Assignment 1

CM

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605 Assignment 1

Problem Set 1

Calculate the dot product u.v where u = [.5;.5] and v = [3;4]

The dot product is a particular case of the inner product. In R, this can be used with **%*%**

```
u <- c(.5,.5)
v <- c(3,4)
u.v
dot <- u %*% v
```

Find the lengths of u and v

The length of a vector are also known as their magnitude or Euclidean Norm. This is a built-in function in R. We pass it the variable as well as type='2' to specify that it is a 2-norm (or Euclidean norm).

```
norm_u <- norm(u, type='2')
norm_v <- norm(v, type='2')
```

what is 3u - 2v

R is a giant calculator. However, multiplication must be specified.

```
answer <- 3*u - 2*v
```

what is the angle between u and v

```
cos_theta = dot/(norm_u * norm_v)
acos(cost_theta)
```

Problem 2

For this problem, I first implemented a package that conducted the Gauss Jordan process, called rref, same as a TI-83.

```
rref <- function(A) {
    rows <- nrow(A)
    cols <- ncol(A)
    r <- 1
    for (i in 1:cols) {
```

```
        pivot <- which.max(abs(A[r:rows, i]))
        pivot <- r + pivot - 1
        m <- abs(A[pivot, i])
        if (m <= 0) {
            A[r:rows, i] <- 0
        }
        else {
            A[c(pivot, r), i:cols] <- A[c(r, pivot), i:cols]
            A[r, i:cols] <- A[r, i:cols] / A[r, i]
            if (r == 1) {
                tmp <- c((r+1):rows)
            }
            else if (r == rows) {
                tmp <- c(1:(r-1))
            }
            else {
                tmp <- c(1:(r-1), (r+1):rows)
            }
            A[tmp, i:cols] <- A[tmp, i:cols] -
                              A[tmp, i] %*% A[r, i:cols]
            if (r == rows) break
            r <- r+1
        }
    }
    return(A)
}
```

I then applied this function to meet the requirements of the assignment

```
gaussian_elimination <- function(A,b){
A <- cbind(A,b)
columns = ncol(A)
answers = rref(A)
return (answers[,4])
}
```

To run the script, input a matrix ‘A’, followed by the answer vector ‘b’ into the function.