1. This week's Problem of the Week in Math is described as follows:

> *There are thirty positive integers less than 100 that share a certain property. Your friend, Blake, wrote them down in the table to the left. But Blake made a mistake! One of the numbers listed is wrong and should be replaced with another. Which number is incorrect, what should it be replaced with, and why?*

The numbers are listed below.

6	10	14	15	21
22	26	33	34	35
38	39	46	51	55
57	58	62	65	69
75	77	82	85	86
87	91	93	94	95

Use the fact that the "certain" property is that these numbers are all supposed to be the product of *unique* prime numbers to find and fix the mistake that Blake made.

Reminder: Code your solution in an R script and copy it over to this `.Rnw` file.

Hint: You may find the `%in%` operator and the `setdiff()` function to be helpful.

Solution: I installed the Primes (Keyes and Egeler, 2025) package to use for creating a list of my prime numbers. From there I created a loop that multlipled each prime number together ensuring that i and j did not equal each other. I then stored this loop in an empty vector. From there I compared that to the original table that we were given using the `setdiff` function to compare the tables and replace the wrong number which was 75 and I replaced it with 74.

```r
install.packages("primes", repos= "https://cran.rstudio.com/")

## package 'primes' successfully unpacked and MD5 sums checked
##
## The downloaded binary packages are in
##   C:\Users\schne\AppData\Local\Temp\RtmpCmpzPt\downloaded_packages

library(primes)

prime.numbers <- generate_primes(max = 100) #this creates our vector of prime number that we will be using


prime.products <- c() #this is our empty vector that stores our prime products created from the loop

for (i in 1:length(prime.numbers)) {
  for (j in 1:length(prime.numbers)) {
    if( i != j){
      product <- prime.numbers[i] * prime.numbers[j]

      if (!is.na(product) && product < 100) {
        prime.products <- c(prime.products, product)
      }
    }
  }
}
prime.products <- sort(prime.products)


given.numbers <- c( 6, 10, 14, 15, 21,
                   22, 26, 33, 34, 35,
                   38, 39, 46, 51, 55,
                   57, 58, 62, 65, 69,
                   75, 77, 82, 85, 86,
                   87, 91, 93, 94, 95)

incorrect_number <- setdiff(given.numbers, prime.products)

correct_number <- setdiff(prime.products, given.numbers)

cat("Incorrect Number in Table:", incorrect_number, "\n")
```

```
## Incorrect Number in Table: 75

cat("Correct Number to Replace It:", correct_number, "\n")

## Correct Number to Replace It: 74
```

References

Keyes, O. and Egeler, P. (2025). *primes: Fast Functions for Prime Numbers.* R package version 1.6.1.