

**Estimating greatest rate of change**

The accompanying plot shows level curves for a function  $f : \mathbb{R}^2 \rightarrow \mathbb{R}$ . We can think of each input as a point on a plane and the corresponding output as a temperature. We will consider distance to be measured in kilometers (km) and temperature to be measured in degrees Celsius ( $^{\circ}\text{C}$ ). There is a scale for distance at the bottom of the plot. A selection of level curves is labeled with the corresponding temperature.

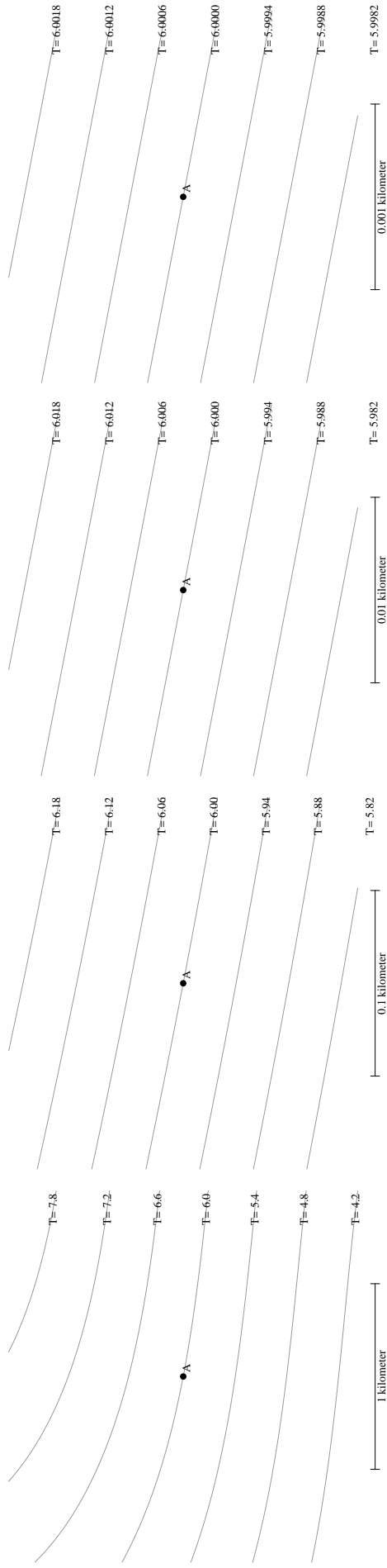
1. For the point  $A$ , estimate the direction of the greatest rate of change in temperature with respect to change in position.
2. For the point  $A$ , estimate the magnitude of this greatest rate of change.
3. Choose a scale for rate of change. Note that this scale is independent of the scale for distance. With the temperature interpretation, rate of change has units of degrees Celsius per kilometer ( $^{\circ}\text{C}/\text{km}$ ) while the length scale is in kilometers (km). To choose a scale for rate of change, go to the bottom of the plot next to the given length scale and draw a horizontal vector (of any size you want) to represent a magnitude of  $1^{\circ}\text{C}/\text{km}$ . You will use this choice in what follows.
4. At the point  $A$ , draw a vector in the direction of the greatest rate of change having magnitude equal to that rate of change. Use the rate of change scale you chose in #3.
5. For the point  $B$ , estimate the direction of the greatest rate of change in temperature with respect to changes in position.
6. For the point  $B$ , estimate the magnitude of this greatest rate of change.
7. At the point  $B$ , draw a vector in the direction of the greatest rate of change having magnitude equal to that rate of change. Use the rate of change scale you chose in #3.



distance between ticks represents 1 kilometer

Level curves for temperature as a function of position.

### Zooming in on Point A



### Zooming in on Point B

