

## Tutorial Exercises Week 6

### Question 1

Write an R function that calculates  $f(x)$  in the equation below:

$$f(x) = \frac{e^x}{1 + e^x}$$

- What is  $f(-2)$ ?
- What is  $f(0)$ ?
- What is  $f(2)$ ?

In each case provide your answer rounded to 4 decimal places.

### Question 2

Plot the function

$$f(x) = x^3 - 12x^2$$

in the interval  $[-6, 13]$ .

At what values of  $x$  are the extreme points of this function? Both extreme points are integers (whole numbers).

*Hint:* Add the layers `theme_minimal() + scale_x_continuous(breaks = -6:13)` to add more line vertical breaks to help see where the extreme points are.

### Question 3

Use R to find the minimum of the following function:

$$f(x) = x^2 - 3x - 12$$

- What is the minimizing value of  $x$ ?
- What value does the function achieve at its minimum?

### Question 4

Use R to find the maximum of the following function:

$$f(x) = 100 + 2x - x^2$$

What value of  $x$  maximizes this function?

### Question 5

Create a function in R with two arguments  $x$  and  $z$  which does the following:

$$f(x, z) = \begin{cases} x + z & \text{if } x > z \\ x - z & \text{if } x = z \\ xz & \text{if } x < z \end{cases}$$

What is the value of the function at the following values:

- $x = 2$  and  $z = 3$ .
- $x = 2$  and  $z = 2$ .
- $x = 3$  and  $z = 2$ .

### Question 6

Download and read in the file [rotterdam-airbnb.csv](#).

Using the data create a factor variable called `n_beds` according to:

- "1" if bedrooms = 1.
- "2" if bedrooms = 2.
- "3+" if bedrooms > 2.

Create a bar plot of the variable `n_beds`. Which describes the shape of the bar plot?

- Most listings have 1 bedroom. Listings with 3+ bedrooms are relatively rare.
- Most listings have 3+ bedrooms. Listings with 1 bedroom are relatively rare.
- Most listings have 2 bedrooms. Listings with 1 bedroom are relatively rare.

### Question 7

Using the same dataset as the previous question, create a factor variable called `affordability` which takes the following values:

- "Cheap" if the price is below 120

- "Expensive" if the price is above 250.
- "Affordable" otherwise (between 120-250).

Set the levels of the factor to go "Cheap", then "Affordable", then "Expensive".

Create a bar plot of the variable `n_beds` from the previous question with colors filling the bars that represent the affordability.

Which category of `n_beds` contains the most listings labelled as "Expensive"?

- 1
- 2
- 3+