

## Problems 13

Due: Friday, 14 January 2022 before 17:00 EST

**P13.1.** Let  $n$  be an integer greater than 1. For any  $(n \times n)$ -matrix  $\mathbf{A}$ , let  $\text{adj}(\mathbf{A})$  denote the adjugate of  $\mathbf{A}$ . Establish the following three equations.

- (i) We have  $\det(\text{adj}(\mathbf{A})) = (\det(\mathbf{A}))^{n-1}$ .
- (ii) When the matrix  $\mathbf{A}$  is invertible, we have  $\text{adj}(\text{adj}(\mathbf{A})) = (\det(\mathbf{A}))^{n-2} \mathbf{A}$ .
- (iii) We have  $\det(\text{adj}(\text{adj}(\mathbf{A}))) = (\det(\mathbf{A}))^{(n-1)^2}$ .

**Hint.** Consider three cases: the zero matrix, a nonzero matrix having determinant equal to zero, and a matrix having a nonzero determinant.

**P13.2.** Provide short answers to the following questions. Some internet research may be useful. Remember to cite your sources.

- (i) In mathematics, what is the difference between an axiom and a theorem?
- (ii) What are Federico Ardila's four axioms about mathematicians?
- (iii) How are the four Ardila axioms and the eight axioms for a vector space similar?

**P13.3.** Provide concise answers to the following questions about the practicalities of online learning.

- (i) Will your internet connection permit you to participate in synchronous lectures and tutorials?
- (ii) Do you have a camera and microphone that would allow you to contribute via video during a [Zoom](#) lecture or tutorial?
- (iii) Are you able to share a white board in Zoom?
- (iv) Are you able to annotate a white board shared by another participant in Zoom?
- (v) Do you have practical suggestions about how to promote peer-to-peer online learning in this course?
- (vi) Do you have any specific concerns related to the online format?
- (vii) What else should we do to facilitate student learning?