

**AME Screening Exam – Spring 2016**  
**Part 1: Applied Mathematics**

Friday, January 22, 2016

Name: \_\_\_\_\_

**Instructions:**

**The exam is closed book and closed notes.**

**Students are to solve 2 problems.**

**This page must be returned as a cover page with your solutions.**

**You must also return the package of exam problems with your solutions.**

# Screening Exam

January 2016

Closed Book and Notes. No Calculators.

Answer questions (i) and (ii)

Let  $B$  be a  $4 \times 4$  matrix to which one wants to apply the following operations

1. double column 1
2. halve row 3
3. add row 3 to row 1
4. interchange columns 1 and 4
5. subtract row 2 from each of the other rows
6. replace column 4 by column 3
7. delete column 1 (so that the column dimension is reduced by 1)

(i) Write the result as a product of eight matrices

(ii) Write it again as a product  $ABC$  (same  $B$ ) of three matrices. Explicitly calculate matrices  $A$  and  $C$ .

*hint: this problem is simpler than it looks! each operation above corresponds to multiplying matrix  $B$  by another matrix whose entries you need to determine.*

University of Southern California  
Ph.D. Screening Examination  
ENGINEERING ANALYSIS

January 2016

Closed Book

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PARTIAL DIFFERENTIAL  
EQUATIONS

For the  $\frac{1}{2}$ -circle region shown,  
solve

$$\nabla^2 \psi(r, \theta) = r^{1/2},$$

with boundary conditions as  
shown.

