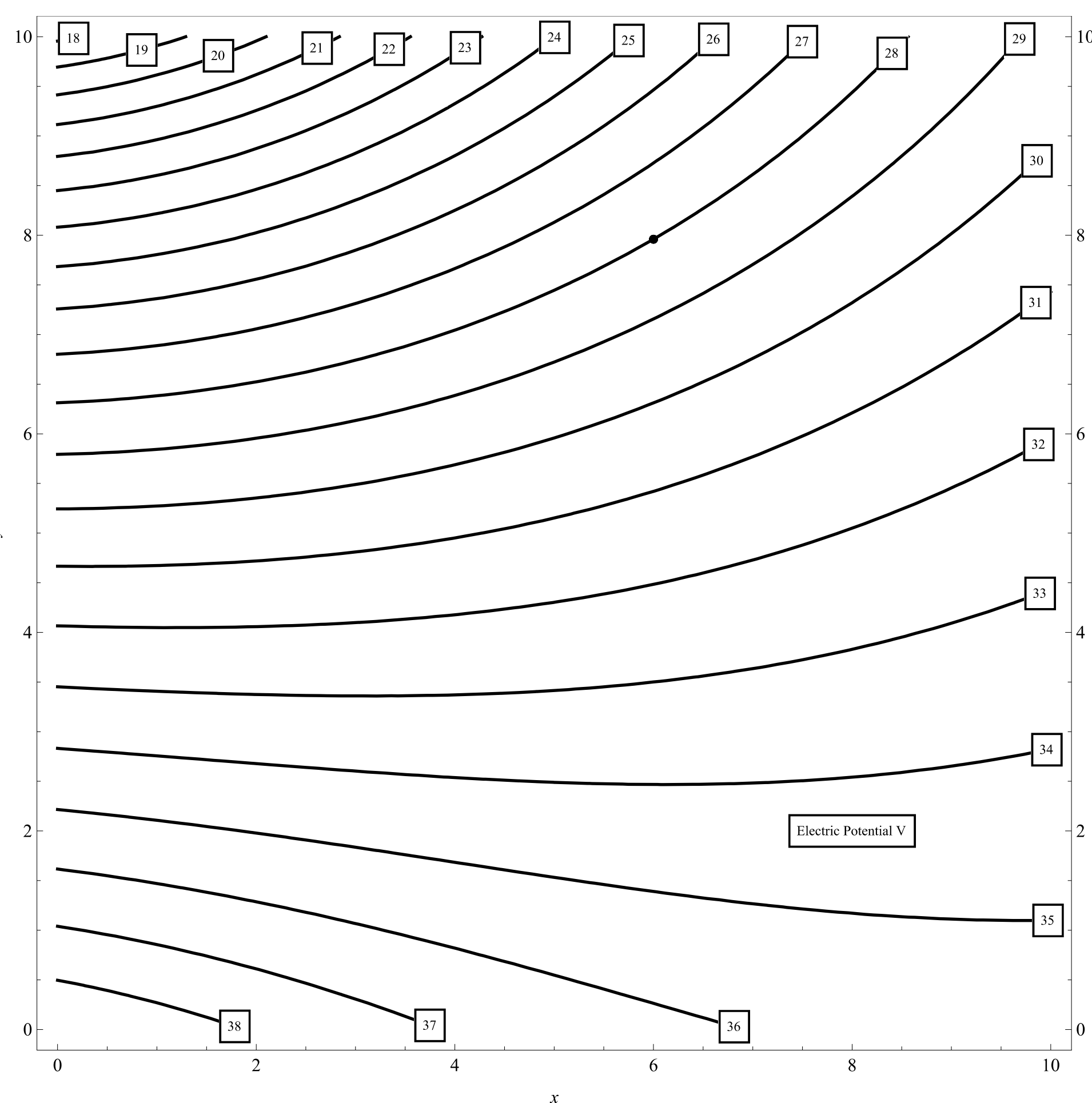


Students find and interpret derivatives from an equipotential graph by adding and accessing representational features.

Interview Question

This graph shows an electric potential V . Determine the derivative of V w.r.t. y at the indicated point.



