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 describe a line in $\mathbb{R}^2$:

- $y = mx + b$
- $ax + by = c$
- $y - y_1 = m(x - x_1)$.

1. Find the line tangent to the graph of $f(x) = 2x^2$ when x=1.

2. Find the local linearization of f when $x = 1$.

3. Use the linearization of f at $(1, 2)$ to approximate $f(1.1)$.

4. How good is the approximation above? That is, what is the difference between your approximation above, and the actual value $f(1.1)$.

Recall any of the following could be used to describe a plane in $\mathbb{R}^3$:

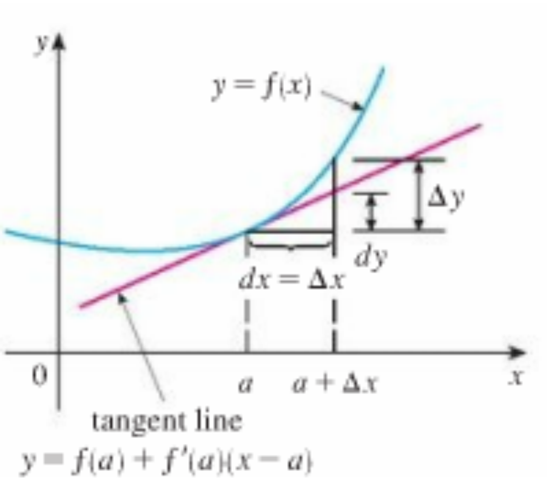
- $\overrightarrow{n} \cdot (\langle x, y, z\rangle - \langle x_1, y_1, z_1\rangle) = 0$
- $ax + by + cz = d$
- $z - z_1 = m_x(x - x_1) + m_y(y - y_1)$.

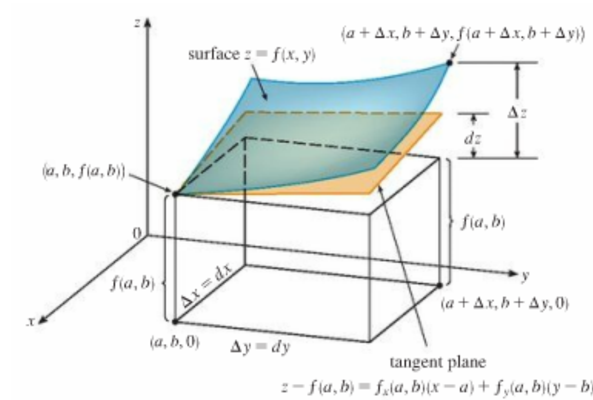
1. Find the plane tangent to the graph of $f(x, y) = 2x^2 + y^2$ when $x = 1$ and $y = 1$.

2. Find the local linearization of f when $x = 1$ and $y = 1$.

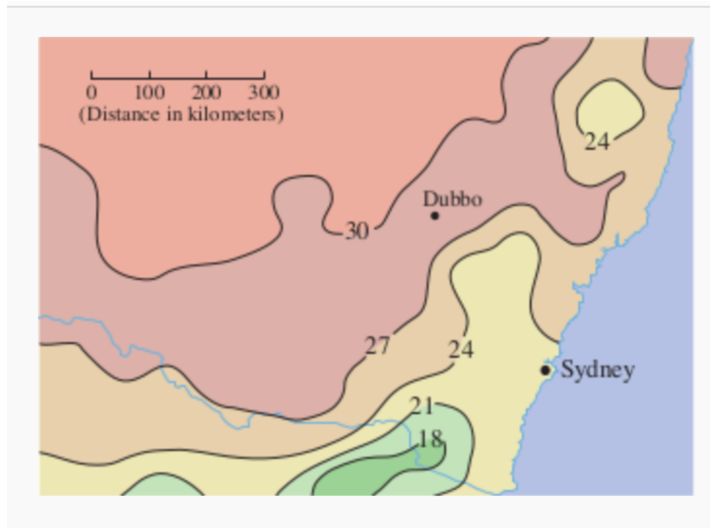
3. Use the linearization of f at $(1, 1, 3)$ to approximate $f(1.1, 1.1)$.

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

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