

# Properties of Matrix Operations

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- Let  $\mathbf{A}$ ,  $\mathbf{B}$ , and  $\mathbf{C}$  be matrices and  $c$  and  $d$  be constants
  1.  $\mathbf{A} + \mathbf{B} = \mathbf{B} + \mathbf{A}$
  2.  $\mathbf{A} + (\mathbf{B} + \mathbf{C}) = (\mathbf{A} + \mathbf{B}) + \mathbf{C}$
  3.  $(cd)\mathbf{A} = c(d\mathbf{A})$
  4.  $1\mathbf{A} = \mathbf{A}$
  5.  $(c + d)\mathbf{A} = c\mathbf{A} + d\mathbf{A}$
  6.  $c(\mathbf{A} + \mathbf{B}) = c\mathbf{A} + c\mathbf{B}$
- Let  $\mathbf{A}$  be a matrix,  $c$  be a constant, and  $\mathbf{O}_{mn}$  be a zero matrix
  1.  $\mathbf{A} + \mathbf{O}_{mn} = \mathbf{A}$
  2.  $\mathbf{A} + (-\mathbf{A}) = \mathbf{O}_{mn}$
  3. If  $c\mathbf{A} = \mathbf{O}_{mn}$ , then  $c = 0$  or  $\mathbf{A} = \mathbf{O}_{mn}$
- Let  $\mathbf{A}$ ,  $\mathbf{B}$ , and  $\mathbf{C}$  be matrices, and  $c$  be a constant
  1.  $\mathbf{A}(\mathbf{BC}) = (\mathbf{AB})\mathbf{C}$
  2.  $\mathbf{A}(\mathbf{B} + \mathbf{C}) = \mathbf{AB} + \mathbf{AC}$
  3.  $(\mathbf{A} + \mathbf{B})\mathbf{C} = \mathbf{AC} + \mathbf{BC}$
  4.  $c(\mathbf{AB}) = (c\mathbf{A})\mathbf{B} = \mathbf{A}(c\mathbf{B})$
- The transpose of a matrix is formed by interchanging rows and columns ( $\mathbf{A}^T$ )
  1.  $(\mathbf{A}^T)^T = \mathbf{A}$
  2.  $(\mathbf{A} + \mathbf{B})^T = \mathbf{A}^T + \mathbf{B}^T$
  3.  $(c\mathbf{A})^T = c\mathbf{A}^T$
  4.  $(\mathbf{AB})^T = \mathbf{B}^T\mathbf{A}^T$
- In a symmetric matrix,  $\mathbf{A}^T = \mathbf{A}$