Methodology

Semi-structured interviews with 7 students after instruction that was

- interactive
- used ratios of changes
- focused on representations, including contour graphs and surfaces

Finding Derivatives from an Equipotential Graph

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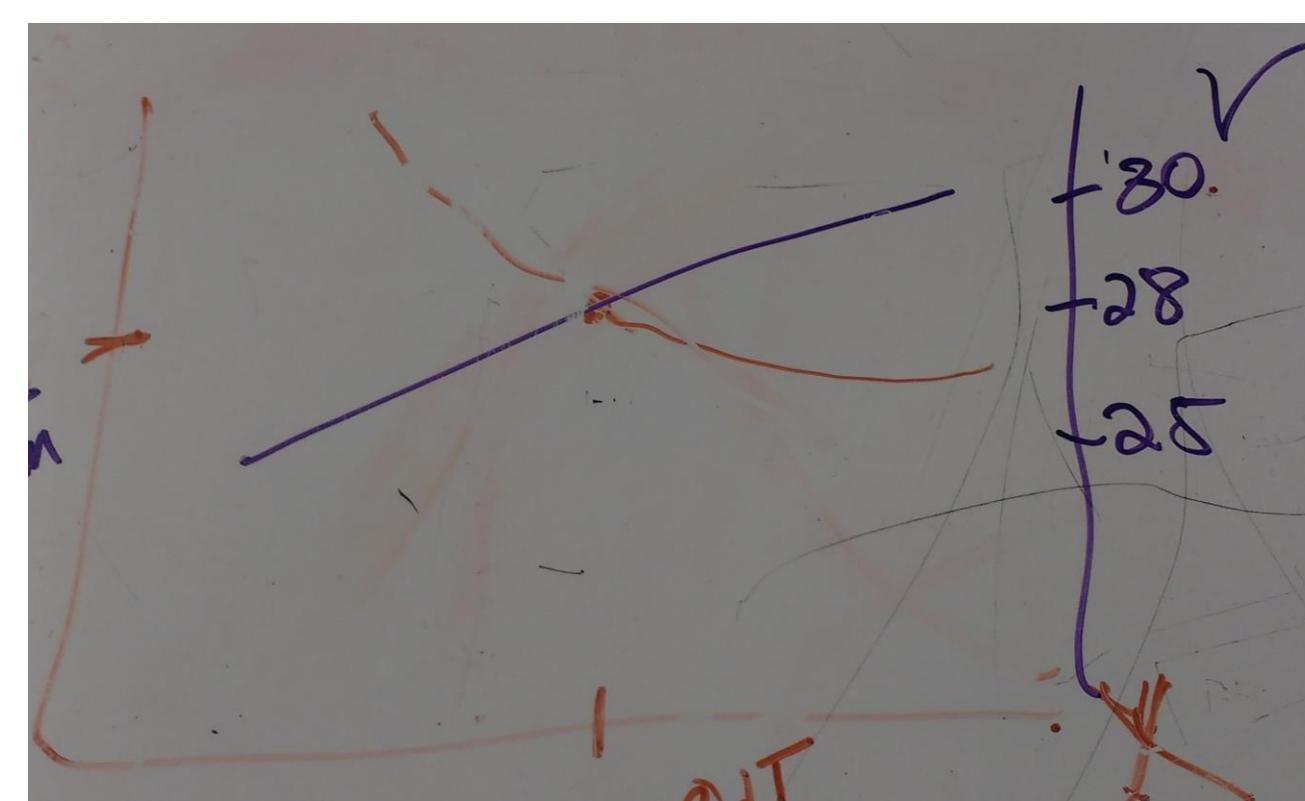
Orienting to the graph of V

Alex: “These lines [the contours] are supposed to represent a two-dimensional V .”

Pat: “[The derivative is] how much the graph is changing in just the y -direction.”

Reflecting on the derivative

Alex gestured and drew a cross-section of V vs. y (in purple, below left).



Drew used the plastic surface (above right) to interpret that the derivative “would be the slope of a tangent line on the surface there.”

Finding the derivative

All students used a ratio of changes:

- choose 2 points on the graph
- most students drew a vertical line or arrow to help choose points
- find $\Delta V/\Delta y$
- all students wrote $\frac{dV}{dy}$ or $\frac{\partial V}{\partial y}$

Three students chose points along a contour or tried to use a gradient before using a ratio of small changes.

Implications

- Our students were able to find a derivative from an equipotential graph
- They had powerful graphical reasoning skills for sensemaking
- No students used thermodynamics

subscript notation: $\left(\frac{\partial V}{\partial y}\right)_x$

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Find the paper at:

<https://osuper.science.oregonstate.edu/content/finding-derivatives-equipotential-graph-o>

Find related activities at:

<https://paradigms.oregonstate.edu/sequences/26/>

