STAT40730
Data Programming with R (Online).
Lab 7: Basic mathematics and statistics in R

1. Use `R` to differentiate the following functions with respect to x:
   (a) $x^2 \sin(x)$
   (b) a^x
   (c) $x + \sin(x) - \log(x)\exp(x) + 7$
2. Use the `curve` and `eval` functions to create plots of these curves and their derivatives. Consider $x \in [0, 10]$ and set $a = 0.5$.
3. Use the `integrate` function to find the following. You should be able to compare the values you get with, e.g. `pnorm(2)` for part (a).
   (a) Integrate `dnorm` to find $P(X \leq 2)$ when $X \sim N(0, 1)$.
   (b) Integrate `dt` to find $P(X > -1)$ when $X \sim t_5$.
4. Use the order function to help you find the following for the birth weight data:
   (a) What were the mother's weights (variable `lwt`) for the youngest 3 mothers?
   (b) What age was the mother of the heaviest child?
5. Solve the simultaneous equations:

$$\begin{aligned} 2x_1 + x_2 - x_3 &= 7 \\ x_2 - 2x_3 &= -9 \\ x_1 + 3x_2 + 2x_3 &= 11 \end{aligned}$$

6. Use `sweep` to subtract the median and divide by the IQR for the variables `age`, `lwt` and `bwt` in the birth weight data set.
7. Compute a linear regression of `bwt` on `age`, `smoke`, and `lwt`. Which variables are important?