Homework 4

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> **❗ Important**
>
> Please read the instructions carefully before submitting your assignment.
>
> 1. This assignment requires you to only upload a `PDF` file on Canvas
> 2. Don't collapse any code cells before submitting.
> 3. Remember to make sure all your code output is rendered properly before uploading your submission.
>
> Please add your name to the author information in the frontmatter before submitting your assignment

We will be using the following libraries:

```r
packages <- c(
  "dplyr",
  "readr",
  "tidyr",
  "purrr",
  "stringr",
  "corrplot",
  "car",
  "caret",
  "torch",
  "nnet",
  "broom"
)
```

```r
# renv::install(packages)
sapply(packages, require, character.only=T)
```

Loading required package: dplyr

Attaching package: 'dplyr'

The following objects are masked from 'package:stats':

    filter, lag

The following objects are masked from 'package:base':

    intersect, setdiff, setequal, union

Loading required package: readr

Loading required package: tidyr

Loading required package: purrr

Loading required package: stringr

Loading required package: corrplot

corrplot 0.92 loaded

Loading required package: car

Loading required package: carData

Attaching package: 'car'

The following object is masked from 'package:purrr':

    some

```
The following object is masked from 'package:dplyr':

    recode

Loading required package: caret

Warning: package 'caret' was built under R version 4.3.3

Loading required package: ggplot2

Loading required package: lattice


Attaching package: 'caret'

The following object is masked from 'package:purrr':

    lift

Loading required package: torch

Warning: package 'torch' was built under R version 4.3.3

Loading required package: nnet

Loading required package: broom

   dplyr    readr    tidyr    purrr  stringr corrplot      car    caret
    TRUE     TRUE     TRUE     TRUE     TRUE     TRUE     TRUE     TRUE
   torch     nnet    broom
    TRUE     TRUE     TRUE
```

Question 1

1.1 (5 points)

```
library(pracma)
```

```
Warning: package 'pracma' was built under R version 4.3.3
```

```
Attaching package: 'pracma'
```

```
The following object is masked from 'package:car':
```

```
    logit
```

```
The following object is masked from 'package:purrr':
```

```
    cross
```

Consider $g(x, y)$ given by

$$g(x, y) = (x - 3)^2 + (y - 4)^2.$$

Using elementary calculus derive the expressions for

$$\frac{d}{dx}g(x, y), \quad \text{and} \quad \frac{d}{dy}g(x, y).$$

d/dx(g(x,y)) = 2x-6 d/dy(g(x,y)) = 2y-8

Using your answer from above, what is the answer to

$$\frac{d}{dx}g(x, y)\bigg|_{(x=3, y=4)} \quad \text{and} \quad \frac{d}{dy}g(x, y)\bigg|_{(x=3, y=4)} \quad ?$$

d/dx(g(x=3,y=4)) = 2·3-6 = 0 d/dy(g(x=3,y=4)) = 2·4-8 = 0

Define $g(x, y)$ as a function in R, compute the gradient of $g(x, y)$ with respect to $x = 3$ and $y = 4$. Does the answer match what you expected?