exercise 1:

Set $f(x,y) = xe^y$.
(i). Find the differential at f at (x,y).
(ii). Approximate $f(1.05, 2.1)$ using the linear approximation to f at $(1,2)$.

exercise 2:

Given $w = 4x + y^2 + z^3$, $x = e^{rs^2}$, $y = \ln \frac{r+s}{t}$, $z = rst^2$, use the multivariate chain rule to find $\frac{\partial w}{\partial t}$.

exercise 3:

Let $f : \mathbb{R}^2 \to \mathbb{R}$ be such that for some n in $\mathbb{N}$ all t in $\mathbb{R}$, $f(tx, ty) = t^n f(x,y)$. Assume that the differentiel of f exists for all (x,y) in $\mathbb{R}^2$. Show that

$$x\frac{\partial f}{\partial x}(x,y) + y\frac{\partial f}{\partial y}(x,y) = nf(x,y),$$

for all (x,y) in $\mathbb{R}^2$. Hint: take a t derivative then set $t = 1$.

exercise 4:

Exercise 3.13.

exercise 5:

Exercise 4.2.

exercise 6:

Exercise 4.10.

exercise 7:

The following curves are given using equations in polar coordinates. In each case, indicate what this curve is.
(i). $r = 2$.
(ii). $\theta = \alpha$.
(iii). $r = \frac{\sin\theta}{\cos^2\theta}$, where $0 < \theta < \frac{\pi}{2}$.

exercise 8:

Let $f(x,y) = \exp(\frac{x}{x^2+y^2})$.

(i). Sketch the vectors e_r, e_θ and write $f(x, y)$ as a function of r and θ.
(ii). Compute the gradient of f in polar coordinates.