Textbook problems
https://openstax.org/books/calculus-volume-3/pages/4-4-tangent-planes-and-linear-approximations
https://openstax.org/books/calculus-volume-3/pages/4-7-maxima-minima-problems
exercise 1: 191. Hint: discuss the continuity of partial derivatives near the point of interest.
exercise 2: 192
exercise 3: 195
exercise 4: 344

Textbook problems
https://openstax.org/books/calculus-volume-3/pages/4-5-the-chain-rule
https://openstax.org/books/calculus-volume-3/pages/4-6-directional-derivatives-and-the-gradient
exercise 5: 215, 216, 219: in each case first find the differential of the function of several variables and then apply the multidimensional chain rule.
exercise 6: 260, 265
exercise 7: 295, 298

exercise 8:
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 9:
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.

Textbook problems
https://openstax.org/books/calculus-volume-3/pages/4-6-directional-derivatives-and-the-gradient
exercise 10: 303, 305

Textbook problems
https://openstax.org/books/calculus-volume-3/pages/4-7-maxima-minima-problems
exercise 11: 318, 341