

# MATH 465 Notes

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## Graphs and Matrices

**Definition.** The *adjacency matrix* of a loopless graph  $G = (V, E)$  with  $V = \{v_1, \dots, v_n\}$  is the  $n \times n$  matrix  $A = A(G)$  whose  $(i, j)$ -th entry is the number of edges between  $v_i$  and  $v_j$ .

*This has good properties:*

(1)  $A$  is symmetric, so  $A^T = A$

(2) Since  $G$  is loopless, diagonal entries are 0.

(3) Fix  $i \in [n]$ , then  $\sum_{j=1}^n A_{ij} = \deg(v_i) = \sum_{j=1}^n A_{ji}$ :

$$\sum_{i=1}^n \sum_{j=1}^n A_{ij} = \sum_{i=1}^n \deg(v_i) = 2|E|$$