# Calculus with a Direction

While working in a group make sure you:

- Expect to make mistakes but be sure to reflect/learn from them!
- Are civil and are aware of your impact on others.
- Assume and engage with the strongest argument while assuming best intent.

1. The contour map shows the average maximum temperature for Nov 2004 (in Celsius).

    (a) Estimate the value of the directional derivative of the temperature function at Dubbo in the direction of Sydney.

    (b) What are the units of the directional derivative you estimated above?
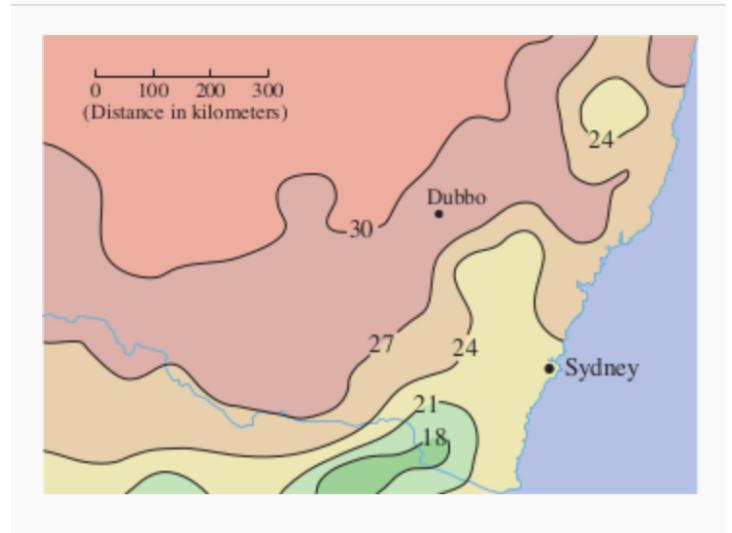
2. Let $f(x, y) = \sin(x - y) + e^{xy}$

    (a) Find ∇f

    (b) Find $D_{\vec{u}} f(-4, 2)$ where $\vec{u} = \vec{i} + \vec{j}$

    (c) Find $D_{\vec{u}} f(-4, 2)$ where $\vec{u} = \langle 1, -1, 0 \rangle$

3. Consider the surface defined by $z = \sin(x - y) + e^{xy}$

   (a) Rewrite the equation above so we have a function of 3 variables equal to a constant.

   (b) Find the equation of the plane tangent to the surface at $(-4, 2, \sin(-4-2)+e^{-4*2})$.