

# Properties of Matrices

## Properties of Matrix Addition and Scalar Multiplication:

Let  $A$ ,  $B$  and  $C$  be matrices of the same size and let  $c$  and  $d$  be scalars. Then

- (a)  $A + B = B + A$
- (b)  $(A + B) + C = A + (B + C)$
- (c)  $A + O = A$
- (d)  $A + (-A) = O$
- (e)  $c(A + B) = cA + cB$
- (f)  $(c + d)A = cA + dA$
- (g)  $c(dA) = (cd)A$
- (h)  $1A = A$

## Properties of Matrix Multiplication:

Let  $A$ ,  $B$  and  $C$  be matrices (whose sizes are such that the indicated operations can be performed) and let  $k$  be a scalar. Then

- (a)  $A(BC) = (AB)C$
- (b)  $A(B + C) = AB + AC$
- (c)  $(A + B)C = AC + BC$
- (d)  $k(AB) = (kA)B = A(kB)$
- (e)  $I_m A = A = A I_n$  if  $A$  is  $m \times n$

## Properties of the Transpose:

Let  $A$  and  $B$  be matrices (whose sizes are such that the indicated operations can be performed) and let  $k$  be a scalar. Then

- (a)  $(A^T)^T = A$
- (b)  $(A + B)^T = A^T + B^T$
- (c)  $(kA)^T = k(A^T)$
- (d)  $(AB)^T = B^T A^T$
- (e)  $(A^r)^T = (A^T)^r$  for all nonnegative integers  $r$