Homework 1

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Problem 1

Find the numeric answers of the following mathematical expressions (up to 2 decimal places if the answer is not an integer).

```
# (a)
round(6 + 5 - 4 / (3) ^ 2, 2)
```

```
## [1] 10.56
```

```
# (b)
round(exp(sqrt((14 + 13) / (12 + 11))), 2)
```

```
## [1] 2.95
```

```
# (c)
round(((11 + factorial(12)) / (factorial(13) + 14)), 2)
```

```
## [1] 0.08
```

Problem 2

The monthly sales figures of Hummer H2 vehicles in the U.S. during 2002 were 2700, 2600, 3050, 2900, 3000, 2500, 2600, 3000, 2800, 3200, 2800, 3400. Please answer the following questions.

```
# (a) Enter this data into a data vector called H2
H2 <- c(2700, 2600, 3050, 2900, 3000, 2500, 2600, 3000, 2800, 3200, 2800, 3400)

# (b) Name the data vector with the month abbreviation
names(H2) <- c("Jan", "Feb", "Mar", "Apr", "May", "Jun", "Jul", "Aug", "Sep",
               "Oct", "Nov", "Dec")
# (c) What is the total number of Hummer H2 sold in 2002?
sum(H2)
```

```
## [1] 34550
```

```
# (d) Using diff(), find the month with the greatest increase from the previous month, and the month wi
diff(H2)
```

```
##  Feb  Mar  Apr  May  Jun  Jul  Aug  Sep  Oct  Nov  Dec
## -100  450 -150  100 -500  100  400 -200  400 -400  600
```

```
print("Greatest increase: December")
```

```
## [1] "Greatest increase: December"
```

```r
print("Greatest decrease: June")
```

```
## [1] "Greatest decrease: June"
```

Problem 3

Rewrite each code block to comply with the "Homework and Project Code Style Guide".

```r
x <- c(1, -2, 3, -4, 5, 100)
y <- x * -1
y[y > 0]
```

```
## [1] 2 4
```

```r
# create a sequence from 1 to 50
z <- seq(1, 50)

# test whether an observation is even
even <- z %% 2 == 0

# subset z by the test above
z <- z[even]
```

```r
mean <- function(x) {
  sum(x) / length(x)
}
```

Problem 4

A twin prime is a prime that has a prime gap of two. Sometimes the term twin prime is used for a pair of twin primes. For example, the five twin prime pairs are (3, 5), (5, 7), (11, 13), (17, 19) and (29, 31). Write a function that returns the number of all twin prime pairs between 1 and a given number n.

```r
twin_primes <- function(n) {
  # vector to hold all numbers between 2 and n
  num <- 2:n
  # logical vector for num to identify primes
  is_prime <- rep(TRUE, length(num))
  if (n <= 2) {
    stop("No twin primes between 1-2. Please enter a number greater than 2.")
  } else {
    for (i in 2:length(num)) {
      for (j in 2:(i - 1)) {
        # skip 3, a special case that breaks the loop
        if (num[i] == 3) {
          next
        } else if (num[i] %% j == 0) {
          is_prime[i] <- FALSE
          next
        }
      }
    }
```

```
  }
  # create vector with all primes between 2 and n
  primes <- rep(num[is_prime])
  # counter to track number of twin primes
  count <- 0
  # iterate through primes vector, stopping 1 before the end due to indexing
  for (k in 1:(length(primes)-1)) {
    # if the current entry is 2 less than the next entry, they are twin primes
    if (primes[k + 1] - primes[k] == 2) {
      count = count + 1
    }
  }
  return(count)
}
```