Automatic Differentiation Exercise

1. **Partial Derivatives**

    (a) Determine, by hand, the partial derivatives of the function:

    $$f(x, y) = e^x(x^2 + y^2)^3$$

    $$\frac{\partial f}{\partial x} =$$

    $$\frac{\partial f}{\partial y} =$$

    (b) Use the formulas from from (a) to determine the following values:

    - $f(0, 2) =$

    - $\dfrac{\partial f(0, 2)}{\partial x} =$

    - $\dfrac{\partial f(0, 2)}{\partial y} =$

2. **Backwards Differentiation**

   Draw a computation graph for the function from (a) above. Show all intermediate values for both the forward and backward pass with $x = 0, y = 2$. You should be able to check your answers against the values you calculated in part (b).

3. **Scalarflow**

   (a) Download the starter code for PA3.

   (b) Create a file named `autodiff_exercise.py`. In that file, create a scalarflow network corresponding to the formula from Question 1.

   (c) Use the `gen_dot` method to generate a dot file corresponding to the graph you drew in Question 2. Use a web-based dot file viewer (for example, `https://dreampuf.github.io/GraphvizOnline/`) to render your dot file as an image. Upload the result to Canvas.