pset_4_R_Q.R

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```
# Goal: Go through set up for pset 4 Q13
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```

```
# Problem Setup: Define matrices A and B, and vector b
```

```
# 2x2 matrix
A <- matrix(c(1, 3, 2, 2), nrow = 2, ncol = 2)
A
```

```
##      [,1] [,2]
## [1,]    1    2
## [2,]    3    2
```

```
# 2x4 matrix
B <- matrix(c(1, 1, 1, 1, 3, 22, 3, 22), nrow = 2, ncol = 4)
B
```

```
##      [,1] [,2] [,3] [,4]
## [1,]    1    1    3    3
## [2,]    1    1   22   22
```

```
# 2x1 vector
b <- matrix(c(1, 3), nrow = 2, ncol = 1)
b
```

```
##      [,1]
## [1,]    1
## [2,]    3
```

```
# Part (a): Custom matrix multiplication function
```

```
# This function takes two matrices, A and B, as input and returns their product A %*% B.
matrix_multiply <- function(my_A, my_B) {

  # Check if matrix dimensions are compatible for multiplication
  if (ncol(my_A) != nrow(my_B)) {
    stop("Number of columns in A must match the number of rows in B")
  }
```

```
  # Initialize an empty matrix for the result with dimensions of A's rows and B's columns
  result <- matrix(0, nrow = nrow(my_A), ncol = ncol(my_B))

  # Loop over the rows of A and columns of B
  for (i in 1:nrow(my_A)) {
    for (j in 1:ncol(my_B)) {

      # Compute the dot product of the ith row of A and the jth column of B
      for (k in 1:ncol(my_A)) {
        result[i, j] <- result[i, j] + my_A[i, k] * my_B[k, j]
      }
    }
  }

  # Return the resulting matrix
  return(result)
}

# Test 1 ------
# Function
matrix_multiply(A, B)
```

```
##      [,1] [,2] [,3] [,4]
## [1,]    3    3   47   47
## [2,]    5    5   53   53
```

```
# R
A %*% B
```

```
##      [,1] [,2] [,3] [,4]
## [1,]    3    3   47   47
## [2,]    5    5   53   53
```

```
# Test 2 ------
# Function
matrix_multiply(my_A = A, my_B = b)
```

```
##      [,1]
## [1,]    7
## [2,]    9
```

```
# R
A %*% b
```

```
##      [,1]
## [1,]    7
## [2,]    9
```

```
# Part (b): Solving matrix equation Ax = b and finding the inverse of A
```

```r
# Use the solve function to calculate A^-1 and the vector x

# Calculate the inverse of A
A_inverse <- solve(A)
A_inverse
```

```
##       [,1]  [,2]
## [1,] -0.50  0.50
## [2,]  0.75 -0.25
```

```r
# Solve for x in Ax = b
x <- solve(A, b)
x
```

```
##              [,1]
## [1,] 1.000000e+00
## [2,] 4.163336e-17
```