(1) (M&T, # 2.1.10) Describe the behavior, as c varies, of the level curves $f(x,y) = c$ for each of these functions
- $f(x,y) = x^2 + y^2 + 1$,
- $f(x,y) = 1 - x^2 - y^2$,
- $f(x,y) = x^3 - x$.

(2) (M&T, # 2.3.1) Find $\partial f/\partial x$, $\partial f/\partial y$ if
- $f(x,y) = xy$
- $f(x,y) = e^{xy}$
- $f(x,y) = x \cos x \cos y$
- $f(x,y) = (x^2 + y^2) \log(x^2 + y^2)$.

(3) (M&T, # 2.5.10) Suppose that the temperature at the point (x,y,z) in space is $T(x,y,z) = x^2 + y^2 + z^2$. Let a particle follow the helix $\vec{r}(t) = (\cos t, \sin t, t)$ and let $T(t)$ be its temperature at time t.
- What is $T'(t)$?
- Find an approximate value for the temperature at $t = \frac{\pi}{2} + 0.01$.

(4) (M&T, # 2.5.18, modified) Compute the directional derivative of f in the given directions $\vec{v}$ at the given points P.
- $f(x,y,z) = xy^2 + y^2z^3 + z^3x$, $P = (4,-2,1)$, $\vec{v} = \frac{1}{\sqrt{14}}(\vec{i} + 3\vec{j} + 2\vec{k})$
- $f(x,y,z) = e^{-z}\sin(x)\sin(y)$, $P = (\pi, \frac{\pi}{2}, 0)$, $\vec{v} = \frac{12}{13}\vec{i} + \frac{3}{13}\vec{j} + \frac{4}{13}\vec{k}$.

(5) (M&T, # 2.5.28) In electrostatics, the force $\vec{P}$ of attraction between two particles of opposite charge is given by $\vec{P} = k\frac{\vec{r}}{\|\vec{r}\|^3}$ (Coulomb's law), where k is a constant and $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$. Show that $\vec{P}$ is the gradient of $f = -\frac{k}{\|\vec{r}\|}$.