Tangents & Approximations

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.

Recall any of the following could be used to Recall any of the following could be used to describe a line in \mathbb{R}^2 :

•
$$y = mx + b$$

•
$$ax + by = c$$

•
$$y - y_1 = m(x - x_1)$$
.

- 1. Let $f(x) = 2x^2$.
 - (a) Find the line tangent to f when x = 1.
- describe a plane in \mathbb{R}^3 :
 - $\overrightarrow{n} \cdot (\langle x, y, z \rangle \langle x_1, y_1, z_1 \rangle) = 0$
 - ax + by + cz = d
 - $z z_1 = m_x(x x_1) + m_y(y y_1)$.
 - 1. Let $f(x, y) = 2x^2 + y^2$.
 - (a) Find the plane tangent to the graph of f when x = 1 and y = 1.

- (b) Find the local linearization of fwhen x = 1.
- (c) Use the linearization of f at (1, 2)to approximate f(1.1).
- (d) How good is the approximation above? That is, what is the difference between your approximation above, and the actual value f(1.1).

- (b) Find the local linearization of fwhen x = 1 and y = 1.
- (c) Use the linearization of f at (1, 1, 3) to approximate f(1.1, 1.1).
- (d) How good is the approximation above? That is, what is the difference between your approximation above, and the actual value f(1.1, 1.1).



- 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 $D_{\overrightarrow{u}}f(-4,2)$ where $\overrightarrow{u} = \overrightarrow{i} + \overrightarrow{j}$
- (c) Find $D_{\overrightarrow{u}}f(-4,2)$ where $\overrightarrow{u} = \langle 1, -1 \rangle$