MATH 520 PRACTICE MIDTERM II SPRING 2017 BROWN UNIVERSITY SAMUEL S. WATSON

This is a pencil-and-paper-only exam. You have two hours.

Problem 1(a)

Solve the matrix equation $AB\mathbf{x} + \mathbf{b}$	$=2AB\mathbf{x}$
for \mathbf{x} , where A and B are invertible $n \times n$ matrices and \mathbf{b} is A , B , and \mathbf{b} and should not contain parentheses.	s an $n \times 1$ vector. Your final answer should be in terms of
Solution	
	Final answer:
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Problem 1(b)	
Problem 1(b) Show by substitution that the matrix $C = B^{-1}A$ satisfies the	ne matrix equation $B^2CA^{-1} = B$.
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Problem 2

The matrices

$$\left[\begin{array}{cccccc} -2 & 4 & 6 & 1 & 0 & 0 \\ 1 & 0 & 2 & 0 & 1 & 0 \\ -3 & 1 & -4 & 0 & 0 & 1 \end{array}\right] \text{ and } \left[\begin{array}{cccccc} 1 & -2 & 0 & 1 & -15 & -6 \\ 0 & 1 & 0 & -1 & 13 & 5 \\ 0 & 0 & 1 & \frac{1}{2} & -5 & -2 \end{array}\right]$$

are row equivalent. Find

$$\left[\begin{array}{ccc} -2 & 4 & 6 \\ 1 & 0 & 2 \\ -3 & 1 & -4 \end{array}\right]^{-1}.$$

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The set $\mathcal{M}_{2\times 2}$ of 2×2 matrices with real entries, equipped with matrix addition and scalar multiplication, is a space. The <i>trace</i> $T(A)$ of a 2×2 matrix A is defined to be the sum of its diagonal entries. In other words, the $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ is $a+d$. Show that T is a linear transformation from $\mathcal{M}_{2\times 2}$ to \mathbb{R}^1 .	a vector trace of
Solution	
Problem 3(b)	
Find the rank and the nullity of T .	
Solution	
Final answer:	

Problem 3(a)

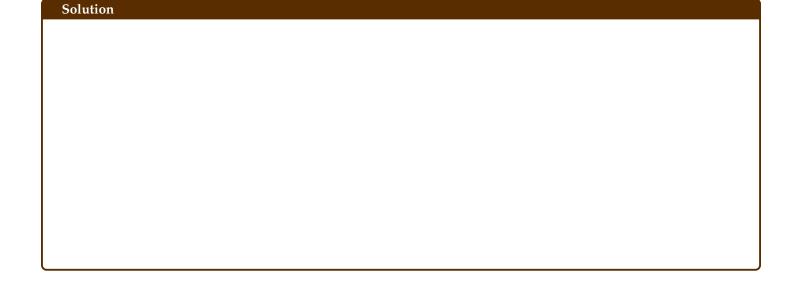
Problem 4(a)

For which values of t is the following matrix invertible? Hint: this problem requires almost no computation; inspect the matrix carefully.

Solution	
	Final answer:

Problem 4(b)

Show that if *A* is a square matrix then $det(A^TA) \ge 0$.



product.)			
Solution			

Problem 5

Problem 6

Consider the vector space \mathbb{P}_3 of polynomials of degree 3 or less, and consider the basis

$$\mathcal{B} = \{1, 1+t, 1+t+t^2, 1+t+t^2+t^3\}$$

of \mathbb{P}_3 . Find the coordinates of $-1 + t^2 - 3t^3$ with respect to \mathcal{B} .

Solution	
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	Final answer:

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Problem 7(b)	
Show that $2 \le \dim U \cap V \le 4$.	
Solution	

Problem 7(a)